REVIEW OF THE CITY OF EKURHULENI BIOREGIONAL PLAN 2020

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LIST OF ACCRONYMS

CBA(s)	Critical Biodiversity Area(s)
CBD	The Convention for Biological Diversity
CELUS	City of Ekurhuleni Land Use Scheme
CoE	City of Ekurhuleni Metropolitan Municipality
ESA(s)	Ecological Support Area(s)
GDARD	Gauteng Department of Agriculture and Rural Development
GIS	Geographical Information System
GPAES	Gauteng Protected Area Expansion Strategy
ha	Hectares
IDP	Integrated Development Plan
MED	Ministerial Executive Committee
NEMA	National Environmental Management Act
NEMBA	National Environmental Management Biodiversity Act
NEMPAA	National Environmental Management Protected Areas Act
PA	Protected Area
RSA	Republic of South Africa
SANBI	South African National Biodiversity Institute
SDF	Spatial Development Framework
SPLUMA	Spatial Planning and Land Use Management Act
UNFCC	United National Framework Convention on Climate Change
WULA	Water Use Licence Application

DEFINITIONS

Source: SANBI (2016) Lexicon of Biodiversity Planning in South Africa. Please refer to the lexicon for definition of other commonly used terms.

Biodiversity	The diversity of genes, species and ecosystems on Earth, and the ecological and evolutionary processes that maintain this diversity
Biodiversity pattern and ecological processes	The combination of the compositional, structural and functional aspects of biodiversity, at the genetic, species or ecosystem level.
Biodiversity priority areas	Natural or semi-natural areas in the landscape that are important for conserving a representative sample of ecosystems and species, for maintaining ecological processes, or for the provision of ecosystem services.
Bioregional plan	A map of Critical Biodiversity Areas and Ecological Support Areas accompanied by contextual information, land- and resource-use guidelines and supporting GIS data, which has been published by the Minister or MEC in terms of the Biodiversity Act. The map must be produced using the principles and methods of systematic biodiversity planning.
Critical Biodiversity Area (CBA)	An area that must be maintained in a good ecological condition (natural or near-natural state) in order to meet biodiversity targets. CBAs collectively meet biodiversity targets for all ecosystem types as well as for species and ecological processes that depend on natural or near-natural habitat, that have not already been met in the protected area network.
Ecological infrastructure	Naturally functioning ecosystems that deliver valuable services to people. It is the nature-based equivalent of built infrastructure, and is just as important for providing services and underpinning economic development.

Ecological processes	The functions and processes that operate to maintain and generate biodiversity. In order to include ecological processes in a biodiversity plan, their spatial components need to be identified and mapped.
Ecological Support Area (ESA)	An area that must be maintained in at least an ecologically functional (moderately modified/semi-natural) state in order to support the ecological functioning of a CBA or protected area, or to generate or deliver ecosystem services, or to meet remaining biodiversity targets when it is not necessary or not possible to meet them in natural or near-natural areas.
Ecosystem	An assemblage of living organisms, the interactions between them and their physical environment.
Natural or near-natural	Good ecological condition: An ecological condition class in which composition, structure and function are still intact or largely intact.
Irreversibly modified	Poor ecological condition: An ecological condition category in which the ecosystem has been modified completely, with an almost complete loss of composition and structure. All or most ecosystem function has been destroyed and the changes are irreversible.
Semi-natural	Moderately modified (Fair ecological condition): An ecological condition class in which ecological function is predominantly unchanged even though composition and structure have been compromised. In the CoE this refers to the historically cultivated secondary grasslands.
Severely modified	Poor ecological condition: An ecological condition category in which loss of composition, structure and ecological function is extensive.
No Natural Remaining (NNR)	An area in a non-natural state that is not required to meet biodiversity targets for ecosystem types, species or ecological processes.
Other Natural Area (ONA)	An area in a natural, near-natural or semi-natural state that is not required to meet biodiversity targets for ecosystem types, species or ecological processes.

1 INTRODUCTION TO THE CITY OF EKURHULENI BIOREGIONAL PLAN 2020

1.1 DESCRIPTION OF THE BIOREGION: THE CITY OF EKURHULENI METROPOLITAN MUNICIPALITY

The City of Ekurhuleni Metropolitan Municipality (CoE) is located on the East Rand of Gauteng Province, covering an area of approximately 1975km^2 (Figure 1.1). The neighbouring municipalities include Gauteng Metropolitan Municipalities of Tshwane and Johannesburg in the north and west, respectively, and Sedibeng District Municipality in the south and east. Victor Khanye Local Municipality of the Nkangala District Municipality of Mpumalanga Province shares a short boundary in the east.

While largely modified by urban, mining and agricultural development, the CoE still supports threatened biodiversity and important ecological infrastructure within the Grassland biome, offering a range of ecosystem services. Due to the significant extent of modification of the natural landscape, most remaining ecosystems in the CoE are threatened.

Development in the CoE has, and will, continue to expand. It is against this backdrop that planning for biodiversity pattern and ecological processes in the CoE has been undertaken. The revised CoE Bioregional Plan (2020) will replace the existing 2015 CoE Bioregional Plan.

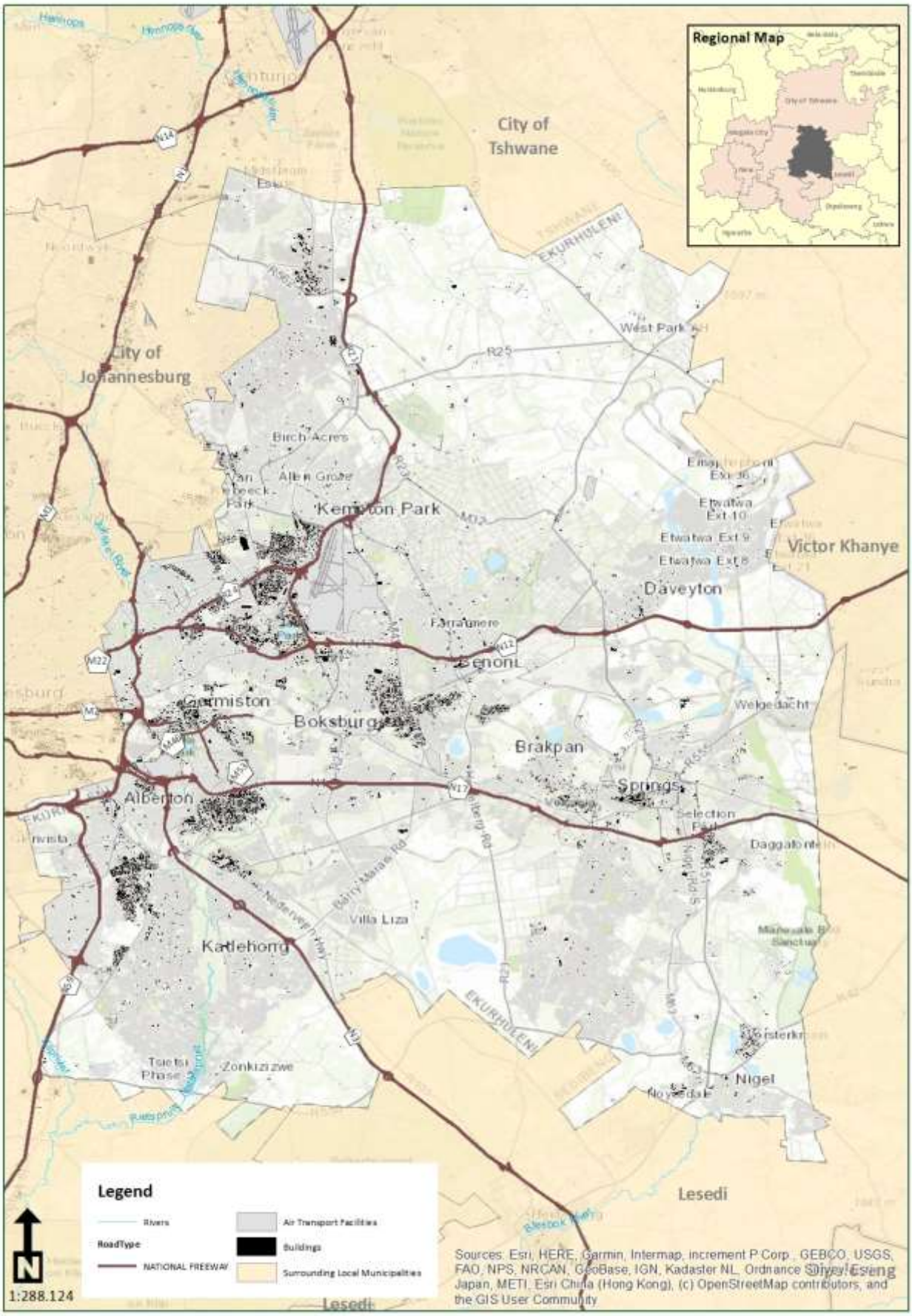

Figure 1.1 Locality of the City of Ekurhuleni Metropolitan Municipality

1.2 BACKGROUND AND APPROACH TO BIOREGIONAL PLANNING IN SOUTH AFRICA

1.2.1 What is a Bioregional Plan?

A Bioregional Plan is a tool that guides and informs **land use and resource-use planning and decision-making** by a full range of sectors whose policies, programmes and decisions impact on biodiversity, to preserve long-term functioning and health of National or regional priority areas known as Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs). It is therefore the official reference for biodiversity priorities that need to be considered in all land-use planning and decision-making processes.

A Bioregional Plan is developed by applying systematic biodiversity planning methods. The process is clearly outlined in the national guidelines for bioregional planning ("NEMBA Guideline regarding the determination of bioregions and the preparation of and publication of Bioregional Plans" No 291 of 2009) and the "Technical Guidelines for CBA maps" (SANBI, 2017).

In summary, a Bioregional Plan produces a map of important biodiversity areas, outside of the Protected Area network, that requires management intervention through land use guidelines, to retain biodiversity pattern and ecological processes. The types of information used to inform this map may include distribution mapping of biodiversity features, mapping land cover and land use and considering the Protected Area network. The process followed to "build" the revised CBA map is explained in more detail in Chapter 5. The components of a Bioregional Plan include the following:

1. Map of CBAs and ESAs, also known as a CBA map, for both terrestrial and freshwater ecosystems
2. Bioregional Plan handbook which includes a biodiversity profile and land use guidelines
3. GIS files and metadata
4. Technical report describing the analyses and processes undertaken to develop the CBA map.

1.3 PURPOSE, AIMS AND OBJECTIVES OF A BIOREGIONAL PLAN

It is important to understand the Purpose and Objective of a Bioregional Plan to correctly interpret, apply and implement the Plan.

1.3.1 Purpose of Bioregional Plans

A Bioregional Plan is not in itself a multi-sectoral tool, but it is **the biodiversity sectors input that should be integrated into other planning processes**.

The primary intention of NEMBA Chapter 3 is to facilitate conservation and management of biodiversity in "**biodiversity priority areas**" or **priority areas for conservation,** outside of the Protected Area network, at a landscape level. Therefore, the **purpose of the Bioregional Plan is to provide a map of the priority biodiversity areas** and develop associated land use management guidelines to inform:

1. Cross-sectoral spatial planning at all levels of government, relevant to sectors whose policies, actions and decisions impact on biodiversity
2. Environmental assessment and authorisations
3. Natural resource management and protected area expansion programmes.

Note: A Bioregional Plan is produced to meet a specific objective, and is designed for a particular set of uses and users. Other management tools designed to achieve biodiversity conservation objectives include:

- Gauteng C Plan 3.3

- Gauteng Protected Area Expansion Strategy
- Biodiversity Management Plans (for ecosystems or species)
- Strategic Environmental Assessments
- Environmental Management Frameworks.

1.3.2 Aim and objectives of a Bioregional Plan

The aim of a Bioregional Plan is, simply put, to reduce further loss or degradation of biodiversity priority areas and ecological support areas.

The objectives of a Bioregional Plan are the following:

1. Identify the minimum spatial requirements needed to maintain a living landscape that continues to support all aspects of biodiversity and retain/maintain essential ecological infrastructure. This is achieved through the selection of areas, based on achieving targets which represent important biodiversity patterns AND ecological processes
2. Serve as the primary source of biodiversity information for land use planning and decision-making
3. Inform conservation and restoration action in key biodiversity areas.

1.4 REVISION OF THE COE REGIONAL PLAN

The first CoE Bioregional Plan was gazetted in 2015. In terms of NEMBA Section 42(1) a Bioregional Plan must be reviewed every 5 years. The reason why the CoE and other urbanised metros specifically require this, is that development is occurring at such a rapid rate that updated information, particularly associated with changes in land cover and land use, need to be captured and assessed, to review interventions that ensure the persistence of biodiversity pattern and ecological processes in the CoE.

It must also be noted that since the CoE Bioregional Plan (2015) was gazetted, a technical guideline was published by SANBI. This provides a more detailed framework for the development of CBA maps and land use guidelines. The 2015 Bioregional plan has been revised to meet these technical requirements.

Once gazetted, the revised CoE Bioregional Plan (2020) will replace the previous published 2015 version. The consequence of not implementing the Bioregional Plan effectively is the continued loss of critical habitat. This critical habitat is not only essential to account for CoE's share of national targets, but also to sustain biodiversity and ecosystems which, in turn, supports its citizens.

1.4.1 CoE Bioregional Plan and the Gauteng C-Plan

The original CoE Bioregional Plan (2015) was based on a systematic biodiversity plan conducted for the Gauteng Province in 2011 (C-Plan 3.3). This ensured that biodiversity targets for the Province were spatially efficient and proportionate, i.e. without burdening any one municipality with disproportionate targets. The revised CoE Bioregional Plan needs to ensure that the CoE accounts for its share of the Provincial targets that can be achieved in natural areas and that it is aligned to the Provincial Biodiversity Spatial Framework, which has been further developed through engagement with GDARD and neighbouring Provinces.

1.4.2 Approach to revision

In South Africa, biodiversity planning typically includes a target-based approach, using either C-Plan or MARXAN software, to select sites that will ensure that the map of Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) represent important biodiversity features. Biodiversity targets for all

ecosystem types in the CoE have been set at 24% (National Spatial Biodiversity Assessment, 2004). The area remaining in a natural or near-natural state in the CoE is approximately 14%. Therefore, the available land for achieving the 24% target for some ecosystem types is not available (i.e. targets are not achieved in the CoE), or are only just met (See CoE Bioregional Plan Technical Report, 2021 for further details). The biodiversity planning process has therefore identified all remaining natural or near-natural sites in the CoE as irreplaceable.

In addition to achieving biodiversity targets, two of considerations need to be noted:

1. Urban development is expanding (and will continue to do so) and encroaching on the surrounding natural landscapes;
2. Natural areas are not all alike. Some areas are natural or near-natural, while others were historically cultivated and are considered semi-natural. Cultivated grasslands support lower levels of biodiversity. However, they are important for maintaining some ecological processes such as foraging areas for bird species, buffering of natural areas and land connectivity (ecological corridors). While some semi-natural areas are important, natural or near-natural uncultivated grasslands are a much higher priority for conservation.

In view of the above, significant emphasis has been placed on the accuracy of the land cover/land use map and establishing ecological condition.

A network of ecological corridors has been designed by reviewing Bioregional and Biodiversity Sector Plans of neighbouring municipalities. These plans have also been used for edge-matching, to ensure that CBAs and ESAs in the CoE Bioregional Plan are aligned to those in neighbouring municipalities and provinces. A detailed account of how the CBA map was developed is available in a CoE Bioregional Plan Technical Report (2021) published as part of this project. The technical report provides the method and techniques employed to generate the map.

The land use guidelines have been developed using the CoE Land Use Scheme (CELUS, 2020) land use categories (Chapter 6), which have been grouped or disaggregated, depending on their anticipated impact on the surrounding natural environment. This will facilitate the integration of the CBA map into the CoE Spatial Development Framework.

Management actions and interventions emanating from the plan should be incorporated into future Integrated Development Plans for CoE. This may include projects for securing biodiversity offset areas, ecosystem restoration projects, environmental education and data gathering, all of which need to be resourced.

Stakeholder engagement is an important component of a Bioregional Plan. Stakeholders from a wide range of sectors and backgrounds have been notified, including relevant CoE departments and Council. A workshop was conducted in March 2020 to gather information and comment that would inform the development of the CBA map and associated land use guidelines. All stakeholders have had an opportunity to review and comment on the Draft CoE Bioregional Plan 2020.

The following steps of approval have been undertaken as part of the adoption process:

1. Through review and comment, gain approval from GDARD and SANBI
2. Submit to Council for approval
3. Submission to MEC/Minister for gazetting.

1.5 LEGAL AND POLICY FRAMEWORK

1.5.1 International Conventions

South Africa is party to a number of international conventions that deal with biodiversity. The CoE Bioregional Plan recognises, and is consistent with, the commitments of these agreements which include:

- Convention on Biological Diversity (1993)
- Convention of Trade and in Endangered Species of Wild Fauna and Flora (CITES 1973)
- Convention on Wetlands (known as the Ramsar Convention, 1971)
- United National Framework Convention on Climate Change (UNFCCC, 1994)
- Convention on the Conservation of Migratory Species of Wild Animals (1983)

South Africa is a ratified signatory of, and therefore party to, The Convention for Biological Diversity (CBD). As such, the country has contracting and reporting obligations. These include developing and implementing the National Biodiversity Strategy and Action Plan (2015) and reporting on the Aichi Biodiversity Targets (CBD, Strategic Plan 2011-2020). The National Biodiversity Strategy and Action Plan outlines a number of Strategic Objectives and Outcomes. The CoE Bioregional Plan fulfils Strategic Objective Outcome 6.3: "*Geographic priority areas for the management, conservation and restoration of biodiversity assets and ecological infrastructure are identified base on best available science*."

The Ramsar Convention is also particularly relevant to the CoE. The artificial Blesbokspruit wetland system was designated as a Ramsar site in 1986 and was added to the Montreux Record In 1996.

1.5.2 National legislation

The **Constitution of the Republic of South Africa** (The Constitution), in the broadest terms, speaks to environmental health and a requirement for sustainable development in terms of the Bill of Rights (Section 24): "*Everyone has the right (a) to an environment that is not harmful to their health or well-being and (b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that (i) prevent pollution and ecological degradation, (ii) promote conservation; and (iii) secure ecological sustainable development and use of natural resources while promoting justifiable economic and social development*." This gives the necessary directive to develop appropriate environmental and biodiversity planning tools and implement appropriate legislation, management plans and programmes.

The **National Environmental Management Act** (NEMA) No. 107 of 1998, (as amended) sets the stage for environmental law in South Africa. In addition to the NEMA principals, which form the foundation for environmental management in South Africa, Chapter 5 Section 24 makes provisions that are relevant to the CoE Bioregional Plan:

- Firstly, in terms of Section 24(2)(a) & (b) of NEMA, the Minister, or an MEC with the concurrence of the Minister, may identify activities which may not commence without environmental authorisation from the competent authority. These activities have been published and are enforced through the **National Environmental Management: Environmental Impact Assessment Regulations (2014, as amended)**. The CBA map of the CoE Bioregional Plan is a geographical trigger for activities in Listing Notice 3
- Secondly, Section 24(3) states that "the Minister, or an MEC with the concurrence of the Minister, may: "*compile information and maps that specify the attributes of the environment in particular geographical areas, including sensitivity, extent, interrelationship and significance of such attributes which must be taken into account by every competent authority*".

The **National Environmental Management Biodiversity Act** (No. 10 of 2004, as amended) (NEMBA) gives the legal framework for integrated and co-ordinated management, conservation and sustainable use of biodiversity. Through NEMBA a number of planning and management tools have been introduced, including: Threatened or Protected Species Regulations, Listing of Threatened Ecosystems (Section 52), Alien and Invasive Species Regulations, and Bioregional Planning Guidelines. Chapter 3, Section 40-42 of NEMBA outlines the procedure for the development and publishing of Bioregions and Bioregional Plans. Bioregions are areas that include whole or several nested ecosystems. A bioregion is characterised by its landforms, vegetation cover, human culture and settlement pattern. Bioregional plans contain measures for the effective management of biodiversity and the components of biodiversity in the region and must be incorporated into municipal Integrated Development Plans and Spatial Development Plans. To date, the CoE Bioregional Plan (2015) has been considered in these plans.

The **National Environmental Management Protected Areas Act** (No. 57 of 2003, as amended) (NEMPAA) governs the network of proclaimed protected areas which formally contribute towards the conservation of biodiversity and natural landscape features. NEMPAA provides the framework for the management of all formal protected areas proclaimed under the Act by: setting roles and responsibilities (e.g. management authorities) and determining reporting requirements (management plans).

1.5.3 Gauteng Environmental Management Framework

The Gauteng Environmental Management Framework (GEMF, 2014) is a valuable tool used to address and manage current environmental impacts and inform future development in terms of environmental sensitivity and the desired state. The key output of the GEMF (2014) is a zoning map which maps 5 zones representing current and future land-use needs and provides recommendations for appropriate land uses within each zone. The intention for Zone 1 is to manage urban development and promote densification. Zone 2 (which are nested within Zone 1) represents areas of high environmental sensitivity which need to be managed for conservation. Zone 3 maps environmentally sensitive areas outside the urban context. Zone 4 and Zone 5 aim to managed agriculture and rural development, and Industrial and commercial development, respectively.

1.5.4 Biodiversity offset guidelines

The Draft National Biodiversity Offset Policy (2017) provides a framework for the consideration, development and implementation of biodiversity offsets. In addition, a best practice guideline for wetland offsets was published by the Water Research Commission (Macfarlane *et al*., 2016). These guidelines must be used to inform the consideration, development and implementation of biodiversity offsets where they are appropriate and the need has been identified.

1.5.5 Additional regulating legislation

Additional legislation, which regulates land uses in the same landscape as the CoE Bioregional Plan, and which will need to be read in conjunction with NEM laws (above), is provided below. This is not an exhaustive list, but is considered to be the most relevant.

Year	Law/Act
1970	Subdivision of Agricultural Land Act (No. 70 of 1970)
1983	Gauteng Nature Conservation Ordinance (No. 12 of 1983)
1983	Conservation of Agricultural Resources Act (No. 43 of 1983)
1998	National Forest Act (No. 84 of 1998)

Year	Law/Act
1998	National Water Act (No.36 of 1998)
1999	National Heritage Resources Act (No 25 of 1999)
2002	Mineral and Petroleum Resources Development Act (No. 28 of 2002)
2004	National Environmental Management: Air Quality Act (No. 39 of 2004)
2008	National Environmental Management: Waste Act (No. 59 of 2008, as amended)
2013	Spatial Planning and Land Use Management Act (No 16 of 2013)

1.6 INTENDED USES AND USERS

1.6.1 By whom, and how, should the CoE Bioregional Plan 2020 be used?

The CoE Bioregional Plan should be used by all sectors involved with land use planning and decision-making in the CoE. This extends to entities that need to use the CoE Bioregional Plan to meet legislative requirements, as well as planners, programmes and developers who would find it useful to inform planning processes. The main users of the CoE Bioregional Plan should include (also see Table 1.1 below):

- All CoE departments who undertake planning functions
- Other National and Provincial development planning departments
- National and Provincial Extended Public Works Programmes
- Government departments and authorities whose decisions and programs impact on biodiversity and the natural environment, including DEFF, GDARD and DMR
- Environmental Assessment Practitioners
- Developers or land owners considering development applications or changes in land use
- Conservation NGOs.

How is the Bioregional Plan used?

Planning ahead:

- Provincial and Municipal planning departments must integrate CBAs, ESAs and the land use guidelines into:
    - Spatial Development Frameworks (SDFs), Integrated Development Plans (IDPs) and other relevant sector plans
    - Strategic Environmental Assessments (SEA) or Environmental Management Frameworks (EMF)
    - Land use zoning schemes or other planning under SPLUMA.
- Environmental Impact Assessment processes, and the scope of work for biodiversity specialist inputs, should be informed by the Bioregional Plan.
- Identification of appropriate sites for the Gauteng Protected Areas Expansion Strategy should be informed by the Bioregional Plan.
- Restoration and rehabilitation programmes should use the Bioregional Plan to identify sites of high biodiversity importance, or that are considered as critical for ecosystem function, as priority areas for programme implementation.

Making decisions

- Decision-making on applications for Environmental Authorisations
- Relevant agricultural applications
- Water-use licence applications (WULAs)
- Authorisation for prospecting and mining.

Table 1.1 Summary of who should use the CoE Bioregional Plan 2020 and how

User	Application	Specific uses
City of Ekurhuleni Metropolitan Municipality	Proactive planning	Informing spatial and development planning through integration as a sectoral plan in SDFs, IDPs and other relevant municipal sector plans
Other National and Provincial development sectors (e.g. DEFF, GDARD, COGTA, etc.)	Proactive planning	Informing environmental and development planning
National and Provincial Extended Public Works Programmes	Proactive planning	Assisting planning and prioritisation of areas for restoration and conservation
Public and private developers, land owners and community organisations contemplating changes in land use (e.g. agriculture, mining or urban development).	Proactive planning	Informing appropriate development, layout and design of proposed land use changes by considering sensitive biodiversity and habitat
Conservation organisations and agencies	Proactive planning	Informing conservation priorities and protected area expansion.
Environmental Assessment Practitioners	Reactive assessment and decision-making	Informing the scope of work for EIAs and biodiversity specialist impact assessments
Competent Authorities (DEA, GDARD, DMR, DWS)	Reactive assessment and decision-making	Informing decision-making/permitting/authorisation

Although the revised CoE Bioregional Plan (2020) is based on the most accurate, recent and available science, due to gaps in biodiversity knowledge, the following must be taken into account:

- The CoE Bioregional Plan cannot be used to the exclusion of other environmental or biodiversity planning initiatives.
- The CoE Bioregional Plan cannot replace onsite surveys and assessments for land use or development applications in terms of NEMA EIA Regulations.

2 BIOPHYSICAL OVERVIEW OF THE COE

2.1 PHYSICAL CHARACTERISTICS

2.1.1 Rainfall and Temperature

The rainfall of the CoE is highly seasonal, annually 650 mm to 950 mm, with most occurring between November and April. Temperatures experienced in the CoE fluctuate between mild warm summers and cold winters where frost and sub-zero temperatures are common. According the South African Risk and Vulnerability Atlas (2017), it is predicted that the CoE will experience similar rainfall, but it will be unpredictable in terms of season, frequency and intensity. Temperature will similarly be affected, with winter temperatures increasing over the next 45 years. The ability of natural land to moderate temperature (through albedo and transpiration) combined with the flood attenuation effect of wetlands, creates a strong case for conserving natural landscapes that are necessary to increase the resilience of communities that live in the CoE.

2.1.2 Topography

The CoE varies in elevation from approximately from 1 480–1 800 metres above sea level (Figure 2.1). A number of higher lying ridges and koppies traverse the CoE roughly east—to—west. These form part of the continental divide. The watershed created by this divide is the source of some of South Africa's major river systems which either flow west towards the Atlantic Ocean or east towards the Indian Ocean. The topography in the remainder of the CoE is low-lying and relatively flat. Flooding associated with high rainfall events in these areas require that suitable development buffer is maintained.

2.1.3 Hydrology and Wetlands

The CoE is characterised by significant hydrological features in the form of permanent rivers, valley bottom wetlands and depression/pan wetlands (Figure 2.2).

The northern portion of the CoE is drained via the Rietvlei and Hennops tributaries, which flow north and converge to form the Rietvlei River. The central and eastern areas are drained by the Blesbokspruit River system, and the south-west is drained by the Rietspruit, Elsburgspruit and Natalspruit rivers which merge to from the Klip River.

The Rietvlei and Klip Rivers systems, which have their origins in this mining, urban and agricultural setting, are the source of some of South Africa's larger rivers, such as the Olifants (east-flowing towards the Indian Ocean) and the Vaal (west-flowing towards the Atlantic Ocean) Rivers, respectively.

Most of the river systems are associated with wetlands, which provide flood relief in periods of high rainfall. Many of the wetlands receive waste water effluent from various land use activities, which will affect the water quality. It is important to note that not all the pans and wetlands are natural. Artificial wetlands (dams) are also mapped in the National Freshwater Priority Areas (NFEPA, 2018).

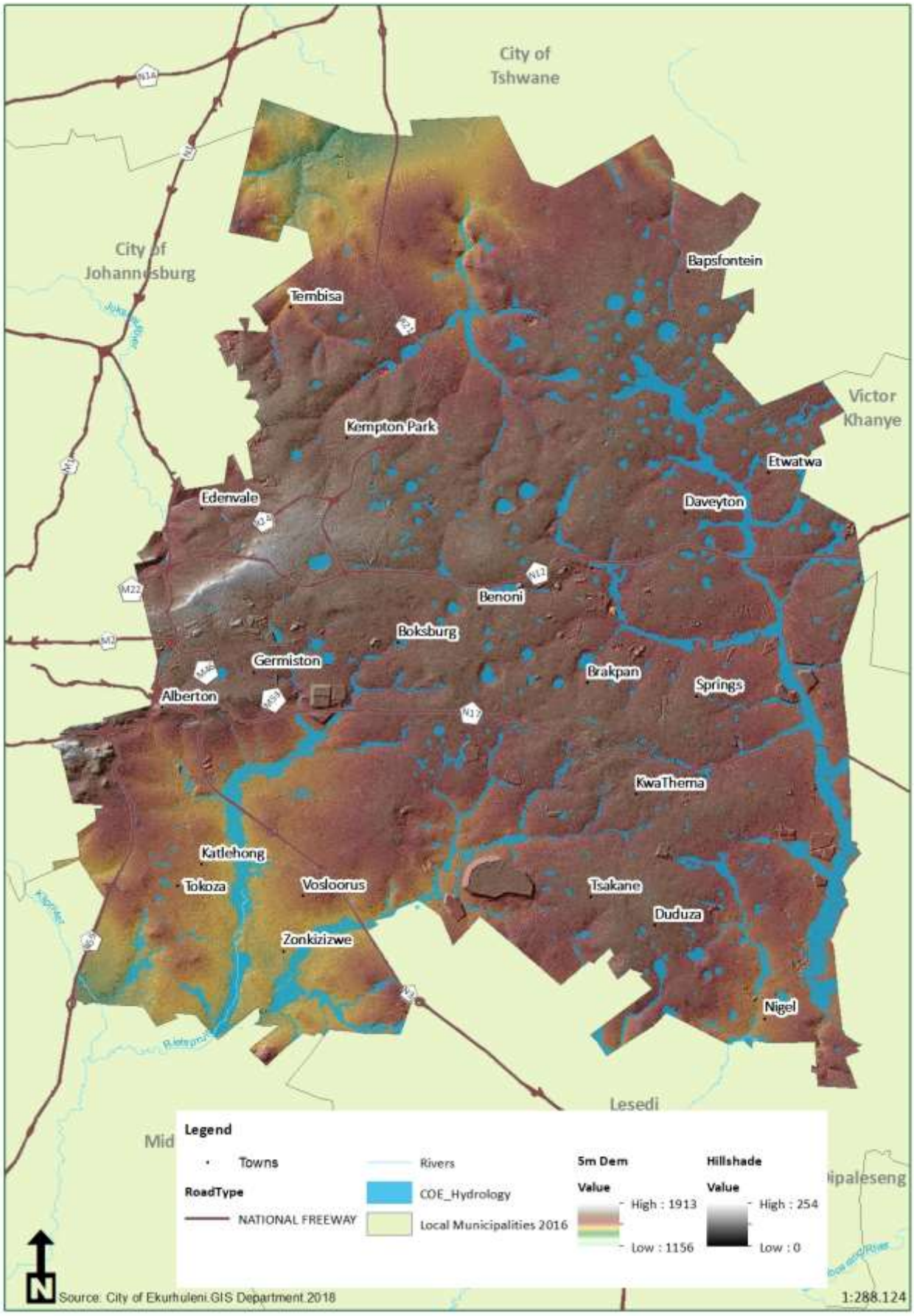

Figure 2.1. Relief of City of Ekurhuleni

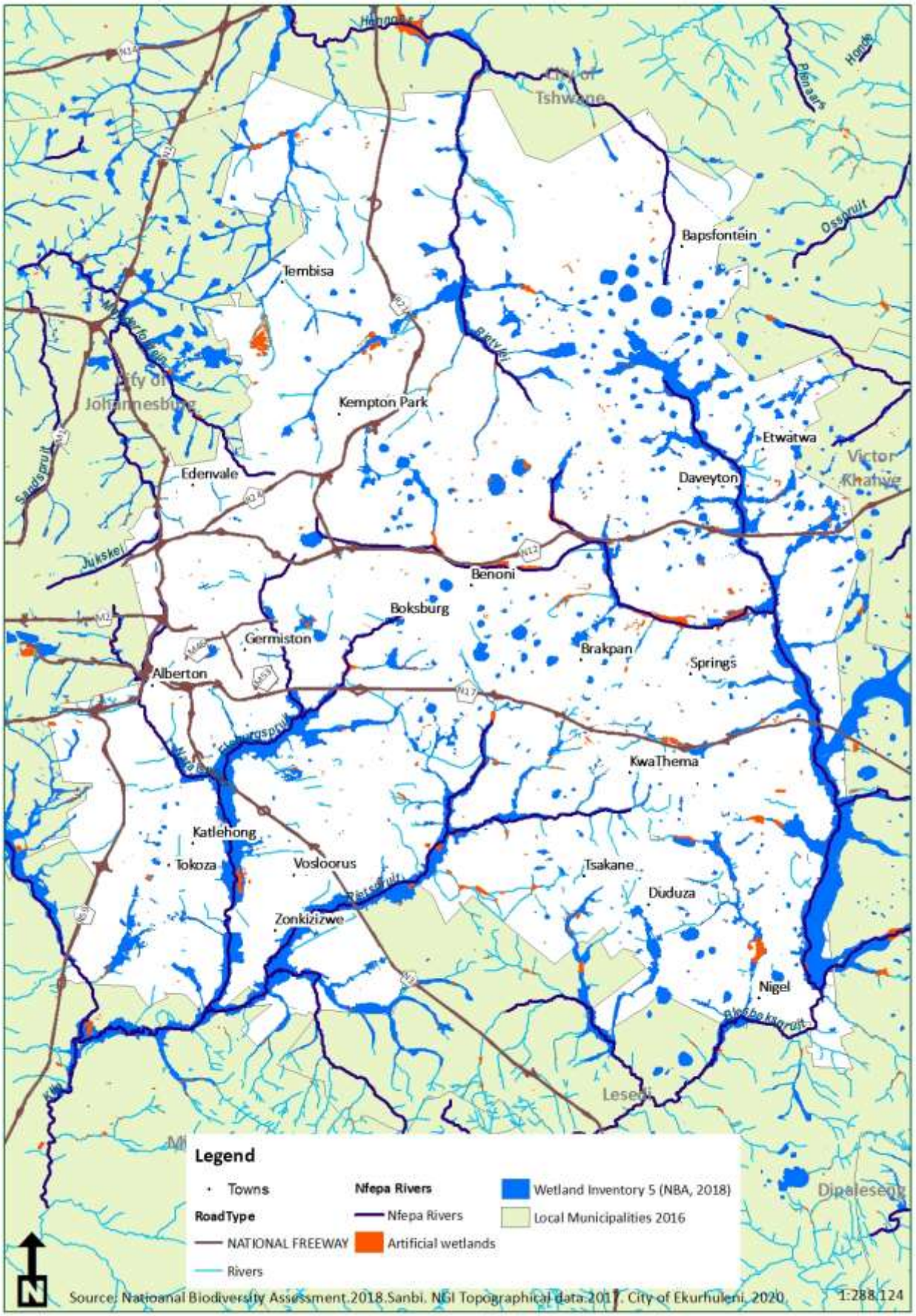

Figure 2.2 Rivers and wetlands of the City of Ekurhuleni

2.2 IMPORTANT BIODIVERSITY AND ECOSYSTEMS

2.2.1 Description of Terrestrial Ecosystem types and Threat Status

According to the Vegetation Map of South Africa (Mucina *et al.*, 2018) there are eight (8) vegetation types in the CoE, five (5) of which are threatened (Table 2.1, Figure 2.3). While the vegetation types have been mapped with boundaries, different ecosystem types transition from one to another through an ecotone, which may be abrupt or gradual.

Egoli Granite Grassland is **Critically Endangered**. Only 5.5% of its entire extent falls within the CoE. Only 25% of its historical extent in the CoE still in a natural or semi-natural (secondary) state (Figure 2.4).

Almost 37% of the entire extent of Tsakane Clay Grassland falls within the CoE. It is **Endangered**, and only 41% of its historical extent in the CoE remains in a natural or semi-natural (secondary) state (Figure 2.4).

Table 2.1 Description of Vegetation Types of the CoE.

Vegetation type	Threat Status (2018)	Historical extent in CoE (ha)	Remaining natural in CoE (ha)	% remaining in CoE	RSA biodiversity target (%)	RSA (ha)	% of historical extent in CoE
Andesite Mountain Bushveld	Least Concern	5 340	3 760	70%	24	201 784	2.7%
Carletonville Dolomite Grassland	Least Concern	53 229	16 985	32%	24	920 045	5.8%
Eastern Highveld Grassland	Vulnerable	24 192	8 168	34%	24	1 277 243	2%
Egoli Granite Grassland	Critically Endangered	6 048	1 498	25%	24	109 319	5.5%
Gold Reef Mountain Bushveld	Least Concern	463	140	30%	24	203 098	0.2%
Rand Highveld Grassland	Vulnerable	5 755	2 982	52%	24	1 030 645	0.5%
Soweto Highveld Grassland	Vulnerable	54 192	20 303	37%	24	1 457 366	3.7%
Tsakane Clay Grassland	Endangered	48 316	19 625	41%	24	131 322	36.8%
Total		**197 536 ha**	**73 459 ha**	**37%**		**5 330 821 ha**	

Within the matrix of these ecosystems, ridges/koppies and a system of wetlands (described in Section 2.1.3) increase the landscape heterogeneity and supports a range of habitat specialists. The threat status of the freshwater ecosystems, including rivers and wetlands, is concerning, with all wetlands ecosystem types and river ecosystem types assessed as **Critically Endangered** in the National Biodiversity Assessment (2018) (Figure 2.5).

Blesbokspruit RAMSAR wetland

Blesbokspruit: The Montreux Record is a register of wetland sites on the List of Ramsar wetlands of international importance where changes in ecological character have occurred, are occurring, or are likely to occur as a result of technological developments, pollution or other human interference. It is a voluntary

mechanism to highlight specific wetlands of international importance that are facing immediate challenges. It is maintained as part of the List of Ramsar wetlands of international importance (Figure 4.1).

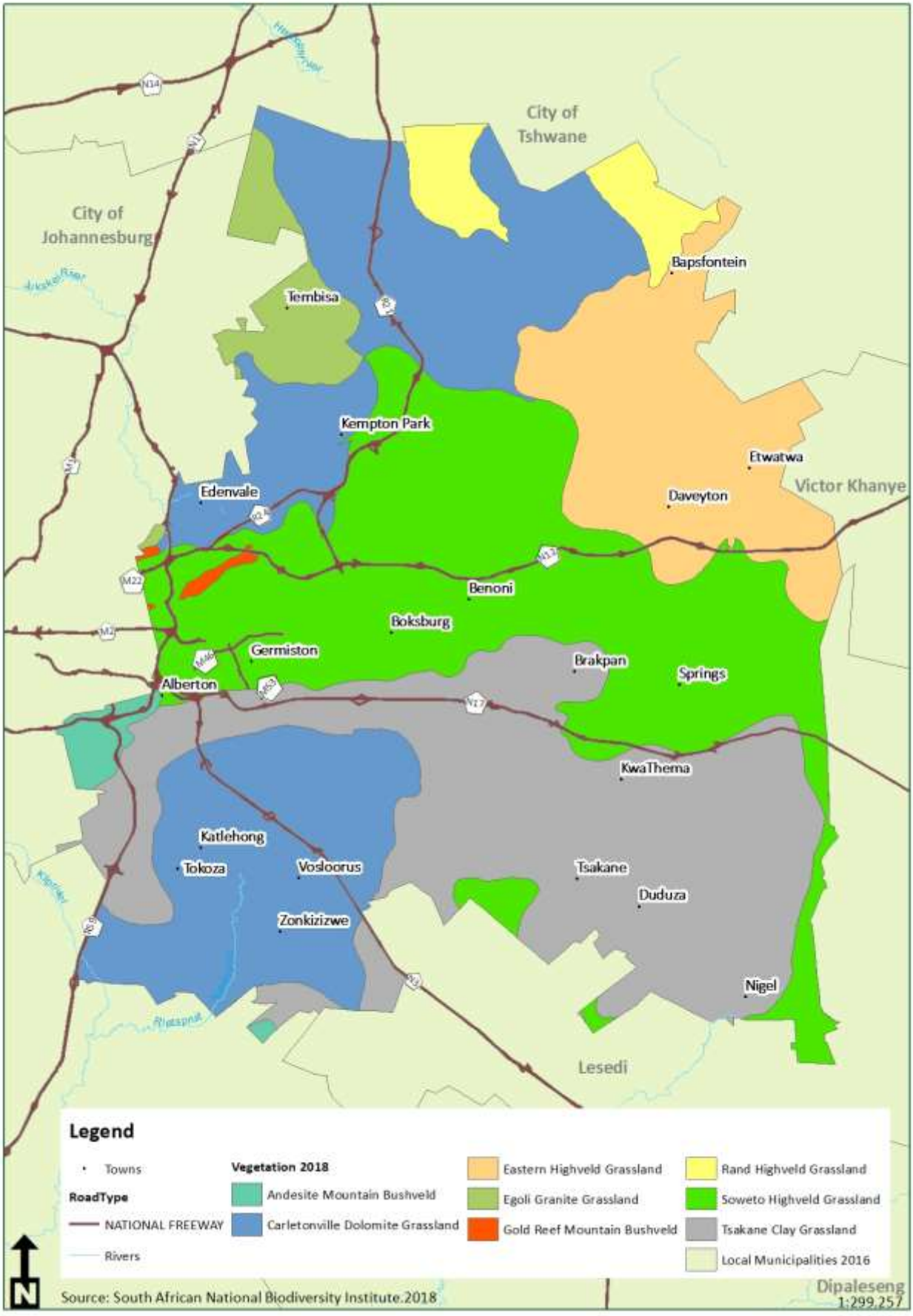

Figure 2.3 Vegetation types of the City of Ekurhuleni

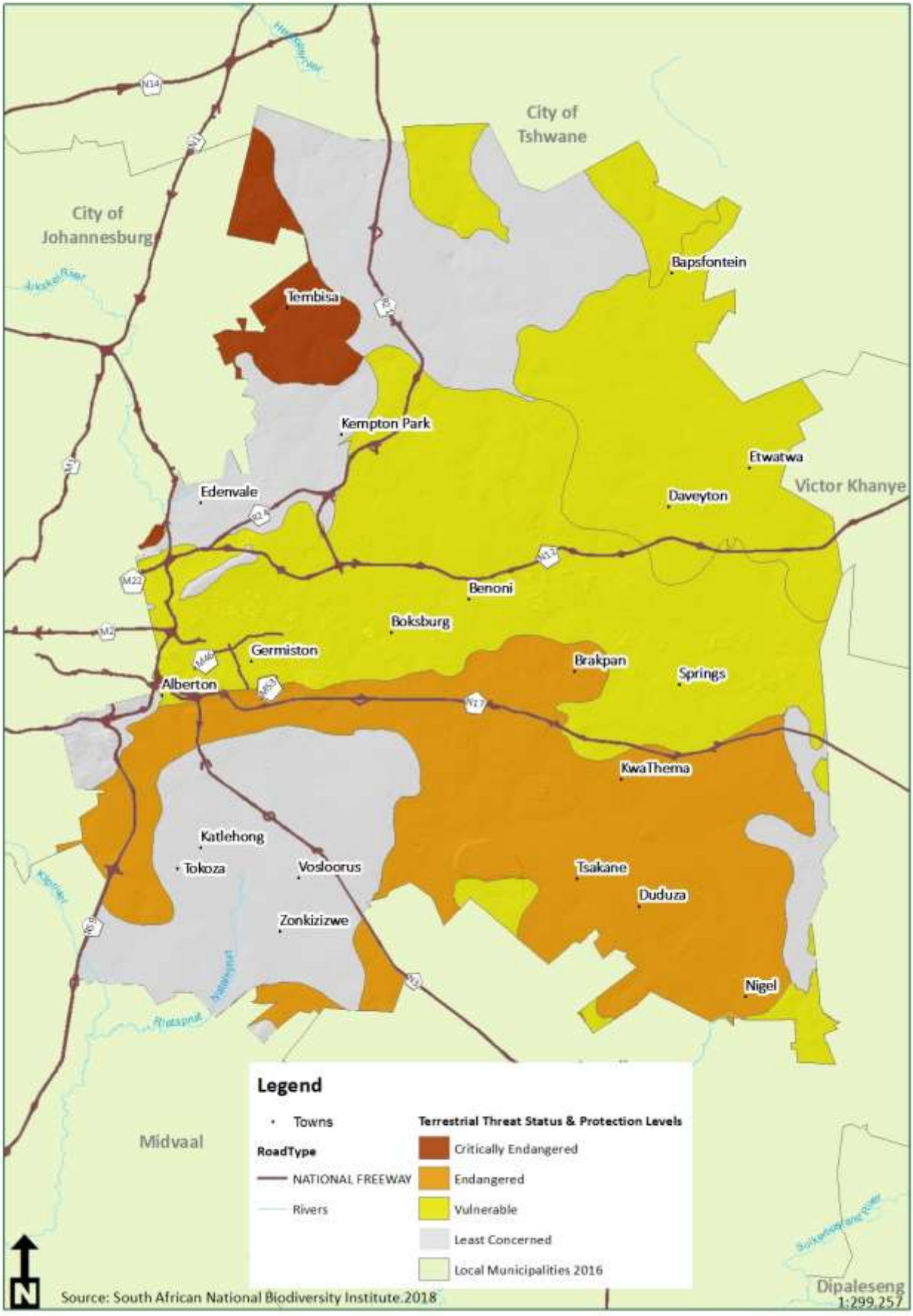

Figure 2.4 Threat status of terrestrial ecosystem types of the City of Ekurhuleni

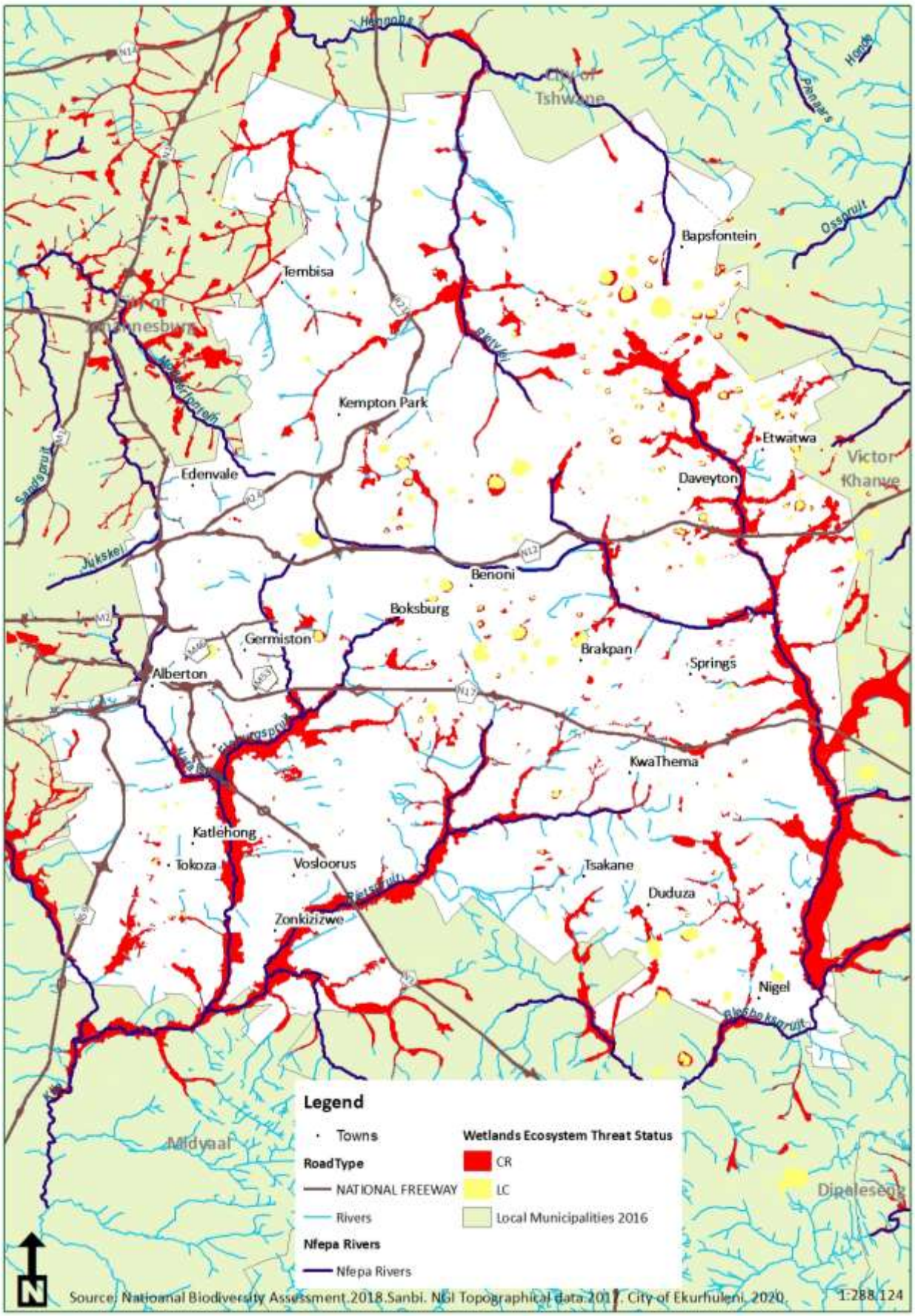

Figure 2.5 Threat status of aquatic ecosystem types of the City of Ekurhuleni (CR – Critically Endangered, EN – Endangered, VU – Vulnerable, LC- Least concern)

2.2.2 Levels of Protection of Terrestrial Ecosystem types as calculated for the CoE

A number of ecosystem types in the CoE are not represented in the CoE Protected Area network (Figure 2.6 and Table 2.2). These ecosystem types may be protected in surrounding municipalities and Provinces and therefore the Level of Protection calculated at a Provincial level may differ. The only ecosystem type to enjoy a moderate level of protection is “Gold Reef Mountain Bushveld”.

Table 2.2 Levels of Protection of Ecosystem types in the CoE

Vegetation type	Level of Protection
Andesite Mountain Bushveld	Poorly protected
Carletonville Dolomite Grassland	Not protected
Eastern Highveld Grassland	Poorly protected
Egoli Granite Grassland	Not protected
Gold Reef Mountain Bushveld	Moderately protected
Rand Highveld Grassland	Poorly protected
Soweto Highveld Grassland	Not protected
Tsakane Clay Grassland	Not protected

Figure 2.6 Levels of Protection of terrestrial ecosystem types in the City of Ekurhuleni

2.2.3 Threatened and endemic biodiversity

The following comments on Species of Conservation Concern does not provide a comprehensive list of species, but summarises some of the key species that have been considered as part of the revision of the CoE Bioregional Plan 2020:

Plants: The revision of the bioregional plan consider the spatial information for 32 orange-listed and red-listed species. One species, *Holothrix micrantha*, is suspected of being extinct, and one species is **Critically Endangered** (*Brachycorythis conica* subsp *transvaalensis*) while three (3) species (including *Delosperma purpureum* and *Habaneria mossii*) are **Endangered**. Fourteen (14) species are **Vulnerable** and 13 species are Near Threatened.

Invertebrates: The species of conservation concern, present in the CoE, includes three (3) **Endangered** butterflies (*Lepidochrysops praeterita*, *Chrysoritis aureus* and *Aloeides dentatis dentatis*), In addition, a number of **Vulnerable** and protected species from the TOPS, including beetles (e.g. *Ichnestoma stobbiai* and *Manticora* spp.) and scorpions (*Opistophthalmus* spp) were used to inform the plan.

Mammals: Two (2) of Gauteng's threatened and species of conservation concern mammal species are found in the CoE. They include the **Vulnerable** White tailed rat (*Mystromys albicaudutus*) and the Spotted-necked otter (*Lutra maculicollis*) and the **Near Threatened** Cape Clawless otter (*Aonyx capensis*).

Birds: The CoE sports over 450 bird species. Some of these species are transient, while others are migratory or permanent residents. Approximately 18 species of conservation concern, relevant and reliant on habitat in the CoE have been used to inform the revision of the Bioregional Plan. Two (2) of these species are **Endangered** (African Marsh-Harrier - *Circus ranivorus* and Yellow-billed Stork - *Ephippiorhynchus senegalensis*). Nine (9) species are **Vulnerable** (including the African Grass-Owl (*Tyto capensis*), which is highly reliant on wetland habitats). In addition, seven (7) **Near Threatened** species such as the Greater and Lesser Flamingos were also considered.

Reptiles and amphibians: While the CoE supports a numerous reptile species, only one threatened species, the Near Threatened Striped Harlequin Snake (*Homoroselaps dorsalis*), has been recorded in the metro. The presence of the Near Threatened Giant Bull Frog (*Pyxicephalus adspersus*) was also confirmed by specialists.

3 LAND COVER/LAND USE: PRESSURES ON BIODIVERSITY IN COE

3.1 LAND COVER AND LAND USE

For the CoE, a 2020 land cover/land use map was generated from detailed mapping. Differences between the 2009 and 2020 land cover/land use map are apparent. It is important to note that some differences between these dates are associated with:

- Improved mapping accuracy (which was conducted at a very high resolution in 2020)
- Differences in how the land cover was categorised(e.g. small-holdings classified as Urban vs Degraded natural)
- Actual changes in land cover and land use. Most notably, bare soils and cultivation mapped in 2009 has decreased, and is reflected as recovered secondary grasslands in 2020, creating the incorrect perception of improving natural conditions.

A number of "Natural or semi-natural" categories in the land cover were quantified (Table 3.1 and Figure 3.1), which includes:

- Undisturbed grasslands (primary or natural)
- Previously cultivated grasslands (secondary or semi-natural)
- Wetlands: in CoE some wetlands are still in good condition, but many have been severely degraded or altered — so there is a range in the 'natural/semi-natural' condition of wetlands. For the purposes of assessing the land cover statistics, all wetlands are considered as a group. The systematic biodiversity planning process has, however, differentiated between natural and semi-natural wetland systems
- Degraded natural sites which include:
    - Areas that have been disturbed by anthropogenic activities, such as dumping or use of the area for movement of people and vehicles
    - Areas invaded by alien invasive species and bare soils.

When combined, these make up approximately 38.1% of the CoE (Table 3.1).

The largest land use category is, as expected, the "Built-up urban" category with over 37% coverage (Figure 3.1), followed by "Cultivation" agriculture covering over 17% of the CoE.

The different land cover categories are not distributed evenly throughout the CoE. Cultivation and agriculture is concentrated in the north-eastern portion, with large cultivation patches associated with wetland systems in the east and south. A large proportion of the remaining natural vegetation is located in the south, while urban development is present along the whole western boundary and extends throughout the CoE in varying densities. An urban built-up corridor bisecting the CoE follows the N12 and N17 (Figure 3.2). The historic mining belt in this corridor shaped these settlement patterns, around which towns developed.

Table 3.1 Description of the CoE land cover 2020 and comparison with land cover 2009 used for CoE (2015)

Land cover class	Area (ha)	% of Total	Area	% of Total
	2009		2020	
Degraded: Alien vegetation	7 261	3.7	2 508	1.3
Degraded: Bare soil	3 629	1.8	990	0.5

Degraded: anthropogenic activities	4 053	2	416	0.2
Built-up urban	69 377	35.1	73 420	37.5
Cultivation	35 254	17.8	33 951	17.2
Informal agriculture (cultivation and kraals)	18	0	2 621	1.3
Low density built up	0	0	1 752	0.9
Mining	7 346	3.7	10 026	5.1
Natural (undisturbed)	56 686	28.7	25 754	13
Semi-natural (secondary)	-	-	27 608	14
Wetlands	17 981	9.1	17 869	9.1
Total	**197 536**		**197 435**	

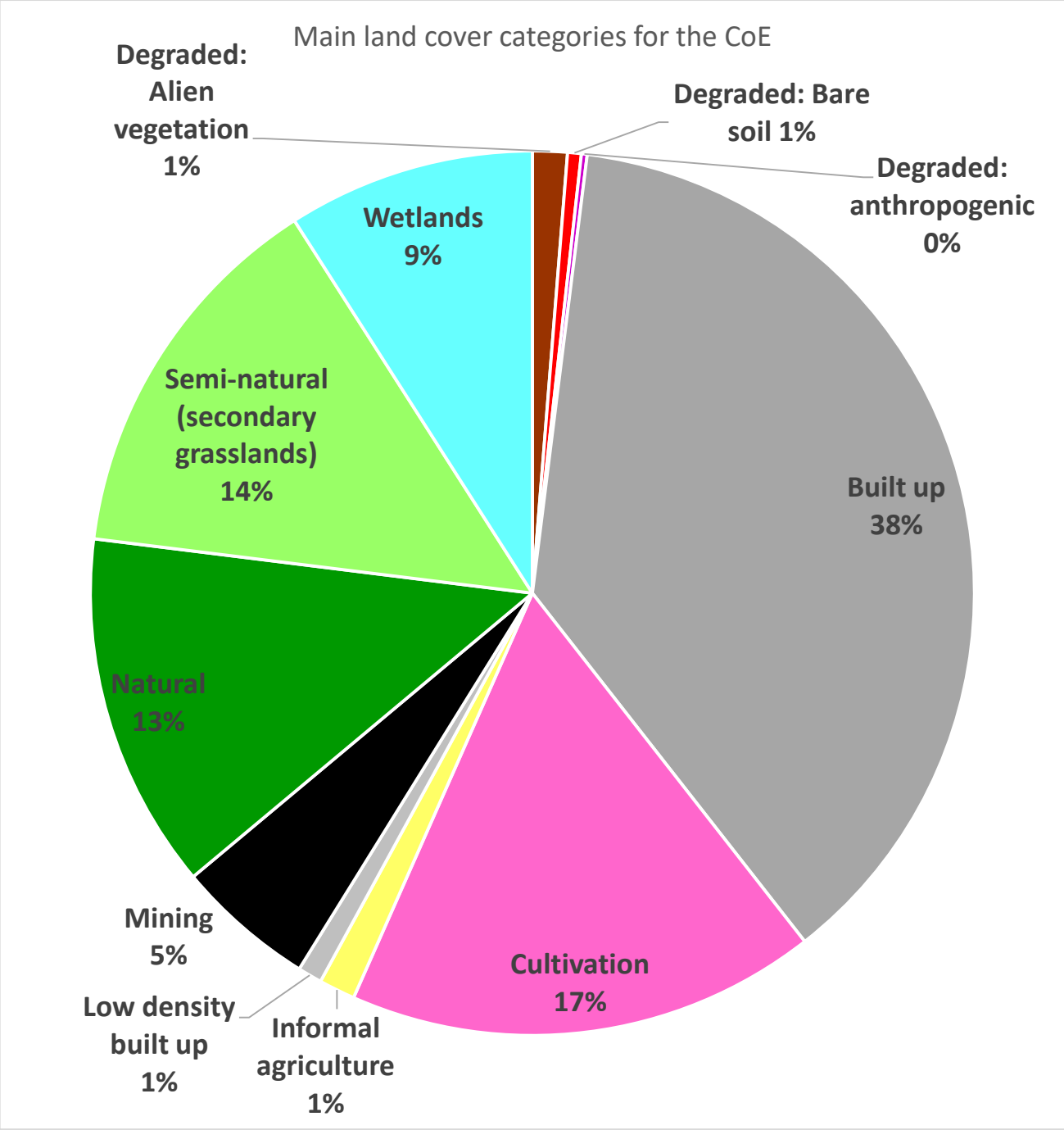

Figure 3.1 Distribution of land cover classes of the City of Ekurhuleni (2020) (value given = % extent)

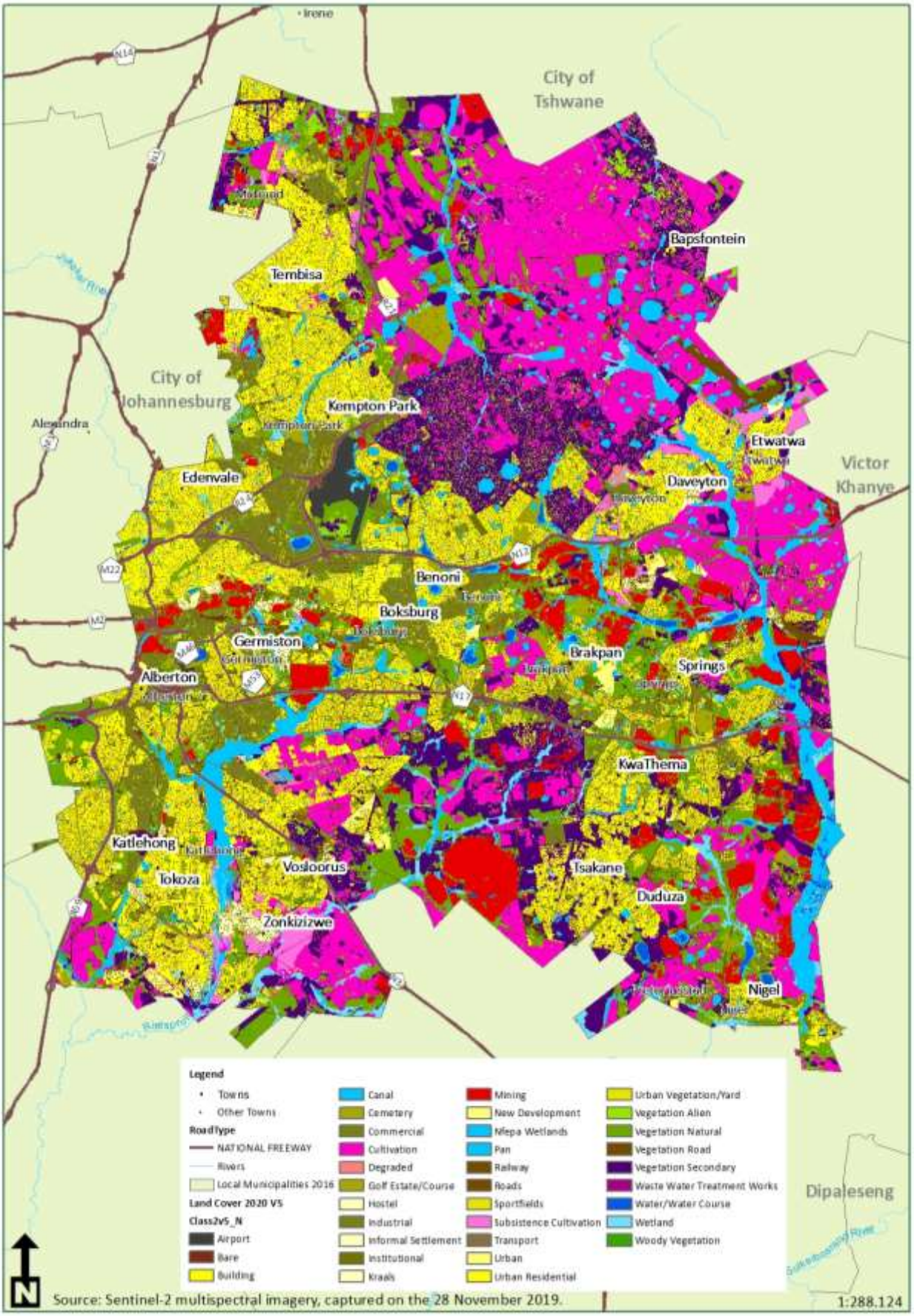

Figure 3.2 Land cover map of the City of Ekurhuleni (2020)

4 PROTECTED AREAS AND OTHER CONSERVATION MECHANISMS

4.1 PROTECTED AREAS OF COE

According to the GDARD database, the CoE has 14 proclaimed and *de facto* Protected Areas (PAs) (Figure 4.1, Table 4.1). Two Provincial nature reserves, Marievale in the east and only small portions of Suikerbosrand in the south, provide refuge for biodiversity of a range of taxonomic groups. The CoE manages numerous bird sanctuaries associated with water bodies, as well as a wetland reserve. These CoE sites are not proclaimed, but are important "islands" for bird species and are therefore considered *de facto* Protected Areas. Three proclaimed Private Nature Reserves (Table PA, yellow shading) are modified and it is highly unlikely that they will function as areas for the conservation of biodiversity.

Protected Areas should be supported by development buffers as per GDARD policy to prevent edge effects within the PA itself. The land directly adjacent to most of the PAs in the CoE is largely modified and no longer in a natural state. This poses a threat to the PAs which will require ongoing monitoring and management.

Table 4.1 Protected Areas of City of Ekurhuleni Metropolitan Municipality (shaded cells; transformed areas)

Name of Protected Area	Management/Ownership	State of PA
Ian P Coetzer	Private Nature Reserve	Two small holding plots.
Andros	Private Nature Reserve	Transformed (old mine)
Avalon	Private Nature Reserve	Transformed (old mine)
Rietvlei	Municipal Reserve	Secondary, but sustaining biodiversity
Bill Stewart	Municipal Reserve	Natural, but fragmented by road infrastructure
Rolfe's pan	Municipal Reserve	Natural, completely surrounding by built-up, but stepping stone for mobile biodiversity.
Pamula	Private Nature Reserve	Terrestrial component all secondary, most of PA = natural pan
Kosman (Westdene Pan)	Bird Sanctuary: Municipal, *de facto*	Natural pan
Victor Penning	Bird Sanctuary: Municipal, *de facto*	Natural wetland/pan. Old WWTW adjacent to site.
D Meyer	Bird Sanctuary: Municipal, *de facto*	Wetland and park. Walking paths through PAs
Grootvaly (Blesbokspruit)	Wetland reserve: Municipal, *de facto*	Natural wetland reserve making up Blesbokspruit RAMSAR
Marievale	Provincial Nature Reserve	Mostly natural
Rondebult	Bird Sanctuary: Municipal, *de facto*	Natural adjacent to WWTW
Suikerbosrand	Provincial Nature Reserve	Natural

4.2 RAMSAR WETLAND AND IMPORTANT BIRD AREA

Both the Blesbokspruit Ramsar Wetland and the Blesbokspruit Important Bird Area (IBA) lie along the eastern border of the CoE and incorporate Grootvaly Wetland Reserve and Marievale Nature Reserve (Figure 4.1).

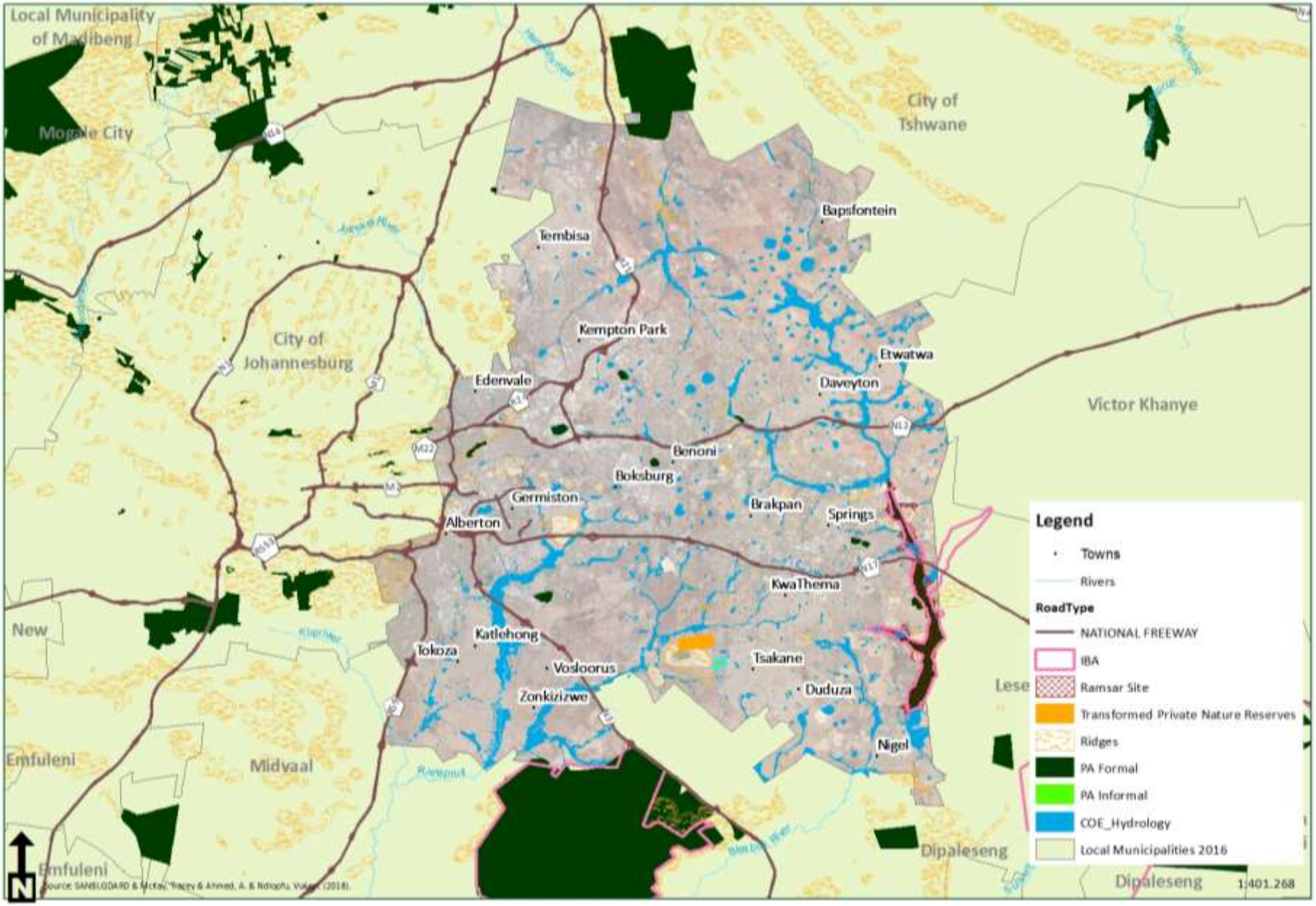

Figure 4.1 Protected Areas of the City of Ekurhuleni

5 SPATIAL MAPPING OF IMPORTANT BIODIVERSITY PATTERNS AND ECOLOGICAL PROCESSES IN THE COE

5.1 SPATIAL PLANNING METHODOLOGY

5.1.1 Planning in the Terrestrial realm

Important and unique biodiversity are not distributed uniformly throughout the landscape. A spatial biodiversity planning exercise **prioritises** and maps information about biodiversity patterns and ecological processes, current and future land use, and the protected area network in the context of achieving biodiversity targets set for species and ecosystems.

A biodiversity target-based approach to identifying CBAs using MARXAN software was used to identify CBAs. Due to the low remaining natural areas, all sites with natural vegetation are required to meet targets. Two vegetation types are over target due to the Gauteng Ridges development policy; these have been included as CBAs. As all natural areas are calculated as irreplaceable (CBA1), there are no “Best design sites” (CBA2) and similarly no “Other Natural Areas” (ONAs) have been mapped.

An equally important biodiversity conservation issue in the CoE is that of landscape connectivity. The highly fragmented nature of the coalescing urban landscapes means that opportunities for creating or retaining landscape ecological linkages are very limited, and are continually being lost due to poor city planning. Therefore, the network of secondary natural sites (ESA1) and croplands and built open spaces (ESA2) support the CBA1 sites by providing important buffers to natural areas and most importantly link up all remaining natural areas into a city-wide landscape ecological corridor network.

When assessing sites during a development application process, it is important to consider both the biodiversity present (especially for natural sites), as well as the landscape ecological context of sites and the role sites play in the larger landscape. ESA sites that do not have natural vegetation, and in some cases can be highly modified, are identified for their role in supporting ecological processes (e.g. movement corridors/landscape connectivity, ecological buffers around natural areas or foraging sites for species) and ecological infrastructure (e.g. wetland buffers and flood mitigation areas). In highly modified contexts just because there is no apparent biodiversity at a sites it does not mean that a site is not important ecologically in the wider landscape context.

How ESAs have been identified and the information contained in the CBA Map attribute table will assist planners and assessors in better understanding and quantifying the wider landscape ecological significance of sites. ESA sites are important and need to be retained. These sites can be priorities for ecosystem restoration. Equally, they can remain under their current land use, especially for croplands or green open spaces in built areas. Collectively, the CBA and ESA network provide the blue-print for the city’s open space network and achieving the goal of 30% open scape within the urban landscape.

The following set of questions (Table 5.1) provide the basis for the steps taken and criteria used in the systematic biodiversity planning process.

5.1.2 Planning in the aquatic realm

While all wetlands are regarded as vital features, they differ in terms of their level of importance as reflected in the CBA map. The wetlands of the CoE have therefore been assessed in terms of a modelled Present

Ecological State and CBA wetlands have been prioritised based on specialist criteria. **ESA 1 – "Priority for restoration" wetlands are degraded to some degree, but have been earmarked as priorities for restoration** due to their potential to support disaster risk management and climate adaptation/mitigation. These wetlands are also deemed critical in supporting effective water resource management by trapping sediments, improving water quality and regulating flows from highly urbanised catchment areas. Although this diverges from the typical focus on conservation and protection of biodiversity, these wetlands play such a pivotal role in terms of supporting downstream biodiversity and water quality as well as contributing towards climate change resilience that restoration of these systems as mapped and described in this plan, must feature as a priority for further action. Wetlands that have been intensively modified and which have also been prioritised for restoration are classified as ESA 2 – "Priority of restoration" wetlands.

Table 5.1 Questions that drive the Systematic Biodiversity Planning Process

Question	Systematic Biodiversity Planning Process: Steps taken
Where in the landscape does biodiversity occur?	Biodiversity information was collected from a number of sources. In addition, a number of specialists were engaged to conduct focussed surveys. The biodiversity information used is considered the best available science.
How much conservation/protection is required to ensure the persistence of that biodiversity?	South Africa has developed biodiversity targets for ecosystems (e.g. vegetation types, rivers). Achieving these biodiversity targets will ensure the persistence of biodiversity and ecological processes. The targets set for the terrestrial ecosystem types in the CoE is 24% of its extent. Portions of these targets have been secured in the South African Protected Area (PA) network. However much of the target is still located outside of PAs and it is in this space that systematic biodiversity planning takes place.
Where are the best places to achieve the conservation/protection ?	Firstly, the ecological condition of the CoE was mapped to determine what areas were in a natural state and what condition they are in. In this step, as much mapping about the land cover was integrated into a single consolidated land cover map. Secondly, a target-based approach using MARXAN was used to select irreplaceable sites that are required to achieve biodiversity targets for ecosystems. Only ecosystem types (i.e. terrestrial vegetation types) were used for this analysis as species data was too course for the scale of the assessment. For all ecosystem types in the CoE, the National biodiversity target has been set at 24%. The CoE Spatial Development Framework (SDF) and landscape ecological context was used as a cost layer in the MARXAN analysis to avoid selecting sites, specifically ESAs that may conflict with future planned development. Thirdly, additional information layers were developed to assist with planning and decision-making. These include important biodiversity areas, critical linkages and ecological process areas such as wetland buffers.
How should the areas be managed?	A set of land use guidelines have been developed based on the prevalent land uses in the CoE and the management objective of each CBA category.
How should this information be communicated and used?	Uptake and implementation of the CoE Bioregional Plan 2020 is crucial for the necessary conservation of the remaining biodiversity. The CBA maps and the associated land use guidelines have been developed to guide users (see Table 1.1) and should be freely accessible.

In the section below, a brief description of the criteria that were used to develop the CBA map is provided. More detailed technical information regarding data inputs and analyses is available in the CoE Bioregional Plan (2020) Technical Report.

5.2 DESCRIPTION OF MAPPING CATEGORIES

The Terrestrial and Aquatic CBA layers have been merged into a single layer. The CBA maps categories include:

- Protected Areas
- Critical Biodiversity Areas
- Ecological Support Areas
- No Natural Habitat remaining.

Further descriptions of each category are provided below:

Protected Areas Protected Areas are areas formally declared or recognised in terms of NEMPAA. This refers to "State owned" reserves, which includes National PAs managed by SANParks, Provincial PAs managed by GDARD, municipal reserves, Private Nature Reserves, and Protected Environments. A number of municipal reserves have not been formally proclaimed under any legislation, but are zoned accordingly in relevant Spatial Development Frameworks and are recognised as *de facto* Protected Areas.
Critical Biodiversity Areas (CBA) Terrestrial and Aquatic CBA areas are selected to meet biodiversity targets for species, ecosystems and ecological processes. These include: • Critically Endangered and Endangered Ecosystems • All natural areas required to meet biodiversity targets and to ensure future persistence of species, ecosystems and special habitats. CBAs are areas of high biodiversity importance and should therefore be maintained in a natural state, with no further loss of habitat and no deterioration in ecological condition.
Ecological Support Areas 1 (ESA 1) Terrestrial and Aquatic ESAs are areas not essential for meeting biodiversity targets, but are **essential** for ensuring landscape connectivity between CBAs, strengthening climate change resilience, and proper function of ecosystem infrastructure for delivery of ecosystem services. ESAs may include riparian areas, powerline corridors, ridges, etc. In the urban fabric of the CoE, creative ways of maintaining these corridors need to be explored. ESAs need to be maintained in at least a semi-natural, if not natural, state. For Aquatic ESA1s, some have been identified as priorities for restoration.
Ecological Support Areas 2 (ESA 2) As per Ecological Support Areas 1 (ESAs) above, but the site is intensively modified and are non-natural including cultivated land and small-holdings and are generally only included as critical linkages in the landscape. For Aquatic ESA2s, some have been identified as priorities for restoration.
No Natural habitat Remaining (NNR) NNR areas that are intensively or permanently modified and are no longer considered natural or semi-natural. Although some biodiversity and ecological function may be retained, irreversible impacts on biodiversity mean that they cannot contribute towards targets.

Table 5.2 Criteria that were used to develop the CBA map

	Map Category	Criteria
	Terrestrial	
Terrestrial map categories	PROTECTED AREAS	Protected Areas: As per GDARD PA database
	CBA	MARXAN selected irreplaceable sites: These are all sites that are still in a natural or near-natural state in the CoE
	ESA 1	Semi-natural areas that maintain landscape connectivity as selected in the MARXAN and Circuitscape analyses (See Technical Report)
	ESA 2	Intensively modified areas that are critical for landscape ecological connectivity
Aquatic map categories	CBA	Wetlands in a natural or near-natural condition with high biodiversity importance, high EIS or WET-Health PES A/B ecological category (*Please see Aquatic section of Technical Report) Wetlands linked to these and/or priority ecological corridors, in WET-health PES A/B/C ecological category
	ESA 1	All remaining semi-natural wetlands that were not classified as CBAs
	ESA 1 Priority for restoration	All remaining semi-natural wetlands that were not classified as CBAs plus these wetlands have been identified as priority sites for wetland restoration
	ESA 2	Intensively modified areas that are critical for landscape ecological connectivity
	ESA 2 Priority for restoration	Intensively modified areas that are critical for landscape ecological connectivity, plus these wetlands have been identified as priority sites for wetland restoration
	NNR	No Natural Habitat Remaining

5.3 CRITICAL BIODIVERSITY AREAS AND ECOLOGICAL SUPPORT AREAS

The development of the terrestrial and aquatic CBA map for the CoE Bioregional Plan 2020 is consistent with the Guidelines for Bioregional Plans (NEMBA, 2009) and the Technical Guidelines (SANBI, 2017). The Terrestrial and Aquatic CBA map developed in the current assessment replaces, in their entirety, the maps developed in the CoE Bioregional Plan 2015. The extent of each CBA category is provided in Table 5.3.

In comparison with the CoE Bioregional Plan (2015), the revised Bioregional Plan has a reduced CBA area by almost 4% (compared with CBA 1 in the 2015 plan) and does not map CBA 2 areas. Conversely, the area of ESA 1 has more than doubled. Areas that are considered to be irreversibility modified have increased by almost 5%. A notable feature of the revised CBA-ESA map is the lack of "Other Natural Areas". These changes are mostly a result of improved land cover mapping of secondary grasslands, which are considered semi-natural areas. Please refer to Table 10 for further detail on CBA-ESA losses and gains.

Table 5.3 The extent of Critical Biodiversity Area categories in the 2015 and 2020 CoE Bioregional Plan.

CBA Map category	Extent (ha) in CoE 2015 and %		Extent (ha) in CoE 2020 and %					
	Combined total		Terrestrial		Aquatic		Combined total	
Protected Areas	2 641	**1.3%**	1 087	**0.5%**	1 554	**0.8%**	2 641	**1.3%**
Critical Biodiversity Area 1	33 303	**17%**	20 559	**10.4%**	5 252	**2.7%**	25 811	**13.1%**
Critical Biodiversity Area 2	2 566	**1%**	0	**0%**	0	**%**	0	**0%**
Ecological Support Area 1	11 372	**6%**	10 087	**5.1%**	14 553	**7.4%**	24 640	**12.5%**
Ecological Support Area 1 – Priority for restoration	N/A	**N/A**	-	**-**	5 387	**2.7%**	5 387	**2.7%**
Ecological Support Area 2	23 427	**12%**	27 637	**14%**	1 453	**0.7%**	29 090	**14.7%**
Ecological Support Area 2 – Priority for restoration	N/A	**N/A**	-	**-**	359	**0.2%**	359	**0.2%**
Other Natural Areas	23 780	**12%**	0	**0%**	0	**0%**	0	**0%**
No Natural Habitat Remaining	100 442	**51%**					110 092	**55.7%**

Figure 5.1 below presents the Terrestrial and Aquatic CBA map for the CoE Bioregional Plan 2020.

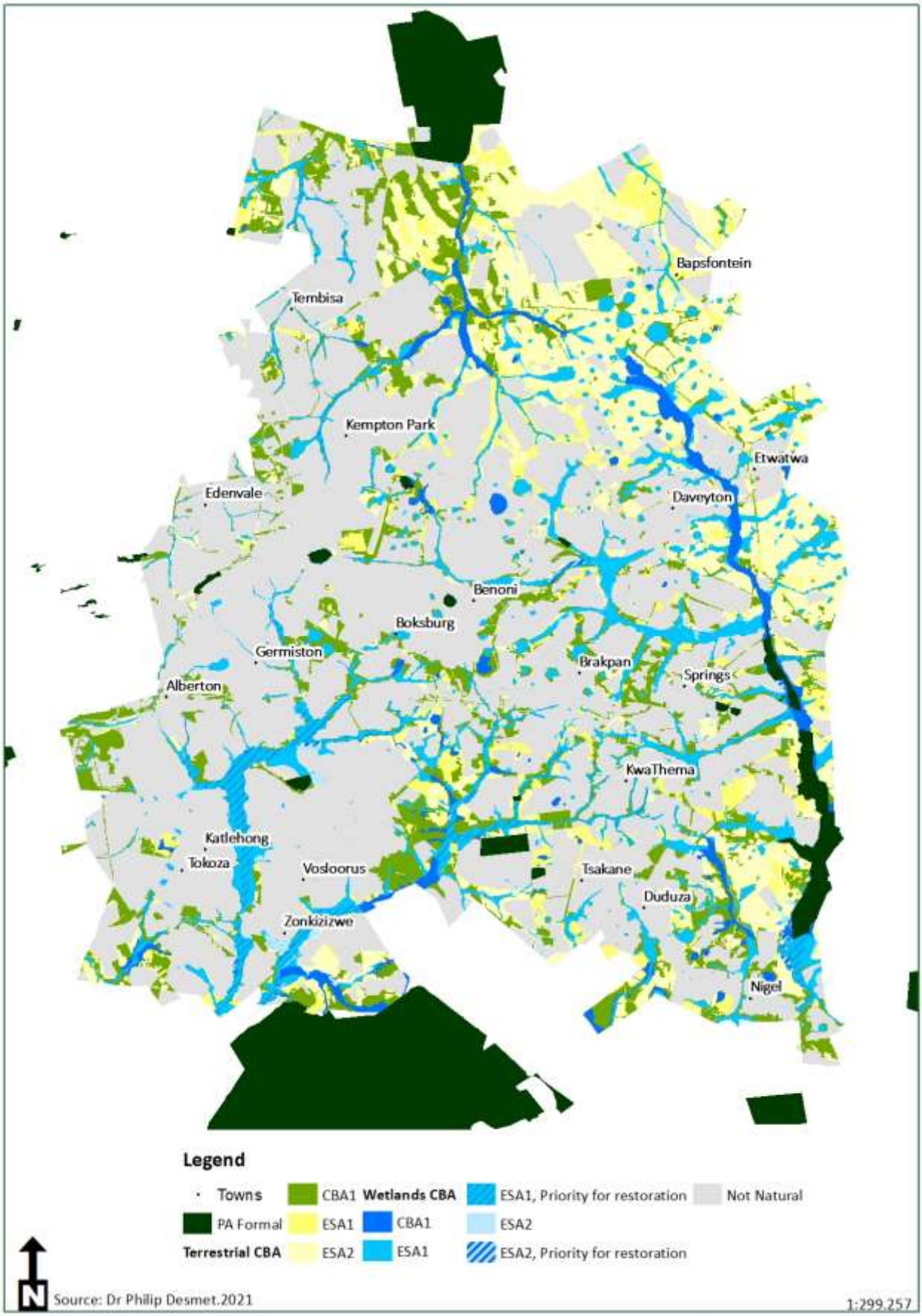

Figure 5.1 Terrestrial and Aquatic CBA map for the City of Ekurhuleni

6 LAND USE GUIDELINES FOR PLANNING AND DECISION-MAKING

The land use guidelines are developed to inform planning and development. Specifically, land use guidelines should inform the spatial planning of land use categories and subsequent zoning schemes of Municipal SDFs. In addition, authorities, decision-makers and Environmental Assessment Practitioners (EAPs) must consider these guidelines when assessing development applications.

The land use guidelines for the CBA map categories have there been informed by:

1. Land management objectives of CBA and ESA categories
2. Anticipated impacts associated with land use activities which can be linked directly to land use categories in the CoE Land Use Scheme.

6.1 DESIRED STATE AND MANAGEMENT OBJECTIVES

Once a CBA map is produced, the next question may be: So what does this mean and how it is implemented? The first step is to define and describe in detail what the desired state of each map category should be. The second step is to develop a set of management objectives required to achieve the desired state (Table 6.1).

Table 6.1 Linking CBA categories to management objectives.

	CBA Map Category	Desired State	Land management objective
	Protected Areas	Natural	Protected Areas are managed through Protected Area Management Plans.
Terrestrial mapping categories	**Critical Biodiversity Areas**	Natural	Maintain in natural or near-natural state that secures the retention of biodiversity pattern and ecological processes: For terrestrial areas classified as CBA1, the following applies: • Ecosystem and species habitats are to remain intact and undisturbed. • Since these areas demonstrate high irreplaceability, if disturbed, biodiversity targets will not be met. • Critically Endangered and Endangered species and ecosystems: these biodiversity features are at, or beyond, their limits of acceptable change. If intensive land use activities that impact on ecological condition are unavoidable in these areas, the feasibility of a Biodiversity Offset must be assessed, and if deemed appropriate, it should be designed and implemented as a legally binding condition of development (See Section 7.4 for further recommendations on offsets).

	Ecological Support Area 1	At least semi-natural	Maintain ecological function within the localised and broader landscape. A functional state in this context means that the area must be maintained in at least a semi-natural state such that ecological function and ecosystem services are maintained.
			
			For areas classified as ESA1, the following applies:
			• These areas are not required to meet biodiversity targets, but they perform essential roles in terms of landscape connectivity, ecosystem service delivery and climate change resilience.
			• These systems may vary in condition and maintaining function is the main objective, therefore:
			  ○ Ecosystems still in natural or near-natural state should preferably be maintained as such;
			  ○ Ecosystems that are moderately disturbed/degraded should not be further modified or disturbed.
			• If activities that impact on ecological condition are unavoidable in these areas, a wetland offset will be required to address significant residual impacts.

	Ecological Support Area 2	No further intensification of land use	Maintain current land use with no intensification. For areas classified as ESA2, the following considerations apply: • These areas have already been subjected to varying degrees of intensive modification and are no longer considered natural.

	CBA Map Category	Desired State	Land management objective

			• These areas are not required to meet biodiversity targets, but they may still perform an *important* function with respect to connectivity, ecosystem service delivery and climate change resilience
			• Objective is to maintain remaining as much ecological function as possible, therefore:
			  ○ Areas should not undergo any further deterioration in ecological function;
			  ○ Opportunities to change land use practices to improve ecological function (i.e. conversion of cultivation agriculture to livestock grazing agriculture) are desirable in ESA2 areas.

	No Natural Remaining (NNR)	Production	No desired state or management objective is provided for NNR.

	CBA Map Category	Desired State	Water management objective
	Since aquatic features are not only impacted by activities within the water course/wetlands but also impacted by activities in the catchment, development planning and proposals must also consider the water management objectives of the receiving aquatic ecosystems.		
Aquatic mapping	**CBA**	Natural	Maintain in natural or near-natural state that secures the retention of biodiversity pattern and ecological processes. For aquatic features classified as CBA1, the following applies: • Ecosystems and species habitats are to remain intact and undisturbed. • Critically Endangered wetlands and rivers: these ecosystem types are at, or beyond, their limits of acceptable change. If activities that impact on ecological condition are unavoidable in CBAs, the feasibility of a Biodiversity Offset must be assessed. If deemed appropriate, it should be designed and implemented as a legally binding condition of development (See Section 7.4 for further recommendations on offsets).
	ESA 1	At least semi-natural	Maintain ecological function within the localised and broader landscape. A functional state in this context means that the area must be maintained in at least a semi-natural state, so that ecological function and ecosystem services are maintained. For aquatic areas classified as ESA1, the following applies:

	CBA Map Category	Desired State	Water management objective
	Since aquatic features are not only impacted by activities within the water course/wetlands but also impacted by activities in the catchment, development planning and proposals must also consider the water management objectives of the receiving aquatic ecosystems.		

			• These areas are not in a pristine natural state, but they perform essential roles in terms of landscape connectivity, ecosystem service delivery and climate change resilience.
			• These systems may vary in condition and maintaining function is the main objective, therefore:
			  ○ Ecosystems still in natural or near-natural state should preferably be maintained as such;
			  ○ Ecosystems that are moderately disturbed/degraded should not be further modified or disturbed.
			
			If activities that impact on ecological condition are unavoidable in these areas, a wetland offset will be required to address significant residual impacts.

	ESA 1 Priority for restoration	At least semi-natural – Prioritise for restoration	The objective for ESA1 "Priority for restoration" is to improve the WET-Health classification to increase the ecological function and ecological service delivery within the localised and broader landscape.
			
			For aquatic areas classified as ESA1 "Priority for restoration", the following applies:
			• These areas are not in a pristine natural state, but they perform essential roles in terms of landscape and aquatic connectivity, ecosystem service delivery and climate change resilience.
			• These systems may vary in condition and improving function is the main objective, therefore:
			  ○ Ecosystems still in natural or near-natural state should preferably be maintained as such;
			  ○ Ecosystems that are moderately disturbed/degraded should prioritised for restoration.
			
			If activities that impact on ecological condition are unavoidable in these areas, a wetland offset will be required to address significant residual impacts.

	ESA 2	No further intensification of land use	Maintain current land use with no intensification. For areas classified as ESA2, the following considerations apply: • These areas have already been subjected to varying degrees of intensive modification and are no longer considered natural. • These areas still perform an *important* function with respect to connectivity, ecosystem service delivery and climate change resilience

	CBA Map Category	Desired State	Water management objective
	Since aquatic features are not only impacted by activities within the water course/wetlands but also impacted by activities in the catchment, development planning and proposals must also consider the water management objectives of the receiving aquatic ecosystems.		
			○ Objective is to maintain as much remaining ecological function as possible, therefore areas should not undergo any further deterioration in ecological function; Opportunities to change land use practices to improve ecological function (i.e. conversion of cultivation agriculture to livestock grazing agriculture) are desirable in ESA2 areas.
	ESA 2 Priority for restoration	No further intensification of land use – where possible prioritise for improved function.	Restore some function and ecological service delivery within the localised and broader landscape. For areas classified as ESA2 Priority for restoration, the following considerations apply: • These areas have already been subjected to varying degrees of intensive modification and are no longer considered natural. • These areas still perform an *important* function with respect to connectivity, ecosystem service delivery and climate change resilience ○ Objective is to restore as much ecological function as possible, therefore areas should not undergo any further deterioration in ecological function and should be prioritised for restoration where appropriate.
	No Natural Remaining (NNR)	Production	No desired state or management objective is provided for NNR.

6.2 RECOMMENDED LAND USE GUIDELINES

Human development and land use activities exert impacts on the surrounding environment. Land use categories in terms of the CoE Land Use Scheme (CELUS, 2020) have been grouped according to typical impacts associated with them for the purposes of managing land use activities to achieve the management objectives for the CBA map. The assessment of land use recommendations with respect to the terrestrial and aquatic CBA/ESA categories (Table 12 and 13) is structured around the following recommendations for each land use group of acceptance for each land use type/purpose:

1. Yes (Y): This is an appropriate land use activity. It is unlikely to compromise biodiversity. The activity is in line with, and may contribute to, the management objective. The land use activity is compliant with the CoE Bioregional Plan.

2. Conditional (C): The activity may compromise the integrity of biodiversity or ecological infrastructure. It may not be in line with management objectives. It will require detailed specialist assessment. It will require restrictive conditions (e.g. reduced footprint, clustering, located only on previously cleared land, etc.) and may require biodiversity offsets or set-asides.

3. Not appropriate (N): This activity will result in the destruction/degradation of important biodiversity and/or ecological support areas. It is not in line with management objectives. Development activities proposed will require detailed specialist assessment* in the appropriate field of study to establish compelling reasons why this activity should be authorised for development. Severe restrictive conditions will be applied and a biodiversity offset plan must be investigated and developed (using the most up-to-date guidelines and policies, with site specific input from experts) and implemented as a legally binding condition of authorisation.

4. Management required (M): It is possible that selected land use activities may not result in further degradation or disruption of biodiversity or ecological infrastructure or processes, provided that these activities are formally managed and monitored throughout the life of the activity. This will require management oversight and will require the development and implementation of a management plan for monitoring and reporting purposes.

* The specialist selected will depend on the biodiversity features present with in the area in question. This will be determined by querying the spatial layers of the CBA map, where attribute information will embed information pertaining to CBA-ESA criteria that were met for the site. For example, an area may be classified as a CBA due to:

- The presence of a threatened vegetation type. In this case, a suitably qualified vegetation specialist should be appointed to undertake a detailed survey of the vegetation.
- The presence of a threatened species (e.g. bird/plant/reptile/amphibian). A taxonomic specialist should be appointed to assess the presence of threatened species and the surrounding habitat to support these species.
- The need of an area to meet South African biodiversity targets. In this case, a biodiversity planner should be appointed to consider the biodiversity present in the project area and provide an opinion on the alignment of the development proposal with the objectives of the CoE Bioregional Plan 2020.
- The presence of priority koppies, river and/or wetland features. Similarly, suitably qualified specialists should be appointed to assist with assessments of these ecosystems.

Table 6.2 summarises the land use groups present in the CoE. Each land use group is described in terms of the CoE land use scheme and typical activities associated with it.

Table 6.2 Matrix of recommended land use and water use guidelines for the CoE

CoE land use definition or zoning scheme	Corresponding activities permissible in the City of Ekurhuleni Land use scheme	Bioregional Plan LU category	CBA 1	ESA 1	ESA 2
Conservation	Land and buildings used for the protection of biological diversity such as, but not limited to, conservancies, protected environments, nature reserves, national parks. For the purposes of the CoE Bioregional Plan, this includes public open spaces zoned as bird sanctuaries and wetland reserves.	Conservation areas	Y	Y	N
Residential 1-4	All residential zoning categories	Urban development: built up	N	N	C
Business 1-3	All business zoning categories				
Industrial 1&2	All industrial zoning categories				
Public garage	Petrol and motor dealers/workshops				
Community Facility	Education, social halls, libraries, sports and recreation, places of worship				
Social Services	Hospitals, clinics, police stations, fire stations, municipal-government offices, old age homes, museums, post offices				
Public Services	Markets, abattoirs, water works, mortuaries, substations, sewage treatment, waste landfill sites				
Parking	Parking bays, garages				
Recreation	Resorts, conference centres, guesthouses, hotels, play parks, social halls, sports and recreational clubs. For purposes of the CoE Bioregional Plan 2020, this activity excludes conservation areas and open parks.				
Transportation	Railway, airports, transport centres, taxi ranks, parking bays/garages				
Infrastructure: powerlines	None	Infrastructure: powerlines	C	Y	Y
Public Services	Linear infrastructure: Water, storm water and sewage pipelines	Urban development: semi-natural/open space	N	C	Y
	Cemeteries, storm water retention/attenuation		N	C	Y
Roads	Streets, roads	Roads and Transportation	N	C	C

CoE land use definition or zoning scheme	Corresponding activities permissible in the City of Ekurhuleni Land use scheme	Bioregional Plan LU category	CBA 1	ESA 1	ESA 2
Mining	Land area which is used for operations and activities for the purposes of searching for and extracting any mineral on or in the earth, water or any residual deposit, as defined and regulated in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002). The CoE scheme includes brick-making into this zone	Mining	N	N	N
Agriculture 1 and 2	Arable, meadow and/or pasture land and buildings used for bona fide farming activities, such as crop or grain farming, grazing, land used for bee-keeping, bird and animal breeding and keeping, livestock farming, dairy farming, game farming, aquaculture, mushroom production, plant nursery gardens, plantations, orchards, market gardens and other ancillary uses and buildings, such as cultivation sheds and store rooms/sheds, farm worker accommodation, equestrian centres	Agriculture: intensive cultivation	N	N	Y
		Subsistence or small-scale agriculture	N	M	M
		Agriculture: grazing	M	Y	Y
Public and private open space	Land set aside or to be set aside for the use by a community as a recreation area. For the purposes of the CoE Bioregional Plan 2020, this only includes parks, natural gardens, storm water retention/attenuation, development exclusion areas (i.e. around landfill sites). See “Recreation” for developed open space.	Public and private open space	C	Y	Y
	Botanical and zoological gardens includes: land and buildings used for the housing, care and exhibition of animals, birds, reptiles and insects for educational and research purposes or for the cultivation with exotic and indigenous plants, which allows restricted access to the public and may include a restaurant	Botanical and zoological gardens	C	Y	Y

7 SPECIFIC RECOMMENDATIONS FOR PARTICULAR SITES OR ECOSYSTEMS INDICATED ON THE MAP

7.1 WETLAND MANAGEMENT AND RESTORATION

Wetlands are the most threatened and least protected ecosystems in South Africa (SANBI, 2019). While this highlights the need for conservation action, they are also recognised as "high-value" ecosystem types which, while only making up a small part of our landscape, provide disproportionate positive benefits to people (SANBI, 2019). In urban settings, in particular, the value of healthy and functioning ecosystems in reducing the impacts of climate change is increasingly being recognised. Additionally, the amenity and cultural benefits provided by natural environments are also starting to be recognised as important in enhancing the liveability of urban environments; especially since the world is becoming more urban and will continue to do so. A preliminary economic valuation of the ecosystems provided by intact and functional ecosystems in South Africa (Turpie *et al*., 2017) concluded that:

"*…maintaining untransformed natural systems generates substantial value equivalent to at least 7% of the country's GDP (R4 014 billion in 2015), either in the form of inputs to productive activities and welfare or the losses avoided by retaining these systems. This is more than three times the value of the agricultural, forestry and fishing sector (2.2%). This is a conservative and incomplete estimate*."

Wetland ecosystems, in particular, are increasingly being recognised as highly valuable natural assets that provide a wide range of ecosystem services to society in support of a number of important agendas such as: (i) biodiversity maintenance, (ii) water resource management, (iii) disaster management and climate resilience/adaptation, and (iv) direct use goods and cultural/amenity services to people. In urban contexts, in particular, their ability to filter and improve the quality of water and reduce the intensity of floods are considered valuable services in supporting biodiversity, water resources, public health and disaster risk management municipal objectives. In response, a broad suite of guidelines have been developed to guide and inform wetland management, with the latest guidelines focussing specifically on providing guidance to municipal planning and decision making (ICLEI, 2018).

Further modification and degradation of the wetlands in the CoE is not appropriate. Land use planning and decisions must take into consideration the critical ecosystems services that the wetlands play for the citizens of CoE and the multitude of communities downstream for the watershed and must ensure that appropriate land uses, which are compatible with the objectives of maintaining and/or improving the state of wetlands, are integrated into development planning and development layouts.

7.2 SITES CRITICAL FOR LANDSCAPE CONNECTIVITY

Given the demand for open land within this rapidly developing urban context, unique multiple-use approaches to land utilisation need to be developed and implemented that achieve both ecological and social-economic objectives. This is particularly relevant in modified landscapes earmarked as ecological linkages (ESA 2 areas) where maintaining current land use is vital for maintaining landscape connectivity that would otherwise be lost if the site was further developed. Examples of three approaches that have been used to maintain critical linkages are outlined below:

- Existing degraded or moderately modified areas that offer an opportunity by restricting future development, such as powerlines, have been integrated into the CBA-ESA network to achieve connectivity.
- Similarly, future development associated with services, such as cemeteries and powerlines, may still function as important network corridors and may therefore be considered in ESA areas.
- Subsistence or small-scale agriculture (grazing and cultivation) represents opportunities to maintain ecological corridors, while maintaining livelihoods and food security in these communities.

The "connectivity" data field in the CBA map layer indicates how important sites are for maintaining ecological connectivity. While some sites may have apparent low biodiversity importance in terms of species or habitats present, the fact that they may function as vital ecological network linkages emphasises the importance of maintaining the current land use and "ecological permeability" of the site.

Land use planning and decisions must take into consideration the role a site plays in maintaining connectivity in the CoE and must ensure that appropriate land uses, which are compatible with the objectives of maintaining connectivity, are integrated into development planning and development layouts.

7.3 EDGE-EFFECTS AND GAUTENG POLICY ON BUFFERS

The CBA-ESA map identifies in detail the location of remnant fragments of natural areas linked together into a city-wide ecological corridor network built around the city's hydrological network. The principals of spatial biodiversity planning include minimising edge-effects by selecting larger contiguous areas rather than many smaller, isolated sites as well as making provision for ecological buffers. Ecological landscape design rules have been applied where ever possible, however, the predominately urban character and highly developed rural landscapes provide very limited options for effectively achieving these rules. Minimising "edge-effects" should be a key land use planning and implementation principle applied throughout the city. Edge-effects are the negative impact that human development has on neighbouring biodiversity. They operate in the area surrounding biodiversity sites. Demarcation of ecological buffers surrounding biodiversity sites and management of land use impacts within these buffers are designed to help mitigate edge-effects.

The nature of the urban landscape implies that almost all biodiversity areas border directly onto developed urban landscapes, hence edge-effects are predicted to be high. Within the urban boundary of the CoE it is mostly impossible to design any form of ecological buffer that utilises natural or near-natural landscapes to buffer critical biodiversity. Creating buffers around critical biodiversity areas within the urban landscape will require management of the developed component of the urban landscape. For example, urban development types with lower environmental impact or higher proportion of green to hard surfaces can be used to buffer biodiversity areas. Eco-estates, golf courses, parks, sports fields, cemeteries, subsistence agriculture, water works, servitudes, etc. can all play a functional ecological role in the urban landscape to buffer critical biodiversity areas and create/maintain landscape connectivity.

Outside the urban edge, maintaining ESA2 areas, that are mostly cropland, is very important for both landscape ecological connectivity but also serve buffer function. Particularly in the east and south of the metro there are several "bio-agri" landscapes where cropping agriculture plays a supporting role for biodiversity. Conversely, biodiversity also plays a supporting role for agriculture by, for example, conserving water resources and providing refuge areas for natural predators of agricultural pests. The CBA map can be used to define "bio-agri" landscapes in the CoE development planning tools.

The ESA map categories are there to buffer CBA categories as well as provide landscape ecological connectivity. Therefore, maintaining ESA is as important as maintaining CBAs from the perspective of maintaining the overall ecological functionality of the corridor network. In addition to the CBA map, GDARD have a number of policies that make provision for general river, wetland, site and species buffers designed to limit edge-effects. In addition, best practice guidelines (such as the Grasslands Ecosystem Guidelines, SANBI (2013) must be used to define site specific buffers, where applicable.

7.4 BIODIVERSITY OFFSETS

South Africa's National development Plan (NDP 2030) recognises that market and policy failures have resulted in the global economy entering a period of "ecological deficit" as natural capital is being degraded, destroyed, or depleted faster than it can be replenished. This is particularly evident in urban areas such as Ekurhuleni which is characterised by rapid urban expansion. It is important to note, however, that the NDP 2030 goes beyond the potentially limiting utilitarian concept of natural capital by requiring that we protect the natural environment in all respects, leaving subsequent generations with an endowment of at least equal value. In light of this situation, there is a growing recognition that biodiversity offsets provides one means of slowing and even reversing ecological deficit by counterbalancing degradation, destruction and depletion through protection, rehabilitation, restoration and replenishment (DEA, 2018).

The environmental impact mitigation hierarchy is the principal tool used to inform effective environmental management for sustainable development (Figure 7.1). In instances where development still results in significant impacts to biodiversity, the concept of Biodiversity Offsets must be considered as a way to offset the losses, particularly where impacts affect CBA 1&2 areas. A provisional framework for considering terrestrial offsets is provided in the Draft National Biodiversity Offset Policy (2018) while guidelines for wetland offsets has been published by the Water Research Commission (SANBI & DWS, 2016). Best available science and latest publications should be applied to inform offset planning in CoE until such time as firm National or regional guidance has been provided.

While it is acknowledged that policy and guidelines to inform biodiversity offsets are still under development, the situation in the CoE is such that urban development is occurring at a rapid rate. The unchecked loss of ecosystems within the CoE increases the threat status of these ecosystems at a national level and thus transfers the burden of achieving national targets to neighbouring municipalities and Province. This in turn places limitations on development in these municipalities.

From a biodiversity perspective, ecosystem and biodiversity loss within the CoE is close to or at thresholds of acceptable loss. Further losses in the CoE could only be balanced (and possibly prevented) by implementing offsets which could involve restoring degraded wetlands and/or securing remaining representative ecosystems for inclusion in the National and Provincial Protected Areas network. It is important to note, however, that there are real constraints to development in the CoE. There are instances where developments should not be considered, especially when the *in-situ* conservation of a biodiversity feature is necessary. Intact remnants of Critically Endangered Egoli granite Grassland and Endangered Tsakane Clay Grassland are particularly important in this respect and should not be developed even if an offset is proposed.

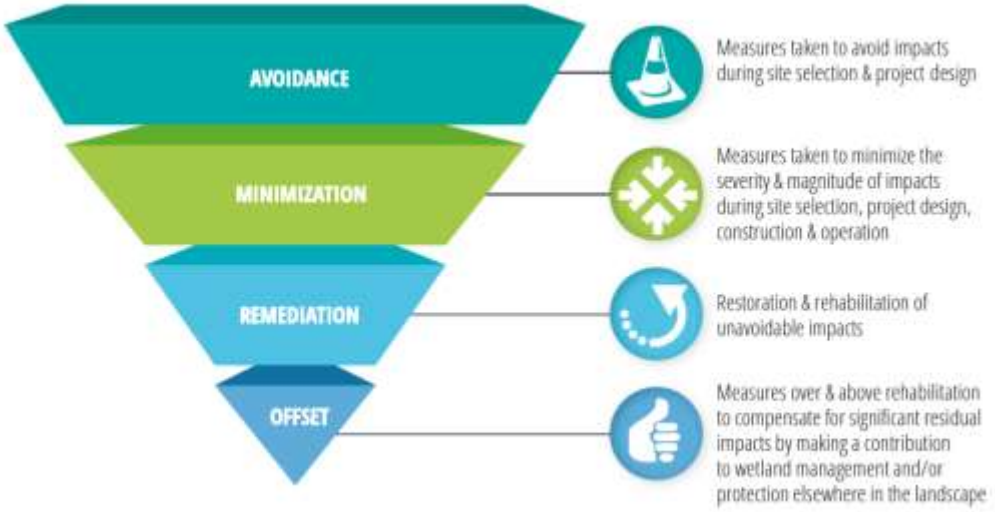

Figure 7.1. Diagram illustrating the mitigation hierarchy (taken from ICLEI, 2018)

Biodiversity offsets are typically identified where threatened species and ecosystems will be affected, but in terms of this Bioregional Plan, important ecological corridors which represent critical pinch-points for achieving connectivity in the landscape may be considered as important sites, the loss of which would also need to be compensated for, through offset activities. This includes the funding for the acquisition of the offset and the long-term ecological maintenance thereof. It must be noted that options for identifying and securing offsets within the CoE with respect to terrestrial ecosystems and habitat are limited. For this reason, sites beyond the CoE boundary may need to be considered.

In the case of wetland ecosystems, there is a growing recognition that policy responses should be fit for purpose rather than simply adopting a one-size-fits-all approach. In instances where existing impacts have already degraded wetland functions to a point where they cannot address water quality concerns and water quality poses a risk to downstream users, a more pro-active policy approach is required. Such an approach has been adopted by the eThekwini Metro to enhance the functioning of wetlands in the landscape (Macfarlane, 2016). A similar approach is advocated in the CoE where ESA "Priority for restoration" wetlands are recognised as offset receiving areas that require special attention. Where developments impact on ESA wetlands, a "no-net-loss" approach is advocated however a "net-gain" approach is advocated for impacts to CBA2 wetlands. To facilitate offset exchanges, a pro-active approach to offset planning is required whereby offset sites are rehabilitated in advance and mechanisms instituted to formalise trading rules through a wetland offset banking scheme.

7.5 GAUTENG PROTECTED AREAS EXPANSION STRATEGY

An important message of the National Spatial Biodiversity Assessment (2005) was that the current network of Protected Areas in the South Africa is not adequate for the objective of securing the protection of representative biodiversity, ecosystems and ecological processes. To address this issue, the National Protected Areas Expansion Strategy was initiated, which identified important priority areas at a National scale.

At the Provincial level, the implementation of the strategy required finer-scale mapping. In 2013, the Gauteng Protected Areas Expansion Strategy (GPAES) was developed to provide a road-map for the expansion of Protected Areas in the Province over a 20-year planning period (the strategy was approved in 2018). Sites for Protected Area expansion, primarily through the implementation of the Stewardship Programme, have been identified in the CoE. The GPAES sites in the CoE expand on existing Protected Areas and identify areas which

contain important wetlands and threatened ecosystems. PAES sites have been earmarked for future conservation, therefore the modification or development of these sites is undesirable. Although PAES sites are not publically available (due to data sensitivity), enquiries may be submitted to GDARD Scientific Services.

8 COMPETING LAND USES AND FUTURE THREATS TO BIODIVERSITY IN COE

8.1 URBAN EXPANSION AND THE CITY OF EKURHULENI SPATIAL DEVELOPMENT FRAMEWORK

Urban expansion is occurring at an exponentially rapid rate. When comparing the land cover generated for this revision with the land cover derived in 2009 for the Gauteng C-Plan 3.3, since 2009 approximately 8 500 ha of land in the CoE has been developed. This which equates to roughly 770 ha per year. At this rate, planning for biodiversity in the landscape needs to focus on maintaining functional ecological infrastructure for the continued delivery of much needed ecosystem services. Although the CBAs have been effective in terms of influencing development into non-CBA areas (see Table 10.1 for % of CBAs and ESAs developed), the socio-economic-political objectives will continue to apply pressure on the remaining biodiversity and ecosystems. It is hoped that the level of land cover accuracy achieved in this Bioregional Plan will provide a stronger case for conserving CBA 1 areas.

Development is largely informed and influence by the CoE Spatial Development Framework (2015) (Figure 8.1). The CoE SDF (2015) (which integrated the CoE Bioregional Plan (2015)) was considered in the revision of the CoE Bioregional Plan. In the development of the Spatial Biodiversity Framework, which is effectively the planning unit layer and ultimately guides the development CBA map, conflict areas were avoided as much as possible where secondary natural or cropland and built open space is concerned. Where natural areas remain in conflict areas these were not avoided given that only 10.4% remains in a natural state. Conflict was also not avoided where landscape connectivity is concerned. Landscape connectivity is vitally important in this landscape so, where no other connectivity options were available, conflict was not avoided.

An assessment of the CoE SDF and the CBA map in this revised CoE Bioregional Plan (2020/2021) indicates that there are still residual conflicts with respect to land use objectives between the plans. It must be noted that the SDF is a high-level and course mapping process and that the CBA map has been undertaken at a much finer scale. Despite this, the following observations were made when overlaying the SDF (2015) with the CBA map (2020/21):

1) The SDF land use zones are in conflict with 60% of the CBA area in the revised map (Table 8.1. The largest conflicts are linked to future planned “urban development”, “mixed-use development” and “agriculture” in CBA1 areas. In terms of the agriculture zone, should the land use be livestock grazing, this would not result in a conflict. However, if the land use is cultivation, this would be a conflict in land use objectives. In addition, a further 21% of CBA1 areas have been zoned for “amenities”, “industry”, “landfill”, “mining” and “transportation”. Only 40% of the CBA area in the map overlaps with the compatible land use zone: “Open space”.
2) While there is less conflict with the ESA map categories, “urban development” is planned for 28% and 19% of ESA 1 and ESA 2 areas, respectively (Table 8.1). The type and layout of development in these areas will be crucial for maintaining connectivity in the landscape.
3) Although the SDF is a high-level, course mapping exercise it is worth noting that development land use zones overlap with 25% of the wetland area in the CoE (Table 8.1).

Table 8.1 Percentage (%) overlap of the CBA-ESA map and land use zones as per the CoE SDF (2015)

	CoE CBA Map Categories				
MSDF Land Use Zones	**CBA1**	**ESA1**	**ESA2**	**Wetland**	**PA**
Agriculture	9	24	39	8	0
Amenities Public and Social Services	6	3	2	3	1
Industrial	5	4	3	3	0
Landfill Site	1	0	0	1	0
Mining	3	3	3	2	2
Mixed Use	10	8	6	4	0
Open Space	40	26	19	67	96
Transportation	6	4	7	2	0
Urban Development	19	28	19	9	1
Total % SDF conflict per CBA/ESA mapping category	**60**	**47**	**39**	**25**	

It is not possible to resolve the residual conflict between development and conservation goals in this Bioregional Plan. The conflicts may be resolved either through the EIA process on a case-by-case basis or through the SDF review process which is currently underway and the following recommendations for the SDF review include the following:

- Where feasible, it would be desirable to exclude urban development from PAs, CBAs and ESAs
- No development should be permitted in wetland areas or within the buffers as per Gauteng Policy (See Section 7.3). It is recommended that wetlands and their buffers are presented in the development map to clearly indicate these development constraints
- Indicate within in the land use zone map all CBAs are irreplaceable sites and will definitely attract a Biodiversity Offset. ESAs are also important, particularly sites that are critical for connectivity, and may attract a Biodiversity Offset and this needs to be noted in the SDF.

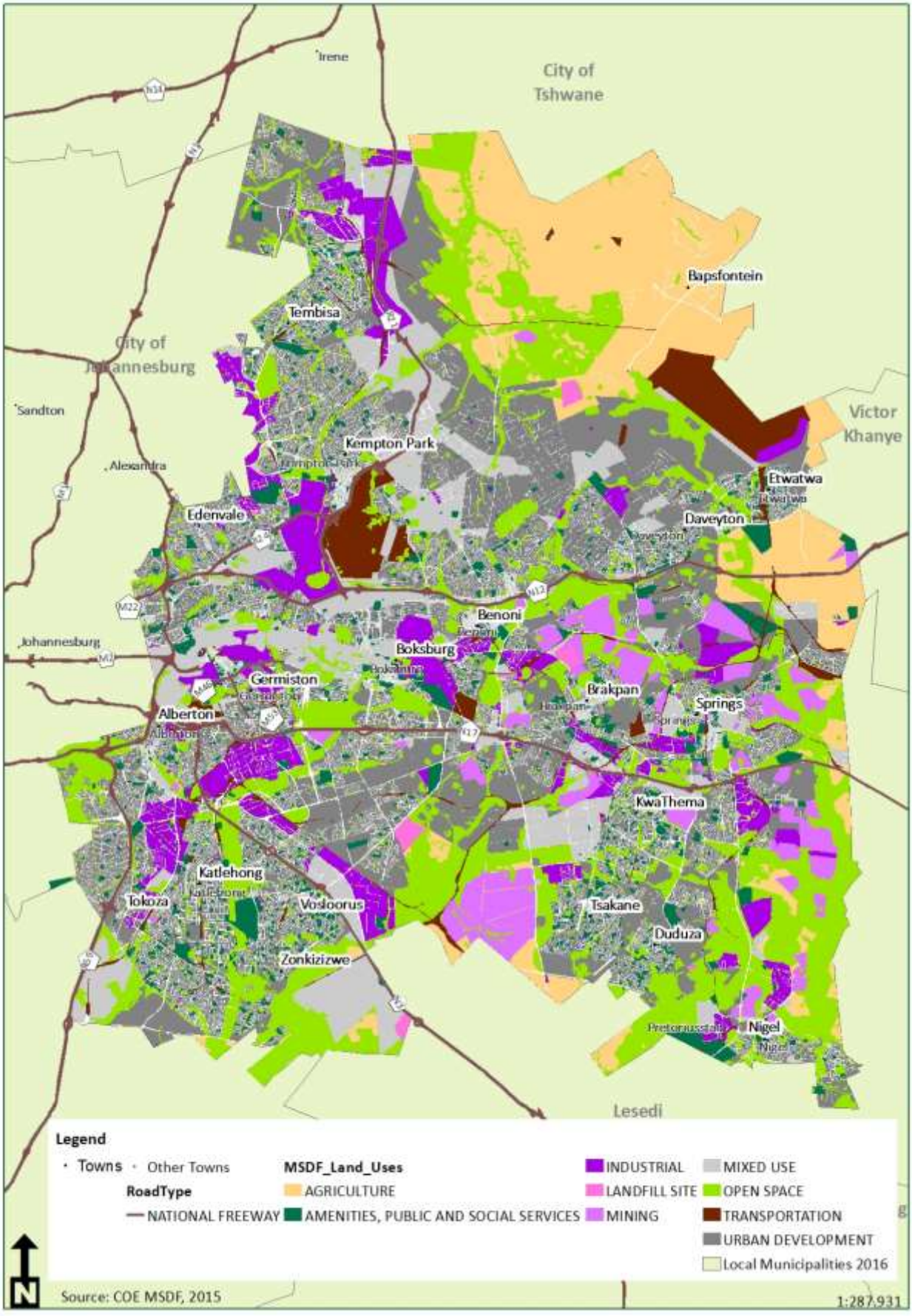

Figure 8.1 Land use zones mapped in the City of Ekurhuleni Spatial Development Framework (2015).

8.2 CLIMATE CHANGE

The integration of climate change mitigation and adaptation has become central to all sectoral planning. Climate change manifestations will affect biodiversity and ecological processes at the level of individuals, populations, communities, ecosystems and biomes through extinction events, loss of vulnerable and fragile ecosystem and changes in distribution ranges. In terms of the Climate Change and Biodiversity Factsheet Series (7 of 7, 2013), the Grassland biome is considered the most threatened under all climate scenarios with a predicted shift to Savanna or Forest biomes, and therefore has the highest priority for action. Maintaining and retaining the grasslands of the CoE is therefore a high priority in terms of Climate Change.

The loss or change of biodiversity, combined with the disruptive effect of changes in temperature and rainfall will affect the level of integrity of ecosystems. This will in turn determine the ability of ecological infrastructure to deliver ecological and social services. Also, pressures currently exerted on the biodiversity and ecological processes are likely to intensify with the progression of climate change manifestations. Maintaining healthy, functioning ecosystems is an important adaptation strategy that enhances the ability of natural systems to build resilience against climate change impacts. Wetlands are a good example of ecological infrastructure that provides effective flood attenuation, which need to be prioritised. To increase natural resilience, it is imperative to develop an integrated approach to biodiversity conservation, poverty alleviation and development.

The Ecological Support Areas (ESA 1 and 2) are designed to maximise connectivity of natural areas and to avoid further fragmentation of the landscape. Connectivity supports landscape-level ecological functioning as well as the ability of ecosystems and species to adapt to climate change. Areas important for ecological processes often play an important role in climate change adaptation, either by acting as climate change refugia or by providing corridors for the movement of species.

8.3 AGRICULTURE

Almost 18% of the CoE is currently involved with cultivation agriculture. The high land capability of the soils and the availability of water make these areas within the CoE an important resource for future food security and should therefore not be built up. This objective overlaps with biodiversity objectives to some degree and, in some cases, synergies may be achieved. However, should an area of high land capability overlap with an area of high biodiversity, which has **not** previously been cultivated, there will be a conflict in land use.

In addition, both agriculture and natural ecosystems are experiencing development pressure in the CoE. It may be desirable to preferentially develop agricultural land, rather than pristine grasslands. This may involve the consideration of an agricultural offset, similar to a biodiversity offset, in neighbouring areas which are contiguous and better suited for commercial production.

8.4 MINING

Current and decommissioned mines have formed and transformed the landscape throughout the CoE along the mining belt. Prospecting applications for future mining have been communicated, but the locality of these applications has not been sourced to date.

Old mines, which include rehabilitated mine dumps and undermined areas, should be earmarked for future development, rather than greenfield development, where it has been deemed safe to do so.

9 ADDITIONAL MEASURES FOR EFFECTIVE MANAGEMENT OF BIODIVERSITY IN THE COE

9.1 DECISION-MAKING FOR SUSTAINABILITY IN THE COE

In the face of expanding urban development, authorising agencies may be required to make decisions that compromise natural resources in favour of socio-economic benefits such as housing, poverty alleviation and job creation. An important goal is to achieve social, economic and environmental ***sustainability***, which is core to the success of any initiative, plan, project or programme.

Decision-makers and planners need to be clear about what is meant by the phrase "sustainable" and must be able to justify their decisions based on sustainability criteria. The word "sustain" has two meanings that bear relevance. "Sustain" means to: strengthen, support, and assist. It also means to: endure or withstand. In all aspects of spatial, social, economic and environmental assessment and decision-making, the following questions should be asked:

1. Will the project/development strengthen, support and assist social needs?
2. Will the project/development strengthen, support and assist economic development?
3. Will the project/development strengthen, support and assist conservation goals and initiatives?

As importantly:

1. Is there a social **desire** and elements of social **investment** associated with the development?
2. Is there a genuine economic **desire** and are there sufficient supporting **economic resources**?
3. Are there opportunities in layout and design to support and sustain ecological function and have these been integrated into the development proposal?
4. Has provision been made for the renewable use and management of natural resources and is the land use compatible with principles of **maintaining biodiversity and ecological integrity** for delivery of ecosystem services, now and in the future?

It is also important to emphasise the potential for biodiversity assets and ecological infrastructure to provide the basis for development in the CoE and to contribute to the achievement of socio-economic goals. There is potential to support both biodiversity conservation and development. Striking this balance should form the framework for sustainable decision-making.

The CBAs mapped in a Bioregional Plan are areas which support important biodiversity and which are required to meet biodiversity targets. The management objective for CBAs is that they are maintained in a natural state. Since there is very little left in the CoE which may be considered natural, further loss of CBAs must be avoided. The mitigation hierarchy must be consistently applied by developers, EAPS and authorities to development proposals in CBAs of the CoE.

9.2 GAUTENG ENVIRONMENTAL MANAGEMENT FRAMEWORK

The Gauteng Environmental Management Framework (GEMF, 2015) is currently being updated, but will not be ready for comparison in the revision of this Bioregional Plan. A comparison has therefore been made with the 2015 GEMF and the original Bioregional Plan (2015) to determine the level of concurrence and identify any tensions between the two products.

The GEMF maps the Province at a high level, dividing Gauteng into five (5) zones (Figure 9.1). These zones, and the land use intentions for them, are listed below:

- Zone 1 Urban development – streamline densification and infill within this zone. EIA listed activities may be exempt at discretion of competent authority
- Zone 2 High control zone within Zone 1– sensitive areas for conservation
- Zone 3 High control zone outside Zone 1– sensitive areas for conservation
- Zone 4 Normal control zone – agricultural areas
- Zone 5 Industrial and large commercial focus zone – streamline non-polluting and large scale commercial (warehouses) activities in existing areas and areas that are degraded, but close to infrastructure

An overlay of the CoE Bioregional Plan (2015) Critical Biodiversity Areas with the GEMF (2015) Zone 1 and Zone 5 reveal some degree of concurrence, but also significant disagreement (Figure 9.2). The divergence may be explained by the sensitivity analysis undertaken in the EMF process which considers a number of environmental criteria and ranks sites across these criteria. This exercise may have diluted the importance of Critical Biodiversity Areas.

Tension between the plans is reinforced by the recommendation by the GEMF for the exemption of EIAs for certain listed activities in Zone 1 and Zone 5; as well as by recommendations supplied in a compatibility matrix which lists conservation land uses as undesirable for Zone 1 and Zone 5. This is in direct conflict with the desired management objectives for Critical Biodiversity Areas that fall within these Zones.

The GEMF is currently being revised, and it recommended that the CBA area mapped in the Bioregional Plan is elevated in importance in the sensitivity assessment to ensure that CBA areas are afforded the conservation intervention that they require.

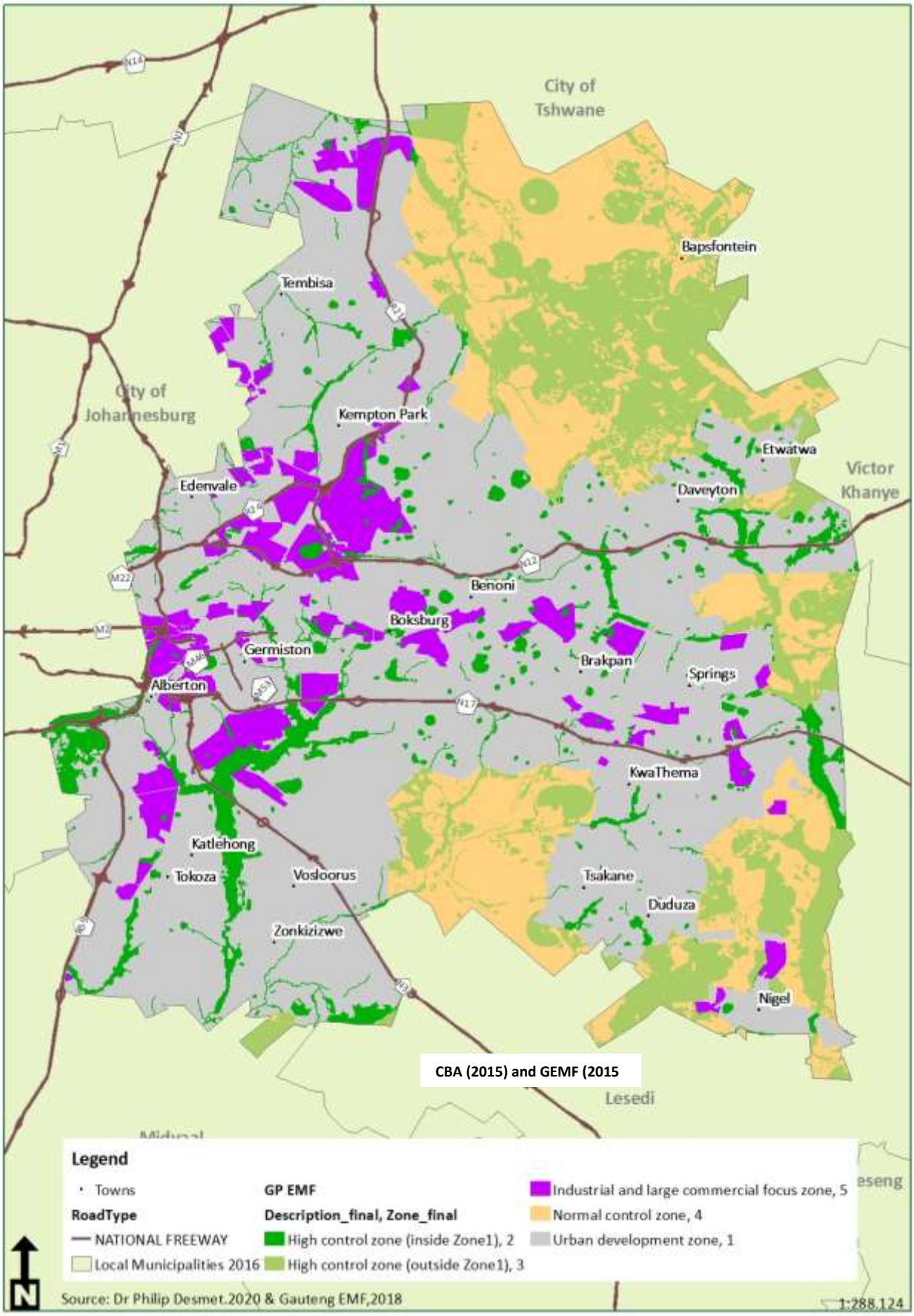

Figure 9.1 Gauteng Environmental Management Framework (2015)

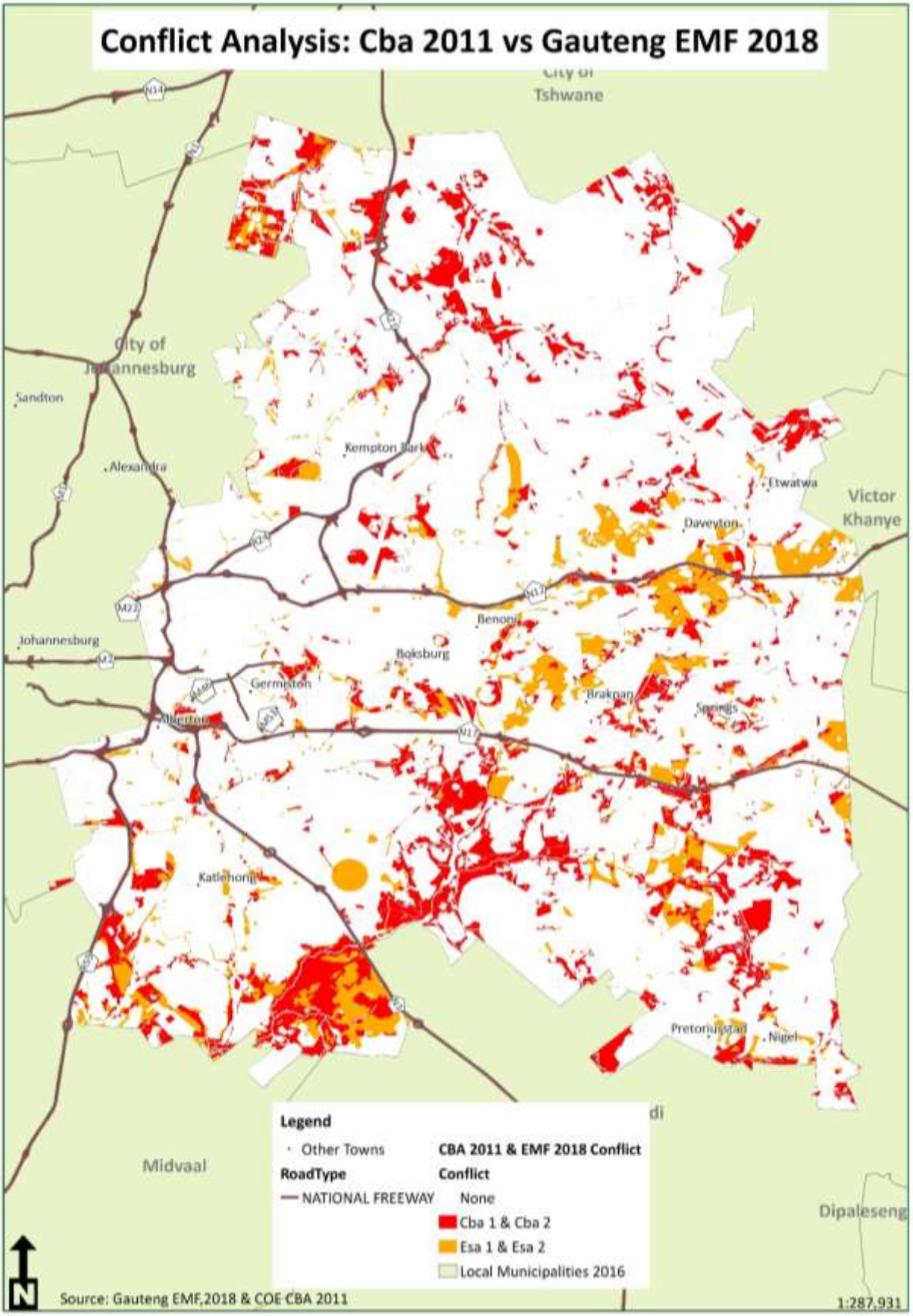

Figure 9.2 Conflicting land use recommendations/objectives between the CoE Bioregional Plan (2015) and the GEMF (2015)

10 MONITORING AND REVISION

The loss or modification of natural environments, due to ongoing changes in land use, as well as changes in distribution or knowledge of biodiversity, may impact on the identified network of Critical Biodiversity Areas (CBA) and Ecological Support Areas (ESA). This highlights the importance of monitoring, evaluation and revision of the CoE Bioregional Plan.

The CoE Bioregional Plan revised in 2020 has been gazetted in terms of the National Environmental Management Biodiversity Act. Provisions in the Act stipulate that plans be monitored and reviewed on at least a five-yearly cycle. It is therefore recommended that formal monitoring, reviewing and updating of the CoE Bioregional Plan takes place to ensure that the CBA map and associated land use recommendations remain current and useful to planning and decision-making.

The City of Ekurhuleni Metropolitan Municipality is the primary responsible agent for the implementation, monitoring, evaluation and review of the CoE Bioregional Plan revised in 2020, while the Gauteng Department of Agriculture and Rural Development (GDARD) is responsible for the systematic biodiversity plan underpinning the bioregional plan.

10.1 REPORTING ON MONITORING INDICATORS

Monitoring and evaluation of the indicators of this Bioregional Plan should be undertaken to inform the plan when it is updated/revised. Some of these indicators must be adopted by the CoE for annual reporting purposes. This would improve the availability of this information for integration into the next revision and also track targets that are discussed below.

The purpose of ongoing monitoring is to:

1. **Evaluate the implementation of the CoE Bioregional Plan,** i.e. is the plan being used a key informant in SDFs and other planning initiatives? This is monitored by checking that the SDF includes and integrates the CBA map and land use recommendations and whether the SDF refers to the Bioregional Plan as a baseline document. A spatial conflict analysis, which calculates the area of land uses mapped in the SDF which align or conflict with Bioregional Plan CBA and land use recommendations, should also be undertaken.
2. **Evaluate the outcomes or impact of the CoE Bioregional Plan**, i.e. by implementing the plan, are biodiversity objectives, such as reduced loss of important species/habitat, are being achieved? This could be monitored by the calculating the % of CBA area lost, versus the % loss of ESA and % loss of Other Natural Area (ONA), using updated land cover layers (See Appendix A for further recommendations). One would expect minimal loss in CBAs and a greater loss in ONAs. The main aim is to analyse trends over time and monitor performance of the CoE and respective role-players.
3. Adopt an adaptive approach towards monitoring the implementation of the revised CoE Bioregional Plan.

The CoE Bioregional Plan 2015 recommended indicators that should be reported on. Data on these indicators have been generated/sourced, for the review process (See Table below). The method for calculating/assessing each indicator is provided in Appendix 1.

Indicators which are monitored over time provides valuable information with respect to trends and data against which to assess the influence of the Bioregional Plan, particularly with respect to land use. However, without attaching a target to these indicators, the reporting exercise is passive and reactive, and does not provide the necessary proactive planning tool that would be elicited when establishing a target associated

with the indicator. A target expresses the desired state or outcome of the indicator. Targets have been applied to each indicator in the table below.

Table 10.1 Indicators for the monitoring of the Bioregional Plan objectives

Indicator no.		2015		2020		Target for 2025
	Indicator	**ha**	**%**	**ha**	**%**	
1	Percentage and area (hectares) of CBAs and ESAs that are under some form of conservation management (including both formal protection, conservation stewardship agreements or municipal zoning which achieve conservation objectives)	The PAs were mapped as PAs in the previous CBA map.	0	0 – no additional PAs have been proclaimed in the CoE since 2009	0	50% of CBAs 20% of ESAs declared as protected areas
2	Percentage and area (hectares) of approved development applications in CBAs and ESAs	NA	NA	Unverified.		0%
3	Percentage of CBAs/ESAs in the CoE and area (hectares) which is receiving biodiversity management interventions (alien invasive plant clearing, wetland restoration). Current value reports on wetland restoration and alien plant clearing	-	-	1 466	2% of CBAs & ESAs in CoE	1.5%
4	Percentage and area (hectares) of CBAs and ESAs that have been intensively modified/lost					
	CBA 1	4 067	12%	Area of CBA to be calculated when reviewed.	Area of CBA to be calculated when reviewed.	0%
	CBA 2	811	32%			0%
	ESA 1	2 664	23%	Area of ESA to be calculated when reviewed.	Area of ESA to be calculated when reviewed.	0%
5	Percentage and area (hectares) of CBAs and ESAs that are in their desired state					
	CBA 1	29 271	88%	Area of CBA to be calculated when reviewed.	Area of CBA to be calculated when reviewed.	100%
	CBA 2	1 757	68%			100%
	ESA 1	8 721	77%	Area of ESA to be calculated when reviewed.	Area of ESA to be calculated when reviewed.	100%

In addition to the indicators mentioned above, changes in the threat status or ecological condition of ecosystems, including terrestrial and aquatic, as determined at a National scale (as assessed and updated in the National Biodiversity Assessment) and at the CoE Metro scale (through the periodic revision of the Bioregional Plan). These are headline indicators typically generated by these processes, so information will be extracted from them for monitoring purposes.

CoE must conduct annual monitoring for indicators 1–3 against the target to provide the necessary basis for proactive action and intervention. CoE will generate an annual spreadsheet report on these indicators, with comment on targets achieved/not achieved, the reasons for this and a brief description of response actions required. This report should be submitted as part of current reporting processes, such as the IDP/SDBIP reporting and provincial reporting to GDARD and COGTA.

Indicator numbers 4 and 5 may only be assessed when updated land cover maps are made available. This may only take place every 5-years. As-and-when land cover maps become available, indicators 4 and 5 must be assessed against the targets and be consolidated into the monitoring report developed for the annual indicators (no 1–3) above. These indicators will reflect land development trends within biodiversity sensitive areas over time.

10.2 Revision of the CoE Bioregional Plan

The CoE Bioregional Plan 2020 should be reviewed and updated (where necessary) at least every five years by CoE/GDARD in accordance with the published guidelines for Bioregional Planning (NEMBA 291 of 2009). The review process should examine:

- Progress of implementation and impact of the CoE Bioregional Plan revised in 2020 (as measured by the implementation of monitoring indicators from Section 10.1 and 10.2 above).
- The need (or lack thereof) for an update of the underlying systematic biodiversity plan. Although the update of a systematic biodiversity plan is a data intensive and time-consuming process, due to the rapidly changing landscape, it may be necessary.
- The need (or lack thereof) for an update of the other components of the Bioregional Plan (e.g. land use guidelines, monitoring indicators and processes).
- Notwithstanding the above, a preliminary assessment indicates that the following data improvements will be required as part of the update:
  I. Detailed updated land cover mapping
  II. Protected area and conservation area map
  III. Inventories of all taxon groups with emphasis on threatened mammals, amphibians, invertebrates and plants.

10.3 Reporting on National Treasury Indicators in the Integrated Development Plan

To report meaningfully on National Treasury Indicators, it is important to understand that differences in accuracy of land cover assessments, scale of data and assessments and biodiversity planning methods change/improve over time. This means that spatial assessments are not always directly comparable and that relative values need to be interrogated to observe trends.

Land cover/land use is one of the key input layers in developing the Bioregional Plan CBA map. Differences of in how the land cover/land use was mapped may result in fundamental differences between CBA maps. In terms of the land cover assessment, there are a number of issues with 2009 land cover (which was used for the CoE Bioregional Plan 2015). Examples of where land cover/land use mapping disparities have affected the comparison between the years includes:

1. **Differences between the 2009 and 2020 land cover, where there has been no material change on the ground.** An example of this is the land associated with small holdings. In 2009, the land cover assessed these areas as non-natural, whereas the 2020 assessment considers these areas natural, but degraded.
2. **Differences between the 2009 and 2020 land cover, where there has been a material change on the ground.** An example of this is the recovery and re-vegetation of 3 600 hectares of "bare soil", the recovery and re-vegetation of 3 000 hectares of cultivated land. These gains are false gains as these areas are considered partially sterilised by vegetation clearing and cultivation and are no longer true representations of a natural state ecosystem. In tandem, mining and urban development have extended but the losses of natural land is not accurately accounted for and is perceived as being maintained. The interrogation of the land cover data, while only demonstrating a 10 000 hectare loss of natural land over the past 11 years, shows that the actual loss of natural land is far greater and pristine land is being replaced by secondary or degraded land, giving it an artificial sense of being stable. This statement is reinforced by the analysis of current land cover against the previous CBA map (CoE Bioregional Plan 2015). In this analysis, 4 000 hectares of CBA1 has been lost to, or modified by, development.

The "Percentage of biodiversity priority areas within the CoE" indicator should be viewed in the light of the land cover/land use mapping, and should be discussed in terms of CBA coverage between the 2015 and 2020/21 City of Ekurhuleni Bioregional Plan.

In comparison with the CoE Bioregional Plan (2015), the revised Bioregional Plan has:

Reduced CBA 1&2 area by almost 4% (from 17% down to 13.1% of the CoE)	There are fewer CBAs as improved land cover mapping has identified areas of historical cultivation, which do not satisfy the condition requirements for CBAs.
Maps no CBA 2 areas (from 1% to 0% of the CoE)	All of the pristine natural areas within the CoE are required to meet targets. Therefore, there is no flexibility in the landscape and all natural areas that are in a degraded state are mapped as ESAs in this Bioregional Plan.
The area of ESA 1 has more than doubled (6% to 12% of the CoE).	The semi-natural areas that may have been mapped as CBA 1 or CBA 2 in the previous Bioregional Plan have been allocated to the ESA 1 category.
The area of ESA 2 has increased from (12% to 15% of the CoE)	The current revision of the Bioregional Plan has identified the need for improving landscape connectivity for the continued functioning of ecosystems and delivery of ecosystem services. ESAs have therefore in some cases been identified in areas that have been modified by cultivation.
There are no "Other Natural Areas" (from 12% to 0% of the CoE)	Due to the expansion of urban development, no "Other Natural Areas" have been identified in the revision of the Bioregional Plan. This seems to indicate that future development in the CoE is constrained. However, it must be noted that there are many options for future development in areas that are already intensively modified. Opportunities for land use changes (i.e. from cultivation agriculture to urban development, or from mining to urban

	development) are to be considered in strategic development planning, such as the SDF review.
No Natural Habitat has increased (from 51% to just below 56% of the CoE)	The percentage of land that is no longer natural, which includes land cover classes such as cultivated land, urban built-up areas and mining, has increased by 5%.

11 GIS DATA USED

Please refer to the Technical Report.

12 APPENDIX 1: DEFINITIONS AND CALCULATIONS OF BIOREGIONAL PLAN MONITORING INDICATORS

Indicator no.	Indicator	**Definition and detailed comment**	**Method of calculating indicator**	**Responsible entity**
1	Percentage and area (hectares) of CBAs and ESAs that are under some form of conservation management (including both formal protection, conservation stewardship agreements or municipal zoning which achieve conservation objectives)	The desired state for CBAs, and some of the important ecological corridors in the CoE, is that they be maintained in a natural state and conserved in this state. One mechanism that achieves these objectives, is formally protecting an areas. An alternative is through municipal zoning for conservation purposes. This indicator calculates the area (hectares) and percentage of CBAs and ESAs that have been placed under some form of conservation management (including formal protection, conservation stewardship agreements, or municipal zoning which achieve conservation objectives). Efforts should be prioritised in protected areas expansion sites as identified by GDARD	Determine area of **CBA and ESA land** that has been zoned for conservation and/or protected by proclamation in terms of NEMPA. The calculation would entail deriving the number of hectares of conservation areas or protected areas in CBAs and ESAs and expressed as a percentage of the total number of hectares of CBA or ESA (as relevant).	CoE Council GDARD NGOs Private

Indicator no.	Indicator	Definition and detailed comment	Method of calculating indicator	Responsible entity
2	Percentage and area (hectares) of approved development applications in CBAs and ESAs	Number and area (hectares) of successful development applications in CBAs and ESAs	Information is derived from GDARD and CoE City Planning. The application/approval is assessed against mapped CBAs and ESAs. The number of applications are recorded and the area within CBAs and ESAs is calculated by intersecting the zoning application with the CBA map, using a GIS software tool. This should be undertaken bi-annually.	GDARD CoE City Planning
3	Percentage and area (hectares) of appropriate biodiversity management interventions (such as alien invasive plant clearing, wetland restoration) that have been undertaken in identified CBAs and ESAs;	Alien invasive eradication: CoE currently implement an alien plant clearing programme in wetlands, which is soon to expand into terrestrial ecosystems. The programme involves annual monitoring and clearing at the same sites. Reporting on aquatic and terrestrial activities should be separate going forward.	The extent of alien clearing in wetlands was calculated by establishing the ***entire area*** of each wetland that is being monitored and managed for alien clearing (not just mapping small areas that are being managed). It is understood that annual follow-up work at all sites is necessary due to re-infestation of alien plants and therefore this indicator is not a reflection of resource allocation, but the effective area that is being managed. The aim is to increase the area over time. In terms of future terrestrial alien invasive plant clearing, the physical extent clearing	Working for Wetlands Working for Water CoE: Environmental Strategy and Planning

Indicator no.	Indicator	Definition and detailed comment	Method of calculating indicator	Responsible entity
			should mapped for this indicator and presented separately. Information from other national programmes that may be operating in the CoE, such as Working for Water and Working for Wetlands, may be presented here too, but must be reflected as separate to CoE activities.	
4	Loss of CBAs and ESAs	Percentage and area (hectares) of CBAs and ESAs that have been intensively modified/lost	When land cover data sets are updated as part of the revision of the CoE Bioregional Plan 2020, intersect all intensively modified land cover with CBAs and ESAs and calculate the area of each category that has been lost/intensively modified.	CoE : Environmental Strategy and Planning
5	CBAs and ESAs that have been maintained in the desired state	Percentage and area (hectares) of CBAs and ESAs that have been maintained in the desired state, i.e: • CBA in a natural or near-natural state • ESA1 in a natural, near-natural or semi-natural state • ESA2 with no further intensification in land use.	When land cover data sets are updated as part of the revision of the CoE Bioregional Plan 2020, intersect all natural land cover with CBAs and ESAs and calculate the area of each category that has been conserved.	CoE : Environmental Strategy and Planning

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