

ANNEXURES: DRAFT NATIONAL SPATIAL DEVELOPMENT FRAMEWORK



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Annexure A: Background to selected data layers used for the analysis of fine grained population, socio economic and climate change analysis and projections

A1. Supportive Information on Spatial Information and Models

This Annexure is not exhaustive and only provides limited information in support of the Draft NSDF 2019.

Over the past number of years, the CSIR, together with other role players, has invested in building capability to provide spatial planning, analysis, modelling and platform support to government, with a focus on strengthening strategic regional, inter-regional and intergovernmental planning, resource allocation and monitoring and evaluation in South Africa. A key focus was the ability to enable a 'whole of country' spatial relational analysis and comparison of key settlement and population data and indicators.

A2. Regional Spatial Data Frame used for Indicators and Settlement Pattern Analysis

➤ http://stepsa.org/socio_econ.html for more detail and to download data

MESOFRAME

The Mesozone data set is referenced several times in the NSDF and was used for the fine grained spatial analysis of a large number of variables and indicators. For more information and to download data, please see http://stepsa.org/socio_econ.html

The 'Mesoframe' is a demarcation of South Africa into a complete grid of approximately 25 000 spatial units. These mesozones are not uniform in shape but aim to be approximately the same size (~50km²) for improved comparison of different spaces and more accurate visual representation and interpretation of data. The mesozones were created in such a way that they (1) fit within the current municipalities, and (2) are largely homogeneous with respect to other significant geo-economic, topographic and historic political area demarcations. The zone boundaries correspond with major travel barriers (such as rivers) as well as areas demarcated as uninhabited/ sparsely populated (Mountainous/ wilderness areas) and areas with medium to high levels of human activity (such as fertile valleys or built up areas).

The population and socio-economic datasets are assigned to mesozones based on an algorithm developed by the CSIR, which is based on the principles of dasymetric mapping. This approach is also used to calculate population distribution at a fine scale. The StatsSA 1996 (Enumerator Areas - EAs), 2001 (Sub Places - SPs), 2011 (SPs) and 2016 (SPs) population figures are used as the input-data for the respective

years. These data sets have different spatial demarcations and the data has thus been re-aligned to the mesozones to create a comparable time series data set using secondary data. The Spot Building Count (SBC), for which ESKOM is the data-custodian, is used as the secondary dataset to assign/ predict the underlying statistical surface of the origin data.

The GVA data for the different economic sectors are produced at local municipal level by Quantec. The municipal level GVA data has been re-assigned to the mesozones using the same principles of dasymetric mapping. Secondary data is used to represent the potential points where production is occurring to re-assign the economic production data to the mesozones. The total employment index per mesozone is derived from the GVA index by firstly calculating the ratio of GVA production per sector to the employment per sector for each local municipality. The employment and GVA data for the different economic sector factor is then multiplied with the economic production values per mesozone.

TOWN TYPOLOGY (2010-2018)

In 2015, the updated CSIR/SACN functional settlement typology that provided a mechanism to identify, calculate and analyse a set of development information and trends pertaining to the range of towns and cities, as well as high density rural settlements across South Africa was published. This typology enables an understanding and analyses of the network of settlements, towns and cities and the hierarchical and functional relationships between them, especially related to government and economic service provision and migration. Given the fact that spatially comparable administrative information covers wall-to-wall municipal jurisdiction areas, the functional town area demarcation and town profiling was used extensively as basis to describe and compare cities and towns across South Africa, as well as town growth trends in support of government policy. This *inter alia* includes the use of (1) the

2010-version of the typology in Chapter 8 in the NDP, 2012; and (2) the updated version in the IUDF, 2015, the SACN SOCR, 2016 and the DRDLR Social Facility Toolkit, 2016.

In February 2018, the CSIR made available a further update and rework of the settlement typology that included:

- Updated socio-economic indicators based on the CSIR Meso-Frame up to 2016; and
- A derived understanding of potential roles of towns within their regional contexts, including an analyses of national and regional gateways and anchors conducted for the Economic Development Department in 2014.

A finer-grained identification and description of small towns and growing rural settlements, considering their service role within local hinterlands and not merely based on the population size but also the economy. This was further informed by the, CSIR Social Facility Settlement Prioritisation, 2016; DRDLR Social Facility Toolkit, 2016 and the SALGA Small Town Regeneration Programme, 2017-2018.

The typology was also updated to include the identification of new and expanding settlement areas by using the unique CSIR Settlement Footprint created in support of the CSIR Green Book, 2019. In this process, the built up area of each settlement was demarcated using a combination of satellite imagery, housing point data and fine grained StatsSA population data sets. This enabled clear demarcation of built-up areas that in turn enabled more accurate calculation of population numbers and profiling of individual settlements and analysis of changing settlement dynamics and trends.

As such, the typology enables calculation of the population and the economy of functional town areas (as opposed to municipal area statistics) and a comparison of town areas relative to non-town areas as well as the ability to explore regional and spatial inter-relations of settlements as well as the trends within specific types of settlements. The Typology also enables regional-scale, temporal and spatial comparison of settlements regardless of administrative boundaries. For access to the spatial frame, and socio-economic indicators, please see 'Indicator' where the data can also be downloaded.

Bibliography:

For more about the CSIR South Africa Functional Town Typology, see van Huyssteen, E. Green, C. Sogoni, Z., Maritz, J. and McKelly, D. South African Functional Town Typology (CSIR 2018 v2).

A3. Population Projections and Spatial Settlement Growth Modelling and Allocation

Population projections and location specific scenario modelling for South Africa was undertaken by the CSIR as part of the Green Book (2019) process. This was made available for use in the NSDF process and was used to explore the most likely spatial implication of population growth projections for both low and high in-migration scenarios. This growth scenario is a first of its kind to explore the implication of population growth taking into consideration migration patterns, as well as spatial-locational attraction and distribution of growth.

In compiling the NSDF, use was also made of the following Green Book (2018) population modelling outputs:

- *National population growth projections at country level within South African-specific context and scientifically verified up to 2050 for two growth scenarios.* A medium and a high growth scenario were generated by the Green Book 2019 – both verified by expert reference groups. After consideration of the scenarios and benchmarking against other projections, the NSDF made use of the medium population growth scenario with respect to planning and implementation.
- *Downscaled medium population growth scenarios* developed at provincial and district scales to understand the most probable regional growth pressures for 2030 and 2050.
- A novel and innovative settlement growth model to derive *settlement level population projections*. This model has been developed to utilise provincial and district scale population growth projections to derive and model growth of individual settlements. The model utilises a gravity model, based on “population potential” during the population growth allocation process. The latter is a measure of the “attractive force” of a particular grid cell for further population growth considers relational spatial impacts in the model. The expectation of different rates of change for the different settlement types was accounted for in the model-making that was done in analysing the spatial attraction of existing agglomeration economies and concentrations based on the CSIR Functional Town Typology, 2018 and CSIR Open Settlement Footprint, 2017*.
- The results of the *Population Projections and CSIR Town Growth Model* were used in the NSDF 2018 as a “*Without Intervention National Settlement Scenario*” of most likely growth pressures for settlements in South Africa.
- The “*Without Intervention National Settlement Scenario*” including national growth projections of model results were then used with the NSDF Vision and implementation frames and the

expected impacts of growth and available resources, as highlighted in **Part 3** of the Draft NSDF, to construct an alternative envisaged settlement-allocation pattern of the “NSDF Implementation Settlement Scenario” that is based on a sustainable national settlement growth outcome through successful implementation of the NSDF Vision. This alternative NSDF Settlement Allocation Scenario is “a Vision of a preferred outcome of future spatial patterns given the available information”, and was informed by (1) significant national development objectives, (2) the national spatial development vision, (3) the national spatial development concepts, (4) resources and outcomes as attractors, and (5) global and national risks as push factors.

The CSIR Green Book modelling approach, inputs and high level outputs available are set out in Figure A1 and national level results in Figure A2.

The population projections of Prof L. van Tonder, the lead expert for the CSIR, Green Book population projection work, 2018 have been proven to be consistently accurate over time when compared to World Bank and United Nations Projections. The modelled national population projections for two scenarios, as developed from the model, are indicated in **Figure 2**. High and medium scenarios refer to differences in international in-migration scenarios. National population projections clearly illustrate the need to plan for at least a 30% increase in population by 2050, with the medium scenario indicating a population of 75 million by 2050, and the higher in-migration scenario, a population of 80 million by 2050. This can have significant spatial implications, with the population projected to grow primarily in the urban core and secondary cities and large towns.

#The Settlement Footprint defines the spatial extent of the actual built up areas of each settlement and differentiates this area from the surrounding rural hinterland. This layer aims to provide a more accurate GIS based extent of the built up footprints of SA settlements. The Settlement footprint was recently developed for South Africa, and was defined based on a spatial extent of the settlement 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 – In process) Settlement footprint layer 2017, CSIR 2017.

Bibliography:

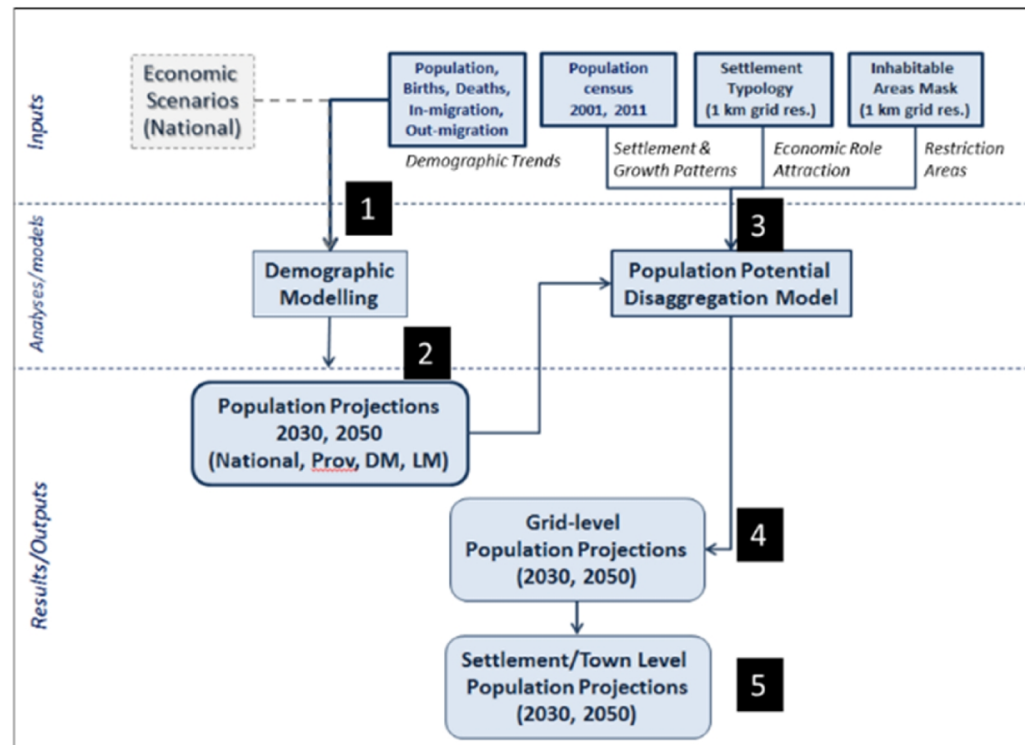
- Green Book. 2019. *Green Book: Adapting South African settlements to climate change*. www.greenbook.csir.co.za
- Griffin, J. (2012, April 3). *The Impact of Climate Change on South Africa* . Retrieved June 13, 2018, from Climate System Emergency Institute;; https://www.climateemergencyinstitute.com/cc_s_africa_griffin.html
- Ziervogel, G., New, M., Archer van Garderen, E., Midgley, G., Taylor, A., Hamann, R., et al. (2014). Climate change impacts and adaptation in South africa. *WIREs Climate Change*, 605-620.

Link to the population projections findings:

Le Roux, A., Arnold, K., Makhanya, S. & Mans, G. 2018. *Green Book – South Africa's urban future. Growth projections for 2050*. <https://pta-gis-2-web1.csir.co.za/portal/apps/GBCascade/index.html?appid=5180459a765c4e63bfb3fa527c7302b3> Pretoria: CSIR

Figure A1: CSIR - National level projections and multi-scale modelling approach to enable South Africa's first national scale town/city level projections

CSIR, 2018 National level projections and multi-scale modelling approach to enable South Africa's first national scale town/city level projections



Step 1: National Demographic Modelling

Step 2: Downscaled Projections for National, Provincial, District and Local areas

Step 3: Population potential locational disaggregation model

Step 4: Grid level – modelled population projections

Step 5: Functional town area – modelled population projections

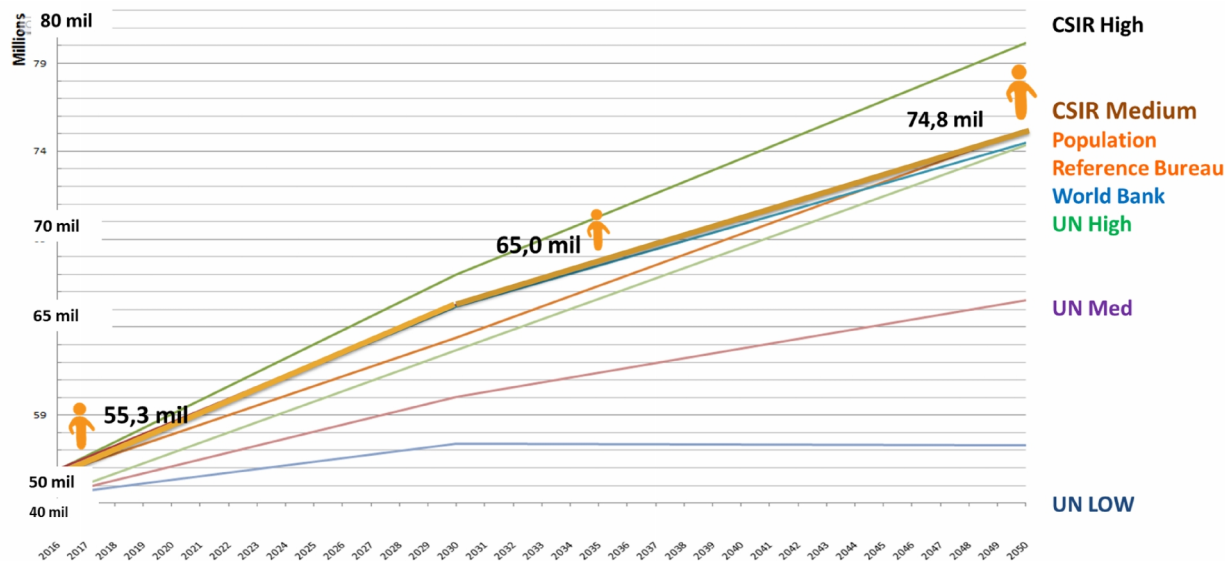


Figure A2: National level projections

Source: CSIR, 2018. Green Book, Population Growth Projections.

Using national level growth projections, provincial and district level allocations were modelled and results can be seen in Figure A 3 and A4. These were in turn used as inputs for the location-specific modelled results at settlement level using a gravity based model. In addition to demographic trends the gravity model developed by the CSIR currently enables consideration of:

- Past settlement growth patterns,
- An economic attraction pull factor depending on the role of a settlement/town or city (using the CSIR, Town Area Typology, 2018 town demarcations and profiles); and
- Location-specific exclusion areas.

The projections were downscaled and the methodology tested against a simulation of 2001-2011 population data that provided very high levels of accuracy-98% for district level and 95% for settlement level. Please see the diagrams below for examples of downscaled district and settlement allocations as used for the "NSDF 2018 Without Intervention National Settlement Scenario" (Medium Population Growth Projections and CSIR Green Book Town Growth Model Results). **Figure 3** provides information of the downscaled projections at a provincial level.

Figure A3: Provincial level projections (Units shown = millions of people)

CSIR, 2018 Downscaled Cohort Component Projections for Provinces

	2016		2030		2050	
	Med	High	Med	High	Med	High
EC	6,89	6,93	7,93	8,13	9,02	9,56
FS	2,75	2,77	2, 86	2, 94	2, 99	3, 16
GT	13,39	13,48	16,67	17,14	20,30	21,79
KZN	10,91	10,99	12,85	13,19	14,75	15,80
LIM	5,71	5,75	6,59	6,76	7,09	7,57
MP	4,30	4,33	5,11	5,24	5,91	6,26
NC	1,19	1,19	1,31	1,34	1,39	1,47
NW	3,97	3,99	4,55	4,61	5,12	5,48
WC	6,23	6,27	7,41	7,58	8,53	9,02
Total	55,33	55,70	65,27	66,99	75,10	80,14

Source: CSIR, 2018. Green Book, Population Growth Projections.

Relative and Absolute population change per District Municipality between 2011 and 2050 Medium Scenario

2050 Population Growth - Medium Estimates Age Breakdowns

Age Group	Percentage	Population (2011-2050)
Age 0-14	8%	17 815 185
Age 15-34	22%	23 535 662
Age 35-64	57%	26 819 101
Age 65+	13%	5 739 108

South Africa

Legend: Population Change 2011 - 2050 (Med)

- <0%
- 0% - 5%
- 5% - 10%
- 10% - 20%
- 20% - 40%
- 40% - 60%
- >60%

Scale: 0 100 200 400 Km

8

A4. Climate Change Projections

Climate change is a term that generally refers to a shift in weather phenomena associated with an **increase** in global average temperatures that would have occurred normally over long time periods. Human intervention, however, is rapidly affecting the average surface temperatures, which in turn are resulting in changes to climate patterns. In compiling the Draft NSDF, use was made of climate change projection data from the CSIR Green Book project.

Overview of methodology used for Climate Modelling

Down Scale Climate Modelling at 8 km resolution was conducted by Prof Francois Engelbrecht, CSIR. The 8 km resolution projections were obtained by further downscaling of the CSIR's existing set of 50 km resolution CORDEX (Coordinated Regional Downscaling Experiment) projections of future climate change. These CORDEX projections are for two emission level mitigation scenarios, namely Regional Concentration Pathway 8.5 (RCP8.5; low mitigation) and RCP4.5 (high mitigation). For each of these emission pathways, six global circulation models (GCMs) that contributed to Assessment Report Five (AR5) of the Intergovernmental Panel on Climate Change (IPCC) were downscaled to 50 km resolution over the globe, as part of the CSIR's contribution to CORDEX.

In the Green Book project, all these simulations (twelve ensemble members in total) were downscaled further to 8 km-resolution over South Africa. The projections were analysed statistically in the Green Book of South Africa Climate Change Projection report and the

implications for South Africa discussed. The uncertainty range described by these projections is still to be described within the context of the much larger, but lower resolution ensemble of AR5 GCM projections.

Results and Implications

In order to sufficiently identify the spatial implications of climate change for South Africa, several fine scaled climate change projections were recently undertaken as part of a project entitled: "Settlement design guidelines for climate change adaptation in South Africa" (Council for Scientific and Industrial Research, 2016)¹. The resulting projections generally predict severe temperature increases for Southern Africa. It is especially the northern and the western parts of South Africa that can expect significantly hotter average temperatures and more very hot days per year by 2050. By the end of the century, temperature increases of between 4 and 7°C can be expected over the interior of the country.

Furthermore, generally drier conditions and the more frequent occurrence of dry spells are plausible over parts of the interior as indicated in Figure 7. Areas most affected by decreases in rainfall are the Western Cape (winter rainfall region), parts of the Northern Cape, central part of the Eastern Cape and areas in Mpumalanga along the eastern escarpment as well as parts of the Limpopo Province.

Increase in annual-average near-surface temperatures are projected to occur over large parts of South Africa, including the western interior and northern parts of South Africa. This is critical as the central and northern parts of the interior are important agriculture production

1

areas currently. Aligned with the increase in temperatures is the likely increase in high fire-danger days, heat-wave days and very hot days and drier conditions referred to above.

For the period 2021-2050, relative to the period 1971-2000, (under low mitigation), rainfall is projected to increase over the central interior and east coast. This is most likely to go hand in hand with extreme rainfall events which have significant implications for infrastructure, flooding and water availability. Severe climate events are likely to endanger lives and cause damage to the built environment, which would have knock-on effects on economic development and negatively impact service delivery and sustainable development in the areas of greatest need. The negative impacts are not likely to be limited to the agricultural sector. The shift in rainfall patterns, together with rising temperatures and atmospheric carbon dioxide is likely to enhance vegetation growth in some regions, which could result in bush encroachment in Savannah regions – the Kruger National Park is one area at risk. This could change ecosystem and population dynamics, leading to a change in plant and animal communities (Griffin, 2012).

Climate change does pose a significant threat to South Africa's current water resources, food security, health, established infrastructure, as well as its ecosystem services and biodiversity. Considering South Africa's high levels of poverty and inequality, these impacts also pose critical challenges for national development (Ziervogel, et al., 2014).

Climate change also has serious long-term implications for human habitation and the productivity of agriculture. These projections

suggest an increasingly important role for the central and south-eastern parts of the country for (1) human settlement and (2) food production. To accommodate both, a concerted 'national spatial compaction, shrinking, and sharing-drive' will be required. Changing climate could also benefit areas allowing different crops to be cultivated in areas not previously possible. See consolidated summary map based on the projections done through the CSIR Green Book (2019) below.

Bibliography:

Link to the climate change projections findings:

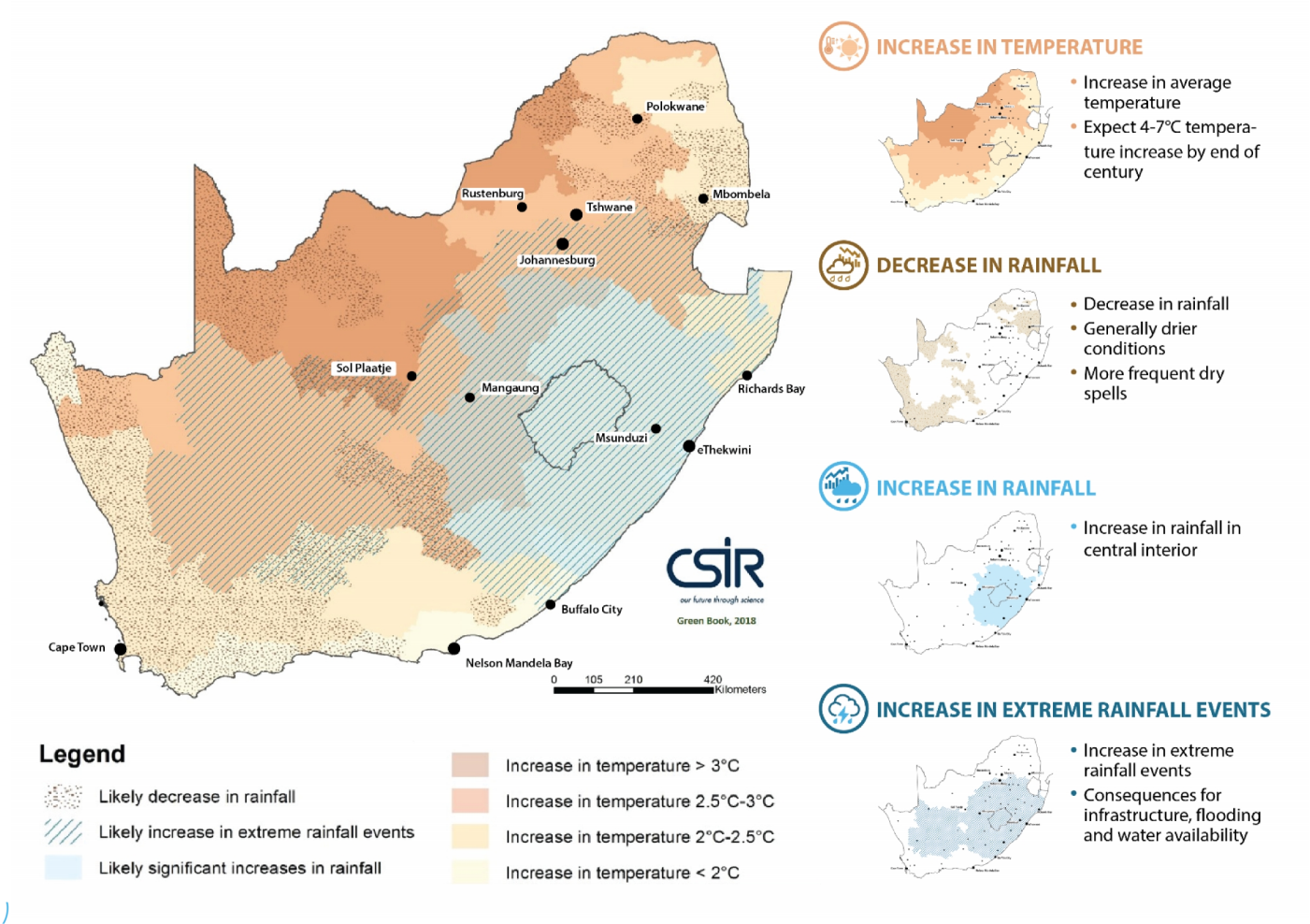
Engelbrecht, F., Le Roux, A. & Arnold, K. 2018. *Green Book – Detailed projections of future climate change over South Africa*. <https://pta-gis-2-web1.csir.co.za/portal/apps/GBCascade/index.html?appid=b161b2f892194ed5938374fe2192e537> Pretoria: CSIR

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Figure A7. CSIR, Green Book Climate Change Projections, CSIR (2019)



Source: Green Book Climate Change Projections, CSIR (2019).

Annexure B: Spatial Descriptions in Support of National Spatial Development Framework

B1. Purpose and role of the Spatial Frame Annexure

This Annexure provides some of the spatial specific information and base considerations in support of the National Spatial Frame and sub-frames, but does not provide an extensive diagnostic and synthesis overview. This Annexure is aimed at providing more detail and clarity on selected conceptual spatial frame elements, and where relevant, an indication of spatial specific extent and location.

B2. Spatial Descriptions of Inter-regional, national frame (Sub-Frame 1)

Significant plans, studies and sources that informed the spatial specific selection of frame elements include, amongst others:

- Africa Union Commission. (2015). Agenda 2063: The Africa We Want.
- United Nations. 2016. Habitat III. Quito. 17-20 October 2016.
- United Nations. 2015. Sustainable Development Goals.
- SADC. (2015). SADC Industrialization Strategy and Roadmap 2015 - 2063. Gabarone: SADC.
- Southern African Development Community. (2012). Regional Infrastructure Development Master Plan. Gabarone: SADC.

- The Presidency. National Spatial Development Perspective, 2006.
- Department of Co-operative Governance. 2016. Integrated Urban Development Framework. A new deal for South African Cities and Towns.
- Department of Co-operative Governance. 2018. *Localising the New Urban Agenda: South Africa Discussion Document*.
- Economic Development Department. 2011. The New Growth Path Framework.
- Selection of **priority corridors, harbours, ports and trade posts** as well as government investment areas (such as SEZs) and inter-regional corridors and networks as outlined in:
 - Damon, M. et al. 2014. Spatial Perspective in Support of the New Growth Path. Unpublished Report prepared for Economic Development Department;
 - Transnet, 2016. National ports plan 2016;
 - TRANSNET. (2016). 30-year Long-term Planning Framework (Chapter 4 Port Development Plan). Johannesburg;
 - TRANSNET Group; Department of Transport. 2015. National Transportation Plan. Department of Transport;
 - Amos, S. (2010). The role of South Africa in SADC regional integration: the making or braking of the organisation. *Journal of International Commercial Law and Technology*, 124-131;
 - Brand, A. 2017. The use of corridor development as a strategic and supporting instrument towards the development of national space economies. Potchefstroom: NWU (Unpublished Thesis – PhD); and
 - Brand, A. and Drewes, JE. 2018. Spatial Corridor Model (SCM) – structuring economic spaces in South Africa.

B3. Spatial Descriptions of Settlements Type (Sub-Frame 2)

B3.1 Significant Urban Regions and Cities

The NSDF spatial frame identifies the **urban-regions and cities** that are foreseen to play a critical role in (1) housing the South African population and (2) in the national economy and that require focussed intervention (see **Table A1**).

The three national **Urban Regions** (identified based on existing densities and size, current and projected future population growth (2050), the size and diversity of the economy and social and economic reach and inter-regional role), are:

- The **Gauteng Urban Region** (and surrounding cities in the urban-innovation belt);
- **Cape Town Urban Region** (extending towards surrounding urban clusters); and
- The **eThekweni Urban Region** (extending to functionally linked areas within iLembe, Ugu, uMgungundlovu Districts and Msunduzi City).

National Urban Nodes include existing and emerging cities identified to play a significant role in national and regional development, are:

- Nelson Mandela Bay Metropolitan region;
- Mangaung City Area;
- Mbombela City Area;
- Rustenburg City Area;
- Buffalo City Area;
- Polokwane City Area;
- Richards Bay Large Regional Centre; and
- Msunduzi City Area.

These urban regions and big cities, as priority national nodes on the urban network, and places within identified growth and transformation corridors, would need to play a critical role for consolidated urban livelihoods and facilitating a more sustainable and just national spatial settlement pattern as set out by the NSDF.

Selection criteria included the following considerations (for studies and references see B3.4):

- *Firstly*, the spatial extent and densities: High density settlement footprint, as well as surrounding functional region that include a network of linked polycentric urban nodes and surrounding 'satellite' towns, former spatially segregated township areas, dense rural settlements and urban social and economic services, characterised by intense socio-economic and daily commuting interaction. The CSIR Settlement Typology 2018 was used as basis for demarcation and calculation. The Town Area Typology is based on a spatial data and indicator framework designed to identify, track and compare regional and inter-regional spatial and settlement patterns and trends. The town area extent is based on the 'GAP Meso Frame' (2018 Update), an extensive series of spatial data indicators derived from StatsSA and verified to enable spatial trend analyses, and verified with the fine grained CSIR Settlement Footprint Layer, 2018 (based on SPOT Building Count, StatsSA Enumerator Areas and disaggregated socio-economic trend data up to 2011).
- *Secondly*, Indicators of size and growth: Population size and growth trends, as well as migration attraction indicators;
- *Thirdly*, indicators of economic size and growth, including total economic output, employment, economic sector specific size and growth trends;
- *Fourthly*, inter-regional and national gate-way functions and services provided, including: administrative functions, ports and trade and logistics, and indexes of economic diversity and regional economic functional-clustering in terms of international head offices, the financial sector and international tourism.

B3.2 National Network of Regional Development Anchors

The **national network of regional development anchors**, that play a key role in the surrounding rural regions were identified as:

Aliwal North	Jozini	Secunda
Barberton	Kokstad	Scottburgh/
Beaufort West	Kuruman	Pennington
Burgersfort	Kroonstad	Springbok
Bela Bela	Ladysmith	Swellendam
Bethal	Lichtenburg	Standerton
Bethlehem	Makopane/Mmabatho	Thohoyandou
Brits	Mossel Bay	Queenstown
Bushbuckridge	Oudtshoorn	Upington
Butterworth	Lephalale	Ulundi
Calvinia	Lusikisiki Lydenburg	Vredenburg
Clanwilliam	Makhado	Vryheid
Cradock	Manguzi	Welkom
Dennilton/Siyabuswa	Matatiele	Worcester
De Aar	Moorreesburg	Vryburg
Ermelo	Musina	
Escourt	Paarl/Wellington	
George	Phalaborwa/Namakgale	
Grahamstown	Plettenberg Bay	
Groblerdsdal	Port	
Giyani	Shepstone/Margate	
Graaff-Reinet	Potchefstroom	
Harrismith	Pongola	
	Piet Retief	

Priority regional development anchors were identified from a wide range of existing and emerging towns, identified as towns that are, and could, fulfil a regional function within productive rural regions in support of national and regional development objectives.

The CSIR Town Typology was utilised as basis (See Table A2), to enable identification of regional settlement nodes. Selection criteria included the following considerations (for studies and references see B3.4):

- Firstly, the **location and spatial extent and densities include areas** (towns) of dense settlement footprints and surrounding functional settlement areas that include former spatially segregated township areas, and dense rural settlements. As outlined in Annexure A, the Town Area Typology is based on (1) a spatial data and indicator framework designed to identify, track and compare regional and inter-regional spatial and settlement patterns and trends ('GAP Meso Frame' (2018 Update) and (2) an extensive series of spatial data indicators derived from StatsSA, which was verified to enable spatial trend analyses. The spatial extent of towns was verified with the fine-grained CSIR Settlement Footprint Layer, 2018 (based on SPOT Building Count, StatsSA Enumerator Areas and disaggregated socio-economic trend data up to 2011).
- Secondly, **indicators of population and economic size and growth**: Population and economic size and growth trends, as well as migration attraction indicators; and
- Thirdly, the identification of **local and regional size and service reach** (including economic, administrative but also social service facility access) of towns within their **unique typographies and diverse development contexts**. This enabled identification of towns that might be smaller in size but do play a significant role in remote regions, or of growing nodes in dense rural settlement regions with limited access to larger cities and towns.

Identification of the NSDF national network of regional development anchors included **consideration of expected and projected regional**

trends and desired national spatial pattern. Given current spatial patterns a specific focus was placed on identification of emerging nodes to support national urbanisation (become the cities of the future) in the central, eastern and coastal transformation and development corridors.

Regional and rural typography, road distance and access analysis under conditions of improved rural connectivity and distance analyses assisted in identifying growth centres that can play the role of strategically located regional and rural development anchors as part of the Regional-Rural Development Model and act as spatial levers.

Provincial plans and strategic focus areas, as well as existing national investments such as Industrial Development Zones, Spatial Economic Development Zones, Agri-Hubs and Aqua focus areas were also taken into consideration in the identification process. Regional development anchor-selection was also informed by the network of towns that play strategic regional roles as identified on the basis of nationally comparative town profiles developed as part of the CSIR, 2018 Town Area Typology. The location of regional development anchors took into consideration key national transport routes and the relationship to the networks of Regional Service Centres and Service Towns identified. The latter are strategically located to act as government and economic service centres within the surrounding service hinterland areas, and act as attractors of urban consolidation. Service Towns (CSIR Settlement Typology, 2018) form the bulk of the identified Rural Service Centres.

B3.3 Identification of regional networks of consolidated and well-connected rural service centres

Rural service centres (see **Table A1** below) across South Africa were identified to provide a select network of towns that play a strategic

regional service role within their regions. They were identified on the basis of (1) the CSIR, 2018 Town Area Typology, (2) regional accessibility, and (3) recently developed priority towns for social investment within the DRDLR Rural Social Facility Toolkit project.

The town area typology is also being used in the identification of potential regional roles for medium and small towns in support of SALGA's Small Town Regeneration Strategy. Furthermore, the role of towns informs the Integrated Urban Development framework Implementation: SALGA Small Town Strategy. Identified points of growth and/or existing development should act as points of settlement consolidation in rural areas especially in areas of high value agricultural and ecological infrastructure.

B3.4 Significant plans, studies and sources that informed the spatial specific selection of frame elements

- Department of Co-operative Governance. 2016. Integrated Urban Development Framework. A new deal for South African Cities and Towns.
- Department of Co-operative Governance. 2018. *Localising the New Urban Agenda: South Africa Discussion Document*.
- Economic Development Department. 2011. The New Growth Path Framework.
- National Planning Commission. 2012. National Development Plan, 2030. Our Future – make it work.
- National Department of Human Settlements. (2015). Towards a Policy Foundation for the Development of Human Settlements Legislation.

- National Treasury, City Support Programme. (2012). CSP Framework. National Treasury.
- Department: Planning, Monitoring and Evaluation. 2017. Research on the Limited Success of Entrepreneurial Activity by Locals in Townships and Rural Areas. Seven Dialogue Locations: Townships, Rural and Informal Settlement. Research Report conducted for Programme Four: National Planning Commission. October. 2017.
- Report of the High-Level Panel on the Assessment of Key Legislation and the Acceleration of Fundamental Change. (2017). Page 32.
- Commission on the Restitution of Land Rights. (2014/15). Strategic Plan. CRLR.
- DRDLR. (2011). Green Paper on Land Reform.
- African National Congress. (2012). Land Reform Policy Discussion Document. Johannesburg: ANC.
- Department of Energy (DOE). 2015. State of Renewable Energy in South Africa. [Online] available at: http://www.gov.za/sites/www.gov.za/files/State%20of%20Renewable%20Energy%20in%20South%20Africa_s.pdf.
- Department of Environmental Affairs (DEA). n/d. About the green economy. [Online] available at: <https://www.environment.gov.za/projectsprogrammes/greenecconomy/about>.
- Renewable Energy Independent Power Producer Procurement Programme (REIPPP) - <http://www.energyintelligence.co.za/reipp-pp-all-you-need-to-know/>
- Renewable Energy Development Zones (REDZ) - https://egis.environment.gov.za/renewable_energy
- Department of Water and Sanitation (DWS). (2017). Draft National Water Plan, DWS (2017: 40-41).

Guidance regarding national urbanisation patterns, nodes and corridors was provided by a range of policies and spatially explicit national plans, initiatives and strategies, including:

- Current *metropolitan, city and secondary cities* (SOCR, 2016; SACN Secondary Cities Work);
- Existing *urban densities and size of population and economy in functional urban regions* (city areas) and cities on the basis of nationally comparative town profiles developed in the CSIR, 2018 Town Area Typology.
- Network of cities with *international gateway functions* as identified using the EU International Gateway Indicators (see Matfield et al. 2014 and EDD, 2014 and EU, 2014). These primarily consider:
 - Projected urbanisation and population growth;
 - International and national trade, logistic centres (land, sea and air ports);
 - Mining, manufacturing and industrial centres;
 - Gateway functions as government services, provincial capitals and education centres;
 - Knowledge economy and research centres;
 - Service economy and green economy size and opportunities; and
 - International tourism nodes,
- NSDF *Spatial vision and settlement pattern scenario based re-modelling of regional patterns of projected urban population distribution* (CSIR, 2018. NSDF Vision Settlement Population Growth Projection).
- SADC. (2015). SADC Industrialization Strategy and Roadmap 2015 - 2063. Gabarone: SADC.
- Southern African Development Community. (2012). Regional Infrastructure Development Master Plan. Gabarone: SADC.

- Selection of *regional growth centres* considered regions envisioned to facilitate national urbanisation (central, eastern and coastal regions), and identified growth and development corridors. (See Frame 1.2 and 1.3).
- The *Integrated Urban Development Framework Implementation: 37 Intermediary City Municipalities* are also expected to play a key role as future urban regions, cities and regional anchor towns in NSDF Spatial Scenario.
- Department of Human Settlements Spatial Master Plan (guiding land release and investment through the Housing Development Agency)
- International journal of urban and regional research, still to be published. Cilliers, J. 2018. Made in Africa: Manufacturing and the Fourth Industrial Revolution. Institute of Security Studies. In Africa and the World Report. April. 2018
- Council for Scientific and Industrial Research. (2016). Settlement design guidelines for climate change adaptation in South Africa. CSIR. Pretoria: CSIR.
- Snowball, Collins and Tarentaal. (2016). Transformation and job creation in the cultural and creative industry in SA, SACO.
- South African Cities Network (SACN). (2014). *Outside the core: Towards and understanding of Intermediate Cities in South Africa*. South African Cities Network: Johannesburg.
- South African Cultural Observatory (SACO). (2016). The Role of Cultural and Creative Industries in Regenerating Urban and Rural Space and Economies in South Africa: A case Study Approach. Submitted to the Department of Arts and Culture.
- South African Cultural Observatory (SACO). (2016). The mapping of the South African creative economy: A baseline. Submitted to the Department of Arts and Culture.
- South African Cultural Observatory (SACO). (2017). Macroeconomic impact assessment and analysis of South Africa's cultural and creative industry (CCI) and creative. Submitted to the Department of Arts and Culture.
- Southern African Development Community (SADC). (2012). Regional Infrastructure Development Master Plan. Gabarone: SADC
- Southern African Development Community (SADC). (2015). SADC Industrialization Strategy and Roadmap 2015 - 2063. Gabarone: SADC.
- South African National Biodiversity Institute (SANBI). (2016). Framework for Investment in Ecological Infrastructure.
- Selection of *priority corridors, harbours, ports and trade posts* as well as government investment areas (such as SEZs) and inter-regional corridors and networks as outlined in:
 - Transnet, 2016. National ports plan 2016;
 - TRANSNET. (2016). 30-year Long-term Planning Framework (Chapter 4 Port Development Plan). Johannesburg;
 - TRANSNET Group; Department of Transport. 2015. National Transportation Plan. Department of Transport;
 - Amos, S. (2010). The role of South Africa in SADC regional integration: the making or braking of the organisation. *Journal of International Commercial Law and Technology*, 124-131.
 - Brand, A. 2017. The use of corridor development as a strategic and supporting instrument towards the development of national space economies. Potchefstroom: NWU (Unpublished Thesis – PhD);
 - Brand, A. and Drewes, JE. 2018. Spatial Corridor Model (SCM) – structuring economic spaces in South Africa.

Spatial analyses informing the selection of *regional development anchors and service centres*, included:

- Rural regional anchors and service centres was identified based on a network of towns with strategic regional roles as identified on the basis of nationally comparative town profiles developed in the CSIR, 2018 Town Area Typology. The town area typology is also

used for the identification of potential regional roles for medium and small towns in support of SALGA's Small Town Regeneration Strategy. The role of towns informs the Integrated Urban Development Framework Implementation: SALGA Small Town Strategy;

- SA CSIR MesoZone 2018v1 Dataset: Available at <http://stepsa.org>. Available at <http://stepsa.org> see http://stepsa.org/socio_econ.html#Indicator

Data was used from the following provincial SDFs in the analyses done in compiling the Draft NSDF and the proposals put forward in the framework:

- KwaZulu-Natal, Provincial Growth & Development Plan, 2018;
- KwaZulu-Natal, Provincial Growth & Development Strategy, 2016;
- Eastern Cape, Provincial Spatial Development Plan, 2010;
- Free State, Provincial Spatial Development Framework, 2014;
- Gauteng, Provincial Spatial Development Framework, 2017;
- Limpopo, Provincial Spatial Development Framework, 2016;
- Mpumalanga, Provincial Spatial Development Framework, 2013;
- Northern Cape, Provincial Spatial Development Framework, 2012;
- North West, Provincial Spatial Development Framework, 2016; and
- Western Cape, Provincial Spatial Development Framework, 2014.

Table A1: Description of current and growing urban regions and urban cores as a basis for envisaged NSDF settlement vision.

NATIONAL URBAN REGIONS AND NODES			
NSDF national urban regions, cores and nodes have been identified on the basis of existing and projected high growth these include 1. City regions, 2. Cities and large regional centres and a select few 3. Regional service centres , as defined in the CSIR, South Africa Functional Town Typology – 2018. These areas will be home to the majority of the population in future. Based on the NSDF Vision they are expected to house 61% of the country's 2050 population (CSIR, 2018. NSDF Vision Settlement Population Growth Projection).			
URBAN REGIONS		NATIONAL URBAN CORES	SMALLER URBAN CORES
Population: > 3 million people AND Economic output > R40 816 mill/yr (2013 - <i>Metros/International Gateways with continuing significant population and economic share.</i>		Cities: Population: >500 000 and Economic output >R7 900mill/yr (2013),	Very Large Regional Centres: Population: >300 000 and Economic output >R4 000mill/yr (2013) Large Regional Centres: Population: >100 000 and Economic output >R1400mill/yr (2013)
Greater Gauteng Urban Region	Ekurhuleni Metro; City of Johannesburg City of Tshwane Metro and Functionally linked areas in West Rand, Sedibeng; Bojanala, Fezile Dabi and Nkangala DM	Nelson Mandela Bay Metropolitan region Mangaung City Area Mbombela City Area Rustenburg City Area Buffalo City Area Polokwane City Area Richards Bay Large Regional Centre Msundusi City Area	Newcastle Large Regional Centre Tzaneen Large Regional Centre Emalahleni (Middleburg)Large Regional Centre Matlosana Large Regional Centre
Greater Cape Town Urban Region	City of Cape Town and Functionally linked areas in Stellenbosch Cape Winelands DM and West Coast DM		Regional Service Centres: Population: >100 000 and Economic output >R1100mill/yr (2013)
Greater eThekweni Urban Region	eThekweni Metro and Functionally linked areas in iLembe, Ugu and Umgungundlovu Districts, up to the Msunduzi City		Sol Plaatje Mthatha e

Table A2: Description of current settlement network as a basis for envisaged NSDF national network of Regional Development Anchors

Regional Development Anchors			
NSDF national network of regional development anchors have been identified on the basis of expected and projected high growth Regional Service Centres and Service Towns that are strategically located. The basis has been the network of Regional Growth Centres and significant Service Towns within the CSIR, South Africa Functional Town Typology – 2018.			
Regional Growth Anchors are made up of Regional Service Centres and a selection of regionally significant and accessible Service Towns. Selection of the service towns considered formal economy and population growth.			
Population variation between 15 000 to just over 100 000 people and economic output >R270mill (2013)			
Expected to house 14% of the country's 2050 population (CSIR, 2018. NSDF Vision Settlement Population Growth Projection).			
REGIONAL SERVICE CENTRES		SERVICE TOWNS	
Bela Bela	Mmabatho	Aliwal North	Lydenburg
Bethal	Mossel Bay	Barberton	Makhado
Bethlehem	Oudtshoorn	Beaufort West	Manguzi
Brits	Paarl/Wellington	Burgersfort	Matatiele
Bushbuckridge	Scottburgh/ Pennington	Calvinia	Moorreesburg
Butterworth	Phalaborwa/Namakgale	Clanwilliam	Musina
Dennilton/Siyabuswa	Port Shepstone/Margate	Cradock	Piet Retief
Ermelo	Potchefstroom	De Aar	Plettenberg Bay
Escourt	Queenstown	Giyani	Pongola
George	Secunda	Graaff-Reinet	Springbok
Grahamstown	Standerton	Harrismith	Swellendam
Groblersdal	Thohoyandou	Jozini	Ulundi
Kroonstad	Upington	Kokstad	Vryburg
Ladysmith	Vredenburg	Kuruman	
Lichtenburg	Vryheid	Lephalale	
Makopane	Welkom	Lusikisiki	
	Worcester		

Table A3: Description of current settlement network as a basis for envisaged regional networks of Rural Service Centres.

Rural Service Centres This group consists of service towns, small service towns and settlements Population: Varies in nodal settlement, large population in direct hinterland Expected to house 5% of the country's 2050 population. (CSIR, 2018. NSDF Vision Settlement Population Growth Projection). E.G. Middelburg EC, Mtubatuba, Barkley East, Bizana etc. See next page for detail list.	
Other Settlements	This category includes the rest of the towns and settlements which were not included in the above categories and incorporates: small towns, dense rural and spare settlements with the following characteristics. Population: Less than 20 000 people in town itself. Even less population hinterland being either dense/sparse rural hinterland. Excepted to house 20% of the country's 2050 population
E.G. Hogsback, St Helena Bay, Tabankulu, Thornhill, Hofmeyer, etc.	<i>See stepSA.co.za for a separate list for a full list of 346 towns and settlements.</i>

Rural Service Centres Table A3 cont.					
Aberdeen	Creighton	Hartswater	Laingsburg	Nongoma	Stanger
Acomhoek	Dalton	Harding	Lamberts Bay	Noupoot	Steinkopf
Adelaide	Darling	Heidelberg-WC	Leandra	Nqamakwe	Stella
Allanridge	De Rust	Heilbron	Lebowakgomo	Nqutu	Sterkspruit
Amersfoort	Dealesville	Hendrina	Libode	Ntambanana	Steynsburg
Amsterdam	Delareyville	Hennenman	Lillydale	Nwamitwa	Stutterheim
Ashton	Delmas	Hermanus	Lindley	Ogies	Swartruggens
Babanango	Dendron/Dikgale	Hertzogville	Lorraine	Olifantshoek	Tarkastad
Balfour	Dewetsdorp	Highflats	Lothair	Ottosdal	Taung
Barkley-West	Dimbaza	Himeville	Louwsburg	Ozwathini	Thabazimbi
Barkley East	Diphuti	Hlabisa	Mabeskraal	Parys	Theunissen
Barrydale	Dordrecht	Hluhluwe	Maclear	Paterson	Trompsburg
Bathhurst	Douglas	Hoedspruit	Madibogo	Paul-Pietersburg	Tshaulu
Belfast	Driekop	Hoopstad	Magatle	Peddie	Tshipise
Bergville	Driekoppies	Hopetown	Malmesbury	Penge	Tugela Ferry
Bethulie	Dullstroom	Idutywa	Mandini	Petrus Steyn	Tweespruit
Bizana	Dundee	Indwe	Marquard	Petrusburg	Umphumulo
Bloemhof	Edenville	Ingwavuma	Mbazwana	Petrusville	Umzinto
Blouberg	Ekuvukeni	Isithebe	Melmoth	Phondweni	Utrecht
Bochum	Elliotdale	Itsoseng	Memel	Piketberg	Vaalkop
Bogalatladi	Engcobo	Ixopo	Middelburg (E.C.)	Port Alfred	Vaalwater
Boshof	Engonyameni	Iziqolweni	Mkuze	Port Nolloth	Ventersdorp
Bothaville	Eshowe	Jamesstown	Modimolle	Port St Johns	Venterstad
Brandfort	Exelsior	Jane Furse	Mogwase	Postmasburg	Victoria West
Bredasdorp	Ficksburg	Jansenville	Molteno	Prieska	Viljoenskroon
Britstown	Flagstaff	Jeffreys Bay	Montagu	Prince Albert	Villiers
Bultfontein	Fort Beaufort	Joubertina	Moorivier	Raditshaba	Volksrust
Bulwer	Fouriesburg	Kakamas	Mookgophong	Rebone	Vrede
Burgersdorp	Frankfort	Kamaqhekeza	Morgenzon	Reddersburg	Vredefort
Cala	Franschhoek	Kathu	Morokweng	Reitz	Vredendal
Caledon	Ga-Kgapane	Kei Mouth	Moruleng	Richmond (KZN)	Warden
Carnarvon	Ga-Mafefe	Keiskammahoek	Mosate	Richmond (NC)	Warrenton
Carolina	Ga-Mmabasotho	Kestell	Motswedi	Riebeek West	Weenen
Cathcart	Ga Pila	Kirkwood	Mount Ayliff	Ritchie	Wepener
Centane	Ganyesa	Knysna	Mount Frere	Riversdale	Wesselsbron
Ceres	Gcwailemini	Koffiefontein	Mphakane	Riviersonderend	Willowmore
Ceza	Genadendal	Komatipoort	Mpheni	Robertson	Willowvale
Christiana	Grabouw	Koppies	Mtubatuba	Rockcliff	Winburg
Citrusdal	Greytown	Koster	Murraysburg	Roosenekal	Wittlesea
Clocolan	Griekwastad	Kranskop	Mutale	Rouxville	Wolmaransstad
Clydesdale	Grobiershoop	Kriel	Nababeep	Sabie	Wolseley
Coffee Bay	Ha-Mandiwana	Kwakhawula Ladismith	Ndumu	Schweizer-Reneke	Xawela
Cofimvaba	Hankey	Lady Frere	Ngodwana	Senekal	Xititlani
Colesberg	Hartbeesfontein (NW)	Lady Grey	Ngqeleni	Seymour	Zastron
Coligny	Hartbeesfontein-A (NW)	Ladybrand	Nhlazartshe	Smithfield	Zeerust T
	Hartebeesfontein (LIM)		Nkandla	Somerset East	

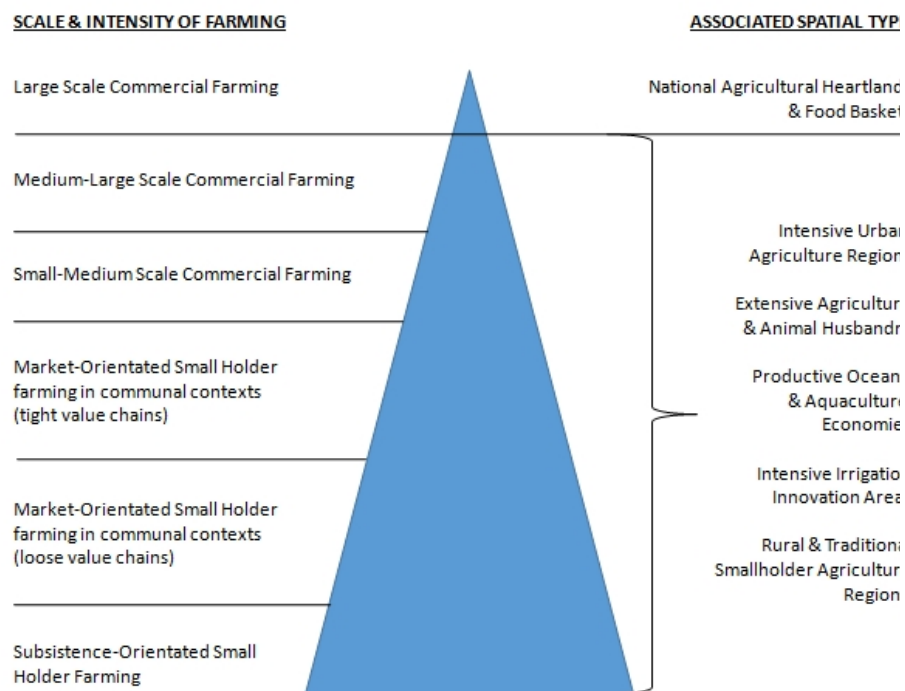
B4. Spatial Logic for Natural Resource Production and Selection Resource Production areas (As used in NSDF Sub-Frame 3)

B4.1 Spatial Logic

Central to the spatial logic of the National Resource Production Regions Sub-Frame 2 are the following:

- Maintenance of national agricultural heartlands in the interests of national food security;
 - The prioritisation of lower order agricultural development areas that exhibit greater cumulative levels of spatial advantage in terms of:
 - Agricultural productivity, crop suitability and viability;
 - Proximity to existing consumption and production chains;
 - Accessibility to higher order settlement typologies;
 - Accessibility to supporting agricultural infrastructure;
 - High population densities;
 - Effective agricultural development through agrarian and land reform will require recognition of and concerted efforts around the following:
 - Realigning and combining models of agrarian and land reform at a policy level;
 - Defining the role of land reform as an instrument to facilitate land access and security of tenure for agricultural development;
 - Optimising the role of stakeholder-based land reform;
 - Steering land reform policy towards boosting productive land use among the rural poor;
- Renewing the emphasis on 'transformation-from-below' for widespread grassroots impact on poverty and unemployment;
 - Facilitating the conversion of underutilized land in communal areas into small scale and/or commercial production;
 - Incorporating indigenous knowledge systems for agriculture in traditional areas in a way that factors traditional spatial relationships between settlement and agricultural practice;
 - Using a spatial targeting approach that factors in the contextual and comparative advantages of region and place;
 - Picking and supporting commercial agriculture sectors and regions that have the highest potential for growth and employment;
 - Focusing on strategic agricultural development areas where expanded irrigation is possible through improved water management and new water schemes;
 - Focusing support on agricultural development areas that have a comparative advantage in terms of proximity and access to production and consumption chain networks, e.g. Regional Development Anchors, Rural Service Centres; and
 - Providing strategic developmental support for potential new production and consumption chains in dense rural hinterlands.

Figure A8: Viable small scale farming and transformation from below as key input in shaping significant “agri-enterprise resource regions”



B4.2 Spatial Description of Production Heartland, Agri-Enterprise Regions and Eco-Resource Production Regions (as used in NSDF Sub-Frame 3)

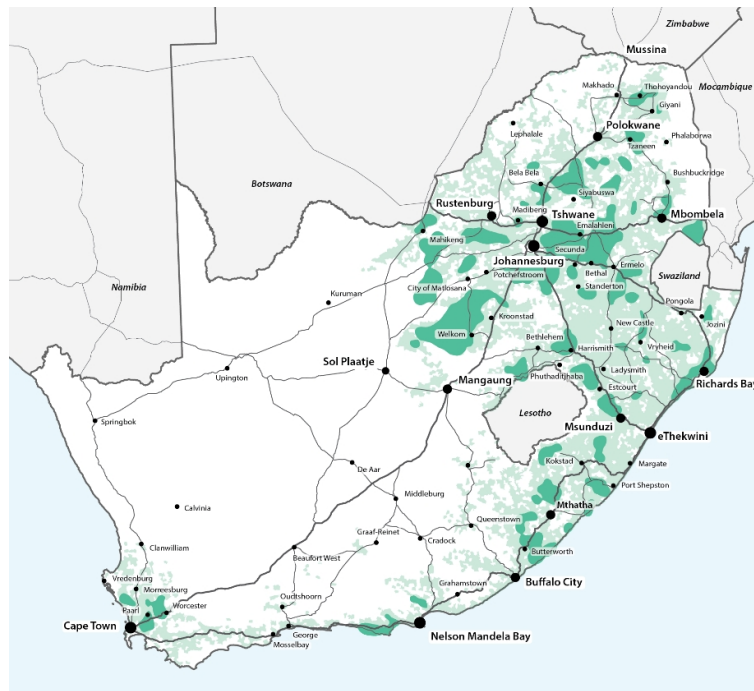
Resource Production Heartland Areas

The frame firstly refers to a central “Heartland” which includes all identified high value production and high potential agricultural land in the central part of the country (as used in Figures 9 and 14 of the main NSDF document and seen in Figure A8 and A9 below). This region is also characterised by high intensity mining production in selected areas.

The agricultural area is identified based on the following inputs: (1) a crop fields layer from the National Department of Agriculture, and (2) the Land Capability data (2018), provided by the National Department of Agriculture.

Crop fields with a land capability index value of 8 and more were selected to represent intermediate to high value agriculture land in the country. The National Department of Agriculture's process of updating this data layer, was used to guide the demarcation of the high value production areas (see **Figure A9**).

Figure A9: High Value Agriculture Areas in Central Heartland and Agri-Enterprise Regions (Land Capability Layers considered as input)



Source: Department of Agriculture, 2018.

Agri-Enterprise Resource Regions

These are identified areas of high and moderate land capability found in, dense settlement areas with water availability and that have high potential for agri-resource enterprise development (see **Figure A9**).

The selection of these areas once again considers (1) crop fields data from the National Department of Agriculture, and (2) Land Capability data (2018) provided by the National Department of Agriculture. Crop fields with a Land Capability Index Value of 8 and more were selected to represent intermediate to high value agriculture land in the country.

The identification of Agri-Enterprise Opportunity Areas shown in **Figure 18** of the **Draft NSDF 2019** considers a number of factors, such as current productive land, (currently cultivated), as well as market access to densely settled and new growth areas. These are considered as key indicators for identifying potential sites for small scale farming schemes close to markets and with good agricultural potential.

The selection of suitable sites for small scale farming thus considered the following criteria and factors:

- High potential agricultural land based on land capability;
- Agriculture infrastructure in existence or planned;
- High priority was given to planned Agri-hubs and agro-processing facilities, proximity to fresh produce markets and other processing facilities;
- Proximity to cities and identified growth regions were of utmost importance with respect to the sustainability of small scale farming. Factors considered amongst others proximity of social facilities such as schools, health facilities and social support services;
- Availability of sources of water, e.g. located downstream from existing dams to ensure good gravity feed;
- Areas where Land Reform and Agriculture Development (LRAD) programs cluster in proximity; and
- Only areas with slopes of less than 6% were selected.

Cognizance should be taken of the broad spectrum of agricultural activity in South Africa, and the need for differentiated responses at each level. Levels of agricultural activity in this regard are represented in the pyramid on the following pages. This spectrum of agricultural activity is categorised according to scale and intensity of production, ranging from large commercial producers at the peak to smaller scale producers towards the base.

Key to the approach considered is a small-scale farming model, indicative of a 'transformation-from-below' approach; one that is espoused by a variety of specialists and academics on the topic of agrarian reform in South Africa. A potentially renewed emphasis on transformation-from-below for agrarian reform will require a spatially differentiated and targeted approach that factors both contextual and comparative advantages of region and place (Figure A9). Viable small scale farming and transformation from below was thus a key input in shaping and identifying significant "agri-enterprise resource regions"

Spatial Description of Natural -Resource Production and Livelihood Regions

There are areas that need to play a key role in resource economies as well as management of national ecological infrastructure – with specific land-development and management implications.

These are areas that are nationally significant for ecological as well as "resource critical regions" for other purposes such as mining, agriculture, energy, settlements, heritage and tourism areas.

The areas are typically under stress from an ecological perspective. They are under pressure in terms of their resilience, but also in terms of the impact of development and risk to critical biodiversity areas (CBA1) and associated ecological service areas such as Strategic Water Source Areas (SWSA).

The Resource Production and Livelihood Regions are characterised by the prominence of Strategic Water Service Areas (SWAs), which contribute significantly to the overall water supply of the country – not merely to the region itself.

These areas are our water factories, supporting growth and development needs that are often a long distance from the SWAs themselves. Land uses that reduce stream flow or affect water quality (e.g. mining, sprawling settlements, plantations, overgrazing) should be avoided in SWAs; wetlands should be kept in good condition or rehabilitated, and invasive alien plants should be cleared.

The areas provide unique opportunities for agri-enterprises, eco-enterprises, and activities including small scale arming, wildlife ranching, marine economies, tourism and restoration related job creation opportunities.

B4.3 Significant plans, studies and sources that informed the spatial specific selection of frame elements

Guidance for national ecosystem and resource regions was provided by a wide range of policies and plans and spatially explicit national plans, initiatives and strategies, including:

- Department of Agriculture: Considering (1) crop fields from the National Department of Agriculture and (2) land capability 2018 from the National Department of Agriculture;
- Land Capability and Agriculture Production (StatsSA, Quantec, CSIR Mesozone, 2017) Department of Agriculture, RSA. 2014. Land capability (Dataset);
- Department: Planning, Monitoring and Evaluation. 2017. Research on the Limited Success of Entrepreneurial Activity by Locals in

- Townships and Rural Areas. Seven Dialogue Locations: Townships, Rural and Informal Settlement. Research Report conducted for Programme Four: National Planning Commission. October. 2017;
- Report of the High-Level Panel on the Assessment of Key Legislation and the Acceleration of Fundamental Change. (2017). Page 32;
 - Commission on the Restitution of Land Rights. (2014/15). Strategic Plan. CRLR;
 - DRDLR. (2011). Green Paper on Land Reform;
 - African National Congress. (2012). Land Reform Policy Discussion Document. Johannesburg: ANC;
 - Department of Energy (DOE). 2015. State of Renewable Energy in South Africa. [Online] available at: http://www.gov.za/sites/www.gov.za/files/State%20of%20Renewable%20Energy%20in%20South%20Africa_s.pdf;
 - Department of Environmental Affairs (DEA). n/d. About the green economy. [Online] available at: <https://www.environment.gov.za/projectsprogrammes/greenecconomy/about>;
 - Renewable Energy Independent Power Producer Procurement Programme (REIPPP) - <http://www.energyintelligence.co.za/reipp-pp-all-you-need-to-know/>;
 - Renewable Energy Development Zones (REDZ) - https://egis.environment.gov.za/renewable_energy;
 - Department of Water and Sanitation (DWS). (2017). Draft National Water Plan, DWS (2017: 40-41);
 - Transnet, 2016. National ports plan 2016;
 - TRANSNET. (2016). 30-year Long-term Planning Framework (Chapter 4 Port Development Plan). Johannesburg;
 - Transnet. 2015. Transnet Freight Rail: Road to Rail Strategy Progress: June 2015. Presentation to the Parliamentary Committee on Public Enterprises, Cape Town, South Africa;
 - Department of Transport (DoT). 2013. National Household Travel Survey datasets. Pretoria, South Africa;
 - Department of Water and Sanitation. National Water and Sanitation Master Plan. Draft 2.6. 2017;
 - Department of Transport (DoT). 2015. National Transport Master Plan 2050. Pretoria, South Africa;
 - Strategic National South African Infrastructure network and plans, including: IDZs, SEZs, Strategic freight, heavy haul and passenger railway networks, Road network and Ports;
 - Green energy suitability – 2017 EGIS data (<https://egis.environment.gov.za/>) available from the Department of Environmental Affairs. It was processed by CSIR to create areas of focus (2017);
 - Hydro Electricity, hydro-electricity, biomass electricity and co-generation electricity, and coal fired power generation sites, provided by ESKOM 2017;
 - Settlement data, provided by the Department of Water Affairs, 2017;
 - Electricity Grid and Coal Fired Power Stations, Eskom 2017;
 - Pipeline Networks, NATMAP;
 - Coal resource areas, Council for Geo-Science;
 - Renewable Energy Development Zones, as identified investment areas for renewable energy resource investment;
 - Ports Regulator of South Africa (PRSA). 2015. South African port capacity and utilisation report 2015/16. Accessed 06 July 2016 at www.portsregulator.org;
 - Department of Environmental Affairs. SEA: National corridors for Gas Pipeline corridor and Electricity Grid Infrastructure Extension, 2018;
 - KwaZulu-Natal, Provincial Growth & Development Plan, 2018;
 - KwaZulu-Natal, Provincial Growth & Development Strategy, 2016;
 - Eastern Cape, Provincial Spatial Development Plan, 2010;
 - Free State, Provincial Spatial Development Framework, 2014;
 - Gauteng, Provincial Spatial Development Framework, 2017;
 - Limpopo, Provincial Spatial Development Framework, 2016;

- Mpumalanga, Provincial Spatial Development Framework, 2013;
- Northern Cape, Provincial Spatial Development Framework, 2012;
- North West, Provincial Spatial Development Framework, 2016; and
- Western Cape, Provincial Spatial Development Framework, 2014.

The green energy infrastructure focus areas, for solar energy, wind energy and as identified in the renewable energy corridors, were considered as resource potential areas, as set out in the various Wind, Solar and Bio-Energy Atlases.

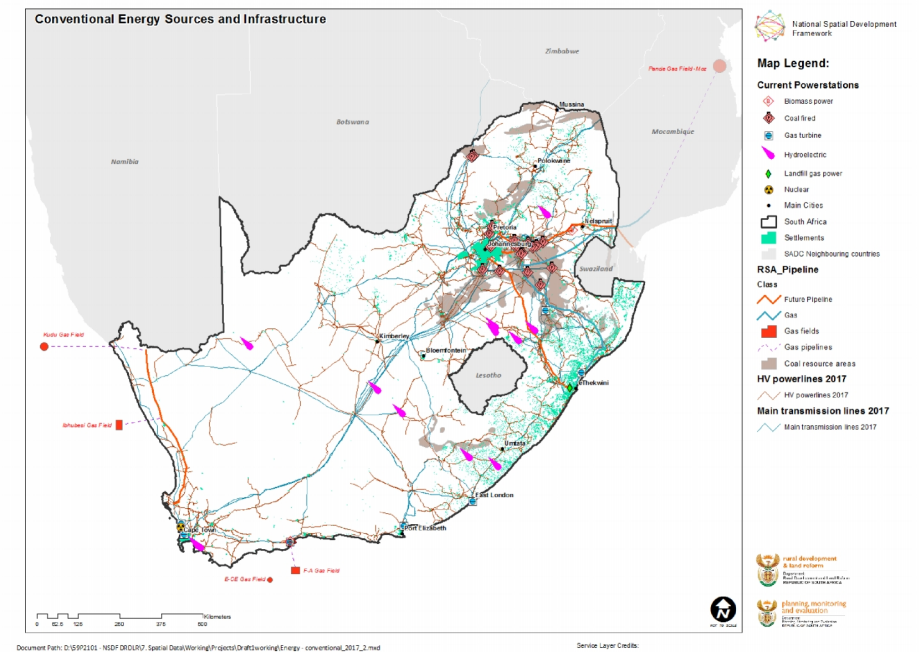
B5. Additional Spatial Descriptions for National Connectivity Network: NSDF Sub-Frame 4:

B5.1 Spatial illustration of national significant energy infrastructure as part of national connectivity network

Infrastructure network to support national energy flows from existing gas fields and coal resource areas, as well as an increased energy mix and existing national and regional networks, as well as current and future settlement patterns. The network infrastructure (see **Figure A10**) primarily consists of:

- Power generation and stations
- Coal fired power stations
- Hydroelectricity power-stations
- Gas turbines
- Nuclear power stations
- Bio-mass power
- Landfill gas power
- Transmission networks:
- Existing pipeline for crude oil and gas;
- Future pipeline for gas;
- Main transmission lines.

Figure A10: National Energy Infrastructure Network



Source: ESKOM, 2017.

B5.2 Significant plans, studies and sources that informed the spatial specific selection of frame elements

This is a wide and varied set, including:

- TRANSNET. (2016). 30-year Long-term Planning Framework (Chapter 4 Port Development Plan). Johannesburg;
- Transnet. 2015. Transnet Freight Rail: Road to Rail Strategy Progress: June 2015. Presentation to the Parliamentary Committee on Public Enterprises, Cape Town, South Africa;
- Department of Transport (DoT). 2013. National Household Travel Survey datasets. Pretoria, South Africa;
- Department of Water and Sanitation. National Water and Sanitation Master Plan. Draft 2.6. 2017;
- The NDP. 2011;
- Transnet, 2016. National ports plan 2016;
- Damon, M. et al. 2014. Spatial Perspective in Support of The New Growth Path. Unpublished Report prepared for Economic Development Department;
- KwaZulu-Natal, Provincial Growth & Development Plan, 2018;
- KwaZulu-Natal, Provincial Growth & Development Strategy, 2016;
- Eastern Cape, Provincial Spatial Development Plan, 2010;
- Free State, Provincial Spatial Development Framework, 2014;
- Gauteng, Provincial Spatial Development Framework, 2017;
- Limpopo, Provincial Spatial Development Framework, 2016;
- Mpumalanga, Provincial Spatial Development Framework, 2013;
- Northern Cape, Provincial Spatial Development Framework, 2012;
- North West, Provincial Spatial Development Framework, 2016;
- Western Cape, Provincial Spatial Development Framework, 2014;
- A Selection of **priority corridors, harbours, ports and trade posts** as well as government investment areas (such as SEZs) and inter-regional corridors and networks as outlined in:
 - Transnet, 2016. National ports plan 2016;
 - TRANSNET. (2016). 30-year Long-term Planning Framework (Chapter 4 Port Development Plan). Johannesburg;
 - TRANSNET Group; Department of Transport. 2015. National Transportation Plan. Department of Transport;
 - Amos, S. (2010). The role of South Africa in SADC regional integration: the making or braking of the organisation. *Journal of International Commercial Law and Technology*, 124-131.
 - Brand, A. 2017. The use of corridor development as a strategic and supporting instrument towards the development of national space economies. Potchefstroom: NWU (Unpublished Thesis – PhD); and
 - Brand, A. and Drewes, JE. 2018. Spatial Corridor Model (SCM) – structuring economic spaces in South Africa.

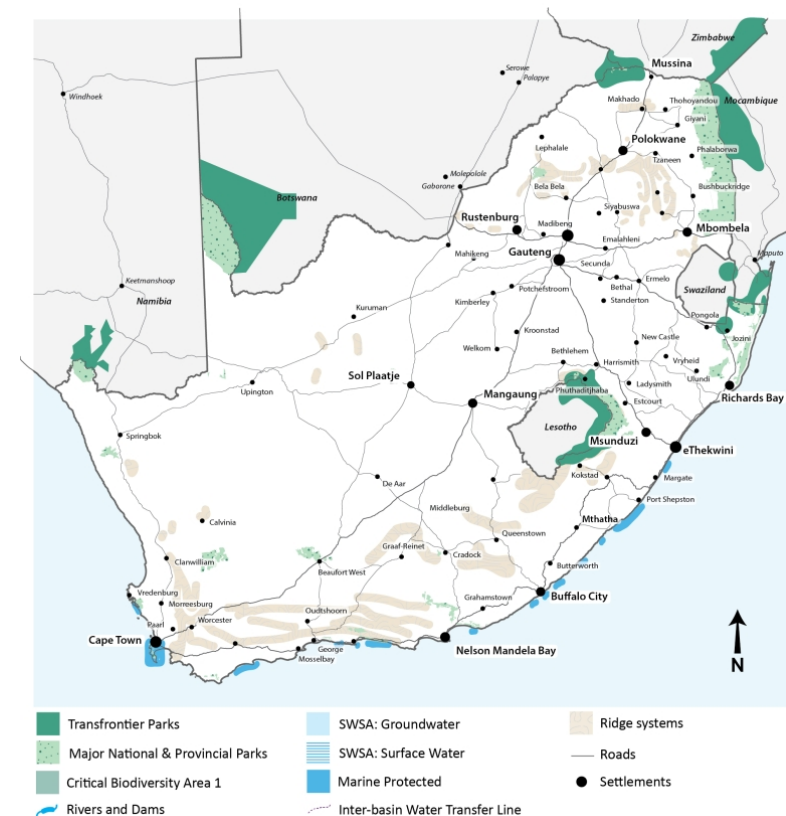
B6. Additional Spatial Descriptions for National Ecological Infrastructure Network and Natural Resource Base: NSDF Sub-Frame 5:

B6.1 Spatial Description of National Protect Areas

National Protected Areas as base for the ecological infrastructure includes:

- Official National and major Provincial Protected areas – Terrestrial and Marine protected areas;
- Transfrontier Parks;
- Biosphere reserves; and
- National Fresh Water Protected Areas (Water bodies).

Figure A11: Major National Protected Areas

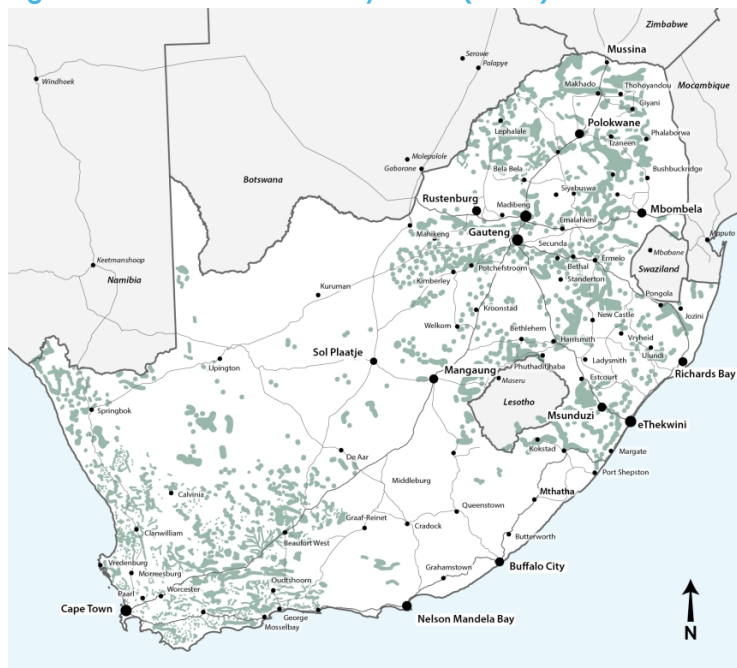


Source: SANBI, 2018.

B6.2 Spatial Description of National Protect Areas

Management and productive use of Critical Biodiversity Areas (CBAs) (Figure A12) and Strategic Water Source (SWS) areas (Figure 12) and National Fresh Water Bodies (Figure 13) have been identified as Priority National Ecological Infrastructure Regions that are of national importance and development.

Figure A12: Critical Biodiversity Areas (CBA1)



Source: SANBI 2018.

Figure A13: Strategic Water Source Areas, National Fresh Water Bodies



Source: SANBI 2018.

The Strategic Water Source Areas (SWSAs) contribute significantly to the overall water supply of the country. They are identified in Atlas of Freshwater Ecosystem Priority Areas in South Africa (Nel et al, 2011). The World Wild Life Fund's 2015 report on SWSAs provide detail descriptions of individual SWSAs.

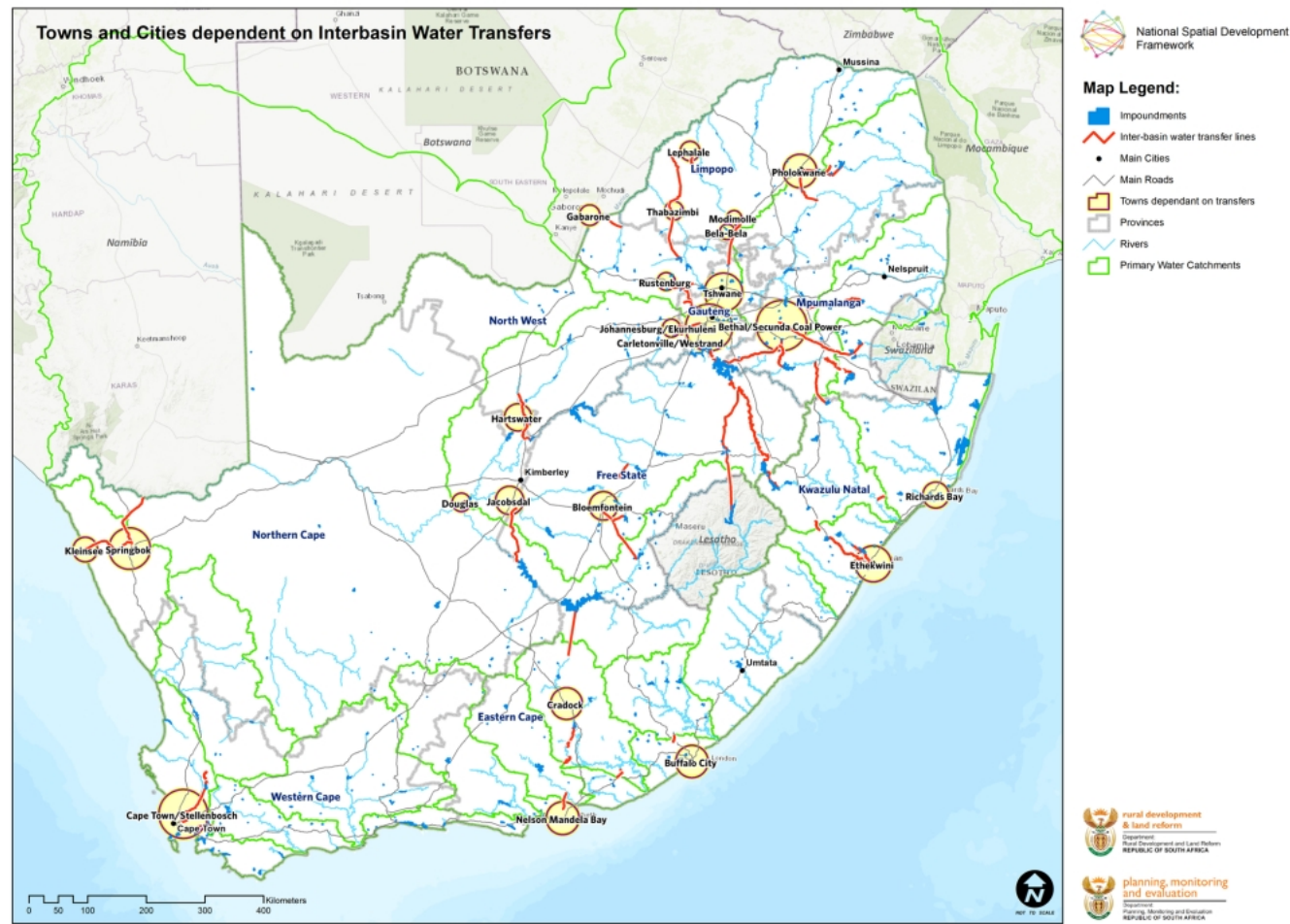
In the Southern and West Coast region and the Central heartland areas, these areas largely coincide with high productive agricultural, urban growth, mining activities and critical bio-diversity areas. Along the eastern coast and inland areas and in the north of the country, strategic water source areas have to be managed within productive agriculture, densely settled and also traditional settlement areas. Management of these areas needs to consider restoration, green enterprise and service delivery, tourism and game farming activities. Strategic Groundwater Areas in the central and arid regions are critical for many towns that are dependent on scarce groundwater sources.

The system of National Fresh Water Bodies and management guidelines is set out in the Implementation manual for freshwater ecosystem priority areas (see Driver A., Nel J.L., Snaddon K., Murray K., Roux D.J., Hill L., Swartz E.R., Manuel J. and Funke N. (2011) Report No. 1801/1/11, Water Research Commission, Pretoria).

B6.3 Spatial Illustration of Significant Inter-Basin Water Transfer Lines

Nationally significant inter-basin water transfer lines and dependent cities were identified and indicated as can be seen in **Figure A13**.

Figure A13. Significant Inter-Basin Water Transfer Lines as used in Figure 42 in main document



Source: Transfers captured through spatial analysis and enquiry Mandala GIS, 2018.

B6.4 Additional Spatial Description of National Resource Risk Areas (NSDF Sub-Frame 5)

National resource risk areas (see **Figure A14**) are both (1) nationally significant and (2) under stress from an ecological perspective, but are also “resource critical regions” for other sectors such as mining, energy, agriculture and human settlement. These areas are under pressure in terms of their resilience, but also in terms of the impact of development and risk to **Critical Biodiversity Areas** (CBA1) and associates ecological service areas as well as high quality water production.

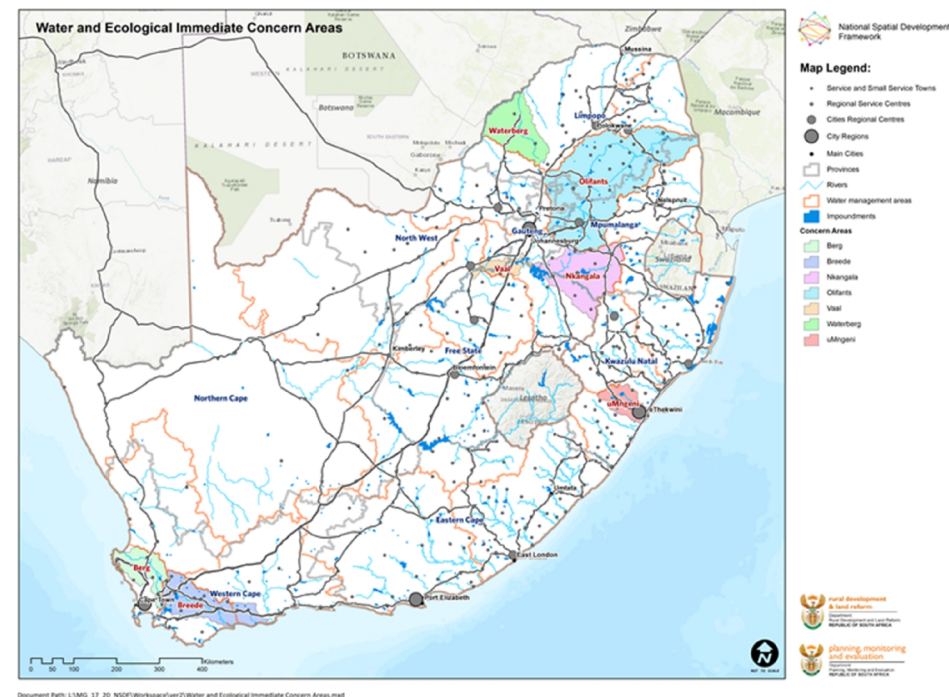
Priority Focus Areas: Stressed Catchments with densely populated Strategic Water Source Areas

Strategic Focus Areas: The risks associated with interregional interdependencies are clearly evident in significant national scale ecological core “competition areas”, which in general show high levels of pollution. The critical areas for short term intervention in this regard are in the:

- Upper Vaal region (Mpumalanga) (SWSA, coal mining, high potential agricultural land);
- Lower Vaal (Gauteng, Free State) (SWSA, water supply for Gauteng, coal mining, industry, high potential agricultural land and expanding settlements);
- Greater uMngeni region (KZN) (water supply for eThekweni, intensive agriculture, expanding settlements);
- Waterberg region (Limpopo) (mining, water and future expansion driven as national priority);

- Olifants Water Management Area (Mpumalanga and Limpopo) (big irrigation scheme, major water quality issues, mining pressure); and
- Berg and Breede River Catchments (WC) (high value agriculture and settlements but with low absorptive capacity for pollution).

Figure A14 Stressed catchments within areas of competing land-use



Source: SANBI-2018. Stressed Catchments of concern due to competition for use.

The Mpumalanga Coal Mining and Coal-Fired Power Plant region will be under increased pressure for environmental considerations, possible decline in demand in coal and large scale employment under threat. Coal Fired Power Station Dependency on Water Transfers. The Lower Vaal Catchment is highly polluted and both the Upper and Lower catchments are key water providers to the Gauteng Metropolitan region which is the area of highest economic production in the country. These areas require (1) enhanced management of water over use and distribution as well as radical action and clean up with regard to pollution management, (2) regional economic diversification and transition, and (3) shared forecasting, phasing, pro-active and regional scale economic transition planning, scenario development and enterprise development between multiple role players and institutions.

B6.5 Significant plans, studies and sources that informed the spatial specific selection of frame elements

- Local Action for Biodiversity: Wetlands South Africa – <http://biodiversityadvisor.sanbi.org/wp-content/uploads/2016/07/LAB-Wetlands-SA-brochure.pdf>;
- Important Bird Areas – <http://www.birdlife.org.za/conservation/important-bird-areas/iba-map>;
- Atlas of Freshwater Ecosystem Priority Areas in South Africa (Nel et al, 2011);
- NDP. Chapter 6. Page 196;
- Department of Water and Sanitation (DWS). (2017). Draft National Water Plan, DWS (2017: 40-41);
- Implementation manual for freshwater ecosystem priority areas. Driver A., Nel J.L., Snaddon K., Murray K., Roux D.J., Hill L.,

- Swartz ER., Manuel J. and Funke N. (2011) Report No. 1801/1/11, Water Research Commission, Pretoria;
- Transnet, 2016. National ports plan 2016;
- TRANSNET. (2016). 30-year Long-term Planning Framework (Chapter 4 Port Development Plan). Johannesburg;
- Transnet. 2015. Transnet Freight Rail: Road to Rail Strategy Progress: June 2015. Presentation to the Parliamentary Committee on Public Enterprises, Cape Town, South Africa;
- Department of Transport (DoT). 2013. National Household Travel Survey datasets. Pretoria, South Africa;
- Department of Water and Sanitation. National Water and Sanitation Master Plan. Draft 2.6. 2017;
- Greenberg. 2013. Institute for Poverty, Land and Agrarian Strategies, UWC. Page 18;
- Greenberg. 2013. Institute for Poverty, Land and Agrarian Strategies, UWC. Page 19;
- Cousins (2015), Aliber et al (2017);
- Atlas of Freshwater Ecosystem Priority Areas National Biodiversity Economy Strategy (DEA);
- EWT report (Taylor et al 2016) on wildlife ranching, which includes an assessment of employment in the sector (65 000 jobs in 2014 – see below);
- WWF's 2015 report on SWSAs – for descriptions of individual SWSAs;
- SANBI, 2016: Framework for Investment in Ecological Infrastructure);
- Driver, A. Ecological Infrastructure FAQs. Unpublished Presentation. 2017;
- KwaZulu-Natal, Provincial Growth & Development Plan, 2018;
- KwaZulu-Natal, Provincial Growth & Development Strategy, 2016;
- Eastern Cape, Provincial Spatial Development Plan, 2010;
- Free State, Provincial Spatial Development Framework, 2014;
- Gauteng, Provincial Spatial Development Framework, 2017;
- Limpopo, Provincial Spatial Development Framework, 2016;

- Mpumalanga, Provincial Spatial Development Framework, 2013;
- Northern Cape, Provincial Spatial Development Framework, 2012;
- North West, Provincial Spatial Development Framework, 2016;
- Western Cape, Provincial Spatial Development Framework, 2014;
- and
- Significant programmes, principles, policies or projects relating to environment:
 - Grasslands Programme (SANBI):
<https://www.sanbi.org/biodiversity-science/science-policyaction/mainstreaming-biodiversity/grasslands-programme;>
 - Freshwater Programme (SANBI):
<https://www.sanbi.org/biodiversity-science/science-policyaction/mainstreaming-biodiversity/freshwater-programme;>
 - Succulent Karoo Programme (SANBI):
<https://www.sanbi.org/biodiversity-science/science-policyaction/mainstreaming-biodiversity/succulent-karoo-programme;>
 - Ecological Infrastructure (SANBI):
<https://www.sanbi.org/biodiversity-science/science-policyaction/mainstreaming-biodiversity/ecological-infrastructure>; and
 - CAPE Programme (SANBI) conservation of the Cape Floristic Region: <https://www.sanbi.org/biodiversity-science/science-policyaction/mainstreaming-biodiversity/fynbos-programme>.