



A Better Place for All

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STRATEGIC
ENVIRONMENTAL
ASSESSMENT (SEA)**

DRAFT SEA REPORT

LIST OF ACRONYMS

CBA	Critical Biodiversity Area
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
DES	Desired Environmental State
DFFE	Department of Forestry, Fisheries and the Environment
DRM	Disaster Risk Management
Eco-DRR	Ecosystem-based Disaster Risk Reduction
EIA	Environmental Impact Assessment
EMF	Environmental Management Framework
ESA	Ecological Support Area
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
IEMP	Integrated Environmental Management Plan
KZN	KwaZulu-Natal
LED	Local Economic Development

LN1	Listing Notice 1
LN2	Listing Notice 2
LN3	Listing Notice 3
M&E	Monitoring and Evaluation
NDZ	Dr. Nkosazana Dlamini Zuma (Local Municipality)
NEMA	National Environmental Management Act (107 of 1998)
NHRA	National Heritage Resources Act (25 of 1999)
PSDF	Provincial Spatial Development Framework
SDF	Spatial Development Framework
SEA	Strategic Environmental Assessment
SPLUMA	Spatial Planning and Land Use Management Act
TSMP	Traditional Settlement Master Plan
UNCCD	United Nations Convention to Combat Desertification
UNFCCC	United Nations Framework Convention on Climate Change
WHS	World Heritage Site

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1. EXECUTIVE SUMMARY

1.1. PURPOSE, CONTEXT AND STRATEGIC POSITIONING OF THE SEA

The Strategic Environmental Assessment (SEA) for the Dr Nkosazana Dlamini Zuma Local Municipality (NDZ LM) has been prepared as a standalone strategic environmental planning instrument to support and inform the Draft Spatial Development Framework (SDF) 2026–2046. The SEA is positioned as an upstream, proactive decision-support tool that integrates environmental considerations into spatial policy formulation at the earliest stages of planning. Unlike project-level Environmental Impact Assessments (EIAs), which assess site-specific impacts once development proposals are defined, the SEA evaluates environmental constraints, cumulative risks, and long-term sustainability implications at a municipal scale.

The purpose of the SEA is to establish a consolidated environmental baseline for the municipality, identify key environmental risks and opportunities, and provide a defensible environmental rationale to guide Council decision-making and provincial oversight. It strengthens the Draft SDF by ensuring that environmental sensitivities, climate resilience, ecological infrastructure, and agricultural sustainability are embedded within spatial structuring principles. In doing so, it aligns with the requirements and principles of SPLUMA and NEMA and reinforces vertical integration with provincial and district planning frameworks, translating environmental policy into operational spatial direction.

1.2. METHODOLOGICAL APPROACH

1.2.1. INTEGRATED ENVIRONMENTAL BASELINE

The SEA methodology reflects established South African strategic environmental assessment practice and is explicitly municipal-wide in scale. The assessment synthesised existing environmental datasets, sector plans,

spatial mapping, and secondary information to develop an integrated understanding of biodiversity patterns, Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs), hydrological systems, catchment conditions, landscape characteristics, agricultural land capability, and climate vulnerability. The emphasis was on identifying broad spatial patterns and environmental thresholds relevant to strategic planning rather than generating new primary environmental data. This approach ensures that spatial policy decisions are informed by consolidated environmental intelligence.

1.2.2. RISK-BASED PLANNING LENS

A core analytical lens applied throughout the SEA is risk-based planning. Environmental risks were classified in terms of sensitivity, reversibility, cumulative impact potential, and long-term sustainability implications. Water systems and biodiversity are identified as high-risk dimensions with strong cumulative impact potential, while agricultural land is classified as moderate–high risk due to its economic importance and vulnerability to irreversible conversion. This risk-based approach allows environmental thresholds to be translated into spatial signals, guiding decisions about settlement expansion, infrastructure placement, and economic development.

1.2.3. STRATEGIC ALTERNATIVES TESTING

The SEA evaluates spatial development alternatives, particularly the contrast between dispersed growth and structured nodal consolidation. The assessment demonstrates that dispersed, incremental development patterns significantly elevate cumulative environmental risk by increasing infrastructure footprints, watercourse crossings, and landscape fragmentation. In contrast, structured consolidation within defined nodes reduces cumulative impacts, enhances service efficiency, and strengthens environmental governance. The

SEA therefore identifies nodal consolidation and “least-sensitive land first” approaches as environmentally preferable spatial strategies that align development objectives with ecological resilience.

1.3. ENVIRONMENTAL BASELINE AND KEY STRATEGIC FINDINGS

1.3.1. BIODIVERSITY AND ECOLOGICAL SYSTEMS

NDZ LM contains extensive areas of Critical Biodiversity Areas (CBA 1 and CBA 2), Ecological Support Areas (ESAs), wetlands, riparian systems, upland catchments, and conservation landscapes. The SEA identifies biodiversity not as a peripheral conservation concern but as a fundamental structuring element of spatial planning. Dispersed settlement expansion, agricultural encroachment, informal growth, and infrastructure corridors pose risks to ecological connectivity and ecosystem services. Protection of ecological corridors and the maintenance of landscape-scale connectivity are therefore treated as central planning imperatives rather than optional conservation measures.

1.3.2. WATER SCARCITY AND CATCHMENT MANAGEMENT

Water systems are identified as a high-risk environmental asset, with water scarcity, catchment degradation, declining water quality, and cumulative river system impacts presenting significant spatial constraints. Settlement growth, dispersed development, and infrastructure backlogs increase pressure on limited bulk water capacity. The SEA emphasises that water availability must directly influence the scale and location of future development and that expansion into headwater areas, riparian zones, and critical catchments should be avoided. Water sensitivity is framed as both an environmental and infrastructure planning determinant.

1.3.3. CLIMATE CHANGE VULNERABILITY

Climate change is identified as a cross-cutting risk multiplier within NDZ LM. Flooding, prolonged droughts, veldfire exposure, and episodic extreme weather events interact with degraded catchments, dispersed settlements, and infrastructure constraints, compounding vulnerability. The SEA reframes climate change adaptation as a spatial structuring determinant rather than a sectoral policy issue. Hazard overlays for flood, fire, and slope instability are introduced to guide growth containment, infrastructure investment, and risk avoidance. This integrated approach ensures that climate resilience is embedded in land use decisions over the 20-year SDF horizon.

1.3.4. AGRICULTURAL LAND AND SOIL DEGRADATION

Agriculture remains a core economic sector within NDZ LM but is simultaneously vulnerable to soil erosion, slope instability, biodiversity encroachment, and cumulative land conversion. The SEA recognises agricultural land capability as a strategic asset linked to food security, economic resilience, and environmental sustainability. Strengthened zoning controls and spatial overlays are recommended to prevent irreversible loss of high-value soils and to align agricultural expansion with ecological thresholds.

1.3.5. DEMOGRAPHIC GROWTH AS A STRATEGIC DRIVER

Population projections indicate sustained growth from approximately 128,565 in 2022 to approximately 158,275 by 2046. The SEA identifies this growth trajectory as a structural shift requiring proactive spatial management. Without intervention, cumulative impacts on water systems, agricultural land, biodiversity corridors, and infrastructure networks will intensify. However, because growth is predictable and incremental, it presents an opportunity for strategic spatial steering, infrastructure sequencing, and enforcement of

environmental overlays. Growth is therefore framed as manageable and potentially beneficial if spatially disciplined.

1.4. ASSESSMENT OF THE DRAFT SDF PROPOSALS

1.4.1. NODAL CONSOLIDATION AS PREFERRED STRATEGY

The SEA concludes that growth must be consolidated within established nodes—Underberg, Himeville, Bulwer, and Donnybrook—with densification and infill preceding outward expansion. Settlement containment boundaries, ecological buffers, and agricultural protection zoning must be formalised within the SDF to prevent environmentally harmful sprawl. Structured consolidation reduces cumulative impacts, limits infrastructure duplication, and strengthens environmental oversight.

1.4.2. INFRASTRUCTURE SEQUENCING

Infrastructure readiness is identified as a prerequisite for development rollout. The SEA recommends reversing historical patterns where development precedes service capacity. Development approvals should be conditional upon confirmed bulk water, sanitation, and service readiness. Consolidation of service footprints and shared infrastructure hubs further reduces landscape fragmentation and long-term environmental risk.

1.4.3. ECONOMIC DEVELOPMENT CONDITIONING

Economic development strategies, including agriculture, agri-processing, tourism, and the green economy, are supported but spatially conditioned by environmental sensitivity. Dispersed agri-processing and warehousing are discouraged in favour of consolidated hubs with strict buffers to watercourses and biodiversity features. Tourism development must respect ecological carrying capacity and avoid sensitive headwaters and ridge lines. Economic

diversification is thus aligned with ecological sustainability rather than pursued at the expense of environmental integrity.

1.5. MITIGATION AND ADAPTATION FRAMEWORK

1.5.1. BIODIVERSITY PROTECTION

The mitigation framework identifies biodiversity protection as a spatial structuring imperative. Ecological buffers, biodiversity corridor overlays, and exclusion of development from high-sensitivity areas must be embedded within the SDF as binding spatial rules. Agricultural land protection is strengthened through zoning controls, ensuring ecological and food security objectives are aligned.

1.5.2. CLIMATE CHANGE RESILIENCE AND GREEN INFRASTRUCTURE

Climate resilience measures include the embedding of hazard overlays, prioritisation of densification, protection of wetlands and ecological infrastructure, and alignment of infrastructure investment with resilience principles. Green infrastructure is positioned as a cost-effective, ecosystem-based adaptation strategy that enhances long-term municipal resilience.

1.5.3. ECOSYSTEM-BASED DISASTER RISK REDUCTION (ECO-DRR)

The SEA introduces risk avoidance as a primary spatial principle, including development exclusion in high-risk zones, settlement consolidation to reduce emergency vulnerability, and infrastructure sequencing tied to hazard mitigation. Mitigation is embedded into spatial rules rather than treated as discretionary guidance, ensuring certainty for regulators and developers.

2. INTRODUCTION

2.1. PURPOSE AND OBJECTIVES OF THE STRATEGIC ENVIRONMENTAL ASSESSMENT

The Strategic Environmental Assessment (SEA) for the Dr Nkosazana Dlamini Zuma Local Municipality has been prepared as a standalone strategic environmental planning instrument to support and inform the Draft Spatial Development Framework (SDF) 2026–2046. The SEA is positioned as an integral component of long-term municipal spatial planning, ensuring that environmental considerations are embedded at the earliest stages of policy formulation and spatial decision-making. Its primary role is to strengthen the environmental integrity, resilience, and sustainability of the Draft SDF by systematically identifying environmental constraints, risks, sensitivities, and opportunities that are relevant at a municipal-wide scale.

Within the South African planning system, a Strategic Environmental Assessment differs fundamentally from project-level environmental assessment processes. Unlike Environmental Impact Assessments (EIAs), which are reactive and applied to specific development proposals, the SEA is proactive and strategic in nature. It operates at a higher level of abstraction, focusing on policies, spatial patterns, cumulative change, and long-term development trajectories. The SEA does not authorise or prohibit individual developments; rather, it provides an evidence-based environmental framework that guides where, how, and under what conditions development should be encouraged, managed, or constrained within the municipal area.

The preparation of this SEA is informed by the principles and requirements of the National Environmental Management Act (NEMA), which establishes sustainability, risk avoidance, precaution, and intergenerational equity as core environmental governance principles. In addition, the SEA responds to the intent of the Spatial Planning and Land Use Management Act (SPLUMA), which requires spatial planning instruments to promote sustainable

development, spatial justice, spatial resilience, and environmental protection. In this context, the SEA provides a critical bridge between environmental management legislation and spatial planning practice, ensuring that environmental considerations are not treated as a parallel or secondary concern, but as a structuring element of spatial policy.

The SEA is explicitly aligned with the Draft SDF 2026–2046 and is intended to inform its spatial vision, development strategies, and land use directives in a descriptive and supportive manner. The SEA does not evaluate the Draft SDF retrospectively; instead, it accompanies the SDF as a parallel strategic assessment that informs spatial logic, settlement structuring, infrastructure prioritisation, and growth management approaches. Through this alignment, the SEA supports the municipality in directing development away from environmentally sensitive or high-risk areas, reinforcing spatial efficiencies, and promoting resilient settlement patterns that are responsive to environmental limits.



The purpose of the SEA can therefore be summarised as fourfold. First, it establishes a coherent environmental baseline and sensitivity understanding for the municipality as a whole, drawing together existing environmental information into a consolidated strategic perspective. Second, it identifies key environmental risks and constraints that may influence long-term spatial development, including climate-related hazards, ecosystem vulnerabilities, and cumulative pressures associated with growth. Third, it highlights environmental opportunities that can be leveraged through spatial planning, such as ecological networks, natural assets, and landscape systems that contribute to resilience and quality of life. Finally, it provides a defensible environmental rationale to support municipal decision-making, Council adoption of the Draft SDF, and provincial oversight by authorities such as the Department of Forestry, Fisheries and the Environment and the Department of Cooperative Governance and Traditional Affairs.

The objectives of the SEA are accordingly framed to support strategic spatial planning outcomes. These objectives include the identification of environmentally sensitive and constrained areas at a municipal scale; the integration of environmental risk considerations into spatial structuring and land use guidance; the consideration of cumulative environmental effects arising from long-term spatial change; and the incorporation of climate resilience principles into spatial policy. Collectively, these objectives ensure that the Draft SDF 2026–2046 is informed by a robust understanding of environmental systems and risks, thereby strengthening its credibility, implementability, and sustainability.

2.2. METHODOLOGICAL APPROACH

The methodological approach adopted for the Strategic Environmental Assessment reflects established South African SEA practice and is tailored to the scale, purpose, and statutory context of municipal spatial planning. The methodology is explicitly strategic in nature and is designed to operate at a municipal-wide level, rather than at the scale of individual sites, precincts, or

development applications. This approach recognises that the primary value of an SEA lies in its ability to influence spatial direction, policy choices, and long-term development trajectories, rather than in the detailed assessment of project-specific impacts.

At its core, the SEA methodology is structured around an integrated assessment of environmental context, risk, sensitivity, and cumulative change. The assessment draws on existing environmental datasets, sector plans, spatial analyses, and secondary sources that are relevant to the municipal area. These sources are synthesised to establish a consolidated understanding of environmental systems, including biodiversity patterns, water resources, landscape characteristics, and areas of environmental constraint or vulnerability. The emphasis is on identifying broad spatial patterns and relationships that are meaningful for strategic planning, rather than generating new primary environmental data.



2.2.1. RISK-BASED PLANNING

A key analytical lens applied throughout the SEA is risk-based planning. This lens focuses on the identification and spatial expression of environmental risks that may influence development sustainability over the SDF planning horizon. Such risks include natural hazards, climate-related events, and areas of heightened vulnerability where environmental conditions may amplify social or economic risk. By integrating risk considerations into spatial analysis, the SEA supports a precautionary and resilience-oriented approach to spatial development, consistent with national environmental management principles.

2.2.2. ENVIRONMENTAL SENSITIVITY CONSTRAINT ANALYSIS

Closely linked to the risk-based approach is the application of environmental sensitivity and constraint analysis. This component of the methodology involves identifying areas where environmental attributes impose limitations on development or require careful management. Sensitivity analysis considers ecological systems, hydrological features, landscape and terrain characteristics, and other environmental factors that influence development suitability. The analysis does not prescribe land uses but provides an evidence base that informs spatial differentiation within the Draft SDF, supporting decisions regarding protection, controlled development, or appropriate intensification.

2.2.3. CUMULATIVE IMPACT PERSPECTIVE

The SEA methodology also incorporates a cumulative impact perspective, recognising that the most significant environmental effects often arise not from individual developments, but from the aggregated impact of multiple activities over time. At a municipal scale, cumulative impacts may manifest through gradual habitat loss, increased pressure on water resources, or the incremental erosion of landscape integrity. The SEA therefore focuses on long-

term spatial trends and patterns associated with growth, settlement expansion, and infrastructure development, rather than on isolated interventions.

2.2.4. CLIMATE CHANGE AND RESILIENCE CONSIDERATIONS

Climate change and resilience considerations form an integral part of the methodological framework. The SEA explicitly acknowledges climate variability and change as cross-cutting factors that influence environmental risk, settlement sustainability, and infrastructure performance. Climate-related considerations are integrated into risk assessment and sensitivity analysis, ensuring that spatial planning responses support adaptation, reduce vulnerability, and enhance the municipality's capacity to respond to future environmental change.

Spatial analysis and mapping play a supporting role within the methodology, providing a means of visualising environmental patterns and relationships at a municipal scale. Mapping is used as an interpretive and integrative tool rather than as a definitive zoning instrument. The SEA does not introduce site-specific spatial prescriptions or precinct-level detail but instead provides strategic overlays and spatial signals that inform the broader spatial logic of the Draft SDF.

The methodology is underpinned by a clear articulation of scope and limitations. The SEA does not assess individual development proposals, nor does it replace statutory environmental authorisation processes required under NEMA. Its purpose is to guide and inform spatial planning decisions, not to determine project feasibility or compliance. By clearly defining these boundaries, the SEA maintains its strategic focus and ensures alignment with established environmental governance processes.

3. POLICY & LEGISLATIVE FRAMEWORK

3.1. INTERNATIONAL DEVELOPMENT FRAMEWORK

TABLE 1: INTERNATIONAL DEVELOPMENT FRAMEWORK

POLICY / LEGISLATIVE INSTRUMENT	DESCRIPTION (PURPOSE AND SCOPE)	IMPLICATIONS FOR THE SEA	DIRECTIVES FOR THE SEA
United Nations Framework Convention on Climate Change (UNFCCC), 1992	Framework treaty guiding global cooperation to stabilise greenhouse gas concentrations and support adaptation planning.	Requires municipal planning to recognise climate change as a systemic risk driver affecting water security, ecosystems, livelihoods and disaster exposure.	(1) Include a municipal climate risk pathway (hazards × exposure × vulnerability) that informs the SDF spatial logic. (2) Embed climate resilience tests for all major land-use proposals (avoidance of high-risk areas; adaptation options).
Kyoto Protocol, 1997	UNFCCC protocol establishing mitigation commitments and mechanisms (historically important for carbon governance).	Reinforces mitigation as a planning consideration, especially in energy/transport/settlement patterns.	(1) Include mitigation-sensitive spatial principles (compact settlement where appropriate; protect carbon sinks). (2) Define indicators for spatial mitigation co-benefits (e.g., reduced travel demand, ecosystem retention).
Paris Agreement, 2015	Global agreement to limit temperature rise and strengthen adaptive capacity and climate-resilient development.	Requires alignment of long-term spatial planning with climate-resilient development and just transition outcomes.	(1) Apply a “Paris-aligned resilience screen” to SDF proposals (infrastructure siting, settlement expansion, ecosystem buffers). (2) Incorporate cumulative climate risk (compound events, cascading service failures).
Convention on Biological Diversity (CBD), 1992	Treaty on conservation, sustainable use of biodiversity, and fair benefit sharing.	Compels biodiversity protection in land-use decision-making and safeguards ecosystem services underpinning municipal development.	(1) Conduct biodiversity sensitivity mapping (priority areas, corridors, ecological support). (2) Apply an avoid–minimise–rehabilitate–offset logic at the strategic level (offset only as last resort, flagged for project-stage).
Cartagena Protocol on Biosafety, 2000	CBD protocol governing safe handling/transfer of living modified organisms.	Relevance mainly through biodiversity risk governance and precaution in environmental management.	(1) Note precautionary principle applicability in SEA assumptions where ecological uncertainty is material. (2) Ensure SEA supports risk-based governance language for biodiversity protection.
Nagoya Protocol, 2010	CBD protocol on access and benefit sharing of genetic resources and traditional knowledge.	Highlights the linkage between biodiversity, traditional knowledge systems, and equitable development outcomes.	(1) Include SEA directives for inclusive stakeholder engagement around biodiversity-sensitive areas. (2) Flag areas where biocultural values should shape land-use guidelines.

POLICY / LEGISLATIVE INSTRUMENT	DESCRIPTION (PURPOSE AND SCOPE)	IMPLICATIONS FOR THE SEA	DIRECTIVES FOR THE SEA
CITES, 1973	Regulates international trade in endangered species to prevent biodiversity loss.	Strengthens conservation emphasis where land-use change threatens habitats of protected species.	(1) Ensure SEA sensitivity mapping considers species habitat risk and fragmentation pressure. (2) Include strategic directives for enforcement-supportive land-use controls in sensitive areas.
Ramsar Convention on Wetlands, 1971	Treaty for conservation and “wise use” of wetlands; SA is a contracting party (entry into force 21 Dec 1975).	Wetlands are strategic ecological infrastructure affecting water quality, flood attenuation, and biodiversity.	(1) Map wetlands and buffers as no-go / high constraint zones in the SEA sensitivity layer. (2) Integrate wetland loss as a cumulative impact indicator linked to settlement/infrastructure expansion. (ramsar.org)
UN Convention to Combat Desertification (UNCCD), 1994	Addresses land degradation and drought risk, especially in vulnerable rural landscapes.	Requires the SEA to address land degradation pathways and drought sensitivity in rural settlement and land-use proposals.	(1) Include land degradation sensitivity mapping (erosion-prone, overgrazed, steep slopes). (2) Apply a drought-resilience planning lens to water-dependent land uses and settlement support.
World Heritage Convention, 1972	Protects cultural and natural heritage of outstanding universal value.	Elevates heritage landscapes and cultural/natural assets as spatial constraints and opportunity areas.	(1) Include heritage landscape screening within the SEA constraints/opportunities. (2) Require heritage-sensitive design principles to be referenced in SDF implementation guidelines.
UNESCO Convention for the Safeguarding of Intangible Cultural Heritage, 2003	Protects living heritage practices and cultural expressions.	Reinforces the need to reflect cultural landscapes and intangible heritage considerations in spatial planning choices.	(1) Include SEA directives to identify biocultural/heritage sensitivity areas via stakeholder input. (2) Add planning guidelines to avoid land-use changes that erode cultural heritage systems.
Basel Convention, 1989	Controls transboundary movements and disposal of hazardous wastes.	Supports strategic waste-risk governance and proper waste facility planning.	(1) Require SEA to include waste-risk screening for settlement/infrastructure growth areas. (2) Identify strategic requirements for compliant waste management spatial planning (buffers, site suitability).
Stockholm Convention on Persistent Organic Pollutants, 2001	Eliminates/restricts persistent organic pollutants harmful to health and ecosystems.	Strengthens pollution control emphasis for land use and service infrastructure planning.	(1) Include SEA directives for pollution hotspot screening and risk-based planning. (2) Require alignment with air/water quality protection in spatial proposals.
Minamata Convention on Mercury, 2013	Protects human health and environment from mercury pollution.	Reinforces precautionary pollution management in catchments and settlements.	(1) Include risk screening for pollution-sensitive receptors (water resources, wetlands). (2) Require SEA to recommend

POLICY / LEGISLATIVE INSTRUMENT	DESCRIPTION (PURPOSE AND SCOPE)	IMPLICATIONS FOR THE SEA	DIRECTIVES FOR THE SEA
			strategic monitoring indicators for contaminants where relevant.
Sendai Framework for Disaster Risk Reduction, 2015–2030	Global framework (non-treaty) for reducing disaster risk via risk-informed planning and resilience.	Strong directive basis for disaster risk-informed spatial planning at municipal scale.	(1) Adopt risk-based spatial planning as a core SEA method (hazard overlays; vulnerability mapping). (2) Require cumulative risk assessment (multi-hazard, cascading infrastructure failures).

3.2. NATIONAL DEVELOPMENT FRAMEWORK

TABLE 2: NATIONAL DEVELOPMENT FRAMEWORK

POLICY / LEGISLATIVE INSTRUMENT	DESCRIPTION	IMPLICATIONS FOR THE SEA	DIRECTIVES FOR THE SEA
Constitution of the Republic of South Africa, 1996 (s24 & co-operative governance principles)	Establishes the environmental right and duties on the state to protect the environment while promoting justifiable development.	SEA must demonstrate that the SDF supports lawful, reasonable, and environmentally sustainable development outcomes.	(1) Frame SEA conclusions as decision-support for balancing development and environmental protection. (2) Explicitly apply risk-based planning to protect rights and reduce vulnerability.
National Environmental Management Act (NEMA) 107 of 1998	Framework law establishing environmental management principles and governance for decision-making.	Provides core principles for SEA (precaution, polluter pays, sustainable development, co-operative governance).	(1) Include a NEMA-principles compliance checklist in SEA. (2) Require sensitivity mapping and cumulative impact logic to operationalise precaution and sustainability.
NEMA EIA Regulations (as amended)	Regulations governing environmental authorisation processes for listed activities.	SEA should not replicate EIAs but must provide upstream screening guidance and strategic avoidance of high-risk areas.	(1) Provide a municipal strategic screening protocol (areas where future EIAs likely triggered). (2) Identify “no-go”/high constraint areas to reduce downstream authorisation risk.
DFFE national guidance on environmental information requirements / IEM practice (incl. SEA-related guidance where applicable)	National guidance improving consistency of environmental assessment and reporting.	SEA must align with accepted national practice and minimum information logic.	(1) Structure SEA baseline, sensitivities, and risk logic to match national expectations. (2) Provide clear, auditable evidence trails for spatial recommendations.

POLICY / LEGISLATIVE INSTRUMENT	DESCRIPTION	IMPLICATIONS FOR THE SEA	DIRECTIVES FOR THE SEA
Spatial Planning and Land Use Management Act (SPLUMA) 16 of 2013	Sets national principles and requirements for spatial planning, including SDFs and land use management.	SEA must directly support SPLUMA-aligned SDF spatial logic (spatial justice, resilience, efficiency, sustainability).	(1) Test SDF proposals against SPLUMA principles using SEA evidence (risk and sensitivity layers). (2) Provide directives for translating SEA constraints into LUMS/land-use scheme provisions.
Municipal Systems Act 32 of 2000 (IDP/SDF integration requirements)	Requires integrated development planning; SDF forms part of IDP architecture.	SEA must strengthen IDP/SDF integration and provide implementable environmental priorities.	(1) Link SEA priority actions to IDP programmes and monitoring indicators. (2) Provide an intergovernmental alignment note (district/provincial environmental mandates).
National Water Act (NWA) 36 of 1998	Governs protection, use, development, conservation, and management of water resources.	Water resource constraints must shape settlement expansion, infrastructure siting, and catchment integrity.	(1) Include catchment and aquatic sensitivity mapping (rivers, wetlands, floodlines, recharge). (2) Apply a water-security test to SDF growth proposals (demand, resilience, ecological reserve risk).
Water Services Act 108 of 1997	Regulates water services provision, standards, and institutional arrangements.	SEA must reflect water services constraints and climate-related service risk.	(1) Identify areas where proposed development is constrained by water services capacity. (2) Recommend spatial phasing aligned to water services feasibility and climate resilience.
National Environmental Management: Biodiversity Act (NEM:BA) 10 of 2004	Provides for biodiversity management and planning tools (bioregional plans, threatened ecosystems/species, invasive species).	SEA must integrate biodiversity planning tools and prioritise avoidance of critical biodiversity areas.	(1) Use biodiversity planning tools (CBA/ESA where available) in sensitivity mapping. (2) Include directives to protect ecological corridors and manage invasive species risks.
National Environmental Management: Protected Areas Act (NEM:PAA) 57 of 2003	Provides for declaration and management of protected areas and related norms/standards.	SEA must recognise protected areas as high-constraint zones and manage edge effects from surrounding land uses.	(1) Map protected areas and buffers as constraints; define compatible land uses. (2) Include cumulative impact assessment of surrounding development pressure.
National Environmental Management: Integrated Coastal Management Act 24 of 2008 (where applicable)	Establishes coastal/estuarine management system and sustainability requirements.	If coastal influences are relevant (estuaries/river systems), SEA must integrate related constraints.	(1) Include estuarine/coastal-type sensitivity rules if relevant to the municipality's hydrological context. (2) Apply ecosystem-based resilience logic for riverine systems and downstream cumulative impacts.

POLICY / LEGISLATIVE INSTRUMENT	DESCRIPTION	IMPLICATIONS FOR THE SEA	DIRECTIVES FOR THE SEA
National Environmental Management: Waste Act 59 of 2008	Governs waste management, licensing, and waste planning.	Settlement growth must align with waste management capacity and environmental safeguards.	(1) Identify waste service capacity risks spatially (growth areas vs. disposal capacity). (2) Define strategic site suitability principles for waste facilities (buffers, water protection).
National Environmental Management: Air Quality Act 39 of 2004	Regulates air quality management and emissions.	SEA must consider air-quality-sensitive receptors and pollution risk from land-use patterns.	(1) Map sensitive receptors and potential emission-generating land uses. (2) Include a risk-based planning directive to avoid locating sensitive uses in pollution-prone areas.
National Heritage Resources Act (NHRA) 25 of 1999	Integrated system for identification, assessment and management of heritage resources.	SEA must incorporate heritage constraints/opportunities and guide heritage screening for spatial proposals.	(1) Include heritage sensitivity mapping (known resources + high-likelihood landscapes). (2) Provide directives for heritage screening triggers in implementation and land use management.
Disaster Management Act 57 of 2002 + Disaster Management Amendment Act 16 of 2015	Establishes disaster risk management system; amendment strengthens DRR and climate adaptation integration.	SEA must embed multi-hazard risk, vulnerability, and resilience into spatial planning and phasing.	(1) Produce a municipal multi-hazard risk overlay (flood, fire, slope failure, drought). (2) Include directives for risk-informed settlement growth and resilient infrastructure siting.
Climate Change Act 22 of 2024 (commencement proclaimed 17 March 2025; not all provisions in force)	Establishes climate change governance architecture across all spheres; supports risk assessment, adaptation planning, and emissions management.	SEA must explicitly integrate climate risk assessment and adaptation logic into the SDF evidence base.	(1) Include a climate risk assessment section aligned to municipal planning duties. (2) Define climate resilience indicators and spatial adaptation priorities (ecological infrastructure, avoidance of high-risk zones).
National Forests Act 84 of 1998	Protects forests and regulates their sustainable management (incl. protected tree provisions).	SEA must recognise forest/woodland ecological value and vulnerability to land-use change and fire regimes.	(1) Map forested ecological assets and apply protection/compatible land-use rules. (2) Include fire-risk and ecosystem resilience directives where forest interfaces are present.
Conservation of Agricultural Resources Act (CARA) 43 of 1983	Regulates soil conservation and control of invasive plants; addresses land degradation.	SEA must address land degradation risk in rural areas and settlement expansion.	(1) Include erosion/land degradation sensitivity mapping and slope constraints. (2) Provide directives for invasive plant risk management as part of SDF implementation.

POLICY / LEGISLATIVE INSTRUMENT	DESCRIPTION	IMPLICATIONS FOR THE SEA	DIRECTIVES FOR THE SEA
National Environmental Management: Integrated Coastal Management Act (policy/guidance as relevant)	National policy instruments supporting ICMA implementation.	Reinforces ecosystem-based management and cumulative impact logic.	(1) Apply cumulative impact assessment for downstream catchment effects (wetlands/river systems). (2) Integrate ecosystem-based adaptation into spatial guidelines.
National Climate Change Response Policy / National Adaptation Strategy (as applicable)	National policy direction for mitigation/adaptation and climate mainstreaming.	SEA must translate national climate priorities into spatial planning principles and prioritisation.	(1) Include adaptation priority areas and resilient settlement typologies. (2) Build monitoring indicators for resilience outcomes (service continuity, ecosystem retention).

3.3. PROVINCIAL DEVELOPMENT FRAMEWORK

TABLE 3: PROVINCIAL DEVELOPMENT FRAMEWORK

POLICY / LEGISLATIVE INSTRUMENT	DESCRIPTION	IMPLICATIONS FOR THE SEA	DIRECTIVES FOR THE SEA
KwaZulu-Natal Planning and Development Act 6 of 2008	Provincial planning law addressing schemes, land development controls and related procedures (historical/ongoing relevance alongside SPLUMA).	SEA must recognise provincial planning context and ensure SDF implementation is procedurally and substantively consistent.	(1) Include an alignment note on how SEA outputs can translate into land use controls/schemes. (2) Provide directives for integrating SEA constraints into approvals and scheme provisions.
KwaZulu-Natal Amafa and Research Institute Act, 2018 (repeals the KZN Heritage Act, 2008)	Establishes the provincial heritage agency framework and related heritage governance arrangements.	SEA heritage directives must align with provincial heritage authority processes and mandates.	(1) Identify heritage consultation/coordination points for SEA-informed planning. (2) Include provincial heritage screening triggers aligned to SDF implementation.
KwaZulu-Natal Provincial Spatial Development Framework (PSDF) (current/draft)	Provincial spatial policy framework guiding spatial priorities and environmental structuring across KZN.	SEA must demonstrate vertical alignment and reflect provincial environmental/spatial structuring priorities.	(1) Crosswalk SEA sensitivity layers against PSDF environmental structuring and development logic. (2) Identify areas where municipal proposals must be constrained/conditioned to maintain provincial ecological networks.

POLICY / LEGISLATIVE INSTRUMENT	DESCRIPTION	IMPLICATIONS FOR THE SEA	DIRECTIVES FOR THE SEA
KwaZulu-Natal Climate Change Response Strategy / related provincial climate instruments	Provincial policy direction for adaptation and resilience planning.	Requires SEA to reflect KZN-specific hazard trends and resilience priorities.	(1) Incorporate provincial climate vulnerability insights into municipal risk mapping. (2) Align SEA adaptation priorities to provincial programmes and monitoring frameworks.
KZN biodiversity planning instruments (e.g., systematic biodiversity plans / CBA-ESA mapping as adopted by competent authorities)	Provincial biodiversity spatial tools that guide land-use decisions.	SEA must use or align to authoritative biodiversity priority layers where available.	(1) Use provincial biodiversity layers in sensitivity mapping and land-use guidelines. (2) Define no-go/high constraint rules and corridor protection directives for the SDF.
Provincial disaster risk management framework / guidelines (where applicable)	Provincial DRM policy instruments guiding risk reduction and preparedness.	SEA must align municipal risk-based spatial planning with provincial DRM priorities.	(1) Align hazard/risk overlays with provincial DRM categories where possible. (2) Include directives for risk reduction through settlement/infrastructure siting and ecological infrastructure protection.
Provincial environmental management instruments (e.g., EMFs where applicable)	Spatially explicit environmental management tools guiding land use and authorisations.	SEA must adopt EMF-like sensitivity logic and ensure compatibility.	(1) Where EMFs exist, integrate their sensitivity categories into SEA mapping. (2) Provide directives for cumulative impact management across sensitive landscapes.

3.4. DISTRICT & LOCAL MUNICIPAL DEVELOPMENT FRAMEWORK

TABLE 4: DISTRICT & LOCAL MUNICIPAL DEVELOPMENT FRAMEWORK

POLICY / LEGISLATIVE INSTRUMENT	DESCRIPTION	IMPLICATIONS FOR THE SEA	DIRECTIVES FOR THE SEA
Harry Gwala District Municipality Growth and Development Strategy (May 2024)	District-level development strategy guiding priorities and spatially relevant programmes.	SEA must demonstrate district alignment and identify environmental constraints/opportunities affecting district priorities.	(1) Cross-reference district priorities against SEA sensitivity and risk layers. (2) Identify environmental conditions required for district-aligned projects (water, biodiversity, hazard avoidance).
Harry Gwala District Climate Change Response Strategy (final)	District climate strategy shaping adaptation/mitigation priorities.	SEA must use district climate priorities to strengthen municipal resilience proposals.	(1) Integrate district climate risk themes into municipal risk assessment and scenario logic. (2) Align SEA

POLICY / LEGISLATIVE INSTRUMENT	DESCRIPTION	IMPLICATIONS FOR THE SEA	DIRECTIVES FOR THE SEA
			monitoring indicators with district climate reporting needs.
Harry Gwala District Municipality Disaster / CC Response Plan (as applicable)	Operational/sector response planning informing preparedness and risk reduction.	Reinforces the need for hazard-informed settlement and infrastructure planning.	(1) Translate key hazards into spatial constraints/opportunity mapping. (2) Include directives for risk-sensitive land-use controls and phased development.
Dr NDZ Local Municipality Draft SDF 2026/27–2046/47 (project document)	Core spatial policy instrument to be supported by the SEA.	SEA must provide defensible environmental evidence (sensitivities/risks/cumulative impacts) to underpin the SDF's spatial choices.	(1) Provide SDF-facing sensitivity atlas (constraints/opportunities) and a risk-based spatial logic. (2) Define SEA-derived spatial conditions and red flags for all major SDF proposals.
Dr NDZ Local Municipality IDP (current cycle – draft/adopted as applicable)	Municipal integrated development planning framework; sets service delivery priorities and programmes.	SEA must connect environmental priorities to IDP delivery and budgeting logic.	(1) Map SEA priority actions to IDP programmes and performance indicators. (2) Identify environmental risk constraints that may affect project feasibility and phasing.
Dr NDZ Disaster Management Sector Plan (project document)	Municipal DRM framework outlining hazards, vulnerability, and response planning.	SEA must embed DRM evidence into SDF settlement and infrastructure proposals.	(1) Build a municipal multi-hazard overlay aligned to the Sector Plan. (2) Require risk-informed development phasing and avoidance of high-risk zones.
Dr NDZ Integrated Waste Management Plan (project document)	Municipal waste planning instrument addressing waste streams, facilities, and service planning.	Land-use growth must align with waste capacity and environmental safeguards.	(1) Include strategic site suitability principles for waste facilities and buffers. (2) Identify areas where settlement expansion increases cumulative waste risk without capacity upgrades.
Dr NDZ Integrated Waste Management By-Law (project document)	Regulatory instrument shaping waste management compliance.	SEA must ensure spatial proposals do not undermine by-law compliance (illegal dumping risk; facility siting).	(1) Flag enforcement-sensitive areas and recommend spatial controls/supporting infrastructure. (2) Include waste-risk monitoring indicators linked to growth areas.
Dr NDZ Environmental Management Plan / IEMP (project document)	Municipal environmental priorities, assets, and management actions.	SEA must incorporate the municipality's environmental asset base and management priorities into spatial recommendations.	(1) Integrate key environmental assets into sensitivity mapping and land-use guidelines. (2) Align SEA mitigation and monitoring indicators to IEMP priorities.
Precinct plans / nodal plans embedded in the SDF suite (e.g.,	Sub-area plans informing local development intensification and infrastructure proposals.	SEA must manage local intensification against environmental constraints and cumulative impacts.	(1) Apply cumulative impact assessment across precinct proposals (water demand, habitat fragmentation, hazard

POLICY / LEGISLATIVE INSTRUMENT	DESCRIPTION	IMPLICATIONS FOR THE SEA	DIRECTIVES FOR THE SEA
Underberg–Himeville, Creighton, Bulwer, Donnybrook) (project documents)			exposure). (2) Provide place-based directives (densification where appropriate; avoid sensitive zones).
Local protected area / biodiversity stewardship agreements (if applicable in the municipal area)	Local conservation instruments that constrain compatible land uses.	SEA must treat these as high constraint zones and maintain ecological connectivity.	(1) Map all protected/stewardship areas and ecological corridors. (2) Provide compatible land-use guidelines and edge-effect management directives.
Municipal land use scheme / planning by-law (if adopted)	Local regulatory framework implementing SPLUMA via land use controls.	SEA must translate sensitivities into implementable zoning/overlay and development parameters.	(1) Recommend SEA-based overlays (biodiversity, heritage, flood, slope, wetlands). (2) Define decision rules for applications in high-sensitivity areas (avoidance/conditions).

4. DESCRIPTION OF THE RECEIVING ENVIRONMENT

This chapter provides a comprehensive, strategic-level description of the receiving environment for the Strategic Environmental Assessment (SEA) of the Dr Nkosazana Dlamini Zuma Local Municipality. In line with established South African SEA practice, the purpose of this chapter is not limited to baseline description, but is explicitly decision-supportive, informing spatial planning choices, growth management, and land-use prioritisation within the Municipal Spatial Development Framework (SDF).

Consistent with the Department of Forestry, Fisheries and the Environment (DFFE) SEA Guidelines (2016 and 2023), the description of the receiving environment serves as:

- a strategic environmental baseline against which future spatial development directions can be tested.
- an early-warning system that identifies environmental sensitivities, thresholds, and constraints prior to project-level decision-making; and
- a foundation for assessing cumulative impacts, spatial risk, and long-term sustainability implications associated with the implementation of the SDF.

The chapter therefore goes beyond inventory-style reporting and explicitly highlights environmental opportunities and limits, enabling informed, defensible spatial planning decisions that reduce downstream Environmental Impact Assessment (EIA) risk and promote proactive environmental governance.

4.1. LEGISLATIVE AND POLICY BASIS

The preparation of this chapter is grounded in the overarching environmental governance framework of South Africa, with particular reference to the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and its associated principles. These principles, which underpin all environmental decision-making, include:

- sustainable development that integrates social, economic, and environmental considerations.
- a risk-averse and precautionary approach, particularly where environmental systems are sensitive or poorly understood.
- the avoidance or minimisation of cumulative environmental degradation; and
- the protection of ecological integrity for the benefit of present and future generations.

In addition, the chapter is explicitly aligned with the DFFE SEA Guidelines (2016; updated 2023), which emphasise that SEAs must:

- be spatially explicit and strategic.
- focus on systems, thresholds, and patterns, rather than individual developments.
- identify environmental sensitivities and no-go areas early in the planning process; and
- meaningfully inform spatial planning instruments such as SDFs, land use schemes, and sector plans.

Within this framework, the description of the receiving environment plays a critical role in ensuring that the SDF is environmentally defensible, legally

compliant, and aligned with national objectives for sustainable land development.

4.2. RELATIONSHIP TO THE MUNICIPAL SPATIAL DEVELOPMENT FRAMEWORK

The SEA is prepared as a standalone statutory report that directly supports and informs the Municipal SDF. This chapter provides the environmental evidence base required to:

- guide the spatial logic of development and conservation areas.
- inform the identification of suitable locations for growth, infrastructure investment, and economic activity.
- flag areas where development may be constrained, conditional, or inappropriate due to environmental sensitivity; and
- support the integration of environmental considerations into spatial policies, development guidelines, and implementation mechanisms.

Importantly, the analysis is undertaken at a municipal-wide scale, consistent with the role of the SDF as a strategic planning instrument. The chapter does not replace or pre-empt project-level EIAs; rather, it seeks to reduce uncertainty and conflict at later stages by clarifying environmental risks and sensitivities upfront.

4.3. APPROACH AND ANALYTICAL METHOD

The description of the receiving environment is based on a spatially explicit, systems-based approach, integrating biophysical, socio-economic, and built environment considerations. The analysis is informed by:

- a suite of SEA-specific GIS maps covering climate-related factors, geology, topography, soils, hydrology, biodiversity, vegetation

conservation status, protected areas, and heritage-related features.

- synthesis of existing municipal and district-level studies, including Integrated Environmental Management Plans (IEMPs), Environmental Management Frameworks (EMFs), Human Settlements Sector Plans (HSSPs), Disaster Management Plans, and Climate Change Response Strategies; and
- established national datasets and policy instruments relevant to environmental sensitivity and land development.

Each environmental component is assessed in terms of:

- its current condition and spatial distribution.
- its sensitivity to change or disturbance.
- its role in supporting ecological functioning, livelihoods, and settlement systems; and
- its implications for future spatial development.

Map-based analysis forms a core component of the chapter, with each thematic map subjected to a dedicated interpretive assessment that links spatial patterns directly to planning and decision-making considerations.

4.4. STRATEGIC ORIENTATION AND LIMITS OF THE ASSESSMENT

This chapter is explicitly strategic in nature. It does not prescribe mitigation measures, development designs, or project-level conditions, nor does it duplicate the role of subsequent SEA impact or alternatives analysis chapters. Instead, it establishes the environmental parameters within which spatial development must occur, highlighting where flexibility exists and where constraints are likely to be non-negotiable.

By doing so, the description of the receiving environment provides a robust platform for:

- risk-informed spatial planning,
- cumulative impact management, and
- alignment between environmental sustainability and long-term municipal development objectives.

4.5. BIOPHYSICAL ENVIRONMENT

4.5.1. CLIMATE

The Dr Nkosazana Dlamini Zuma Local Municipality is located within a predominantly summer rainfall region, characterised by marked altitudinal and topographic variation. Rainfall patterns are spatially uneven, with higher precipitation associated with elevated areas and orographic effects, while lower-lying areas experience comparatively reduced and more variable rainfall. Seasonal rainfall concentration increases the municipality's sensitivity to flooding, soil erosion, and infrastructure vulnerability, particularly where settlements and roads are located within steep or incised landscapes.

Temperature regimes similarly vary across the municipal area, with cooler conditions prevailing in higher-altitude zones and more extreme temperature fluctuations occurring in lower-lying areas. These climatic gradients have direct implications for agricultural potential, water availability, biodiversity distribution, and settlement comfort levels. Periodic extreme weather events—including intense rainfall episodes, drought conditions, and cold spells—are significant features of the local climate system and exert pressure on both natural and human systems.

From a spatial planning perspective, the climate context signals the need for risk-aware land use allocation, particularly in areas susceptible to flooding,

storm damage, and climate-induced land degradation. Development patterns that intensify surface runoff, remove vegetative cover, or encroach into flood-prone zones are likely to exacerbate existing climatic risks at a cumulative scale.

4.5.2. GEOLOGY AND TOPOGRAPHY

The municipal area exhibits a complex geological structure that underpins a highly varied topography. Geological formations influence soil development, slope stability, groundwater movement, and the distribution of mineral and construction resources. The landscape is dominated by undulating to steep terrain, with extensive areas characterised by moderate to steep slopes and deeply incised river valleys.

Topographic variability imposes inherent constraints on settlement expansion, infrastructure placement, and agricultural activities. Steep slopes are particularly sensitive to erosion, landslides, and structural instability, especially where development involves extensive earthworks, vegetation removal, or poorly managed stormwater systems. In contrast, gentler slopes and valley floors offer relatively higher development potential but are often associated with flood risk and high ecological sensitivity.

From an SEA perspective, geology and topography function as primary structuring elements that define where development can occur with acceptable levels of environmental risk. Spatial planning that disregards these constraints is likely to trigger repeated EIA requirements, infrastructure failure, and long-term maintenance burdens.

The topography map illustrates a landscape characterised by significant altitudinal variation and widespread steep slopes, reflecting the rugged physiography of the municipality. Elevated areas, deeply incised valleys, and rolling uplands dominate much of the municipal area, with relatively limited expanses of flat or gently sloping land.

From a strategic environmental perspective, this topographic profile represents a primary determinant of development suitability. Steep slopes are inherently sensitive to disturbance, with increased susceptibility to erosion, slope instability, and landslides, particularly where vegetation cover is removed or altered. Development in such areas typically requires extensive cut-and-fill, road terracing, and engineered stormwater solutions, all of which increase environmental risk and the likelihood of triggering EIA Listing Notice activities.

The map highlights that many existing settlements and transport routes are already located within or adjacent to steeply sloping terrain. While these patterns are historically entrenched, they represent areas of elevated cumulative risk, especially where incremental settlement expansion or infrastructure upgrades continue over time. Repeated interventions in steep terrain—such as road widening, service trenching, and slope stabilisation—are likely to result in recurring environmental authorisation requirements under Listing Notices 1 and 3, particularly in areas with sensitive landforms.

Conversely, areas of gentler slope are limited and spatially constrained, often coinciding with valley bottoms and floodplains. While these areas may appear more suitable for development from a topographic perspective, they are frequently associated with hydrological sensitivity, creating a trade-off between slope stability and flood risk. This reinforces the need for integrated interpretation of topography alongside hydrology and biodiversity maps in spatial decision-making.

Strategically, the topography map signals that:

- large portions of the municipality are physically constrained for conventional urban expansion;
- dispersed settlement growth across steep terrain significantly increases cumulative environmental and infrastructure risk; and
- future spatial development must be highly selective and terrain-responsive, prioritising areas where slope-related risks can be

managed without disproportionate environmental and financial cost.

The topographic receiving environment therefore imposes a non-negotiable constraint on the spatial form of development and must be explicitly reflected in the SDF through growth management, settlement consolidation, and infrastructure prioritisation strategies.

The geology map depicts a geologically diverse municipal area, comprising multiple lithological units that influence land stability, soil formation, groundwater movement, and the suitability of land for development. Geological formations across the municipality vary in terms of hardness, weathering characteristics, and structural integrity, resulting in spatially differentiated development constraints.

From an SEA perspective, geological conditions act as a foundational determinant of environmental risk, particularly in relation to slope stability, erosion susceptibility, and construction feasibility. Certain geological units are more prone to weathering and instability, especially where development activities involve extensive excavation, blasting, or vegetation removal. In these areas, even relatively small-scale development can result in disproportionate environmental disturbance and long-term maintenance challenges.

The map indicates that infrastructure networks and settlements frequently traverse or overlie geologically sensitive formations. While this reflects historical development patterns, it has important implications for cumulative impact. Repeated infrastructure upgrades, road realignments, and service trenching in geologically constrained areas increase the likelihood of slope failure, sediment mobilisation, and downstream water quality impacts. Such activities are likely to trigger multiple EIA Listing Notice activities over time, particularly under Listing Notice 1 (activities involving earthworks) and Listing Notice 3 (activities in sensitive environments).



DATA SOURCES:
 Roads: DOT & SANRAL
 Place Names: COGTA
 Traditional Authorities: COGTA
 Cadastral: SGO
 Enviro Data: DFFE & SANBI
 Economic Data: KZN EDTEA
 Social Facilities: DPE, DOH, & DPW
 Housing Data: DHS



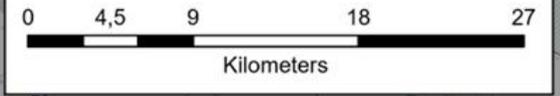
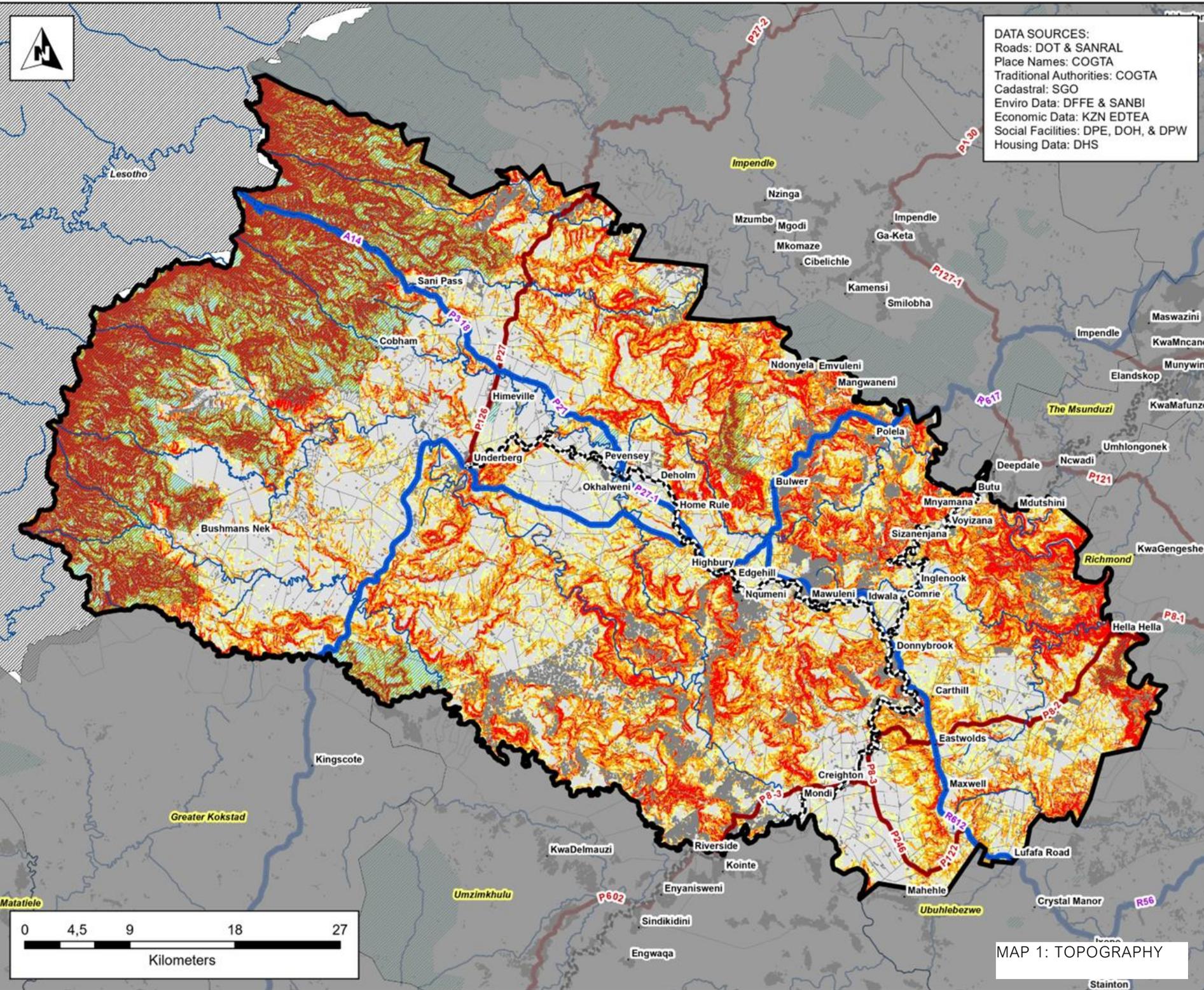
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Topography

Legend

- NFEPA River
- Railway
- National Road
- Provincial Road
- Cadastral
- Settlement
- Protected Area
- 1:3 and Steeper
- 1:3 - 1:6
- 1:6 - 1:8
- 1:8 - 1:10
- 1:10 and Flatter



MAP 1: TOPOGRAPHY



4.5.3. SOILS AND LAND CAPABILITY

Soil types within the municipality vary in depth, fertility, drainage capacity, and susceptibility to erosion. Large portions of the area are characterised by moderate to low land capability, with soils that are vulnerable to degradation when exposed to intensive land use or inappropriate cultivation practices. Shallow soils on steeper slopes are particularly sensitive to erosion, while deeper alluvial soils in valley bottoms tend to be more productive but are often associated with hydrological sensitivity.

The distribution of soil capability has direct implications for both agricultural viability and settlement development. Areas with higher agricultural potential represent strategic natural assets that support livelihoods and food security, while marginal soils are less suitable for intensive use and are more likely to experience degradation under development pressure.

Strategically, the soil environment reinforces the need for land capability-informed spatial planning, where settlement expansion and infrastructure development are directed away from high-value agricultural soils and erosion-prone areas. Failure to align land use with soil capability increases cumulative environmental impacts and undermines long-term sustainability objectives.

4.5.4. HYDROLOGY AND AQUATIC SYSTEMS

The municipality is traversed by a network of rivers, streams, wetlands, and drainage lines that form part of larger catchment systems. These aquatic features perform critical ecological functions, including water supply, flood attenuation, sediment regulation, and habitat provision. Wetlands and riparian zones are particularly sensitive to disturbance and play a disproportionate role in maintaining downstream water quality and ecosystem resilience.

Floodplains associated with major river systems represent zones of heightened risk, where settlement expansion and infrastructure development can result in

repeated flood damage, water pollution, and disruption of natural flow regimes. Informal settlements and rural infrastructure located within or adjacent to these systems are especially vulnerable to both gradual degradation and extreme flood events.

At a strategic level, hydrological systems constitute high-risk, high-sensitivity components of the receiving environment. Spatial planning decisions that allow incremental encroachment into riparian corridors and wetlands are likely to generate cumulative impacts that trigger EIA Listing Notices repeatedly over time, particularly in relation to linear infrastructure and service extensions.

The hydrology map illustrates a dense and interconnected network of rivers, streams, wetlands, and drainage lines across the Dr Nkosazana Dlamini Zuma Local Municipality. These aquatic systems form part of larger regional catchments and play a critical role in water supply, flood attenuation, sediment regulation, and the maintenance of ecological integrity both within and beyond the municipal boundary.

From a strategic environmental perspective, hydrological features represent some of the most sensitive components of the receiving environment. River corridors, wetlands, and floodplains are inherently dynamic systems that are highly responsive to disturbance. Development within or adjacent to these systems—particularly settlement expansion, road construction, and bulk service infrastructure—poses a high risk of altering natural flow regimes, degrading water quality, and increasing downstream flood risk.

The map indicates that many existing settlements, agricultural activities, and transport routes are located in close proximity to watercourses. While this reflects historical patterns of settlement around water availability, it also highlights areas of elevated cumulative impact risk. Incremental encroachment into riparian zones, even where individual interventions are small, results in progressive loss of ecological function and increased regulatory exposure.

From an EIA perspective, hydrological sensitivity is a frequent trigger for environmental authorisation under:

- Listing Notice 1, for activities involving watercourse crossings, earthworks, and infrastructure within regulated distances; and
- Listing Notice 3, where activities occur in watercourses or within specified buffer zones in environmentally sensitive areas.

The cumulative risk is particularly pronounced where linear infrastructure—such as roads, pipelines, and electricity lines—repeatedly crosses rivers and wetlands. Each crossing represents a discrete regulatory trigger, but collectively these interventions can significantly compromise catchment health.

Strategically, the hydrology map signals that:

- riparian corridors and wetlands function as non-negotiable environmental buffers.
- development pressure within flood-prone areas increases long-term disaster risk and service disruption; and
- spatial planning must prioritise avoidance of watercourses wherever possible, rather than relying on mitigation at project level.

Within the SDF context, hydrological systems should be treated as structuring elements that guide the location of development and infrastructure, reinforcing the need for compact settlement patterns and environmentally responsive infrastructure routing.



DATA SOURCES:
 Roads: DOT & SANRAL
 Place Names: COGTA
 Traditional Authorities: COGTA
 Cadastral: SGO
 Enviro Data: DFFE & SANBI
 Economic Data: KZN EDTEA
 Social Facilities: DPE, DOH, & DPW
 Housing Data: DHS



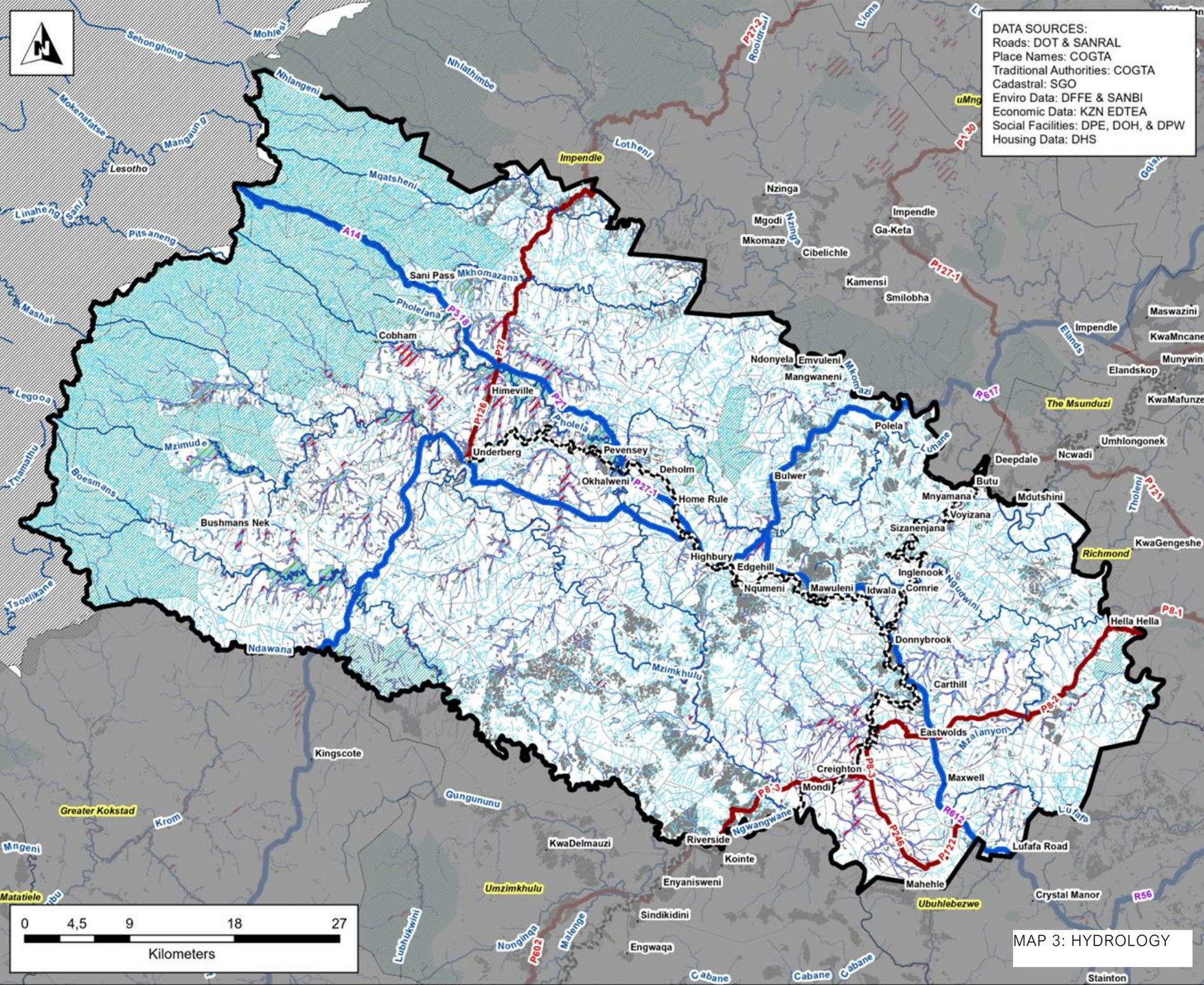
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Hydrology

Legend

- NFEPA River
- Railway
- National Road
- Provincial Road
- 100yr Floodline
- Wetland
- Wetland 32m Buffer
- River 32m Buffer
- Cadastral
- Settlement
- Protected Area



MAP 3: HYDROLOGY



4.5.5. BIODIVERSITY AND ECOLOGICAL SYSTEMS

The municipality contains areas of significant biodiversity value, including designated Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs). These areas are essential for maintaining ecosystem functioning, ecological connectivity, and biodiversity persistence at both local and regional scales. CBAs represent areas that are irreplaceable or near-irreplaceable for meeting biodiversity conservation targets, while ESAs support ecological processes such as water regulation, migration, and climate adaptation.

Ecological systems within the municipality are subject to multiple pressures, including settlement expansion, agricultural intensification, infrastructure development, and habitat fragmentation. While individual developments may appear minor in isolation, their cumulative effect can significantly undermine ecological integrity, particularly where development is dispersed across sensitive landscapes.

From an SEA and SDF perspective, CBAs and ESAs function as strategic environmental constraints rather than discretionary considerations. Spatial planning decisions that permit incremental loss or fragmentation of these areas increase regulatory risk and compromise the municipality's ability to meet national biodiversity obligations.

4.5.6. CONSERVATION AND PROTECTED AREAS

The municipal area includes formally protected areas, conservation zones, and landscapes of recognised ecological and heritage value, including areas associated with broader conservation initiatives and World Heritage-related contexts. In addition, vegetation types within the municipality display varying conservation statuses, ranging from relatively intact systems to those that are threatened or under significant pressure.

Protected and conservation areas serve as anchors for ecological resilience, tourism potential, and ecosystem service provision. However, their effectiveness is highly dependent on the management of surrounding land uses. Incompatible development adjacent to protected areas can erode conservation value through edge effects, pollution, and increased human disturbance.

Strategically, conservation areas and threatened vegetation types represent non-negotiable environmental assets within the spatial planning framework. The SDF must therefore reinforce protective buffers, limit incompatible land uses, and recognise the role of these areas in supporting long-term environmental and economic sustainability.

The biodiversity and Critical Biodiversity Areas (CBA) map identifies a spatial network of areas that are irreplaceable or near-irreplaceable for achieving biodiversity conservation targets within the municipality. These areas include formally mapped CBAs and associated Ecological Support Areas (ESAs) that maintain ecological processes such as hydrological regulation, species migration, and climate resilience.

From a strategic SEA perspective, CBAs represent high-sensitivity, low-tolerance environments. Development within these areas carries a disproportionate risk of irreversible biodiversity loss and ecosystem degradation. The map demonstrates that CBAs are not isolated pockets but form a connected ecological system across the municipality, often aligned with river corridors, wetlands, steep terrain, and intact natural vegetation.

The spatial overlap between CBAs and existing or emerging development pressures is a key concern. In several areas, dispersed rural settlements, agricultural expansion, and linear infrastructure intersect with mapped CBAs. While individual land-use changes may appear limited in scale, their cumulative impact threatens habitat connectivity and undermines the ecological functioning of the broader landscape.

From a regulatory perspective, development activities within CBAs are highly likely to trigger environmental authorisation requirements under:

- Listing Notice 3, due to the sensitivity of the receiving environment; and
- Listing Notice 1, where activities involve vegetation clearance, earthworks, or infrastructure development.

Repeated linear infrastructure development—such as access roads, pipelines, and electricity lines—within or across CBAs presents a particularly high cumulative triggering risk, increasing regulatory burden and long-term environmental liability.

Strategically, the CBA map signals that:

- CBAs and ESAs should be treated as spatial no-go or highly constrained areas within the SDF.
- development pressure should be actively redirected away from these areas rather than managed on a case-by-case basis; and
- ecological connectivity must be maintained at a municipal scale to ensure long-term resilience.

Within the SEA and SDF framework, CBAs constitute non-negotiable environmental constraints that must shape spatial development patterns, settlement consolidation strategies, and infrastructure planning.

The protected areas map identifies formally protected areas and conservation estates within and adjacent to the Dr Nkosazana Dlamini Zuma Local Municipality. These areas include nature reserves, conservation areas, and other legally recognised protected landscapes that contribute to biodiversity conservation, ecosystem service provision, and regional ecological resilience.

From a strategic SEA perspective, protected areas represent the highest level of environmental protection within the municipal landscape. Their ecological

value extends beyond their boundaries, with surrounding land uses playing a critical role in determining their long-term viability. Incompatible development in proximity to protected areas can result in edge effects, habitat disturbance, pollution, and increased human–wildlife conflict, eroding conservation outcomes even where core areas remain formally protected.

The map indicates that protected areas are embedded within a broader mosaic of agricultural land, rural settlements, and infrastructure networks. This spatial configuration highlights a zone of influence around protected areas where land use decisions have a direct bearing on conservation effectiveness. Incremental development pressure in these zones increases cumulative impacts and heightens the risk of regulatory non-compliance.

In regulatory terms, activities within or adjacent to protected areas are highly likely to trigger environmental authorisation under:

- Listing Notice 3, due to the sensitivity and legal status of the receiving environment; and
- Listing Notice 1 or 2, depending on the scale and nature of the proposed activity.

Repeated linear infrastructure development near protected areas presents a particular cumulative risk, as each intervention incrementally fragments habitat and increases disturbance.

Strategically, the protected areas map signals that:

- protected areas function as core environmental anchors within the municipal spatial structure.
- surrounding buffer zones are critical to maintaining ecological integrity; and
- spatial planning must actively prevent incompatible land uses in proximity to protected areas.

Within the SDF, protected areas should therefore be reinforced through protective zoning, buffer delineation, and alignment of development away from conservation-sensitive landscapes.

The World Heritage Sites map identifies areas of internationally recognised cultural and natural significance within or adjacent to the municipality. These areas carry exceptional universal value and are subject to stringent protection requirements under both national and international frameworks.

From an SEA perspective, World Heritage contexts introduce absolute environmental and heritage constraints on development. Activities that compromise visual integrity, landscape character, ecological processes, or cultural values are highly constrained and subject to intense regulatory scrutiny.

Development pressures within the zone of influence of World Heritage Sites—particularly infrastructure expansion, tourism development, and settlement growth—carry elevated cumulative impact risk. Even indirect impacts, such as increased traffic, pollution, or visual intrusion, can undermine heritage value.

Strategically, the presence of World Heritage Sites requires the SDF to:

- maintain strict protection of core and buffer areas.
- carefully manage compatible land uses; and
- recognise heritage landscapes as defining spatial structuring elements rather than residual constraints.

The Ramsar Sites map identifies wetlands of international importance, recognised for their ecological significance, biodiversity value, and role in hydrological regulation. Ramsar-listed wetlands are among the most sensitive components of the receiving environment.

From a strategic environmental perspective, Ramsar sites function as critical ecological infrastructure, providing flood attenuation, water purification, and

habitat for a wide range of species. Disturbance to these systems has far-reaching consequences beyond municipal boundaries.

Development activities within or near Ramsar sites are highly likely to trigger:

- Listing Notice 3, due to the sensitivity and international status of the environment; and
- additional regulatory processes linked to international conservation commitments.

Cumulative impacts from incremental infrastructure crossings, water abstraction, and land use change pose a significant risk to Ramsar site integrity. As such, strategic avoidance and strict spatial protection are essential.

Within the SDF, Ramsar sites should be treated as absolute no-go areas for incompatible development, with surrounding land uses managed to support long-term wetland function and resilience.



DATA SOURCES:
 Roads: DOT & SANRAL
 Place Names: COGTA
 Traditional Authorities: COGTA
 Cadastral: SGO
 Enviro Data: DFFE & SANBI
 Economic Data: KZN EDTEA
 Social Facilities: DPE, DOH, & DPW
 Housing Data: DHS



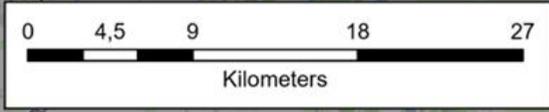
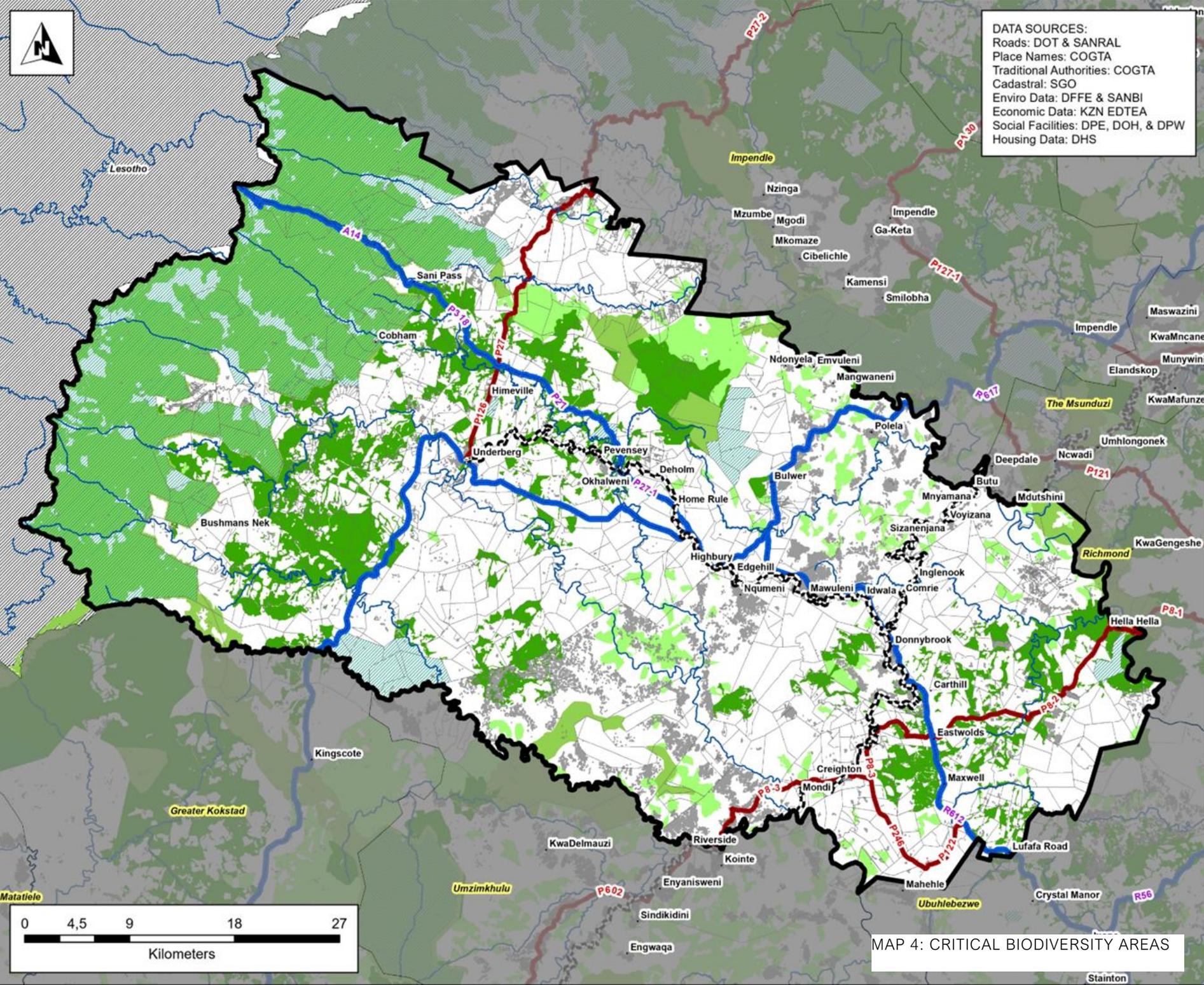
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Critical Biodiversity Areas

Legend

- NFEPA River
- Railway
- National Road
- Provincial Road
- Cadastral
- Settlement
- Protected Area
- Irreplaceable
- Optimal
- ESA



MAP 4: CRITICAL BIODIVERSITY AREAS





DATA SOURCES:
 Roads: DOT & SANRAL
 Place Names: COGTA
 Traditional Authorities: COGTA
 Cadastral: SGO
 Enviro Data: DFFE & SANBI
 Economic Data: KZN EDTEA
 Social Facilities: DPE, DOH, & DPW
 Housing Data: DHS



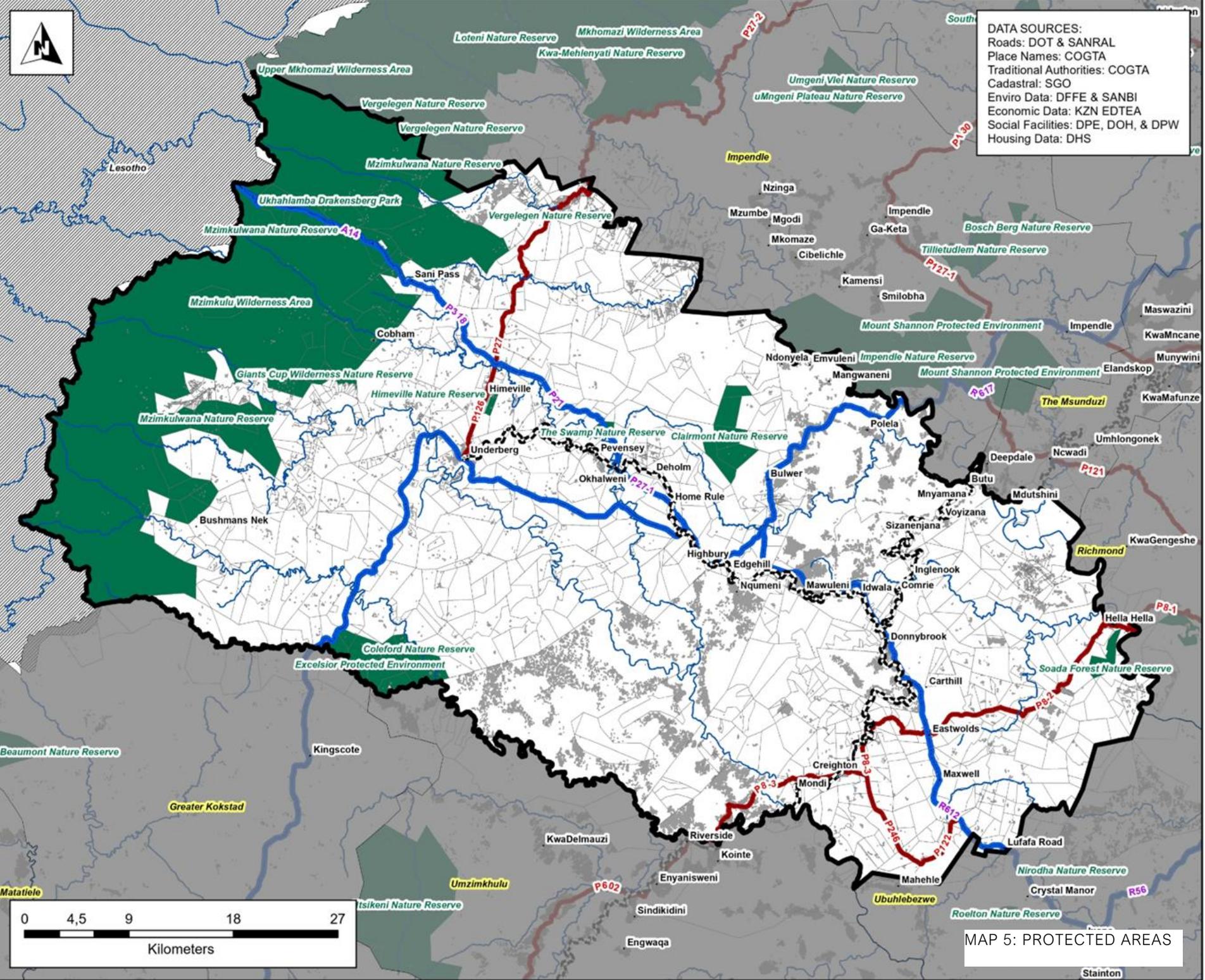
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Protected Areas

Legend

- NFEPA River
- Railway
- National Road
- Provincial Road
- Cadastral
- Settlement
- Protected Area



MAP 5: PROTECTED AREAS





DATA SOURCES:
 Roads: DOT & SANRAL
 Place Names: COGTA
 Traditional Authorities: COGTA
 Cadastral: SGO
 Enviro Data: DFFE & SANBI
 Economic Data: KZN EDTEA
 Social Facilities: DPE, DOH, & DPW
 Housing Data: DHS



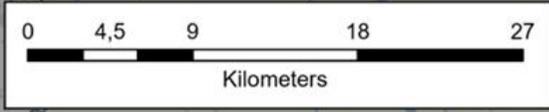
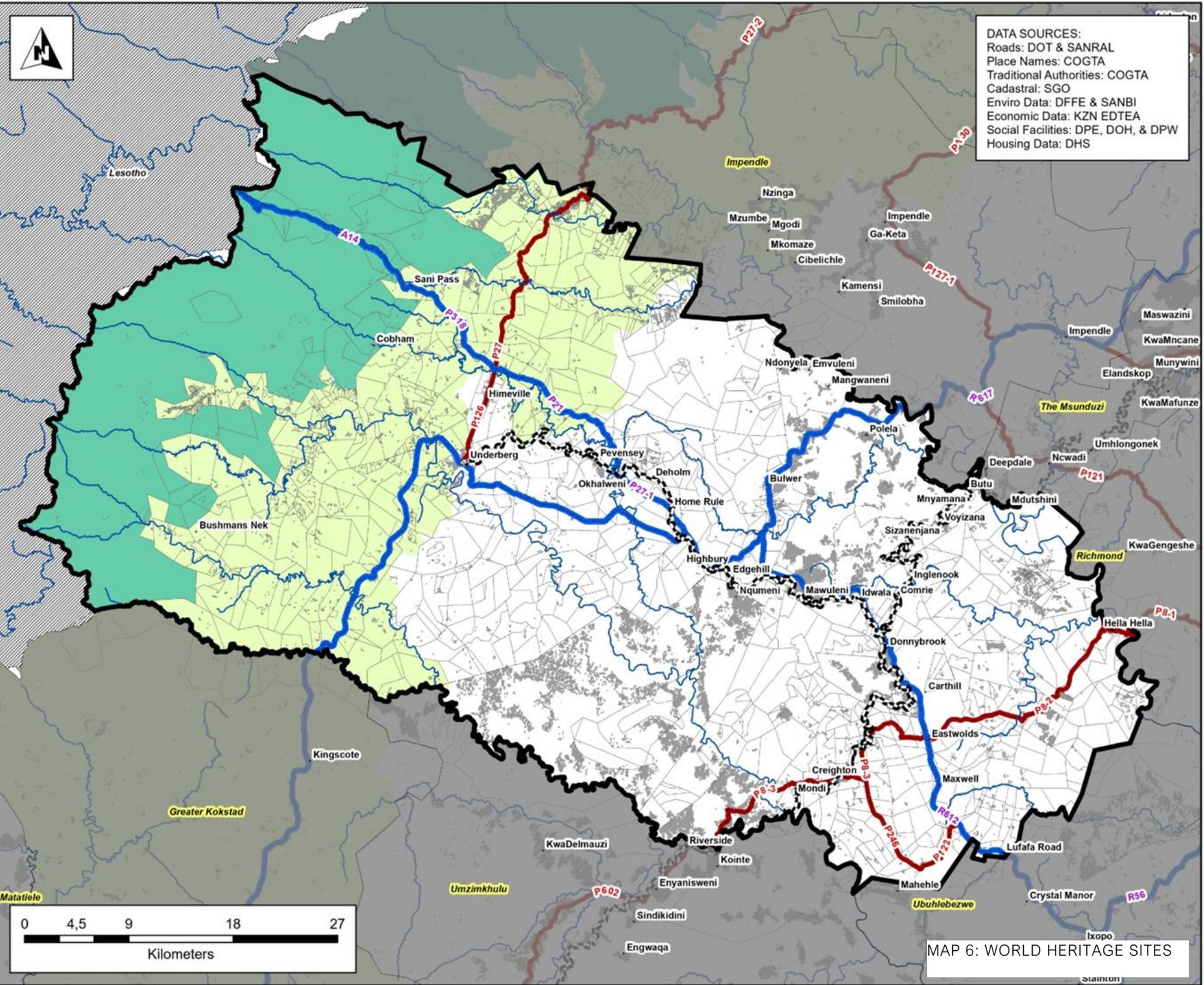
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World Heritage Sites

Legend

- NFEPA River
- Railway
- National Road
- Provincial Road
- Cadastral
- Settlement
- WHS
- WHS Buffer Zone



MAP 6: WORLD HERITAGE SITES





DATA SOURCES:
 Roads: DOT & SANRAL
 Place Names: COGTA
 Traditional Authorities: COGTA
 Cadastral: SGO
 Enviro Data: DFFE & SANBI
 Economic Data: KZN EDTEA
 Social Facilities: DPE, DOH, & DPW
 Housing Data: DHS



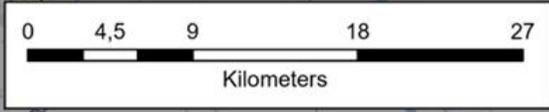
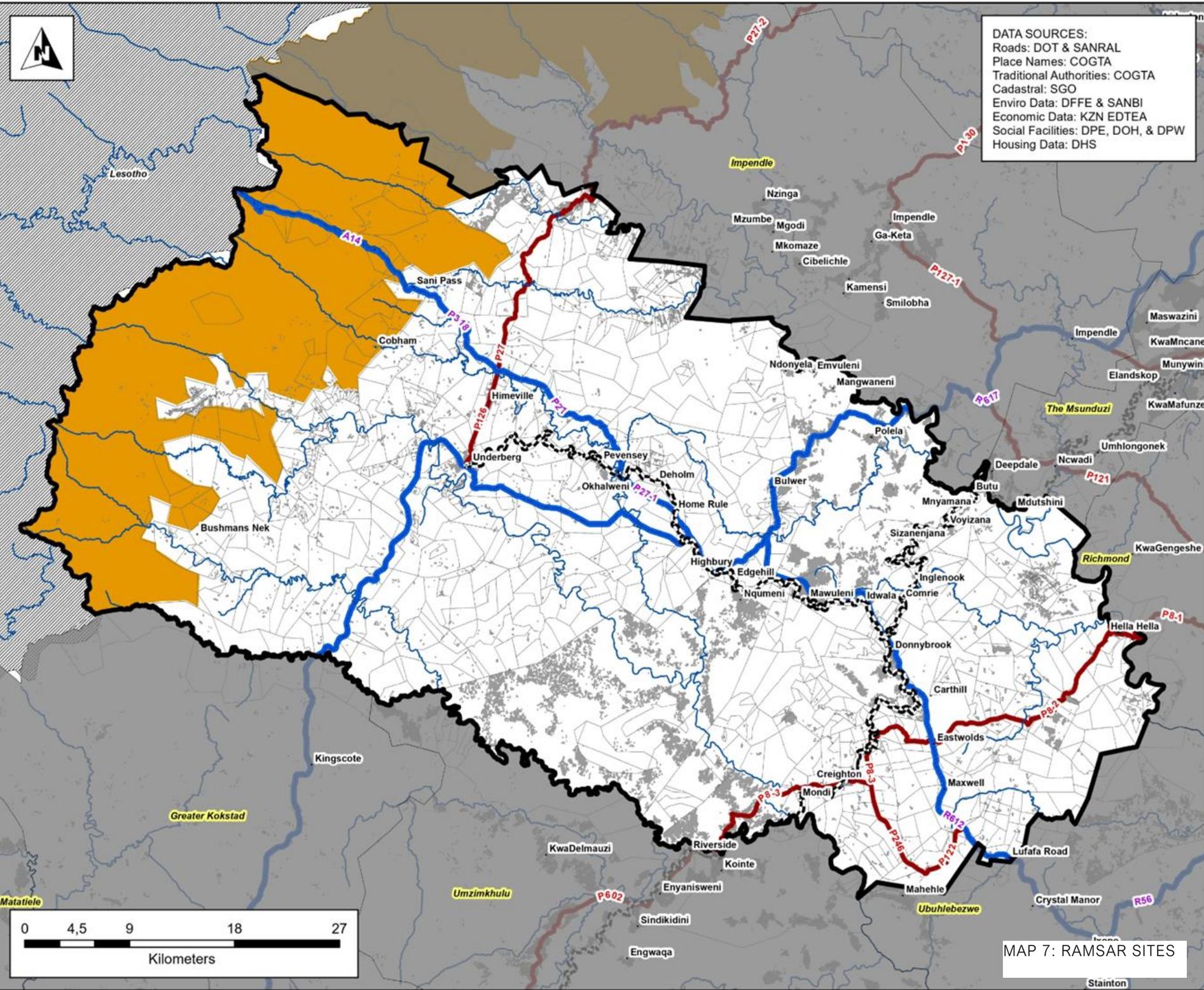
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Ramsar Sites

Legend

- NFEPA River
- Railway
- National Road
- Provincial Road
- Cadastral
- Settlement
- Ramsar



MAP 7: RAMSAR SITES



The vegetation conservation status map illustrates the condition and conservation significance of vegetation types within the Dr Nkosazana Dlamini Zuma Local Municipality. The map differentiates between vegetation units that remain relatively intact and those that are classified as vulnerable, endangered, or critically endangered, reflecting varying degrees of historical transformation and ongoing pressure.

From a strategic environmental perspective, vegetation conservation status provides a clear indicator of ecological tolerance to change. Vegetation types that are already significantly transformed or threatened have a reduced capacity to absorb additional disturbance without irreversible loss of biodiversity and ecosystem function. In these areas, even limited land use change can result in the loss of remaining intact habitat fragments, further undermining conservation targets.

The spatial distribution of threatened and vulnerable vegetation types often overlaps with areas of agricultural activity, settlement expansion, and infrastructure development. This overlap indicates zones of heightened cumulative impact risk, where incremental clearing for housing, roads, or services contributes to progressive habitat loss. While individual activities may fall below thresholds of concern in isolation, their cumulative effect can be substantial and difficult to reverse.

In regulatory terms, development within threatened vegetation types is likely to trigger environmental authorisation requirements under:

- Listing Notice 3, due to the sensitivity of the receiving environment; and
- Listing Notice 1, where activities involve vegetation clearance, earthworks, or infrastructure installation.

The repeated triggering of EIA processes in these areas highlights the importance of strategic avoidance rather than reactive, project-by-project assessment.

From an SEA and SDF perspective, the vegetation conservation status map underscores the need to:

- prioritise the protection of remaining intact vegetation.
- limit further fragmentation of threatened vegetation types; and
- align future development with areas of lower ecological sensitivity.

Vegetation conservation status therefore represents a critical spatial filter for development decision-making, reinforcing the necessity of integrating biodiversity considerations into all aspects of spatial planning.

The vegetation biomes map illustrates the distribution of major biome types across the municipality, reflecting broad ecological patterns driven by climate, geology, and topography. These biomes provide the ecological context within which more detailed biodiversity features, such as CBAs and threatened ecosystems, are situated.

From a strategic perspective, biome distribution highlights ecological heterogeneity across the municipal area, with different biomes exhibiting varying sensitivities to disturbance and land use change. Some biomes are more resilient to certain forms of land use, while others are inherently fragile and slow to recover once degraded.

The map underscores that development impacts must be interpreted within the context of the underlying biome, as similar land uses can have markedly different environmental consequences depending on biome characteristics. Failure to account for biome-level sensitivity increases the risk of inappropriate land allocation and cumulative ecological degradation.

Within the SEA and SDF, biome mapping supports a graduated approach to spatial planning, where development intensity and land use controls are calibrated to underlying ecological capacity rather than applied uniformly across the municipality.

The threatened ecosystems map highlights vegetation ecosystems that are classified as vulnerable, endangered, or critically endangered at a national level. These ecosystems have experienced extensive historical transformation and retain limited remaining natural extent, making them particularly sensitive to further land use change.

From an SEA perspective, threatened ecosystems represent low-resilience environments with minimal capacity to absorb additional disturbance. Development within these ecosystems carries a high likelihood of irreversible ecological loss, even where impacts appear modest in spatial extent. The map shows that threatened ecosystems often coincide with areas of agricultural activity and settlement pressure, creating persistent conflict between development needs and conservation imperatives.

The cumulative impact risk within threatened ecosystems is significant. Incremental clearing for housing, roads, and services progressively erodes remaining habitat fragments, undermining ecosystem functioning and increasing regulatory scrutiny.

In regulatory terms, activities within threatened ecosystems are likely to trigger:

- Listing Notice 3, due to the sensitivity of the environment; and
- Listing Notice 1, where activities involve vegetation clearance or earthworks.

Strategically, the threatened ecosystems map reinforces the principle that avoidance is the preferred management response. Within the SDF, these ecosystems should be treated as highly constrained or no-go areas for new

development, with land use planning focused on protection and consolidation rather than expansion.



DATA SOURCES:
 Roads: DOT & SANRAL
 Place Names: COGTA
 Traditional Authorities: COGTA
 Cadastral: SGO
 Enviro Data: DFFE & SANBI
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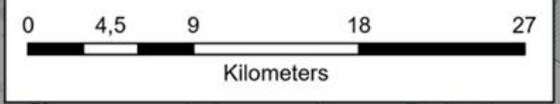
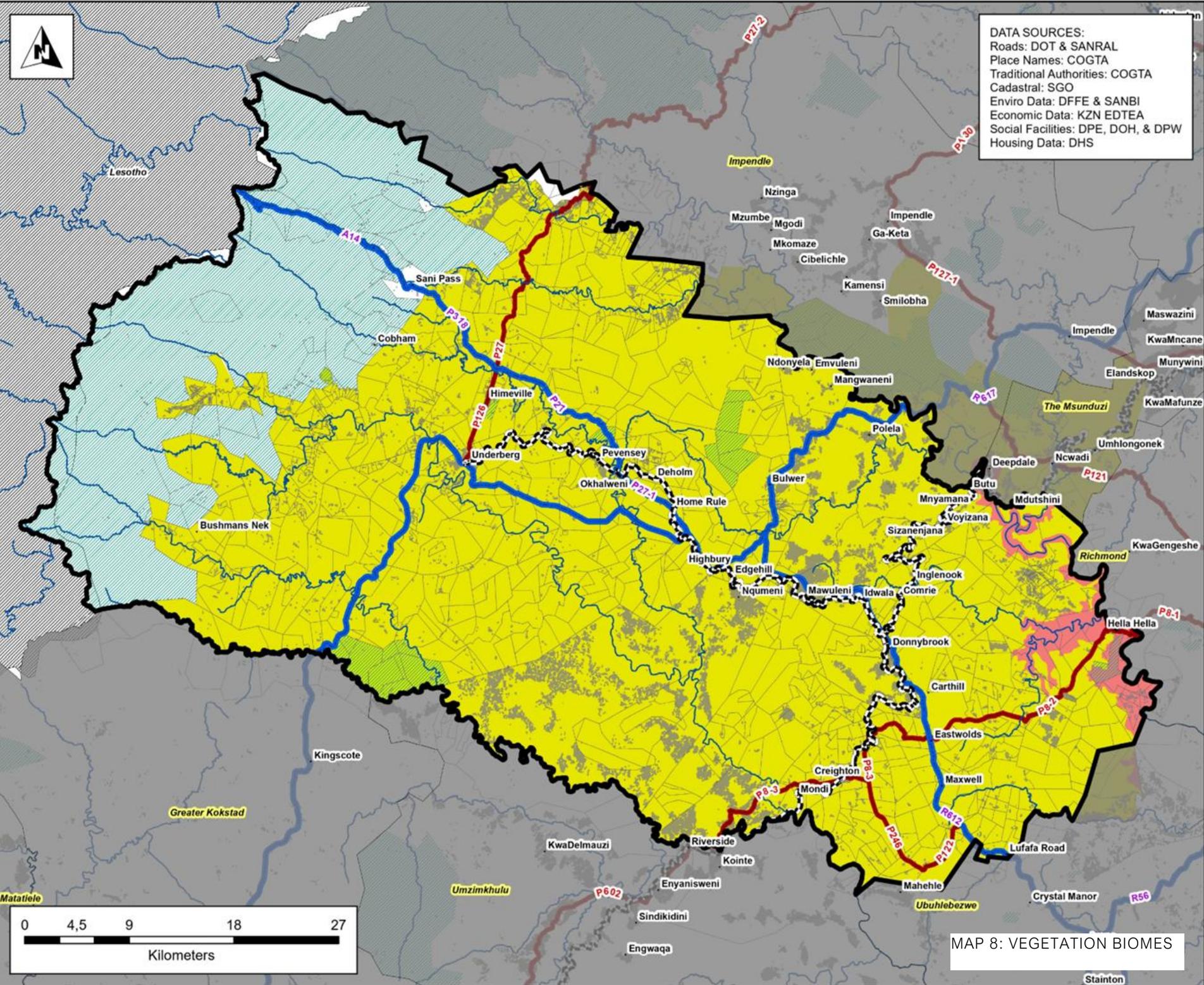


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Vegetation Biomes

Legend

- NFEPA River
- Railway
- National Road
- Provincial Road
- Cadastral
- Settlement
- Protected Area
- Grassland Biome
- Savanna Biome



MAP 8: VEGETATION BIOMES





DATA SOURCES:
 Roads: DOT & SANRAL
 Place Names: COGTA
 Traditional Authorities: COGTA
 Cadastral: SGO
 Enviro Data: DFFE & SANBI
 Economic Data: KZN EDTEA
 Social Facilities: DPE, DOH, & DPW
 Housing Data: DHS



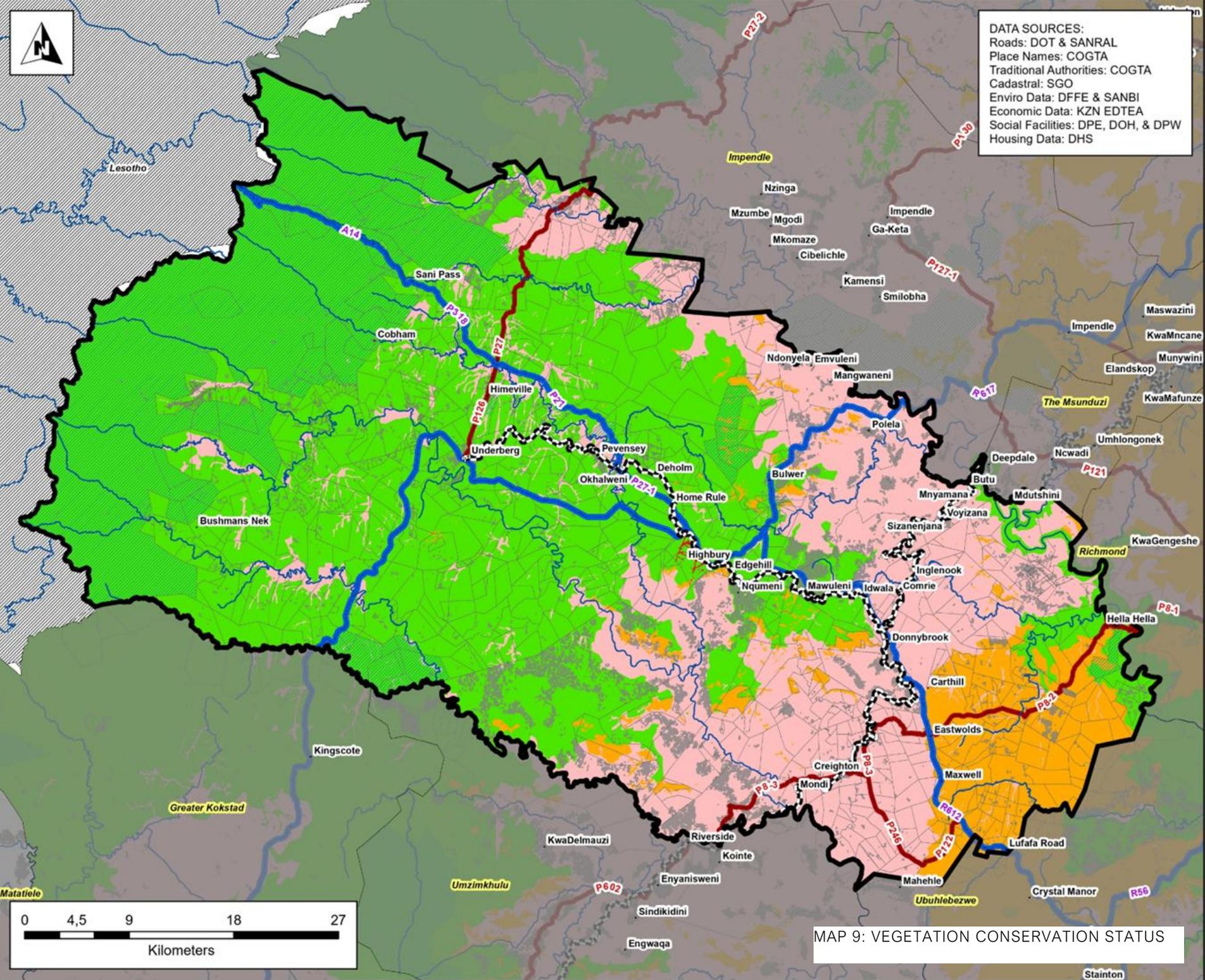
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Vegetation Conservation Status

Legend

- NFEPA River
- Railway
- National Road
- Provincial Road
- Cadastral
- Settlement
- Protected Area
- CR
- EN
- LT
- VU



MAP 9: VEGETATION CONSERVATION STATUS



4.6. EIA LISTING NOTICE TRIGGER AND CUMULATIVE RISK

This section translates the sensitivities identified in the receiving environment and map-based analyses into a strategic screening framework aligned with the Environmental Impact Assessment (EIA) Regulations (2014, as amended). In accordance with the DFFE SEA Guidelines, the purpose of this matrix is not to pre-empt project-level EIA outcomes, but to anticipate where spatial development patterns and cumulative activities are likely to trigger environmental authorisation requirements, thereby informing SDF decision-making, sequencing, and risk avoidance. The matrix explicitly references Listing Notices 1, 2, and 3, including activity numbers, and highlights cumulative triggering risk, particularly in relation to repeated linear infrastructure, incremental settlement expansion, and land use change in environmentally sensitive areas.

TABLE 5: STRATEGIC EIA TRIGGER AND RECEIVING ENVIRONMENT IMPLICATIONS MATRIX

ENVIRONMENTAL ATTRIBUTE / SPATIAL FEATURE	APPLICABLE EIA LISTING NOTICE & ACTIVITY NUMBERS	TYPICAL DEVELOPMENT ACTIVITIES LIKELY TO TRIGGER AUTHORISATION	POTENTIAL IMPACTS ON THE RECEIVING ENVIRONMENT	CUMULATIVE TRIGGERING RISK	STRATEGIC IMPLICATIONS FOR THE SEA AND SDF
Rivers, streams, wetlands, floodplains	LN1: Activity 19, 21; LN3: Activity 12	Road crossings, pipelines, bulk water and sanitation infrastructure, settlement expansion near watercourses	Alteration of flow regimes, wetland degradation, water pollution, increased flood risk	High – repeated crossings and service extensions incrementally degrade aquatic systems	Treat riparian corridors as structuring elements; avoid crossings where possible; consolidate development away from watercourses
Critical Biodiversity Areas (CBAs) & ESAs	LN1: Activity 27; LN3: Activity 12	Vegetation clearance, infrastructure development, rural settlement expansion	Habitat loss, fragmentation, loss of ecological connectivity	High – dispersed development and linear infrastructure repeatedly trigger authorisations	CBAs must function as no-go or highly constrained zones within the SDF
Threatened ecosystems & threatened vegetation types	LN1: Activity 27; LN3: Activity 12	Housing development, agriculture expansion, road upgrades	Irreversible loss of remaining habitat, undermining conservation targets	High – incremental clearing progressively erodes remaining extent	Direct development to less sensitive areas; prioritise avoidance over mitigation
Protected areas and buffers	LN3: Activity 14; LN1: Activity 19	Infrastructure upgrades, tourism facilities, access roads	Edge effects, disturbance, pollution, reduced conservation effectiveness	Medium-High – cumulative edge impacts increase regulatory scrutiny	Reinforce buffers and compatible land uses; prevent incompatible development near protected areas

ENVIRONMENTAL ATTRIBUTE / SPATIAL FEATURE	APPLICABLE EIA LISTING NOTICE & ACTIVITY NUMBERS	TYPICAL DEVELOPMENT ACTIVITIES LIKELY TO TRIGGER AUTHORISATION	POTENTIAL IMPACTS ON THE RECEIVING ENVIRONMENT	CUMULATIVE TRIGGERING RISK	STRATEGIC IMPLICATIONS FOR THE SEA AND SDF
Ramsar wetlands	LN3: Activity 12; LN1: Activity 21	Water abstraction, infrastructure crossings, land use change	Loss of international wetland function, downstream impacts	Very High – even minor repeated impacts are significant	Treat Ramsar sites as absolute no-go areas for incompatible development
World Heritage Site contexts	LN3: Activity 14; LN1: Activity 19	Tourism infrastructure, roads, bulk services	Visual intrusion, landscape degradation, heritage value loss	High – cumulative indirect impacts undermine integrity	Use heritage landscapes as primary spatial structuring constraints
Steep slopes and unstable terrain	LN1: Activity 19; LN3: Activity 15	Earthworks, housing, road construction	Erosion, landslides, sedimentation of watercourses	Medium–High – repeated earthworks increase instability	Avoid intensive development in steep terrain; prioritise consolidation
Agricultural land with moderate–high capability	LN1: Activity 27 (where vegetation clearance applies)	Settlement expansion, infrastructure development	Loss of productive land, increased erosion	Medium – incremental conversion reduces long-term viability	Protect strategic agricultural land; discourage ad hoc conversion
Linear infrastructure corridors (roads, pipelines, powerlines)	LN1: Activity 19, 21; LN2: Activity 15 (scale-dependent)	New routes, upgrades, maintenance	Habitat fragmentation, repeated watercourse crossings	Very High – multiple discrete triggers over time	Infrastructure routing must follow environmental avoidance logic at SDF level
Dispersed rural and informal settlements	LN1: Activity 27; LN3: Activity 12 (where sensitive areas are affected)	Incremental housing, service extensions	Progressive encroachment into sensitive areas	High – cumulative expansion drives repeated triggers	Promote settlement consolidation and nodal development

4.7. CLIMATE CHANGE

4.7.1. CLIMATE CHANGE CONTEXT AND TRENDS

The municipality is already experiencing climate-related pressures consistent with broader regional and national trends, including:

- increased rainfall variability, characterised by more intense rainfall events interspersed with longer dry periods;
- rising average temperatures, with implications for evapotranspiration rates and water demand; and
- greater frequency and intensity of extreme weather events, including flooding, droughts, and cold spells in higher-altitude areas.

These trends are not uniformly distributed across the municipal area. Variations in altitude, topography, land cover, and settlement patterns result in spatially differentiated climate risks, with some areas significantly more exposed and vulnerable than others. Climate change therefore reinforces the importance of a place-based, risk-informed approach to spatial planning.

4.7.2. INTERACTION WITH BIOPHYSICAL SYSTEMS

Climate change has a direct and compounding influence on key biophysical systems within the municipality:

- Hydrological systems are increasingly stressed by altered rainfall regimes, resulting in higher peak flows during storm events and reduced base flows during dry periods. This increases flood risk in low-lying and riparian areas while simultaneously threatening water availability and aquatic ecosystem health.
- Soils and land capability are affected through heightened erosion risk, particularly on steep slopes and in areas where vegetation

cover has been removed. Intense rainfall accelerates soil loss, while prolonged dry conditions reduce soil productivity and resilience.

- Biodiversity and ecosystems face pressure from shifting climatic envelopes, habitat fragmentation, and reduced ecological connectivity. Climate change reduces the ability of ecosystems to recover from disturbance, making cumulative impacts more severe and long-lasting.
- Vegetation systems, particularly those already classified as threatened or vulnerable, are less able to adapt to rapid climatic shifts, increasing the risk of irreversible biodiversity loss.

From an SEA perspective, these interactions indicate that areas already identified as environmentally sensitive—such as CBAs, wetlands, floodplains, steep slopes, and marginal soils—will become progressively less tolerant of development pressure over time.

4.7.3. INTERACTION WITH SETTLEMENTS AND INFRASTRUCTURE

Climate change also has significant implications for the municipality's settlement patterns and infrastructure systems:

- Dispersed rural settlements and informal expansion increase exposure to climate-related hazards, particularly flooding, storm damage, and water insecurity.
- Infrastructure networks, including roads, water supply systems, and sanitation infrastructure, are vulnerable to damage from extreme rainfall events and flooding, especially where located in flood-prone or unstable terrain.
- Service delivery pressures are intensified by climate change, as increased water demand, infrastructure maintenance costs, and disaster response requirements place additional strain on municipal capacity.

Spatial planning that enables settlement growth or infrastructure investment in high-risk areas is likely to result in recurrent damage, escalating costs, and repeated regulatory intervention, including the triggering of EIA processes for infrastructure upgrades and repairs.

4.7.4. CUMULATIVE RISK AND LONG-TERM SPATIAL IMPLICATIONS

A key concern from a strategic perspective is the cumulative nature of climate-related risk. Incremental development decisions—such as repeated road upgrades, service extensions, or settlement infill within sensitive areas—may appear manageable in isolation but collectively undermine environmental resilience and adaptive capacity.

Climate change therefore introduces a temporal dimension to the receiving environment, where areas that may currently appear marginally suitable for development could become untenable over the lifespan of the SDF. This reinforces the need for:

- conservative development assumptions in environmentally sensitive areas.
- avoidance of irreversible land-use decisions in high-risk zones; and
- prioritisation of development in locations with lower long-term climate exposure.

4.7.5. STRATEGIC IMPLICATIONS FOR THE SDF AND SEA

Within the context of the SEA, climate change must be understood as a cross-cutting constraint that shapes all subsequent spatial planning decisions. The receiving environment analysis demonstrates that climate change:

- heightens the importance of protecting ecological buffers such as wetlands, riparian corridors, and CBAs.
- strengthens the case for compact, risk-aware settlement patterns.
- increases the regulatory and financial risk associated with development in flood-prone and unstable areas; and
- necessitates a precautionary approach to spatial expansion in marginal or environmentally sensitive landscapes.

Accordingly, climate change considerations must be embedded throughout the SDF, influencing growth management, infrastructure prioritisation, and land-use allocation in a manner that reduces long-term vulnerability and supports municipal resilience.

4.8. BUILT ENVIRONMENT

4.8.1. INFRASTRUCTURE NETWORKS

Infrastructure networks within the municipality—particularly water supply, sanitation, roads, and energy infrastructure—are spatially extensive and closely aligned with settlement distribution patterns. Given the predominantly rural and dispersed nature of settlements, infrastructure provision relies heavily on linear networks that traverse large areas of the landscape, often crossing environmentally sensitive zones such as river corridors, wetlands, steep slopes, and CBAs.

Water and sanitation infrastructure is particularly constrained by hydrological sensitivity and topographic complexity. Infrastructure located in flood-prone areas or steep terrain is vulnerable to damage, service disruption, and environmental contamination, especially during extreme weather events. Road networks similarly intersect sensitive environments, and incremental upgrades or maintenance works frequently trigger environmental authorisation requirements due to their location within regulated areas.

From a strategic perspective, the built infrastructure environment is a key driver of cumulative environmental risk, as repeated small-scale interventions collectively intensify disturbance across sensitive landscapes. Spatial planning that continues to support dispersed settlement growth will exacerbate this pattern, increasing regulatory complexity and long-term maintenance costs.

4.8.2. BROAD LAND USE PATTERNS

Broad land use patterns within the municipality are dominated by agriculture, rural settlements, natural and conservation areas, and limited urban development around established towns. These land uses are often interwoven,

with agricultural activities and settlements occurring in close proximity to ecologically sensitive areas.

The absence of clear spatial separation between intensive land uses and environmentally sensitive zones increases the likelihood of land use conflict, habitat fragmentation, and degradation of ecosystem services. Incremental land use change—such as the conversion of agricultural or natural land to settlement use—may appear minor at a local scale but contributes to significant cumulative impacts over time.

From an SEA perspective, broad land use patterns reveal the need for strong spatial structuring within the SDF, including clearer differentiation between development zones, agricultural protection areas, and conservation priorities. Without such structuring, the built environment will continue to expand in an ad hoc manner that undermines environmental integrity and planning certainty.

4.8.3. HUMAN SETTLEMENTS

Human settlements within the municipality range from formal towns to dispersed rural settlements and informal settlement clusters. Many settlements are located in areas with inherent environmental constraints, including proximity to watercourses, steep slopes, and marginal soils. These locational patterns increase exposure to environmental hazards and complicate the provision of safe, reliable services.

Settlement expansion often occurs incrementally, driven by household-level decisions rather than coordinated planning. This form of growth results in a diffuse built footprint, increasing pressure on natural systems and leading to repeated environmental authorisation triggers for infrastructure extensions and upgrades.

Strategically, settlement patterns represent a critical interface between the built and natural environments. The SEA identifies unmanaged settlement

growth as a major source of environmental risk and cumulative impact, underscoring the importance of guiding future settlement development toward areas with lower environmental sensitivity and higher infrastructure efficiency.

4.8.4. STRATEGIC BUILT ENVIRONMENT IMPLICATIONS

The configuration of the built environment within the municipality reflects historical development trajectories and ongoing socio-economic pressures. However, from an SEA perspective, it also highlights systemic risks associated with dispersed development, infrastructure placement in sensitive areas, and weak alignment between land use and environmental capacity.

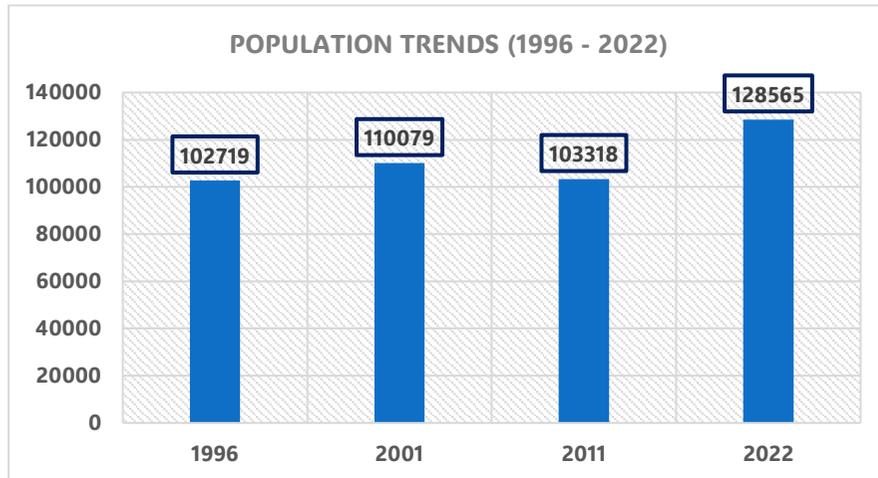
Key strategic implications include:

- increased regulatory risk due to frequent triggering of EIA Listing Notices for infrastructure and settlement-related activities.
- heightened vulnerability of infrastructure to climate-related impacts.
- long-term financial and environmental costs associated with maintaining infrastructure in high-risk locations; and
- erosion of environmental assets that underpin livelihoods and ecosystem services.

These factors reinforce the need for an SDF that actively reshapes the built environment in a manner that reduces environmental risk, limits cumulative impacts, and supports sustainable spatial development.

5. SOCIOECONOMIC ENVIRONMENT

5.1. POPULATION TRENDS



GRAPH 1: POPULATION TRENDS

Source: Census 1996, 2001 & 2022

The graph reflects total population figures for 1996 (102,719), 2001 (110,079), 2011 (103,318), and 2022 (128,565). The trend is non-linear. Moderate growth occurred between 1996 and 2001, followed by decline between 2001 and 2011. The most significant shift occurred between 2011 and 2022, with a sharp increase of approximately 25,000 people (+24.4%).

The 2022 figure represents the highest recorded population and signals renewed demographic growth. This shift indicates increasing settlement pressure and rising demand for land, infrastructure, and environmental resources over the SDF horizon.

5.1.1. ENVIRONMENTAL IMPLICATIONS FOR THE RECEIVING ENVIRONMENT

Population growth increases pressure on water, land, biodiversity, infrastructure, and climate resilience. In a rural municipality such as NDZ, these pressures are spatially significant.

5.1.1.1. WATER RESOURCES

Increased population implies higher potable water demand and wastewater generation. Without bulk upgrades, this may strain river systems and groundwater abstraction. Hydrological stress risk is high if infrastructure expansion does not keep pace.

5.1.1.2. LAND TRANSFORMATION & SETTLEMENT EXPANSION

Growth is likely to manifest through peri-urban expansion and incremental rural settlement spread. This may lead to agricultural land conversion, wetland encroachment, and inefficient land consumption unless spatial containment is enforced.

5.1.1.3. BIODIVERSITY & ECOLOGICAL CORRIDORS

Settlement expansion and increased resource use may fragment habitats and compromise CBAs and ESAs. Cumulative ecological degradation risk is high where spatial controls are weak.

5.1.1.4. AGRICULTURAL LAND CAPABILITY

Expansion onto high-capability soils may reduce long-term agricultural productivity and undermine the local agrarian economy. Loss of agricultural land is largely irreversible.

5.1.1.5. CLIMATE CHANGE VULNERABILITY

Growth in flood-prone or slope-constrained areas increases disaster exposure and reduces adaptive capacity. Population expansion amplifies climate risk where spatial steering is absent.

5.1.1.6. WASTE GENERATION & POLLUTION LOADS

Increased population leads to higher waste volumes and landfill pressure. Where service coverage is limited, informal dumping and pollution may intensify.

5.1.1.7. ENERGY DEMAND & EMISSIONS

Electricity demand will increase. In rural areas, biomass harvesting may intensify where grid access is limited, contributing to environmental degradation.

5.1.2. SEA RISK CLASSIFICATION

TABLE 6: SEA RISK CLASSIFICATION

DIMENSION	RISK LEVEL	REVERSIBILITY	CUMULATIVE RISK
Water systems	High	Moderate	High
Biodiversity	High	Low	High
Agricultural land	Moderate-High	Low	High
Waste systems	Moderate	Moderate	Moderate
Climate exposure	Strategic	Low	High

Overall, the population increase constitutes a strategic environmental driver with high cumulative risk potential.

5.1.3. SEA DIRECTIVES FOR THE NDZ SPATIAL DEVELOPMENT FRAMEWORK

Demographic growth requires proactive spatial management within the SDF.

Spatial Structuring Directives: Growth should be consolidated within existing nodes (Underberg, Himeville, Bulwer, Donnybrook). Densification must precede greenfield expansion. Settlement expansion into environmentally sensitive or high agricultural value land must be avoided.

Environmental Safeguarding Measures: Buffer zones around rivers and biodiversity corridors must be enforced. Development in high-sensitivity areas should be restricted. Agricultural land protection must be strengthened through zoning controls.

Infrastructure & Services Directives: Development approvals should be conditional on confirmed bulk water and sanitation capacity. Water demand management and decentralised sanitation solutions should be prioritised in dispersed settlements.

5.1.4. MONITORING INDICATORS FOR SEA

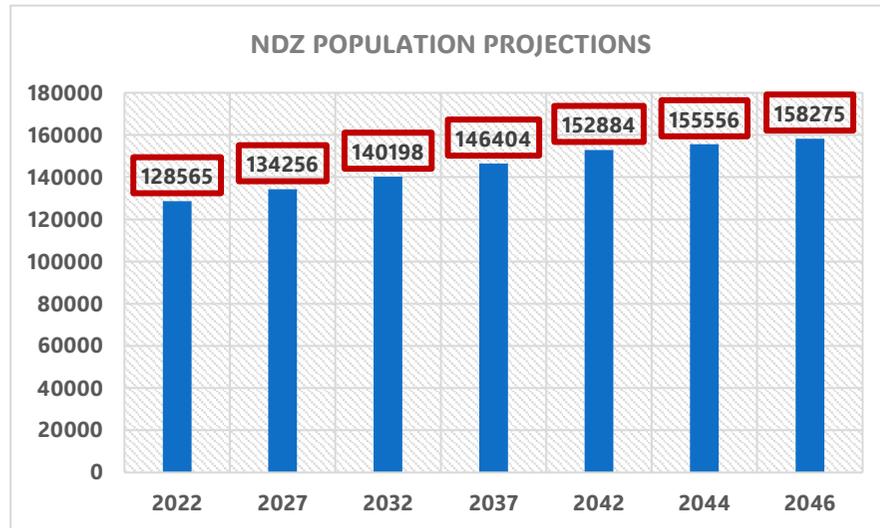
TABLE 7: POPULATION TRENDS - MONITORING INDICATORS FOR THE SEA

INDICATOR	MONITORING PURPOSE
Per capita water consumption	Track demand stress
% growth within nodes	Measure spatial efficiency
Land conversion rate	Monitor agricultural loss
Waste generation per capita	Service capacity tracking
Development in sensitive areas	Compliance monitoring

5.1.5. STRATEGIC INTERPRETATION

The 2011–2022 population surge represents a structural turning point. NDZ is entering a renewed growth phase. If unmanaged, cumulative environmental degradation and infrastructure strain will intensify. If strategically directed through nodal consolidation, environmental overlays, and infrastructure sequencing, growth can strengthen economic viability while safeguarding ecological systems over the 20-year SDF horizon.

5.2. POPULATION PROJECTIONS



GRAPH 2: POPULATION PROJECTIONS

The graph reflects projected population growth from 2022 to 2046. The population increases from 128,565 (2022) to 158,275 (2046). Intermediate projections show steady growth: 134,256 (2027), 140,198 (2032), 146,404 (2037), 152,884 (2042), and 155,556 (2044).

The projections indicate consistent linear growth over a 24-year horizon, representing an increase of approximately 29,700 people (+23%). Unlike the previous volatility observed historically, the projections assume sustained, stable demographic expansion.

This growth trajectory signals a predictable and cumulative increase in demand for land, services, infrastructure, and environmental resources over the SDF planning period (2026/27–2046/47).

5.2.1. ENVIRONMENTAL IMPLICATIONS FOR THE RECEIVING ENVIRONMENT

Projected growth of nearly 30,000 additional residents will significantly increase cumulative environmental pressures across NDZ.

5.2.1.1. WATER RESOURCES

Sustained population growth will increase potable water demand and wastewater generation over the next two decades. Without bulk upgrades and demand management, abstraction pressure on rivers and groundwater systems will intensify.

Hydrological stress risk is high over the long term, particularly in already constrained rural supply schemes.

5.2.1.2. LAND TRANSFORMATION & SETTLEMENT EXPANSION

An additional ±30,000 residents will require residential land, social facilities, and infrastructure. If growth is dispersed, it may accelerate agricultural land conversion, peri-urban sprawl, and encroachment into sensitive areas.

Spatial containment and nodal consolidation will be critical to prevent inefficient land consumption.

5.2.1.3. BIODIVERSITY & ECOLOGICAL CORRIDORS

Incremental settlement expansion may fragment habitats and place additional pressure on CBAs and ecological corridors. Over a 20-year horizon, even small annual land transformations accumulate into substantial ecological loss if not spatially directed.

5.2.1.4. AGRICULTURAL LAND CAPABILITY

Projected growth increases the probability of settlement encroachment onto productive agricultural soils. Long-term agricultural viability may decline if land protection mechanisms are weak. Losses in agricultural land are largely irreversible.

5.2.1.5. CLIMATE CHANGE VULNERABILITY

Expanded settlement footprints increase exposure to floodplains, steep slopes, and climate-sensitive areas. Over time, cumulative settlement expansion may heighten disaster risk and increase municipal adaptation burdens.

5.2.1.6. WASTE GENERATION & POLLUTION LOADS

Population growth of nearly 30,000 people implies increased solid waste volumes and landfill demand. Without expansion of waste infrastructure and recycling systems, pollution loads may increase progressively.

5.2.1.7. ENERGY DEMAND & EMISSIONS

Projected growth will increase electricity demand and infrastructure pressure. In rural areas, increased biomass use may persist where electrification is incomplete. Cumulative energy demand growth will require forward planning and renewable integration.

5.2.2. SEA RISK CLASSIFICATION

TABLE 8: POPULATION PROJECTION & SEA RISK CLASSIFICATION

DIMENSION	RISK LEVEL	REVERSIBILITY	CUMULATIVE RISK
Water systems	High	Moderate	High
Biodiversity	High	Low	High
Agricultural land	Moderate–High	Low	High
Waste systems	Moderate	Moderate	Moderate–High
Climate exposure	Strategic	Low	High

The projections confirm long-term cumulative environmental risk rather than short-term fluctuation.

5.2.3. SEA DIRECTIVES FOR THE NDZ SPATIAL DEVELOPMENT FRAMEWORK

Projected growth must be spatially structured and infrastructure-led to prevent environmental degradation.

Spatial Structuring Directives: Growth must be consolidated within established nodes (Underberg, Himeville, Bulwer, Donnybrook). Settlement containment boundaries should be formalised. Densification and infill must precede outward expansion. High-sensitivity ecological and agricultural areas must be excluded from future growth footprints.

Environmental Safeguarding Measures: Ecological buffers, wetland protection zones, and biodiversity corridor overlays must be embedded in the SDF. Agricultural land protection zoning should be strengthened. Growth management tools should align with environmental sensitivity mapping.

Infrastructure & Services Directives: Infrastructure planning must be sequenced to match projected growth. Bulk water, sanitation, electricity, and waste systems must be scaled progressively. Water demand management and decentralised service solutions should be prioritised in dispersed settlements.

5.2.4. POPULATION PROJECTIONS & MONITORING INDICATORS FOR SEA

TABLE 9: POPULATION PROJECTIONS AND MONITORING INDICATORS FOR SEA

INDICATOR	MONITORING PURPOSE
Annual population growth vs serviced capacity	Infrastructure stress tracking
% new development within nodes	Spatial containment efficiency
Agricultural land loss (ha/year)	Food security monitoring
Per capita water use	Demand management effectiveness
Waste generated per capita	Landfill pressure monitoring

5.2.5. STRATEGIC INTERPRETATION

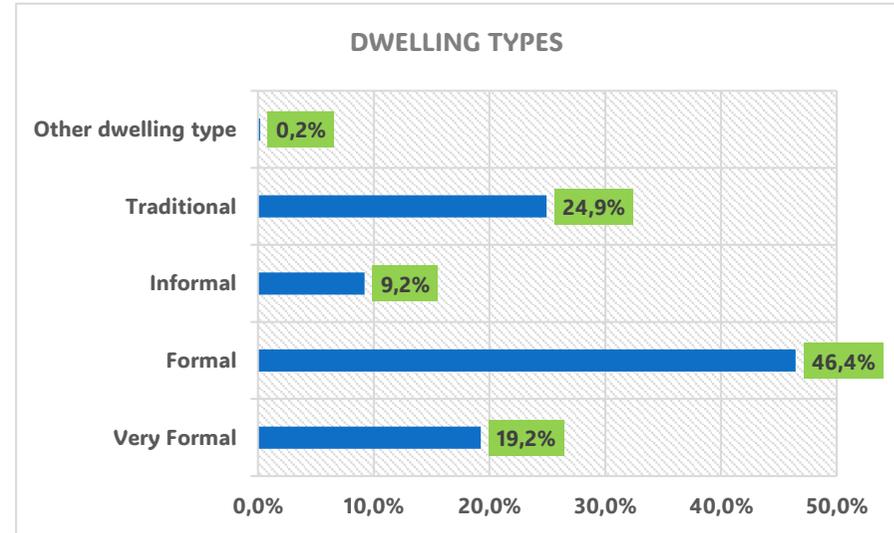
The projections confirm that NDZ will experience steady, cumulative growth over the 20-year SDF horizon. This is not episodic growth but sustained expansion.

If unmanaged, cumulative impacts will intensify pressure on water systems, agricultural land, biodiversity corridors, and infrastructure networks. However, because growth is predictable, it provides an opportunity for proactive spatial steering, infrastructure sequencing, and environmental overlay enforcement.

The projections therefore reinforce the need for a containment-based, infrastructure-led spatial strategy to ensure that long-term growth strengthens

rather than undermines environmental resilience and agricultural sustainability within NDZ.

5.3. HOUSEHOLD DWELLING TYPES



GRAPH 3: HOUSEHOLD DWELLING TYPES

Source: S&P Market Intelligence, 2024

The graph reflects the distribution of dwelling types within the municipality. Formal dwellings constitute 46.4% of the housing stock, followed by Traditional dwellings at 24.9%, Very Formal dwellings at 19.2%, Informal dwellings at 9.2%, and Other dwelling types at 0.2%.

This indicates that approximately 65.6% of households reside in formal or very formal structures, while roughly one-third (34.4%) occupy traditional or informal dwellings. The relatively high proportion of traditional dwellings reflects the rural character of NDZ, while the presence of informal dwellings signals areas of service backlog and unstructured settlement growth.

The dwelling profile therefore reflects a hybrid rural-urban housing pattern with both structured formal settlements and dispersed traditional or informal settlement forms.

5.3.1. ENVIRONMENTAL IMPLICATIONS FOR THE RECEIVING ENVIRONMENT

Housing typology has direct implications for land consumption patterns, infrastructure demand, environmental degradation risk, and service delivery efficiency.

5.3.1.1. WATER RESOURCES

Traditional and informal dwellings often rely on lower service levels, including communal standpipes or inadequate sanitation systems. This may increase groundwater contamination risk, especially where pit latrines are used in high-density rural clusters.

Where formal housing increases without bulk upgrades, water demand pressures may intensify. The mixed dwelling profile suggests uneven water infrastructure coverage and potential cumulative hydrological stress.

5.3.1.2. LAND TRANSFORMATION & SETTLEMENT EXPANSION

Traditional settlements typically occupy larger land parcels and follow dispersed patterns. Informal settlements may develop incrementally in environmentally marginal areas. This may result in inefficient land consumption, agricultural land fragmentation, and encroachment into wetlands or slope-constrained areas.

The dwelling mix therefore signals spatial inefficiency risk if growth is not consolidated within defined nodes.

5.3.1.3. BIODIVERSITY & ECOLOGICAL CORRIDORS

Dispersed traditional housing and informal settlement expansion can fragment ecological corridors and increase pressure on CBAs and ESAs. Fuelwood harvesting, small-scale cultivation, and unmanaged waste disposal may intensify ecological degradation in rural landscapes.

5.3.1.4. AGRICULTURAL LAND CAPABILITY

Traditional settlements often overlap with agricultural land. Expansion of homesteads and incremental densification may reduce productive agricultural area over time. This creates long-term land-use tension between settlement needs and agrarian viability.

5.3.1.5. CLIMATE CHANGE VULNERABILITY

Informal and traditional dwellings may be more vulnerable to flooding, extreme weather events, and slope instability due to construction type and location. Settlement patterns in marginal areas increase exposure to climate hazards.

5.3.1.6. WASTE GENERATION & POLLUTION LOADS

Lower service levels in traditional and informal areas may lead to unmanaged solid waste disposal. This may increase surface water contamination and land degradation.

5.3.1.7. ENERGY DEMAND & EMISSIONS

Traditional dwellings are more likely to rely on biomass for cooking and heating. This increases pressure on surrounding vegetation and contributes to localized environmental degradation.

5.3.2. HOUSEHOLD DWELLING TYPES & SEA RISK CLASSIFICATION

DIMENSION	RISK LEVEL	REVERSIBILITY	CUMULATIVE RISK
Water contamination	Moderate–High	Moderate	High
Biodiversity fragmentation	Moderate–High	Low	High
Agricultural land loss	Moderate	Low	High
Waste impacts	Moderate	Moderate	Moderate
Climate exposure	High (informal/traditional)	Low	High

The dwelling profile indicates cumulative environmental risk driven by dispersed rural settlement patterns and service backlogs.

5.3.3. SEA DIRECTIVES FOR THE NDZ SPATIAL DEVELOPMENT FRAMEWORK

The housing structure requires spatially differentiated planning interventions.

Spatial Structuring Directives: Encourage consolidation of traditional settlement clusters into defined service nodes. Promote incremental densification rather than outward sprawl. Prevent informal settlement expansion into environmentally sensitive areas.

Formal and very formal housing growth should be prioritised within serviced nodes.

Environmental Safeguarding Measures: Enforce buffer zones around wetlands and rivers in traditional settlement areas. Introduce slope and floodline development controls. Protect high-capability agricultural land from incremental homestead expansion.

Infrastructure & Services Directives: Prioritise sanitation upgrades in traditional and informal settlements. Introduce decentralized sanitation systems where bulk connection is not feasible. Expand electrification and renewable energy integration to reduce biomass dependence.

5.3.4. HOUSEHOLD DWELLING TYPES & MONITORING INDICATORS FOR SEA

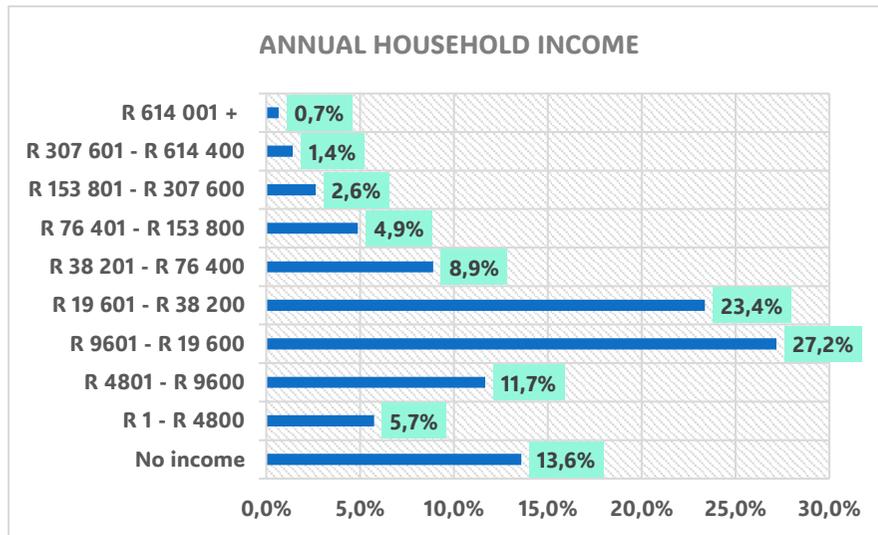
INDICATOR	MONITORING PURPOSE
% households with full waterborne sanitation	Service upgrade tracking
Informal settlement growth rate	Sprawl monitoring
Agricultural land conversion in traditional areas	Land protection monitoring
Biomass reliance per household	Energy transition tracking
Households in flood-prone areas	Climate vulnerability monitoring

5.3.5. STRATEGIC INTERPRETATION

The dwelling typology profile confirms that NDZ remains predominantly rural with a substantial proportion of traditional and informal housing. While formal housing dominates numerically, dispersed traditional settlement patterns drive spatial inefficiency and cumulative environmental risk.

The SDF must therefore pursue settlement consolidation, infrastructure upgrading, and environmental overlay enforcement to prevent continued fragmentation of agricultural land and ecological systems over the 20-year planning horizon.

5.4. ANNUAL HOUSEHOLD INCOME



GRAPH 4: ANNUAL HOUSEHOLD INCOME

Source: Census 2011

The income distribution reflects a predominantly low-income profile. The largest income brackets are:

- R 9,601 – R 19,600: 27.2%
- R 19,601 – R 38,200: 23.4%
- R 38,201 – R 76,400: 8.9%
- R 4,801 – R 9,600: 11.7%
- R 1 – R 4,800: 5.7%
- No income: 13.6%

Higher income categories above R 153,800 collectively represent a very small proportion (below 5%).

This indicates that the majority of households fall within lower income brackets, with a significant proportion either earning below subsistence thresholds or having no income at all. The municipal economy is therefore characterized by high poverty levels and limited disposable income.

5.4.1. ENVIRONMENTAL IMPLICATIONS FOR THE RECEIVING ENVIRONMENT

Income distribution directly influences land use patterns, service affordability, environmental degradation risk, and infrastructure sustainability.

5.4.1.1. WATER RESOURCES

Low-income households may struggle to afford full-cost recovery tariffs, leading to increased reliance on communal or informal water access points. Inadequate sanitation infrastructure in poorer settlements increases the risk of groundwater contamination and surface water pollution.

Affordability constraints may also limit investment in water-efficient technologies.

5.4.1.2. LAND TRANSFORMATION & SETTLEMENT EXPANSION

Low-income households are more likely to occupy informal or traditional settlements with lower land values and limited infrastructure. This may result in incremental settlement expansion into marginal or environmentally sensitive land.

Poverty-driven land occupation increases spatial fragmentation and complicates service provision.

5.4.1.3. BIODIVERSITY & ECOLOGICAL CORRIDORS

Where income levels are low, reliance on natural resources (fuelwood harvesting, small-scale subsistence farming) may increase. This places additional pressure on surrounding vegetation and biodiversity corridors.

Environmental degradation may therefore be poverty-driven rather than development-driven.

5.4.1.4. AGRICULTURAL LAND CAPABILITY

Lower-income households may depend on small-scale agriculture for subsistence. While this can support food security, unregulated expansion of homestead cultivation may reduce long-term agricultural land productivity.

5.4.1.5. CLIMATE CHANGE VULNERABILITY

Low-income households typically have reduced adaptive capacity and are more vulnerable to climate shocks. Housing quality, location in marginal areas, and limited access to insurance or resilient infrastructure increase disaster exposure.

5.4.1.6. WASTE GENERATION & POLLUTION LOADS

While lower-income areas may generate less waste per capita, limited waste service coverage increases the likelihood of informal dumping and burning, contributing to localized pollution.

5.4.1.7. ENERGY DEMAND & EMISSIONS

Lower income brackets are more likely to rely on biomass or paraffin for energy. This increases pressure on natural vegetation and contributes to indoor air pollution and localized environmental degradation.

5.4.2. HOUSEHOLD INCOME SEA RISK CLASSIFICATION

TABLE 10: HOUSEHOLD INCOME & SEA RISK CLASSIFICATION

DIMENSION	RISK LEVEL	REVERSIBILITY	CUMULATIVE RISK
Water contamination	Moderate–High	Moderate	High
Biodiversity pressure (resource reliance)	Moderate–High	Low	High
Agricultural land stress	Moderate	Low	Moderate–High
Climate vulnerability	High	Low	High
Waste impacts	Moderate	Moderate	Moderate

The income profile suggests cumulative environmental risk driven by poverty-linked vulnerability and resource dependence.

5.4.3. SEA DIRECTIVES FOR THE NDZ SPATIAL DEVELOPMENT FRAMEWORK

The income structure requires socially responsive spatial planning interventions.

Spatial Structuring Directives: Prioritise affordable housing delivery within serviced nodes to prevent poverty-driven sprawl. Integrate low-income housing within existing infrastructure footprints to reduce environmental encroachment.

Encourage mixed-income spatial integration to prevent environmental degradation in marginal land areas.

Environmental Safeguarding Measures: Protect sensitive areas from informal settlement expansion through enforcement and early intervention. Promote community-based environmental stewardship programmes to reduce poverty-driven resource degradation.

Infrastructure & Services Directives: Subsidised sanitation and water upgrades should be prioritised in low-income settlements. Expand electrification and renewable energy programmes to reduce biomass reliance. Strengthen waste collection coverage in poorer rural areas.

5.4.4. HOUSEHOLD INCOME & MONITORING INDICATORS FOR SEA

TABLE 11: HOUSEHOLD INCOME & MONITORING INDICATORS FOR SEA

INDICATOR	MONITORING PURPOSE
% households below poverty threshold	Socio-environmental vulnerability tracking
Informal settlement growth rate	Poverty-driven sprawl monitoring
Biomass reliance rate	Resource pressure tracking
Sanitation access levels	Pollution risk tracking
Households in climate risk zones	Adaptation vulnerability monitoring

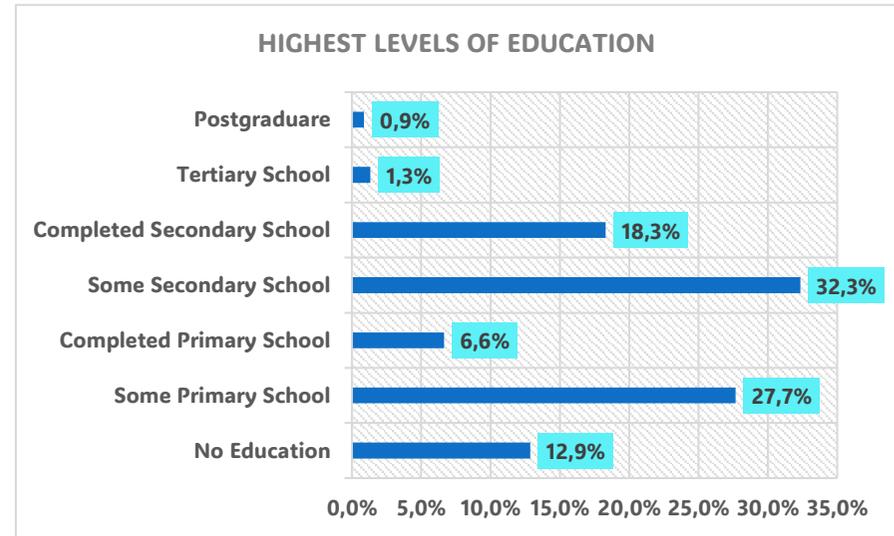
5.4.5. STRATEGIC INTERPRETATION

The income profile confirms that NDZ remains a predominantly low-income rural municipality with significant poverty levels. Environmental risk is therefore closely linked to socio-economic vulnerability rather than high-consumption development pressures.

If unmanaged, poverty-driven settlement expansion and resource reliance may cumulatively degrade ecological systems. However, with integrated housing delivery, service upgrading, and environmental protection overlays, spatial

planning can reduce vulnerability while safeguarding agricultural land and biodiversity over the SDF planning horizon.

5.5. HIGHEST LEVELS OF EDUCATION



GRAPH 5: HIGEST LEVELS OF EDUCATION

Source: Census 2022

The education profile indicates that the majority of the population has not completed secondary schooling. The largest categories are:

- Some Secondary School: 32.3%
- Some Primary School: 27.7%
- Completed Secondary School: 18.3%
- No Education: 12.9%
- Completed Primary School: 6.6%
- Tertiary School: 1.3%
- Postgraduate: 0.9%

The data shows that only a small proportion (approximately 2.2%) has tertiary or postgraduate qualifications. A significant share of the population has either incomplete schooling or no formal education. This indicates limited high-level skills within the municipality and a predominantly low-to-medium education base.

5.5.1. ENVIRONMENTAL IMPLICATIONS FOR THE RECEIVING ENVIRONMENT

Education levels influence employment patterns, environmental awareness, resource use behaviour, and the municipality's capacity to transition toward sustainable development.

5.5.1.1. WATER RESOURCES

Lower education levels may limit awareness of water conservation practices and sanitation management. Poor understanding of groundwater protection and waste disposal practices may increase pollution risks in rural settlements.

5.5.1.2. LAND TRANSFORMATION & SETTLEMENT EXPANSION

Limited education and skills may constrain formal employment opportunities, reinforcing informal or subsistence-based settlement expansion. This may increase incremental land occupation and spatial inefficiency, particularly in rural areas.

5.5.1.3. BIODIVERSITY & ECOLOGICAL CORRIDORS

Lower levels of environmental literacy may contribute to unsustainable resource harvesting (fuelwood, grazing pressure) and limited compliance with environmental protection regulations. This may increase cumulative ecological degradation.

5.5.1.4. AGRICULTURAL LAND CAPABILITY

While lower education levels may support subsistence agriculture practices, limited access to advanced agricultural knowledge may reduce productivity and sustainable land management practices over time.

5.5.1.5. CLIMATE CHANGE VULNERABILITY

Lower education levels may reduce adaptive capacity, awareness of climate risk, and uptake of resilience measures. Vulnerability to extreme weather events may therefore remain high in certain communities.

5.5.1.6. WASTE GENERATION & POLLUTION LOADS

Limited environmental education may increase informal dumping and improper waste disposal practices, particularly in rural and traditional settlements.

5.5.1.7. ENERGY DEMAND & EMISSIONS

Lower educational attainment may slow the transition toward renewable energy adoption and energy-efficient technologies, particularly in low-income rural households.

5.5.2. EDUCATION LEVELS & SEA RISK CLASSIFICATION

TABLE 12: EDUCATION LEVELS & SEA RISK CLASSIFICATION

DIMENSION	RISK LEVEL	REVERSIBILITY	CUMULATIVE RISK
Water & sanitation practices	Moderate	Moderate	Moderate–High
Biodiversity pressure	Moderate	Low	High
Agricultural sustainability	Moderate	Moderate	Moderate
Climate vulnerability	Moderate–High	Low	High
Waste management behavior	Moderate	Moderate	Moderate

The education profile suggests cumulative environmental risk linked to limited environmental awareness and constrained economic diversification.

5.5.3. SEA DIRECTIVES FOR THE NDZ SPATIAL DEVELOPMENT FRAMEWORK

Educational attainment must be integrated into spatial and socio-environmental planning strategies.

Spatial Structuring Directives: Prioritise clustering of educational facilities within established nodes to strengthen human capital development. Integrate vocational and skills training centres within growth nodes to support economic diversification and reduce poverty-driven sprawl.

Environmental Safeguarding Measures: Introduce community-based environmental education programmes linked to settlement planning initiatives. Strengthen awareness campaigns regarding wetland protection, floodline development, and waste management practices.

Infrastructure & Services Directives: Link infrastructure upgrades to public education programmes on water conservation, sanitation maintenance, and waste separation. Promote renewable energy education and training initiatives to accelerate clean energy transition.

5.5.4. EDUCATION LEVELS & MONITORING INDICATORS FOR SEA

TABLE 13: EDUCATION LEVELS & MONITORING INDICATORS

INDICATOR	MONITORING PURPOSE
% population completing secondary school	Human capital tracking
Tertiary qualification rate	Economic diversification potential

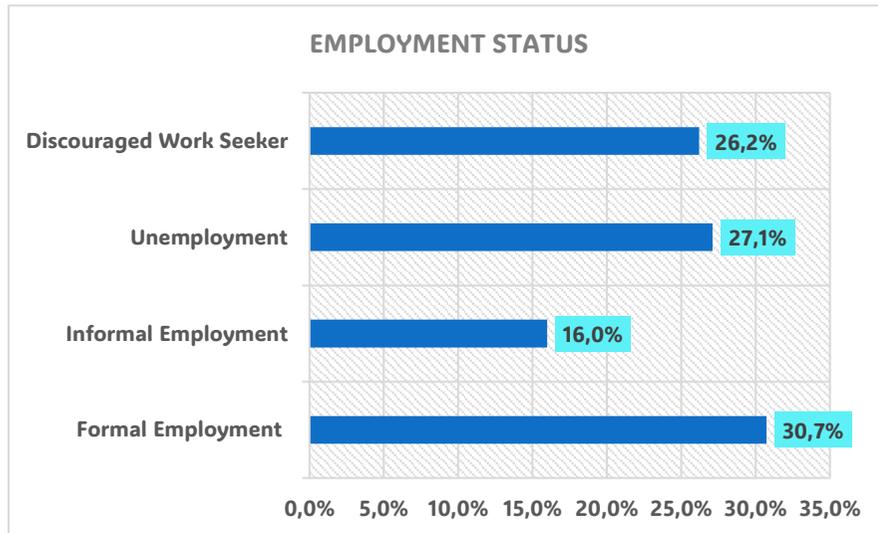
INDICATOR	MONITORING PURPOSE
Participation in environmental awareness programmes	Behavioral risk monitoring
Informal dumping incidents	Waste behavior tracking
Climate adaptation training uptake	Resilience capacity tracking

5.5.5. STRATEGIC INTERPRETATION

The education profile confirms that NDZ has a predominantly low-to-medium skills base with limited tertiary attainment. Environmental risk is therefore partly linked to socio-economic constraints and limited environmental literacy.

Without investment in education and skills development, poverty-driven settlement expansion and resource dependence may persist. However, strengthening educational infrastructure and environmental awareness within nodal growth areas can enhance adaptive capacity, reduce environmental degradation, and support sustainable economic diversification over the SDF planning horizon.

5.6. EMPLOYMENT STATUS



GRAPH 6: EMPLOYMENT STATUS

Source: S&P Market Intelligence, 2024

The employment profile reflects a structurally weak labour market. The distribution is as follows:

- Formal Employment: 30.7%
- Informal Employment: 16.0%
- Unemployment: 27.1%
- Discouraged Work Seekers: 26.2%

Combined unemployment and discouraged work seekers account for over 53% of the working-age population. Only approximately one-third of the population is formally employed. Informal employment constitutes a notable but secondary share.

This indicates high labour market exclusion, low income stability, and economic vulnerability. The economy is therefore characterized by limited formal job absorption and substantial dependence on informal or non-participatory labour categories.

5.6.1. ENVIRONMENTAL IMPLICATIONS FOR THE RECEIVING ENVIRONMENT

Employment structure influences land use patterns, resource dependency, settlement expansion dynamics, and environmental pressure.

5.6.1.1. WATER RESOURCES

High unemployment and informal employment levels may constrain municipal revenue collection for water services. Poor cost recovery may limit infrastructure maintenance, increasing the risk of system failures and water losses.

Lower-income and informal households may rely on communal infrastructure, increasing pressure on localized water sources.

5.6.1.2. LAND TRANSFORMATION & SETTLEMENT EXPANSION

High unemployment may drive informal settlement expansion and incremental occupation of marginal land. Limited formal income reduces access to planned housing, increasing risk of poverty-driven sprawl.

Informal employment often correlates with dispersed settlement patterns, intensifying spatial inefficiency.

5.6.1.3. BIODIVERSITY & ECOLOGICAL CORRIDORS

High labour exclusion may increase reliance on natural resources (fuelwood harvesting, informal agriculture, small-scale extraction). This may elevate pressure on ecological corridors and sensitive landscapes.

5.6.1.4. AGRICULTURAL LAND CAPABILITY

Where employment opportunities are limited, households may depend on subsistence agriculture. While this supports food security, unstructured expansion of cultivation areas may fragment agricultural land and reduce long-term productivity.

5.6.1.5. CLIMATE CHANGE VULNERABILITY

High unemployment reduces adaptive capacity and resilience. Households without stable income are more vulnerable to climate shocks and may settle in hazard-prone areas due to affordability constraints.

5.6.1.6. WASTE GENERATION & POLLUTION LOADS

Limited municipal revenue due to high unemployment may constrain waste service expansion. Informal trading and unregulated economic activity may increase localized waste generation without adequate collection systems.

5.6.1.7. ENERGY DEMAND & EMISSIONS

High unemployment and informal employment are often associated with reliance on biomass or low-cost energy sources. This increases pressure on surrounding vegetation and contributes to localized environmental degradation.

5.6.2. EMPLOYMENT STATUS & SEA RISK CLASSIFICATION

TABLE 14: EMPLOYMENT STATUS & SEA RISK CLASSIFICATIONS

DIMENSION	RISK LEVEL	REVERSIBILITY	CUMULATIVE RISK
Water infrastructure sustainability	Moderate–High	Moderate	High
Informal settlement expansion	High	Low	High
Biodiversity pressure (resource reliance)	Moderate–High	Low	High
Agricultural fragmentation	Moderate	Low	Moderate–High
Climate vulnerability	High	Low	High

The employment profile indicates cumulative environmental risk driven by economic vulnerability and poverty-linked spatial pressures.

5.6.3. SEA DIRECTIVES FOR THE NDZ SPATIAL DEVELOPMENT FRAMEWORK

The employment structure necessitates integrated economic and spatial planning responses.

Spatial Structuring Directives: Consolidate economic activity within defined nodes to stimulate formal employment growth. Promote mixed-use development within serviced areas to reduce informal sprawl. Locate economic hubs within infrastructure-serviced zones to prevent peripheral expansion.

Environmental Safeguarding Measures: Prevent informal settlement encroachment into environmentally sensitive areas through early spatial

planning interventions. Introduce green job programmes linked to environmental rehabilitation and biodiversity protection.

Infrastructure & Services Directives: Prioritise infrastructure investment in economic nodes to support job creation. Expand electrification and service coverage in informal and low-income settlements to reduce environmental degradation. Link public works programmes to environmental infrastructure upgrades.

5.6.4. EMPLOYMENT STATUS & MONITORING INDICATORS FOR SEA

TABLE 15: EMPLOYMENT STATUS & MONITORING INDICATORS

INDICATOR	MONITORING PURPOSE
Formal employment growth rate	Economic resilience tracking
Informal settlement expansion rate	Poverty-driven sprawl monitoring
Municipal revenue collection rate	Infrastructure sustainability tracking
Biomass reliance rate	Resource pressure monitoring
Green job creation numbers	Environmental-economic integration tracking

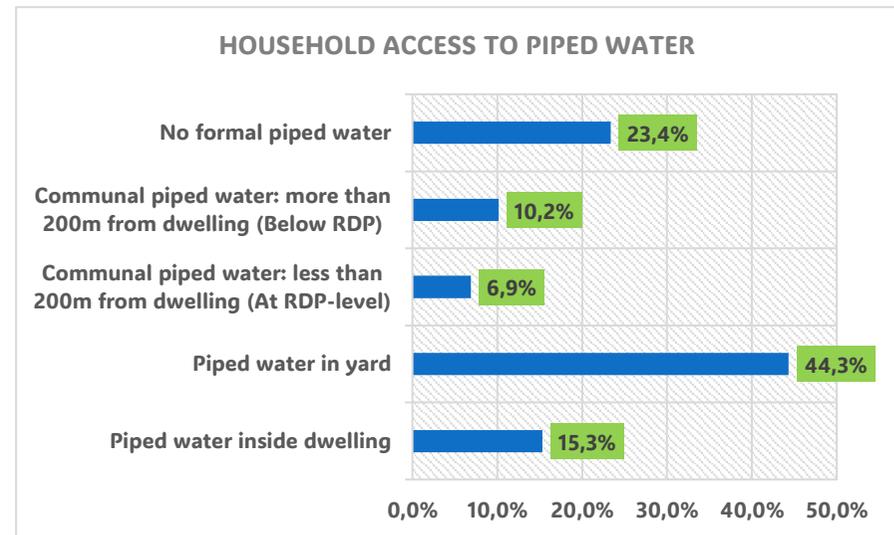
5.6.5. STRATEGIC INTERPRETATION

The employment profile confirms that NDZ faces structural labour market weakness, with more than half of the working-age population unemployed or discouraged. Environmental pressures are therefore closely linked to economic vulnerability and poverty-driven land use dynamics.

Without economic diversification and nodal job creation, cumulative environmental degradation may intensify through informal settlement growth and natural resource reliance. However, aligning economic development with spatial consolidation and environmental rehabilitation initiatives presents an

opportunity to strengthen both economic resilience and environmental sustainability over the SDF planning horizon.

5.7. WATER INFRASTRUCTURE



GRAPH 7: HOUSEHOLD ACCESS TO PIPED WATER

Source: S&P Market Intelligence, 2024

The graph reflects varying levels of access to piped water:

- Piped water in yard: 44.3%
- Piped water inside dwelling: 15.3%
- Communal piped water (<200m from dwelling): 6.9%
- Communal piped water (>200m from dwelling): 10.2%
- No formal piped water: 23.4%

While approximately 59.6% of households have yard or in-house piped water, nearly one-quarter (23.4%) lack formal piped access altogether. An additional 17.1% rely on communal systems, some located more than 200 meters from dwellings.

The data indicates significant service inequality and persistent water access backlogs, particularly in dispersed rural settlements.

5.7.1. ENVIRONMENTAL IMPLICATIONS FOR THE RECEIVING ENVIRONMENT

Water access levels directly influence environmental health, settlement sustainability, and infrastructure resilience.

5.7.1.1. WATER RESOURCES

Households without formal piped water may rely on rivers, boreholes, or informal sources, increasing pressure on local water bodies and groundwater systems. Where sanitation is inadequate, this raises contamination risks.

Uneven access also suggests stress on communal supply systems, potentially leading to over-abstraction or infrastructure degradation.

5.7.1.2. LAND TRANSFORMATION & SETTLEMENT EXPANSION

Dispersed settlements with limited water infrastructure complicate efficient service provision. Extending bulk infrastructure to remote households increases financial and environmental costs, potentially encouraging outward sprawl rather than nodal consolidation.

5.7.1.3. BIODIVERSITY & ECOLOGICAL CORRIDORS

Reliance on natural water sources may increase trampling, erosion, and ecological disturbance along riverbanks and wetlands. Informal water access points can degrade sensitive riparian environments.

5.7.1.4. AGRICULTURAL LAND CAPABILITY

Where households lack reliable water, subsistence agriculture may depend on nearby streams or shallow groundwater, potentially affecting both water quality and soil productivity.

5.7.1.5. CLIMATE CHANGE VULNERABILITY

Limited access to reliable piped water reduces resilience during drought conditions. Climate variability may disproportionately affect households dependent on informal or communal water systems.

5.7.1.6. WASTE GENERATION & POLLUTION LOADS

Inadequate water access often correlates with lower sanitation service levels. This increases risks of surface water contamination and localized pollution.

5.7.1.7. ENERGY DEMAND & EMISSIONS

Where water is not piped into dwellings, energy is expended in water collection and pumping. Future infrastructure expansion may increase energy demand unless efficient systems are implemented.

5.7.2. SEA RISK CLASSIFICATION

TABLE 16: WATER INFRASTRUCTURE & SEA RISK CLASSIFICATION

DIMENSION	RISK LEVEL	REVERSIBILITY	CUMULATIVE RISK
Water contamination risk	High	Moderate	High
Infrastructure inefficiency	High	Moderate	High
Biodiversity disturbance	Moderate–High	Low	High
Climate vulnerability (drought exposure)	High	Low	High
Agricultural water stress	Moderate	Moderate	Moderate–High

The access profile indicates structural service inequality with significant cumulative environmental and resilience risk.

5.7.3. SEA DIRECTIVES FOR THE NDZ SPATIAL DEVELOPMENT FRAMEWORK

Water access must be treated as a spatial structuring determinant in the SDF.

Spatial Structuring Directives: Prioritise growth within areas where bulk water capacity exists. Discourage further settlement expansion in remote areas without feasible infrastructure provision. Align settlement containment strategies with water infrastructure corridors.

Environmental Safeguarding Measures: Protect river catchments and riparian zones from informal abstraction and contamination. Introduce strict development controls near wetlands and watercourses.

Infrastructure & Services Directives: Prioritise eradication of households without formal piped water. Expand yard-level connections before full in-house upgrades where financially constrained. Implement water demand management and NRW reduction to ensure system sustainability.

5.7.4. WATER INFRASTRUCTURE & MONITORING INDICATORS FOR SEA

TABLE 17: WATER INFRASTRUCTURE & MONITORING INDICATORS

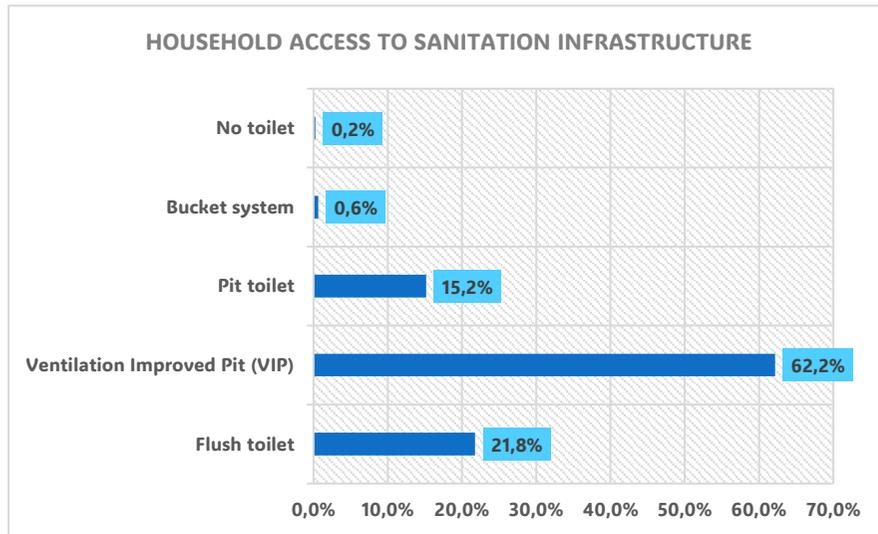
INDICATOR	MONITORING PURPOSE
% households without formal piped water	Backlog reduction tracking
Per capita water consumption	Demand management monitoring
Incidents of waterborne disease	Water quality risk monitoring
Infrastructure loss rate (NRW)	System sustainability tracking
Development approvals outside serviceable zones	Spatial containment monitoring

5.7.5. STRATEGIC INTERPRETATION

The water access profile reveals significant inequality and a persistent service backlog, particularly in dispersed rural areas. While over half of households have yard or in-house piped water, nearly one-quarter remain without formal access.

Without spatially aligned infrastructure investment, cumulative environmental degradation, groundwater contamination, and climate vulnerability will intensify. However, integrating water infrastructure planning with nodal consolidation and environmental overlays presents a clear opportunity to enhance resilience, protect catchments, and ensure sustainable growth over the 20-year SDF horizon.

5.8. SANITATION INFRASTRUCTURE



GRAPH 8: HOUSEHOLD ACCESS TO SANITATION INFRASTRUCTURE

Source: S&P Market Intelligence, 2024

The sanitation profile reflects the following distribution:

- Ventilated Improved Pit (VIP): 62.2%
- Flush toilet: 21.8%
- Pit toilet (non-VIP): 15.2%
- Bucket system: 0.6%
- No toilet: 0.2%

The data indicates that the majority of households rely on on-site sanitation systems (VIP and pit latrines collectively 77.4%), while only approximately one-fifth of households have flush toilets connected to waterborne systems. Although the proportion of households without any sanitation is very low, the

dominance of on-site systems reflects the municipality's rural character and limited bulk sewer infrastructure coverage.

5.8.1. ENVIRONMENTAL IMPLICATIONS FOR THE RECEIVING ENVIRONMENT

Sanitation type directly influences groundwater quality, river health, land suitability, and climate resilience.

5.8.1.1. WATER RESOURCES

The high reliance on pit-based systems increases the risk of groundwater contamination, particularly in areas with shallow water tables, high densities, or poor soil permeability. Cumulative leachate infiltration may affect both boreholes and nearby streams.

Where flush toilets exist without adequate wastewater treatment capacity, downstream river pollution risks may increase.

5.8.1.2. LAND TRANSFORMATION & SETTLEMENT EXPANSION

On-site sanitation systems require adequate plot sizes and soil suitability. Densification of settlements without transitioning to appropriate sanitation technologies may create environmental and public health risks.

Spatial planning must therefore align density thresholds with sanitation typologies.

5.8.1.3. BIODIVERSITY & ECOLOGICAL CORRIDORS

Infiltration from pit latrines near wetlands, riparian zones, or environmentally sensitive areas may degrade ecological systems. Nutrient loading can affect aquatic biodiversity and downstream ecosystem services.

5.8.1.4. AGRICULTURAL LAND CAPABILITY

Where pit systems are poorly managed, nutrient leaching may affect soil quality. However, in low-density rural areas, on-site sanitation can be environmentally sustainable if appropriately located and maintained.

5.8.1.5. CLIMATE CHANGE VULNERABILITY

On-site systems may be vulnerable to flooding during extreme rainfall events, increasing contamination risks. Climate variability may therefore amplify sanitation-related environmental hazards in flood-prone areas.

5.8.1.6. WASTE GENERATION & POLLUTION LOADS

Although bucket systems are minimal, pit-based systems still require periodic management. Failure to manage sludge disposal can result in secondary pollution risks.

5.8.1.7. ENERGY DEMAND & EMISSIONS

Flush toilet expansion increases water and energy demand through pumping and wastewater treatment. Transition strategies must therefore balance environmental protection with infrastructure sustainability.

5.8.2. SANITATION INFRASTRUCTURE & SEA RISK CLASSIFICATION

TABLE 18: SANITATION INFRASTRUCTURE & SEA RISK CLASSIFICATION

DIMENSION	RISK LEVEL	REVERSIBILITY	CUMULATIVE RISK
Groundwater contamination	High (localized)	Moderate	High
River nutrient loading	Moderate-High	Moderate	High
Flood-related contamination	High (in risk zones)	Low	High

DIMENSION	RISK LEVEL	REVERSIBILITY	CUMULATIVE RISK
Infrastructure strain (flush expansion)	Moderate	Moderate	Moderate
Sludge management risk	Moderate	Moderate	Moderate

The sanitation profile indicates localized but potentially high cumulative groundwater and surface water contamination risks, particularly where density increases without system upgrades.

5.8.3. SEA DIRECTIVES FOR THE NDZ SPATIAL DEVELOPMENT FRAMEWORK

Sanitation planning must be integrated with spatial density and environmental sensitivity mapping.

Spatial Structuring Directives: Align settlement density with appropriate sanitation technologies. Promote nodal densification only where waterborne systems and treatment capacity exist. Restrict densification in areas reliant on on-site systems where soil or groundwater conditions are unsuitable.

Environmental Safeguarding Measures: Prohibit pit-based sanitation in high water table, wetland, or floodplain areas. Introduce buffer zones between sanitation systems and watercourses. Incorporate sanitation suitability mapping into the SDF.

Infrastructure & Services Directives: Prioritise safe management and upgrading of VIP systems. Expand wastewater treatment capacity in nodes targeted for densification. Implement climate-resilient sanitation solutions in flood-prone settlements.

5.8.4. SANITATION INFRASTRUCTURE & MONITORING INDICATORS FOR SEA

TABLE 19: SANITATION INFRASTRUCTURE & MONITORING INDICATORS

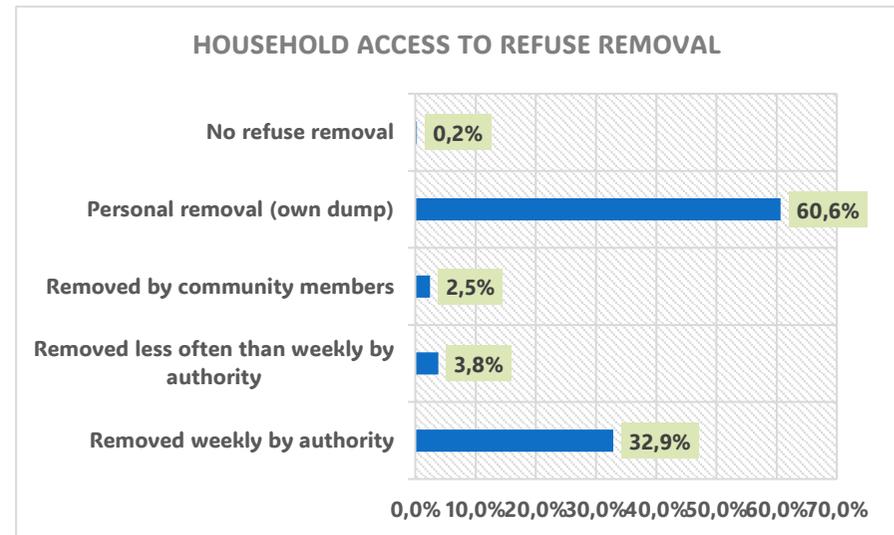
INDICATOR	MONITORING PURPOSE
% households using on-site sanitation	Density-pressure tracking
Groundwater quality monitoring results	Contamination detection
Sludge disposal compliance rate	Environmental health tracking
Sanitation systems in flood-prone zones	Climate risk monitoring
Wastewater treatment capacity utilisation	Infrastructure sustainability tracking

5.8.5. STRATEGIC INTERPRETATION

The sanitation profile confirms that NDZ is predominantly dependent on on-site systems, consistent with its rural settlement structure. While this is not inherently unsustainable, increasing population density without technological transition poses cumulative groundwater and surface water contamination risks.

Over the SDF horizon, sanitation planning must shift from reactive upgrades to spatially aligned infrastructure sequencing. Integrating density thresholds, environmental overlays, and treatment capacity expansion will be essential to safeguard water resources and ecological systems while accommodating projected growth.

5.9. REFUSE REMOVAL & WASTE MANAGEMENT



GRAPH 9: HOUSEHOLD ACCESS TO REFUSE REMOVAL

Source: S&P Market Intelligence, 2024

The refuse removal profile reflects the following distribution:

- Personal removal (own dump): 60.6%
- Removed weekly by authority: 32.9%
- Removed less often than weekly by authority: 3.8%
- Removed by community members: 2.5%
- No refuse removal: 0.2%

The data indicates that the majority of households (over 60%) dispose of waste independently, rather than through formal municipal collection. Only approximately one-third receive weekly refuse removal by the authority.

This reflects significant service coverage gaps, particularly in rural and dispersed settlements, and suggests limited formal waste management infrastructure outside established nodes.

5.9.1. ENVIRONMENTAL IMPLICATIONS FOR THE RECEIVING ENVIRONMENT

Refuse removal practices directly influence land degradation, water pollution, biodiversity health, and climate resilience.

5.9.1.1. WATER RESOURCES

Personal dumping practices increase the risk of waste entering streams, wetlands, and drainage channels. During rainfall events, unmanaged waste may be transported into water bodies, contributing to pollution and blockages.

Leachate from informal dumpsites poses localized groundwater contamination risks.

5.9.1.2. LAND TRANSFORMATION & SETTLEMENT EXPANSION

High levels of personal dumping often lead to informal landfill sites in open land, riverbanks, or agricultural areas. Over time, these areas become degraded and unsuitable for productive use.

Dispersed settlement patterns increase the cost and complexity of formal waste service provision.

5.9.1.3. BIODIVERSITY & ECOLOGICAL CORRIDORS

Uncontrolled dumping degrades ecological corridors and natural habitats. Plastic pollution, open burning, and waste accumulation negatively impact wildlife and ecosystem services.

5.9.1.4. AGRICULTURAL LAND CAPABILITY

Waste dumping in agricultural areas may contaminate soils and reduce long-term land productivity. Open burning of waste may also affect air quality and crop health.

5.9.1.5. CLIMATE CHANGE VULNERABILITY

Unmanaged waste can block stormwater systems and increase localized flooding risk. Open burning of refuse contributes to greenhouse gas emissions and air pollution.

5.9.1.6. WASTE GENERATION & POLLUTION LOADS

With 60.6% of households relying on self-disposal, cumulative pollution loads are likely significant. The limited reach of formal collection systems increases environmental health risks.

5.9.1.7. ENERGY DEMAND & EMISSIONS

Open burning of waste increases emissions and contributes to localized air pollution. Expansion of formal waste systems will increase energy demand but may reduce overall environmental degradation.

5.9.2. REFUSE REMOVAL & SEA RISK CLASSIFICATION

DIMENSION	RISK LEVEL	REVERSIBILITY	CUMULATIVE RISK
Water pollution from dumping	High	Moderate	High
Land degradation	High	Low	High
Biodiversity impact	High	Low	High
Flood risk (waste blockages)	Moderate–High	Moderate	High
Air pollution (burning)	Moderate	Moderate	Moderate–High

The refuse removal profile indicates substantial cumulative environmental risk due to limited formal service coverage.

5.9.3. SEA DIRECTIVES FOR THE NDZ SPATIAL DEVELOPMENT FRAMEWORK

Waste management must be treated as a core spatial sustainability issue.

Spatial Structuring Directives: Prioritise expansion of formal refuse removal services within established nodes and high-density settlements. Align settlement consolidation strategies with feasible waste service corridors to reduce environmental degradation.

Environmental Safeguarding Measures: Prohibit informal dumping in environmentally sensitive areas. Identify and rehabilitate degraded informal dump sites. Introduce buffer zones around watercourses and ecological corridors.

Infrastructure & Services Directives: Expand weekly municipal refuse collection beyond core nodes. Develop transfer stations and community recycling initiatives. Formalise waste collection points in dispersed settlements where full service coverage is not immediately feasible.

5.9.4. REFUSE REMOVAL & MONITORING INDICATORS FOR SEA

TABLE 20: REFUSE REMOVAL & MONITORING INDICATORS

INDICATOR	MONITORING PURPOSE
% households receiving weekly municipal collection	Service coverage tracking
Number of illegal dump sites	Environmental degradation monitoring

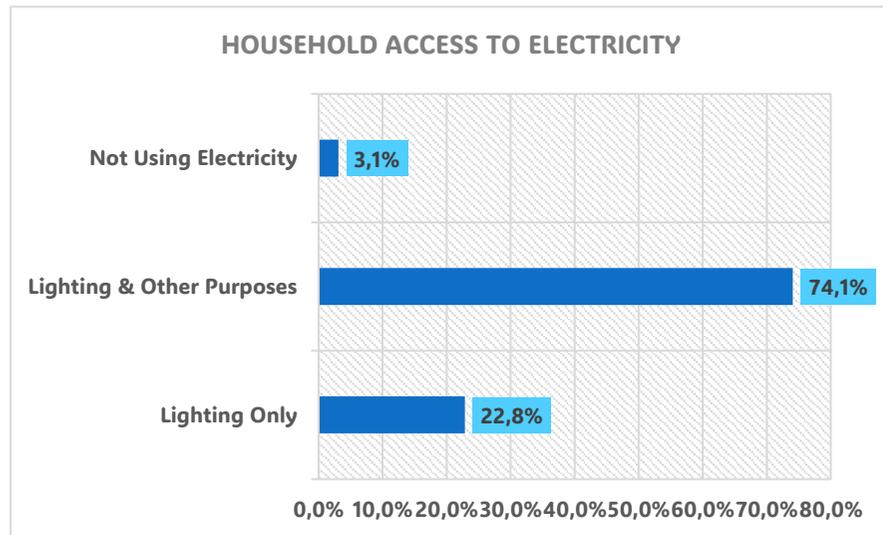
INDICATOR	MONITORING PURPOSE
Waste volume delivered to formal facilities	Infrastructure utilisation tracking
Recycling rate	Waste diversion monitoring
Flood incidents linked to waste blockages	Climate-risk linkage tracking

5.9.5. STRATEGIC INTERPRETATION

The refuse removal profile reveals a structurally weak waste management system, with the majority of households relying on personal dumping. This creates cumulative environmental risks affecting water systems, biodiversity corridors, agricultural land, and climate resilience.

Without expansion of formal waste services and spatial consolidation of settlements, environmental degradation will intensify over the SDF horizon. However, integrating waste infrastructure planning with nodal development and environmental rehabilitation programmes offers a clear pathway toward improved ecological resilience and sustainable growth within NDZ.

5.10. ELECTRICITY INFRASTRUCTURE



GRAPH 10: HOUSEHOLD ACCESS TO ELECTRICITY

Source: S&P Market Intelligence, 2024

The electricity access profile reflects the following distribution:

- Lighting & Other Purposes: 74.1%
- Lighting Only: 22.8%
- Not Using Electricity: 3.1%

The data indicates that approximately 96.9% of households use electricity in some form, with the majority (74.1%) using it for broader household purposes beyond lighting. However, 22.8% rely on electricity for lighting only, suggesting limited appliance use and potentially constrained household economic activity.

While electrification coverage is high, usage intensity varies, reflecting income disparities and differing service levels.

5.10.1. ENVIRONMENTAL IMPLICATIONS FOR THE RECEIVING ENVIRONMENT

Electricity access influences energy transitions, biomass pressure, emissions, and infrastructure demand.

5.10.1.1. WATER RESOURCES

Increased electrification supports pumped water systems and sanitation infrastructure. However, rising electricity demand for water pumping and treatment may increase operational energy requirements.

5.10.1.2. LAND TRANSFORMATION & SETTLEMENT EXPANSION

High electrification levels support formal settlement consolidation. However, expansion of electricity infrastructure into dispersed settlements increases network extension costs and environmental disturbance.

5.10.1.3. BIODIVERSITY & ECOLOGICAL CORRIDORS

Where households use electricity beyond lighting, reliance on biomass harvesting for cooking and heating may decline, reducing pressure on surrounding vegetation. However, households using electricity for lighting only may still depend on fuelwood, maintaining ecological pressure.

5.10.1.4. AGRICULTURAL LAND CAPABILITY

Reduced biomass harvesting due to broader electricity use may lessen vegetation degradation in agricultural and rural areas. Conversely, expansion of transmission infrastructure may fragment land if not carefully routed.

5.10.1.5. CLIMATE CHANGE VULNERABILITY

High electrification improves adaptive capacity, enabling cooling, heating, communication, and emergency response. However, if electricity is generated from fossil fuels, cumulative emissions may increase unless renewable energy integration is prioritised.

5.10.1.6. WASTE GENERATION & POLLUTION LOADS

Expanded electricity use may increase electronic waste generation over time. Proper disposal and recycling systems will be necessary to manage this emerging waste stream.

5.10.1.7. ENERGY DEMAND & EMISSIONS

With 74.1% of households using electricity for broader purposes, demand growth is likely as incomes improve. Without renewable energy expansion, cumulative emissions may increase. However, electrification reduces reliance on open biomass burning, improving local air quality.

5.10.2. ELECTRICITY INFRASTRUCTURE & SEA RISK CLASSIFICATION

TABLE 21: ELECTRICITY INFRASTRUCTURE & SEA RISK CLASSIFICATION

DIMENSION	RISK LEVEL	REVERSIBILITY	CUMULATIVE RISK
Biomass pressure	Moderate (declining)	High	Moderate
Infrastructure expansion impact	Moderate	Moderate	Moderate
Emissions (grid-dependent)	Moderate	Moderate	Moderate-High
Climate resilience	Positive impact	—	—
Electronic waste	Emerging	Moderate	Moderate

Overall, the electrification profile presents more environmental opportunity than risk, provided renewable integration and infrastructure planning are managed strategically.

5.10.3. SEA DIRECTIVES FOR THE NDZ SPATIAL DEVELOPMENT FRAMEWORK

Electricity access should be leveraged to strengthen environmental sustainability.

Spatial Structuring Directives: Prioritise electrified nodes for future housing and economic development. Discourage expansion into remote areas where grid extension is environmentally and financially unsustainable.

Environmental Safeguarding Measures: Promote renewable energy installations within established nodes. Ensure transmission and distribution infrastructure avoids sensitive ecological areas.

Infrastructure & Services Directives: Expand electricity access for households currently limited to lighting only, enabling economic participation. Integrate solar and hybrid systems in rural settlements to reduce grid pressure and emissions.

5.10.4. ELECTRICITY INFRASTRUCTURE & MONITORING INDICATORS FOR SEA

TABLE 22: ELECTRICITY INFRASTRUCTURE & MONITORING INDICATORS

INDICATOR	MONITORING PURPOSE
% households with full electricity use	Energy access tracking
Biomass reliance rate	Vegetation pressure monitoring
Renewable energy adoption rate	Emissions reduction tracking

INDICATOR	MONITORING PURPOSE
Electricity demand growth	Infrastructure capacity monitoring
Electronic waste collection rate	Emerging waste stream monitoring

5.10.5. STRATEGIC INTERPRETATION

The electricity access profile reflects high electrification coverage, providing a strong foundation for improved environmental resilience and economic participation. While infrastructure expansion and grid-based emissions pose moderate risks, electrification reduces biomass dependence and improves adaptive capacity.

Over the SDF horizon, integrating renewable energy, consolidating settlement growth within electrified nodes, and managing demand growth will be essential to ensure that electrification supports both environmental sustainability and long-term economic resilience within NDZ.

5.11. SYNTHESIS AND STRATEGIC IMPLICATIONS

5.11.1. INTEGRATED UNDERSTANDING OF THE RECEIVING ENVIRONMENT

The receiving environment of the municipality is characterised by a high degree of environmental sensitivity, shaped by the interaction of rugged topography, complex hydrological systems, biodiversity priority areas, threatened ecosystems, and climate variability. These biophysical characteristics are closely interwoven with dispersed rural settlement patterns, extensive linear infrastructure networks, and livelihoods that are directly dependent on natural resources.

A key finding of the SEA is that environmental sensitivity is not confined to isolated locations but is distributed across much of the municipal area. This creates a context in which conventional models of spatial expansion—particularly low-density, dispersed development—are inherently misaligned with the environmental capacity of the landscape.

5.11.2. DOMINANT ENVIRONMENTAL CONSTRAINTS

The analysis identifies several non-negotiable environmental constraints that must shape spatial planning decisions:

- Aquatic systems, including rivers, wetlands, floodplains, and Ramsar sites, represent critical ecological infrastructure with low tolerance for disturbance and high cumulative impact risk.
- Critical Biodiversity Areas, Ecological Support Areas, and threatened ecosystems constitute irreplaceable ecological assets where development pressure must be avoided or strictly limited.
- Steep slopes, unstable geology, and erosion-prone soils impose physical constraints that increase environmental risk, infrastructure vulnerability, and long-term maintenance costs.
- Protected areas and World Heritage contexts introduce legal and reputational constraints that significantly limit acceptable forms of land use change.

Collectively, these constraints indicate that a substantial proportion of the municipal area is environmentally constrained, requiring a precautionary and selective approach to spatial development.

5.11.3. CUMULATIVE IMPACT AND REGULATORY RISK

One of the most critical insights from the receiving environment assessment is the cumulative nature of environmental risk within the municipality. The

dominant drivers of impact are not large-scale once-off developments, but rather:

- repeated linear infrastructure interventions.
- incremental settlement expansion into sensitive areas; and
- progressive vegetation clearance and land transformation.

These patterns result in frequent triggering of EIA Listing Notices 1, 2, and 3, particularly within CBAs, aquatic systems, threatened ecosystems, and heritage landscapes. Without strategic spatial intervention, the municipality faces escalating regulatory burden, increased project delays, and growing environmental liability.

5.11.4. STRATEGIC SIGNALS FOR SPATIAL PLANNING

The receiving environment analysis sends clear strategic signals that must be embedded within the SDF:

- **Avoidance must be prioritised over mitigation:** Environmentally sensitive areas should be excluded from development rather than managed on a case-by-case basis.
- **Settlement consolidation is essential:** Compact, nodal settlement patterns reduce environmental footprint, infrastructure demand, and cumulative impact.
- **Infrastructure must follow environmental logic:** Routing and sequencing of infrastructure should be informed by environmental sensitivity mapping to minimise repeated regulatory triggers.
- **Environmental systems are structuring elements:** Rivers, CBAs, protected areas, and heritage landscapes should actively shape spatial form, not be treated as residual constraints.

These signals reinforce the role of the SDF as a risk management instrument, not merely a spatial vision.

5.11.5. IMPLICATIONS FOR LONG-TERM SUSTAINABILITY

The receiving environment analysis demonstrates that long-term sustainability within the municipality is contingent on aligning spatial development with environmental capacity and resilience. Climate change amplifies existing sensitivities, reducing the margin for error in land-use decision-making and increasing the consequences of inappropriate development. Accordingly, the SEA establishes that:

- development opportunities exist, but are spatially limited and conditional;
- failure to respect environmental constraints will undermine service delivery, livelihoods, and ecosystem services; and
- proactive, strategic spatial planning offers the most effective mechanism for balancing development needs with environmental protection.

5.11.6. ROLE OF THE RECEIVING ENVIRONMENT IN THE SEA

Within the broader SEA, this chapter provides the environmental baseline and constraint framework against which spatial alternatives, development scenarios, and policy options must be assessed. It defines the environmental “rules of the game” that cannot be negotiated at later stages without incurring significant ecological, regulatory, and financial risk.

The receiving environment therefore functions as a foundational decision-support tool, ensuring that subsequent SEA analyses and the final SDF are grounded in environmental reality and aligned with the principles of sustainable development set out in NEMA.

6. STRATEGIC ENVIRONMENTAL ISSUES

This chapter is prepared as a core component of the Strategic Environmental Assessment (SEA) for the Dr Nkosazana Dlamini Zuma Local Municipality and is intended to function as a decision-support instrument directly informing the Municipal Spatial Development Framework (SDF). The SEA is a standalone statutory planning document, annexed to the SDF, and structured to support consideration and adoption by Municipal Council, as well as review by provincial and national environmental and planning authorities. The strategic environmental issues identified and assessed in this chapter are therefore framed to directly influence spatial decision-making, land use management, and long-term development trajectories within the municipal area.

6.1. STATUTORY BASIS

The assessment of strategic environmental issues is explicitly aligned with the Department of Forestry, Fisheries and the Environment (DFFE) Strategic Environmental Assessment Guidelines (2016 and the 2023 update), which require SEAs to move beyond baseline environmental description and to proactively identify environmental limits, risks, and development thresholds relevant to strategic spatial planning. The chapter is further grounded in Section 2 of the National Environmental Management Act (NEMA), particularly the principles of sustainability, the precautionary approach, risk aversion, intergenerational equity, and the avoidance of significant or irreversible environmental harm. In addition, the analysis is informed by the decision-making logic embedded in the Spatial Planning and Land Use Management Act (SPLUMA), which requires spatial plans to integrate environmental risk, infrastructure constraints, and long-term resilience when directing growth and development.

Within this statutory context, strategic environmental issues are not treated as isolated environmental themes, but as structuring factors that determine where

development may be appropriate, where it should be constrained or avoided, and under what conditions it may proceed. The chapter therefore positions environmental considerations as integral to spatial planning decisions rather than as secondary compliance matters.

6.2. ROLE OF STRATEGIC ENVIRONMENTAL ISSUES IN THE SEA

In line with national SEA practice, strategic environmental issues are understood as systemic and cross-cutting risks that, if not explicitly addressed, have the potential to undermine long-term spatial sustainability and resilience. This chapter identifies and analyses those issues that are most likely to shape, constrain, or redirect spatial development outcomes at a municipal scale. The focus is on cumulative and compounding effects, particularly where environmental pressures intersect with settlement expansion, infrastructure backlogs, agricultural practices, and climate change dynamics.

Rather than cataloguing environmental assets or impacts, the chapter translates environmental risks and sensitivities into spatial planning implications. In doing so, it supports the integration of environmental considerations upstream in the planning process, ensuring that spatial proposals, growth management strategies, and land use frameworks are informed by an understanding of environmental limits and vulnerabilities.

6.3. METHODOLOGICAL APPROACH

The assessment is based on a planning-level synthesis approach consistent with DFFE guidance for SEAs that support spatial frameworks. The methodology adopts a municipal-wide strategic focus, while recognising spatial variation across environmental systems, settlement typologies, and

land use patterns. The analysis draws on existing adopted and draft municipal, district, and provincial plans, including environmental management, disaster risk management, climate change response, waste management, and human settlements instruments.

6.4. SPATIAL SCALE AND DIFFERENTIATION

Although the assessment is undertaken at a municipal scale, it explicitly acknowledges that environmental risks and sensitivities are unevenly distributed across the municipal landscape. The analysis therefore differentiates between formal towns, rural settlements, dispersed traditional areas, and agricultural landscapes, as well as between river valleys and floodplains, upland and escarpment areas, and zones with varying levels of infrastructure provision.

Distinctions are also made between communal land under traditional governance and commercial farmland, and between areas characterised by relatively higher environmental sensitivity and those where environmental constraints are less pronounced. This spatial differentiation is used to support nuanced planning directives without descending into site-specific or parcel-level analysis, thereby maintaining the integrity of a strategic, municipal-wide assessment.

6.5. DECISION-SUPPORT ORIENTATION

A defining characteristic of this chapter is its explicit decision-support orientation. Strategic environmental issues are analysed with the specific intent of informing spatial planning choices, land use management provisions, and development sequencing within the SDF. The assessment identifies development constraints, highlights environmental thresholds and red-flag conditions, and signals where development should be avoided, restricted, or subject to additional scrutiny at subsequent planning or assessment stages.

To ensure that this decision-support function is explicit and operational, each strategic environmental issue addressed in subsequent sections concludes with a structured matrix. These matrices summarise the key risks and drivers associated with each issue, outline the implications for the SEA, and set out clear planning directives for the SEA and SDF. The directives are framed as actionable instructions, such as avoidance, restriction, conditional development, or the requirement for further assessment, rather than as general recommendations. This approach is intended to ensure that environmental considerations are translated into concrete spatial planning guidance that can be applied consistently in decision-making processes.

6.6. BIODIVERSITY LOSS AND ECOSYSTEM SERVICES

Biodiversity and ecosystem services constitute a foundational component of the environmental integrity and long-term resilience of the Dr Nkosazana Dlamini Zuma Local Municipality. The municipal area encompasses a range of ecologically significant landscapes, including river systems, wetlands, grassland ecosystems, upland and escarpment environments, and agriculturally productive areas that are functionally linked to natural ecological processes. These systems collectively provide critical ecosystem services, including water regulation, soil stabilisation, flood attenuation, climate regulation, grazing support, and the maintenance of landscape connectivity. The progressive loss or fragmentation of these systems presents a strategic environmental risk with direct implications for spatial development planning.

6.6.1. STRATEGIC BIODIVERSITY CONTEXT

At a municipal scale, biodiversity patterns within the municipality are characterised by a mosaic of natural and semi-natural habitats interspersed with agricultural land uses, rural settlements, and small urban centres. Ecological functionality is strongly associated with river corridors, wetland complexes, upland grasslands, and connected open space networks that

traverse administrative and settlement boundaries. These areas frequently coincide with Critical Biodiversity Areas (CBAs), ecological support areas, and strategic landscape corridors identified in district- and provincial-level planning instruments.

Biodiversity loss within the municipality is not driven by a single pressure, but by the cumulative effects of settlement expansion, infrastructure development, agricultural intensification, and incremental land transformation within communal and commercial landscapes. In particular, dispersed rural settlement patterns, linear infrastructure expansion along river valleys and transport routes, and cultivation on marginal or erosion-prone land contribute to habitat fragmentation and the erosion of ecosystem functionality. While individual land use changes may appear minor, their cumulative impact poses a significant strategic risk to biodiversity integrity at a municipal scale.

6.6.2. ECOSYSTEM SERVICES AND SPATIAL RESILIENCE

The municipality's biodiversity assets underpin a range of ecosystem services that are directly relevant to spatial planning decisions. Riparian zones and wetlands play a critical role in regulating water quality and flow, attenuating floods, and sustaining downstream water availability. Upland grasslands and intact catchment areas contribute to baseflow maintenance, erosion control, and climate regulation, while agricultural landscapes depend on healthy soils, pollination services, and stable hydrological systems.

The degradation or loss of these ecosystem services increases the municipality's vulnerability to climate variability, water scarcity, and disaster risk. From a spatial planning perspective, this creates a feedback loop in which environmentally insensitive development amplifies long-term infrastructure costs, service delivery challenges, and disaster exposure. Biodiversity loss therefore represents not only an ecological concern, but a strategic constraint on sustainable settlement growth, infrastructure investment, and economic development.

6.6.3. SPATIAL DIFFERENTIATION OF BIODIVERSITY RISK

Biodiversity-related risks are unevenly distributed across the municipal area. River valleys, wetlands, and associated floodplains are particularly sensitive to land use change, given their ecological importance and their role in supporting water-related ecosystem services. Upland and escarpment areas, while often perceived as less developmentally constrained, are frequently characterised by fragile soils, high erosion potential, and grassland ecosystems that are slow to recover once disturbed.

Communal land areas under traditional governance often experience incremental and uncoordinated land transformation, which can result in diffuse habitat loss and fragmentation over time. In contrast, commercial agricultural areas may exert pressure through more intensive land use practices, including cultivation up to riparian edges or the removal of natural vegetation. Formal towns and rural service centres introduce additional pressures through edge expansion, infrastructure servicing, and increased demand for land, often encroaching into ecologically sensitive areas at their peripheries.

These spatial patterns underscore the need for differentiated spatial planning responses that recognise varying levels of biodiversity sensitivity and ecosystem service importance across the municipal landscape.

TABLE 23: BIODIVERSITY LOSS AND ECOSYSTEM SERVICES

STRATEGIC ENVIRONMENTAL ISSUE	KEY RISKS & DRIVERS	IMPLICATIONS FOR THE SEA	DIRECTIVES FOR THE SEA & SDF
Biodiversity loss and habitat fragmentation	Settlement expansion, dispersed rural development, linear infrastructure, agricultural encroachment into sensitive areas	Biodiversity loss represents a cumulative and long-term constraint on spatial development and resilience	Avoid development in CBAs, ecological corridors, riparian zones, and high-sensitivity habitats
Degradation of ecosystem services	Wetland loss, riparian disturbance, soil erosion, vegetation clearing	Reduced water regulation, increased flood risk, declining land productivity	Restrict development that compromises key ecosystem services, particularly water-related systems
Loss of ecological connectivity	Incremental land transformation and infrastructure severing corridors	Fragmentation undermines landscape-scale resilience and biodiversity recovery	Require maintenance of ecological corridors and buffers in spatial frameworks and land use schemes
Development pressure in sensitive landscapes	Expansion of towns, rural settlements, and agriculture into upland and riverine areas	Increased environmental risk and downstream service delivery costs	Conditionally permit development subject to heightened scrutiny and alignment with environmental overlays
Cumulative impacts across communal and commercial land	Uncoordinated land use change over time	Incremental impacts exceed ecological thresholds without clear triggers	Require strategic environmental assessment considerations to inform growth boundaries and land use controls

6.7. WATER SCARCITY AND CATCHMENT MANAGEMENT

Water availability and catchment integrity represent a critical strategic environmental issue for the Dr Nkosazana Dlamini Zuma Local Municipality, with direct implications for settlement sustainability, agricultural productivity, ecosystem health, and long-term spatial resilience. The municipal area forms part of upper and mid-catchment systems that supply water to both local users and downstream areas, rendering water resources particularly sensitive to cumulative land use change, infrastructure backlogs, and climate variability. Water scarcity in this context is not solely a function of absolute water availability, but of catchment degradation, water quality decline, inefficient land use patterns, and uneven infrastructure provision.

6.7.1. STRATEGIC CATCHMENT CONTEXT

The municipality is characterised by a network of river systems, tributaries, wetlands, and groundwater-dependent ecosystems that collectively underpin local water supply and ecological functioning. These systems are closely linked to upland grasslands, agricultural areas, and settlement patterns, particularly where development has historically concentrated along river valleys and transport corridors. As an upstream catchment area, land use decisions within the municipality have disproportionate implications for downstream water availability and quality.

Strategic pressures on catchment systems arise from settlement expansion into riparian zones, inadequate sanitation infrastructure in rural and dispersed settlements, agricultural practices that extend into sensitive water source areas, and the cumulative impacts of road crossings, dams, and small-scale abstractions. While individual pressures may appear manageable in isolation, their combined effect contributes to declining catchment health and increasing water insecurity at a municipal scale.

6.7.2. WATER SCARCITY AS A SPATIAL PLANNING CONSTRAINT

Water scarcity within the municipality must be understood as a structural constraint on spatial development rather than a short-term service delivery issue. Areas experiencing rapid settlement growth, particularly where bulk water and sanitation infrastructure is limited or absent, place increasing pressure on local water resources and compromise water quality through diffuse pollution pathways. This is especially pronounced in dispersed rural settlements and communal land areas where on-site sanitation systems are prevalent and formal stormwater management is limited.

Formal towns and rural service centres introduce a different set of pressures, including increased demand for potable water, wastewater generation, and stormwater runoff associated with higher levels of impervious surface coverage. Where such growth occurs within water source areas or along river corridors, the risks to catchment integrity and downstream users are amplified. From a strategic planning perspective, water scarcity therefore constrains not only the scale of development that can be accommodated, but also the locations and sequencing of future growth.

6.7.3. CATCHMENT DEGRADATION AND WATER QUALITY RISKS

Catchment degradation within the municipality is closely linked to land use practices that increase erosion, sedimentation, and pollutant loading in river systems. Cultivation on steep slopes, grazing pressure in riparian areas, removal of natural vegetation, and poorly managed road infrastructure contribute to increased sediment loads and reduced water quality. In parallel, inadequate waste management and sanitation services introduce nutrients, pathogens, and contaminants into surface and groundwater systems.

These processes reduce the natural capacity of catchments to regulate water flows and maintain water quality, thereby increasing reliance on engineered infrastructure and raising long-term service delivery costs. From an SEA

perspective, such degradation represents a cumulative risk that undermines the sustainability of spatial development patterns and exacerbates vulnerability to climate-related shocks, including droughts and floods.

6.7.4. SPATIAL DIFFERENTIATION OF WATER-RELATED RISK

Water-related risks are spatially differentiated across the municipal area. River valleys, wetlands, and associated floodplains are particularly sensitive to land use change and serve as critical water source and regulation areas. Upland catchments and headwater zones, while often less visibly constrained, play a vital role in sustaining baseflows and water quality and are highly vulnerable to degradation through inappropriate land use practices.

Communal land areas often experience diffuse pressures related to settlement expansion, livestock access to watercourses, and limited formal infrastructure, resulting in incremental but widespread impacts on catchment health. Commercial agricultural areas may exert more intensive pressures through irrigation, fertiliser use, and cultivation practices, particularly where buffer zones are inadequate. Formal settlements and towns, where growth is concentrated, pose risks associated with increased water demand and wastewater generation, especially where bulk infrastructure capacity is constrained.

Recognising these spatial variations is essential for directing development toward areas where water-related risks can be more effectively managed and for avoiding development in locations where water scarcity and catchment sensitivity intersect.

6.7.5. IMPLICATIONS FOR STRATEGIC SPATIAL PLANNING

Water scarcity and catchment degradation constitute a strategic environmental issue that must directly inform the spatial logic of the SDF. The SEA identifies water resource constraints as a limiting factor for settlement

expansion, infrastructure investment, and land use intensification in certain parts of the municipality. Spatial development that fails to account for water availability and catchment sensitivity risks entrenching unsustainable service delivery models and increasing long-term vulnerability to climate variability.

Accordingly, water-sensitive areas should be explicitly recognised as environmental red-flag zones within the SDF, with development controls calibrated to the level of risk and sensitivity. Growth management strategies should prioritise consolidation and infill in areas with existing infrastructure capacity, while limiting or deferring expansion into water source areas, riparian zones, and degraded catchments. Where development is considered in water-constrained areas, higher levels of scrutiny and alignment with catchment management objectives should be required.

TABLE 24: WATER SCARCITY AND CATCHMENT MANAGEMENT

STRATEGIC ENVIRONMENTAL ISSUE	KEY RISKS & DRIVERS	IMPLICATIONS FOR THE SEA	DIRECTIVES FOR THE SEA & SDF
Water scarcity linked to settlement growth	Increasing demand, limited bulk infrastructure, dispersed settlements	Water availability constrains the scale and location of future development	Restrict settlement expansion in water-constrained areas; prioritise infill where infrastructure exists
Catchment degradation	Erosion, vegetation loss, agricultural encroachment, infrastructure impacts	Degraded catchments reduce resilience and increase service delivery costs	Avoid development in headwater areas, riparian zones, and critical catchments
Declining water quality	Sanitation backlogs, diffuse pollution, inadequate buffers	Water quality risks undermine potable supply and ecosystem health	Require protective buffers and alignment with catchment management objectives
Cumulative impacts on river systems	Incremental land use change and infrastructure crossings	Thresholds exceeded without clear triggers	Apply precautionary planning thresholds and cumulative impact considerations
Climate–water interaction	Drought–flood cycles intensifying water stress	Water scarcity amplifies climate vulnerability	Integrate water sensitivity into climate-resilient spatial planning

6.8. CLIMATE CHANGE VULNERABILITY: FLOODS, DROUGHT, AND SNOW HAZARDS

Climate change represents a cross-cutting strategic environmental issue that amplifies existing environmental, infrastructural, and socio-spatial vulnerabilities within the Dr Nkosazana Dlamini Zuma Local Municipality. The municipality's location within a predominantly rural, agriculturally productive, and topographically diverse landscape renders it particularly sensitive to climate variability and extreme weather events. Climate-related risks in this context do not occur in isolation, but interact with settlement patterns, infrastructure capacity, land degradation, and water resource constraints, resulting in compounding and cumulative impacts that must be explicitly addressed through strategic spatial planning.

6.8.1. CLIMATE CHANGE AS A COMPOUNDING RISK DRIVER

Climate change manifests within the municipality through an increasing frequency and intensity of extreme weather events, most notably flooding, prolonged droughts, and episodic snow and extreme cold conditions in higher-lying areas. These hazards interact with existing environmental pressures, such as catchment degradation, biodiversity loss, and soil erosion, as well as with structural service delivery and infrastructure constraints. As a result, climate change functions as a risk multiplier, exacerbating vulnerabilities that are already embedded in the municipal spatial structure.

From an SEA perspective, climate change vulnerability must therefore be assessed in terms of how climate hazards intersect with spatial development patterns and long-term land use decisions. Settlement expansion into flood-prone areas, development in water-scarce catchments, and infrastructure investment in climatically exposed locations all increase the municipality's exposure to climate-related risks and constrain its adaptive capacity over time.

6.8.2. FLOOD RISK AND SPATIAL DEVELOPMENT

Flooding represents a significant climate-related risk within the municipality, particularly along river corridors, floodplains, and low-lying valley areas where settlements, agricultural activities, and transport infrastructure are often concentrated. Intensifying rainfall events, combined with catchment degradation and increased surface runoff from impervious surfaces, elevate both the frequency and severity of flood events.

Spatial development patterns that encroach into flood-prone areas amplify flood risk by reducing natural flood attenuation capacity and increasing exposure of people, infrastructure, and assets. Informal and dispersed rural settlements are often disproportionately affected due to limited drainage infrastructure, inadequate road design, and proximity to watercourses. From a strategic planning perspective, flood risk imposes clear constraints on settlement expansion, infrastructure siting, and land use intensification in river valleys and associated floodplains.

6.8.3. DROUGHT RISK AND WATER SECURITY

Drought represents a structurally embedded climate risk within the municipality, interacting directly with water scarcity, agricultural productivity, and ecosystem health. Prolonged dry periods reduce surface water availability, strain groundwater resources, and compromise the viability of rain-fed agriculture and livestock systems. These impacts are magnified where catchments are degraded, water infrastructure is limited, or settlement patterns are dispersed.

Drought risk has direct spatial implications, particularly in areas where settlement growth is not aligned with reliable water supply or where agricultural expansion occurs on marginal land. From an SEA perspective, drought underscores the need for water-sensitive spatial planning that limits development in water-stressed areas, prioritises efficient land use patterns,

and protects ecological systems that contribute to water regulation and resilience.

6.8.4. SNOW AND EXTREME COLD EVENTS

Although less frequent than floods and droughts, snow and extreme cold events constitute a significant climate hazard in higher-lying parts of the municipality. These events disrupt transport networks, damage infrastructure, and compromise access to services, particularly in remote rural areas. Agricultural activities are also vulnerable to frost and cold-related losses, affecting both livelihoods and local food security.

Snow-related hazards interact with settlement location, road design, and infrastructure maintenance regimes. Development in climatically exposed upland areas, particularly where access routes are limited or poorly maintained, increases vulnerability to isolation during extreme weather events. From a strategic spatial planning perspective, snow risk reinforces the importance of considering climatic exposure when directing settlement growth and infrastructure investment.

6.8.5. SPATIAL DIFFERENTIATION OF CLIMATE VULNERABILITY

Climate vulnerability within the municipality is spatially differentiated. River valleys and floodplains are primarily exposed to flood risk, while upland and escarpment areas face heightened exposure to snow, frost, and erosion. Drought risk is more pervasive, but its impacts are most acute in areas with limited water infrastructure, degraded catchments, and high dependence on rain-fed agriculture.

Communal land areas with dispersed settlement patterns often experience compounded vulnerability due to limited infrastructure, reliance on natural resources, and constrained adaptive capacity. Formal towns and service centres, while generally better serviced, concentrate assets and populations,

increasing the potential scale of climate-related losses if development occurs in high-risk locations. These spatial variations highlight the need for differentiated, risk-informed planning responses rather than uniform development approaches.

6.8.6. IMPLICATIONS FOR STRATEGIC SPATIAL PLANNING

Climate change vulnerability represents a fundamental structuring consideration for the SDF. The SEA identifies climate-related hazards as constraints that must shape settlement expansion, infrastructure siting, and land use management decisions. Spatial development that fails to account for flood, drought, and snow risks entrenching vulnerability, increasing disaster response costs, and undermining long-term resilience.

The SDF should therefore incorporate climate risk considerations into growth management strategies, explicitly avoiding or limiting development in high-risk areas and prioritising development in locations with greater adaptive capacity. Where development in climatically exposed areas is unavoidable, it should be subject to heightened scrutiny and aligned with climate-resilient planning principles. The SEA provides the strategic basis for such risk-informed decision-making, ensuring that climate change considerations are embedded early in the planning process.

TABLE 25: CLIMATE CHANGE VULNERABILITY

STRATEGIC ENVIRONMENTAL ISSUE	KEY RISKS & DRIVERS	IMPLICATIONS FOR THE SEA	DIRECTIVES FOR THE SEA & SDF
Flood risk	Intensifying rainfall, catchment degradation, settlement in floodplains	Flood-prone areas constrain safe settlement expansion	Avoid development in floodplains and river corridors; restrict expansion in high-risk zones
Drought risk	Reduced rainfall reliability, water scarcity, degraded catchments	Drought limits sustainable growth and agricultural viability	Restrict development in water-stressed areas; prioritise water-sensitive spatial planning
Snow and extreme cold	Climatic exposure of upland areas, vulnerable infrastructure	Snow disrupts access, services, and livelihoods	Conditionally permit development in climatically exposed uplands subject to risk assessment
Compounding climate impacts	Interaction of floods, droughts, and land degradation	Cumulative risks undermine resilience	Require climate risk screening for strategic spatial proposals
Infrastructure vulnerability	Poorly located or designed infrastructure	Increased disaster response and maintenance costs	Align infrastructure siting with climate risk avoidance and resilience principles

6.9. WASTE MANAGEMENT AND POLLUTION

Waste management and pollution constitute a strategic environmental issue within the Dr Nkosazana Dlamini Zuma Local Municipality due to their direct implications for environmental health, water quality, human well-being, and the sustainability of spatial development patterns. The municipality's predominantly rural settlement structure, combined with uneven service delivery coverage and constrained waste management infrastructure, creates multiple pollution pathways that operate cumulatively across the municipal landscape. These challenges are further compounded by settlement expansion, limited institutional capacity, and the interaction between waste management backlogs and environmentally sensitive areas.

6.9.1. STRATEGIC WASTE MANAGEMENT CONTEXT

At a municipal scale, waste generation and management are closely linked to settlement typologies, population distribution, and levels of service provision. Formal towns and service centres generate higher volumes of waste and are typically better served by formal collection and disposal systems, although capacity constraints and infrastructure backlogs remain evident. In contrast, dispersed rural settlements and communal land areas often experience limited or irregular waste collection, resulting in widespread informal dumping and uncontrolled disposal practices.

Waste management challenges are not confined to solid waste alone, but extend to liquid waste and effluent, particularly in areas where sanitation infrastructure is inadequate or reliant on on-site systems. These conditions contribute to diffuse pollution across the landscape, with impacts that are spatially extensive and difficult to remediate once entrenched.

6.9.2. POLLUTION PATHWAYS AND ENVIRONMENTAL RISK

Pollution within the municipality manifests through multiple interconnected pathways, including surface water contamination, soil pollution, and degradation of sensitive ecosystems. Informal dumping sites, poorly managed landfill facilities, and inadequate waste storage in settlements introduce contaminants into river systems and wetlands, particularly during rainfall events. These impacts are amplified where dumping occurs within riparian zones, floodplains, or areas with high groundwater vulnerability.

Liquid waste and sanitation-related pollution represent a further risk, particularly in rural and peri-urban areas where pit latrines and septic systems are prevalent. Inadequate siting, poor maintenance, and high water tables increase the likelihood of groundwater contamination and surface runoff of pollutants. From an SEA perspective, these pollution pathways represent cumulative environmental risks that intersect with water scarcity, biodiversity loss, and climate vulnerability.

6.9.3. INFRASTRUCTURE CAPACITY AND SPATIAL MISMATCH

A key strategic issue is the spatial mismatch between settlement growth and waste management infrastructure capacity. Expansion of settlements, particularly in peripheral and rural areas, often outpaces the provision of waste collection services and disposal facilities. This mismatch results in increasing environmental pressure on surrounding landscapes and undermines the effectiveness of existing waste management systems.

Formal waste management infrastructure, such as landfill sites and transfer stations, also poses spatial planning challenges. Poorly located facilities can generate secondary environmental impacts, including odour, leachate, and increased traffic, particularly where buffer zones are inadequate or where facilities are situated near sensitive environmental or residential areas. From a strategic planning perspective, the location, capacity, and servicing of waste

management infrastructure must therefore be aligned with broader spatial development objectives and environmental constraints.

6.9.4. SPATIAL DIFFERENTIATION OF WASTE-RELATED RISK

Waste-related environmental risks vary across the municipal area. River valleys, wetlands, and flood-prone areas are particularly vulnerable to pollution due to their role in transporting contaminants downstream and their ecological sensitivity. Rural settlements and communal land areas experience diffuse and widespread impacts associated with informal dumping and limited service coverage, while formal towns concentrate waste generation and infrastructure-related risks.

Agricultural areas are also affected, as illegal dumping and effluent discharge degrade soils, contaminate water used for irrigation or livestock, and reduce land productivity. These spatial patterns underscore the need for differentiated waste management strategies that respond to varying levels of risk, sensitivity, and service provision across the municipal landscape.

6.9.5. IMPLICATIONS FOR STRATEGIC SPATIAL PLANNING

From an SEA perspective, waste management and pollution represent a strategic constraint on spatial development that must inform settlement expansion, land use zoning, and infrastructure planning. Development that proceeds without adequate waste management capacity risks entrenching pollution pathways that are costly and complex to reverse. The SEA therefore identifies waste-related risks as environmental red flags in areas where settlement growth intersects with sensitive environments, water source areas, or limited service provision.

Spatial planning responses should prioritise consolidation of development in areas where waste services can be efficiently provided, while restricting or carefully managing expansion into areas where service delivery is constrained.

The siting of waste management infrastructure should be guided by environmental sensitivity, buffer requirements, and long-term capacity considerations, ensuring alignment with both environmental protection objectives and spatial efficiency.

TABLE 26: WASTE MANAGEMENT AND POLLUTION

STRATEGIC ENVIRONMENTAL ISSUE	KEY RISKS & DRIVERS	IMPLICATIONS FOR THE SEA	DIRECTIVES FOR THE SEA & SDF
Inadequate waste service coverage	Dispersed settlements, limited collection capacity	Diffuse pollution undermines environmental and human health	Restrict settlement expansion where waste services cannot be sustainably provided
Informal dumping	Service gaps, lack of disposal facilities	Cumulative soil and water contamination	Avoid development that exacerbates dumping in sensitive areas
Pollution of water resources	Poor waste and sanitation management	Water quality degradation amplifies scarcity and health risks	Require protective buffers and alignment with water management objectives
Poorly located waste infrastructure	Inadequate buffers, proximity to sensitive uses	Secondary environmental and social impacts	Conditionally permit waste facilities subject to environmental sensitivity screening
Cumulative pollution impacts	Incremental land use change and infrastructure gaps	Thresholds exceeded without clear triggers	Apply precautionary planning thresholds and cumulative impact considerations

6.10. LAND DEGRADATION, SOIL EROSION, AND AGRICULTURE

Land degradation, soil erosion, and pressures on agricultural systems represent a critical strategic environmental issue within the Dr Nkosazana Dlamini Zuma Local Municipality. The municipality's rural character, dependence on agriculture for livelihoods and economic activity, and varied topography combine to create a landscape that is both productive and highly vulnerable to degradation. These pressures have direct implications for long-term food security, ecosystem functioning, water resource sustainability, and the spatial viability of settlement expansion. From an SEA perspective, land degradation is both a symptom of unsustainable land use practices and a driver of cumulative environmental risk that must be addressed through spatial planning controls.

6.10.1. STRATEGIC AGRICULTURAL AND LAND CAPABILITY CONTEXT

Agriculture within the municipality occurs across a spectrum of land capability conditions, ranging from highly productive commercial farmland to marginal land used for subsistence and livestock grazing within communal areas. Much of the municipality is characterised by sloping terrain, erodible soils, and climatic variability, which place inherent limits on the intensity and form of agricultural and settlement-related land use that can be sustainably supported.

Agricultural land is therefore a strategic resource that is unevenly distributed and sensitive to inappropriate land use change. Encroachment of settlements into high-potential agricultural areas, cultivation on steep or erosion-prone slopes, and overgrazing in communal rangelands collectively contribute to declining soil quality and reduced land productivity. These processes undermine both commercial agricultural viability and subsistence livelihoods, reinforcing cycles of land degradation and rural vulnerability.

6.10.2. SOIL EROSION AND DEGRADATION PROCESSES

Soil erosion within the municipality is driven by a combination of natural and anthropogenic factors. High rainfall intensity, steep slopes, and fragile soil types create a natural predisposition to erosion, which is exacerbated by vegetation removal, inappropriate cultivation practices, and uncontrolled surface runoff associated with roads and settlement infrastructure. In many rural areas, informal access routes, poorly designed stormwater systems, and livestock movement contribute to gully formation and sediment loss.

Land degradation extends beyond erosion to include soil compaction, nutrient depletion, and loss of organic matter, particularly in areas subjected to continuous grazing or cultivation without adequate management. These processes reduce the land's capacity to support agriculture, increase runoff and sedimentation in river systems, and interact with water scarcity and biodiversity loss. From a strategic planning perspective, soil degradation represents a long-term constraint that reduces the resilience and productivity of the municipal landscape.

6.10.3. AGRICULTURE AS AN ECONOMIC SECTOR UNDER PRESSURE

Agriculture remains a key component of the local economy and a primary source of livelihoods, particularly in rural and communal areas. However, the sector faces increasing pressure from climate variability, declining soil quality, water scarcity, and competition for land from settlement expansion and infrastructure development. These pressures are unevenly distributed, with small-scale and subsistence farmers often bearing the greatest risk due to limited adaptive capacity and reliance on marginal land.

Spatial planning decisions that fail to protect viable agricultural land or that allow uncoordinated settlement growth within agricultural landscapes exacerbate these pressures. Over time, such decisions can erode the economic base of the municipality, increase dependency on external food

sources, and intensify land use conflicts. The SEA therefore treats agriculture not only as an economic activity to be supported, but as a land use that requires spatial protection and management to remain sustainable.

6.10.4. AGRICULTURE AS A DRIVER OF ENVIRONMENTAL RISK

While agriculture is economically and socially important, certain agricultural practices also function as drivers of environmental risk. Cultivation up to riverbanks, overgrazing of communal rangelands, and the conversion of natural vegetation to cropland increase erosion, reduce biodiversity, and degrade water quality. Inappropriate expansion of agriculture into marginal or environmentally sensitive areas amplifies these impacts and undermines the ecological systems on which agriculture itself depends.

This dual role of agriculture—as both a vulnerable sector and a contributor to environmental degradation—necessitates a nuanced spatial planning response. The SEA recognises that unmanaged agricultural expansion and intensification can exceed environmental thresholds, triggering cascading impacts across catchments, ecosystems, and settlement systems.

6.10.5. SPATIAL DIFFERENTIATION OF LAND DEGRADATION RISK

Land degradation risks are spatially differentiated across the municipality. Upland and escarpment areas are particularly prone to erosion due to steep slopes and thin soils, while river valleys are vulnerable to sedimentation and nutrient loading resulting from upstream land use practices. Communal land areas often experience diffuse degradation linked to grazing pressure, settlement expansion, and limited land management capacity, whereas commercial agricultural areas may exert more localised but intensive pressure through mechanised cultivation and irrigation.

Settlement expansion into agricultural land, particularly on the peripheries of towns and rural service centres, represents a critical interface where land

degradation risk is heightened. These spatial patterns highlight the importance of aligning settlement growth boundaries, agricultural protection measures, and environmental overlays within the SDF.

6.10.6. IMPLICATIONS FOR STRATEGIC SPATIAL PLANNING

Land degradation, soil erosion, and agricultural pressure constitute a strategic environmental constraint that must directly inform spatial development decisions. The SEA identifies the protection of agricultural land and the management of erosion-prone areas as essential to maintaining long-term spatial resilience, food security, and environmental sustainability. Spatial development that disregards land capability and degradation risk risks entrenching unsustainable land use patterns that are costly to remediate and difficult to reverse.

The SDF should therefore incorporate land capability considerations into growth management strategies, explicitly limiting settlement expansion into high-potential agricultural land and erosion-prone areas. Development in marginal or degraded landscapes should be carefully controlled and sequenced, with higher levels of scrutiny applied where land degradation risks intersect with other environmental constraints such as water scarcity or biodiversity sensitivity. The SEA provides the strategic basis for embedding these considerations into spatial planning and land use management frameworks.

TABLE 27: LAND DEGRADATION, SOIL EROSION, AND AGRICULTURE

STRATEGIC ENVIRONMENTAL ISSUE	KEY RISKS & DRIVERS	IMPLICATIONS FOR THE SEA	DIRECTIVES FOR THE SEA & SDF
Soil erosion and land degradation	Steep slopes, vegetation loss, poor land management	Degraded land undermines agricultural productivity and ecosystem health	Avoid development in erosion-prone and degraded areas
Loss of agricultural land	Settlement expansion, infrastructure encroachment	Reduced food security and economic resilience	Restrict settlement growth on high-potential agricultural land
Unsustainable agricultural practices	Overgrazing, riparian cultivation, marginal land use	Cumulative environmental impacts exceed thresholds	Require spatial controls and buffers for agricultural activities
Pressure on subsistence livelihoods	Climate variability, declining soil quality	Increased rural vulnerability and land use conflict	Conditionally permit development subject to land capability considerations
Cumulative degradation across landscapes	Incremental land use change over time	Long-term loss of land productivity and resilience	Apply precautionary planning thresholds and integrate land capability into SDF zoning

6.11. CONSOLIDATED SYNTHESIS OF STRATEGIC ENVIRONMENTAL ISSUES

The strategic environmental issues identified and assessed in this chapter—biodiversity loss and ecosystem services, water scarcity and catchment management, climate change vulnerability, waste management and pollution, and land degradation, soil erosion, and agriculture—are deeply interconnected and collectively define the environmental limits within which spatial development in the Dr Nkosazana Dlamini Zuma Local Municipality must occur. When considered in isolation, each issue presents a significant planning challenge; when considered together, they reveal a pattern of cumulative and compounding risk that has direct implications for the structure, sequencing, and intensity of future spatial development.

6.11.1. INTERCONNECTED AND COMPOUNDING ENVIRONMENTAL RISKS

A defining feature of the municipal environmental context is the degree to which strategic environmental issues reinforce one another. Land degradation and soil erosion contribute to catchment degradation, which in turn exacerbates water scarcity and flood risk. Biodiversity loss and the fragmentation of ecological corridors reduce the resilience of ecosystems to climate variability, increasing vulnerability to both droughts and extreme rainfall events. Inadequate waste management and pollution place additional pressure on already stressed water resources and sensitive ecosystems, amplifying risks to human health and service delivery.

Climate change acts as a systemic risk multiplier across all environmental themes. Floods intensify the impacts of catchment degradation and pollution, while droughts magnify the consequences of water scarcity, soil degradation, and agricultural vulnerability. Snow and extreme cold events further expose weaknesses in settlement location, infrastructure design, and access networks, particularly in upland and remote areas. These interacting pressures

underscore the necessity of addressing strategic environmental issues in an integrated manner rather than through isolated sectoral responses.

6.11.2. ENVIRONMENTAL LIMITS AND SPATIAL DEVELOPMENT CONSTRAINTS

The synthesis of strategic environmental issues highlights clear environmental limits that must inform spatial planning decisions. River valleys, floodplains, wetlands, headwater catchments, upland grasslands, and erosion-prone slopes emerge as areas where environmental sensitivity intersects with high levels of risk. Settlement expansion, infrastructure development, and land use intensification in these areas carry a high likelihood of exceeding ecological and service delivery thresholds, resulting in long-term environmental degradation and increased vulnerability.

Conversely, areas with relatively lower environmental sensitivity and existing infrastructure capacity present greater potential to accommodate growth, provided that development is managed in a compact, efficient, and environmentally responsive manner. The SEA therefore reinforces the principle that spatial development should be directed away from environmentally constrained areas and towards locations where environmental risks can be more effectively managed and mitigated through strategic planning.

6.11.3. IMPLICATIONS FOR SETTLEMENT PATTERNS AND GROWTH MANAGEMENT

The cumulative assessment of environmental issues has direct implications for settlement patterns within the municipality. Dispersed and uncoordinated settlement expansion emerges as a key driver of environmental risk, particularly in communal land areas and along environmentally sensitive corridors. Such patterns increase pressure on water resources, complicate

waste management, accelerate land degradation, and heighten exposure to climate hazards.

From a strategic planning perspective, the SEA supports a shift toward more consolidated and serviced settlement patterns, with growth prioritised in areas that offer a combination of lower environmental sensitivity and greater infrastructure capacity. This approach reduces cumulative environmental impacts, improves service delivery efficiency, and enhances resilience to climate variability. Growth management tools within the SDF should therefore be explicitly informed by environmental thresholds and risk profiles identified in this SEA.

6.11.4. INFRASTRUCTURE PLANNING AND ENVIRONMENTAL RISK ALIGNMENT

Infrastructure planning and environmental risk are closely linked across all strategic issues assessed. Water, sanitation, waste management, transport, and stormwater infrastructure both influence and are influenced by environmental conditions. Poorly sited or inadequately designed infrastructure exacerbates environmental degradation, while degraded environmental systems increase infrastructure vulnerability and maintenance costs.

The synthesis underscores the need for infrastructure investment to be spatially aligned with environmental constraints and opportunities. Infrastructure-led development should be directed toward areas where environmental risk is lower and where investments can support consolidation rather than expansion into sensitive landscapes. The SEA provides a strategic basis for prioritising infrastructure investment in a manner that reinforces environmental sustainability and spatial efficiency.

6.11.5. STRATEGIC PLANNING SIGNALS FOR THE SDF

Collectively, the strategic environmental issues assessed in this chapter translate into a set of overarching planning signals for the SDF. These include the identification of environmental red-flag zones where development should be avoided, areas where development should be restricted or subject to heightened scrutiny, and locations where development may be conditionally supported based on alignment with environmental capacity and resilience considerations.

The synthesis reinforces the need for the SDF to integrate environmental overlays, growth boundaries, and land capability considerations into its spatial logic and land use management provisions. Environmental considerations should be embedded as structuring elements of the spatial framework, rather than as secondary constraints addressed at later stages of development control.

6.11.6. STRATEGIC VALUE OF THE SEA IN SPATIAL DECISION-MAKING

The consolidated assessment demonstrates the strategic value of the SEA as a decision-support tool that informs spatial planning at an early stage. By identifying cumulative risks, environmental limits, and spatially differentiated constraints, the SEA enables the municipality to proactively manage environmental risk and avoid development pathways that would undermine long-term sustainability and resilience.

In doing so, the SEA supports compliance with national environmental and spatial planning legislation, aligns with best practice in strategic environmental assessment, and provides a defensible basis for spatial decision-making. The integration of these strategic environmental insights into the SDF will be critical to achieving a spatial development pattern that is environmentally sustainable, economically viable, and socially resilient over the long term.

TABLE 28: CONSOLIDATED STRATEGIC ENVIRONMENTAL ISSUES MATRIX: HIGH-LEVEL SPATIAL PLANNING RULES

STRATEGIC ENVIRONMENTAL THEME	SPATIAL RISK CONTEXT	KEY ENVIRONMENTAL CONSTRAINTS & THRESHOLDS	HIGH-LEVEL SPATIAL PLANNING RULES (SDF-READY)
Biodiversity loss & ecosystem services	CBA, ecological corridors, riparian zones, wetlands, upland grasslands	Loss of habitat connectivity; irreversible ecosystem service degradation once thresholds are exceeded	Avoid development in CBAs, ecological corridors, wetlands, and riparian buffers. Restrict land use change in ecosystem service areas critical for water regulation and landscape connectivity.
Water scarcity & catchment management	Headwater catchments, river valleys, water source areas, infrastructure-constrained settlements	Catchment degradation reduces water availability and quality beyond recovery thresholds	Restrict settlement expansion in water-stressed catchments. Direct growth toward areas with confirmed water and sanitation capacity. Avoid development in headwater and riparian zones.
Climate change vulnerability (floods, drought, snow)	Floodplains, low-lying river valleys, upland and escarpment areas	Climate hazards intensify cumulative risk and infrastructure failure	Avoid development in flood-prone areas. Conditionally permit development in climatically exposed uplands subject to climate risk screening. Integrate climate resilience as a structuring principle in settlement and infrastructure planning.
Waste management & pollution	Dispersed rural settlements, poorly serviced areas, sensitive receiving environments	Diffuse pollution pathways and cumulative contamination of soil and water systems	Restrict new development where waste services cannot be sustainably provided. Direct development toward areas where waste infrastructure exists or can be efficiently extended. Avoid waste facilities near sensitive environmental or residential areas without adequate buffers.
Land degradation & soil erosion	Steep slopes, erosion-prone soils, degraded communal rangelands	Loss of land productivity and increased sedimentation once degradation thresholds are exceeded	Avoid settlement expansion and intensive land use in erosion-prone areas. Restrict development on marginal land. Integrate land capability into zoning and growth management decisions.
Agricultural land protection	High-potential agricultural land, productive valleys, irrigated areas	Permanent loss of agricultural land undermines food security and livelihoods	Protect high-potential agricultural land from non-agricultural development. Restrict settlement expansion into productive agricultural zones.
Settlement pattern & form	Dispersed rural settlements, peri-urban expansion zones	Dispersed growth amplifies environmental and service delivery risk	Prioritise consolidation and infill in existing settlements. Discourage dispersed expansion in environmentally sensitive or poorly serviced areas.
Infrastructure siting & investment	Flood-prone, water-scarce, climatically exposed areas	Poorly sited infrastructure increases long-term maintenance and disaster costs	Align infrastructure investment with environmental capacity and risk avoidance. Avoid locating critical infrastructure in high-risk environmental zones.

STRATEGIC ENVIRONMENTAL THEME	SPATIAL RISK CONTEXT	KEY ENVIRONMENTAL CONSTRAINTS & THRESHOLDS	HIGH-LEVEL SPATIAL PLANNING RULES (SDF-READY)
Cumulative environmental risk	Areas where multiple constraints overlap	Incremental impacts exceed environmental thresholds without triggering safeguards	Apply precautionary planning thresholds where multiple environmental risks coincide. Require higher-order scrutiny for strategic development proposals in cumulative risk zones.
Environmental governance & decision-making	Municipal-wide spatial planning and land use management	Downstream EIAs cannot correct poor strategic spatial decisions	Embed environmental constraints upstream in the SDF and land use scheme. Use SEA findings as binding spatial guidance rather than advisory input.

7. OPPORTUNITIES AND CONSTRAINTS

7.1. OPPORTUNITIES FOR CONSERVATION CORRIDORS AND ECOLOGICAL CONNECTIVITY

7.1.1. STRATEGIC FRAMING AND REGULATORY LOGIC

In accordance with the DFFE Strategic Environmental Assessment Guidelines (2016; 2023 update) and the NEMA Section 2 principles, conservation corridors and ecological connectivity constitute a core strategic opportunity for the Dr. Nkosazana Dlamini Zuma Local Municipality to manage cumulative environmental risk while enabling spatially appropriate development. Within the SEA framework, conservation corridors are not conceptualised as discretionary green infrastructure, but as fundamental ecological systems that underpin biodiversity persistence, hydrological integrity, climate resilience, and long-term landscape functionality. As such, their identification and protection are intrinsic to risk-based spatial planning and form a primary mechanism through which precautionary and preventative decision-making is operationalised.

From a decision-support perspective, conservation corridors provide the spatial logic necessary to distinguish between areas where development must be avoided entirely, areas where development may be conditionally considered subject to strict controls, and areas where development is generally permissible. Their role within the SEA is therefore both environmental and regulatory, translating abstract ecological principles into defensible spatial directives that can be consistently applied through the SDF and subsequent land-use decision-making processes.

7.1.2. LANDSCAPE-SCALE OPPORTUNITY LOGIC

Opportunities for conservation corridors within the municipality emerge from the interaction between topography, hydrological systems, biodiversity patterns, and settlement form. These opportunities are spatially differentiated and must be interpreted through distinct landscape typologies rather than applied uniformly across the municipal area.

Upland and escarpment-associated landscapes function as ecological source areas that support relatively intact habitat mosaics and enable altitudinal species movement. Within these landscapes, conservation corridors present an opportunity to maintain ecological gradients that are critical for climate change adaptation and long-term biodiversity resilience. The SEA identifies the primary opportunity here as preventative in nature: avoiding incremental fragmentation caused by linear infrastructure, dispersed rural settlement expansion, or inappropriate tourism intensification that would irreversibly compromise ecological connectivity.

River valleys, wetlands, and associated riparian systems represent inherently linear ecological corridors that structure connectivity across the municipal landscape. These systems provide a strategic opportunity to reinforce ecological connectivity while simultaneously supporting flood attenuation, water quality regulation, and climate resilience. From an SEA perspective, the opportunity lies in formally recognising these systems as spatial structuring elements within the SDF, ensuring that settlement expansion, agricultural practices, and infrastructure development are aligned to strengthen rather than sever riparian connectivity.

Communal land areas characterised by dispersed rural settlement patterns retain extensive semi-natural landscapes due to historically low levels of formal

development. These landscapes present a significant opportunity to secure landscape-scale ecological connectivity without the need for extensive land acquisition or formal conservation proclamation. The SEA frames this opportunity as time-sensitive and preventative, emphasising the importance of embedding corridor logic into settlement expansion rules before infrastructure-led development results in irreversible fragmentation.

Within commercial agricultural landscapes, conservation corridors primarily function as ecological support areas rather than pristine habitats. Opportunities in these areas include the retention and rehabilitation of riparian buffers, drainage lines, and landscape linkages that support ecosystem services such as pollination, soil stability, and climate resilience. The SEA recognises that while agricultural production remains a dominant land use, ecological corridors within these landscapes must be treated as non-negotiable spatial structuring elements rather than residual or expendable land.

7.1.3. RELATIONSHIP TO PROTECTED AREAS AND BIODIVERSITY PRIORITY ZONES

Opportunities for conservation corridors are most pronounced where they reinforce the functional integrity of existing protected areas and biodiversity priority zones. Corridors that link formally protected areas to surrounding natural or semi-natural landscapes reduce isolation effects and enhance long-term ecological viability. Similarly, corridors that reinforce Critical Biodiversity Areas and Ecological Support Areas identified in existing environmental frameworks serve to buffer sensitive ecosystems from edge effects associated with adjacent land-use intensification.

From a SEA perspective, these linkages are essential to avoid the creation of isolated conservation fragments that would undermine the objectives of biodiversity protection and conflict with the NEMA principles of sustainability and intergenerational equity. The strategic opportunity therefore lies in using

corridor identification to extend the functional influence of protected areas beyond their formal boundaries.

7.1.4. STRATEGIC IMPLICATIONS FOR SPATIAL PLANNING

The identification of conservation corridors presents a significant strategic opportunity to strengthen the defensibility and clarity of spatial planning decisions. By clearly delineating corridors and their associated sensitivity levels, the SDF can provide unambiguous spatial signals regarding development suitability, thereby reducing uncertainty in project-level environmental assessments and land-use applications. This enables more consistent decision-making and reduces reliance on ad hoc mitigation at later stages of the development cycle.

Failure to capitalise on this opportunity would result in incremental and often individually insignificant land-use changes that collectively erode ecological connectivity. Such cumulative impacts are typically difficult to reverse and pose a substantial risk to long-term environmental sustainability. The SEA therefore positions conservation corridors as a proactive planning instrument rather than a reactive environmental safeguard.

7.1.5. OPPORTUNITIES, IMPLICATIONS, AND SEA DIRECTIVES

TABLE 29: CONSERVATION CORRIDORS AND ECOLOGICAL CONNECTIVITY

OPPORTUNITY IDENTIFIED	IMPLICATIONS FOR THE SEA	DIRECTIVES FOR THE SEA AND SDF
Consolidation of upland and escarpment-associated ecological corridors	High ecological sensitivity; critical for climate adaptation and biodiversity persistence	Red-flag area: Exclude new settlement expansion, mining, and major infrastructure. Permit only conservation-compatible land uses and essential linear services subject to strict routing controls
Strengthening riparian corridors along major river systems	High cumulative impact risk with dual biodiversity and disaster-risk functions	Conditional area: Development prohibited within riparian buffers; adjacent development subject to EIA and hydrological assessment
Protection of semi-natural communal land landscapes as connectivity zones	Preventative opportunity to avoid future fragmentation	Conditional area: Low-intensity land uses permissible; settlement expansion only where corridor continuity is demonstrably maintained
Retention of ecological linkages within commercial agricultural areas	Moderate sensitivity; ecosystem support function	Generally permissible with controls: Agriculture allowed; no further corridor narrowing or removal; expansion subject to environmental screening
Buffering of protected areas and biodiversity priority zones through linked corridors	Reduction of edge effects and cumulative pressures	Red-flag / conditional transition zone: Prohibit high-impact land uses; tourism and agriculture subject to strict intensity thresholds

7.2. OPPORTUNITIES FOR RENEWABLE ENERGY DEVELOPMENT

7.2.1. LANDSCAPE-SCALE OPPORTUNITY CONTEXT

Opportunities for renewable energy development within the municipality are strongly influenced by topography, landscape sensitivity, existing land uses, and proximity to environmentally sensitive features. From a strategic planning perspective, renewable energy opportunities are most appropriately considered in modified or working landscapes, where additional land-use change would not result in disproportionate environmental harm.

In commercial agricultural areas and certain peri-urban landscapes, small- to medium-scale renewable energy installations may present an opportunity to supplement local energy supply and support farm-based or settlement-level energy resilience. In these contexts, the opportunity lies in integrating renewable energy infrastructure into existing land-use patterns without introducing new fragmentation or visual intrusion into sensitive landscapes.

Conversely, upland areas, escarpments, and intact natural landscapes—while sometimes technically attractive from an energy-generation perspective—are often environmentally inappropriate for renewable energy development due to their role in supporting biodiversity connectivity, scenic value, and climate adaptation processes. The SEA therefore explicitly cautions against equating technical feasibility with environmental suitability.

7.2.2. SCREENING CONSTRAINTS AND EXCLUSION LOGIC

A critical component of the SEA's approach to renewable energy opportunities is the identification of screening constraints that define exclusion and conditional zones. Protected areas, biodiversity corridors, Critical Biodiversity Areas, and Ecological Support Areas represent high-sensitivity environments where renewable energy development would pose an unacceptable risk to

ecological integrity and cumulative impact thresholds. These areas are therefore treated as red-flag zones for renewable energy infrastructure.

Similarly, steep slopes, erosion-prone terrain, and visually sensitive landscapes introduce both environmental and engineering risks that significantly constrain renewable energy development. In these areas, infrastructure installation may exacerbate soil instability, alter drainage patterns, and permanently degrade landscape character. The SEA further recognises aviation routes, existing settlement proximity, and infrastructure servicing requirements as additional screening layers that constrain location suitability.

Where constraints are moderate rather than prohibitive, renewable energy may be conditionally permissible, subject to rigorous environmental authorisation, cumulative impact assessment, and demonstration of alignment with spatial planning objectives.

7.2.3. CUMULATIVE IMPACT AND SCALE CONSIDERATIONS

Renewable energy development poses particular risks of cumulative impact, especially where multiple small or medium installations are incrementally approved across a landscape. The SEA highlights that such cumulative effects—on visual character, biodiversity connectivity, access routes, and service infrastructure—are often under-assessed at project level when spatial guidance is weak.

Accordingly, the opportunity for renewable energy development must be interpreted not only in terms of individual project suitability, but also in relation to overall landscape carrying capacity. The SEA positions spatial planning as the primary instrument through which cumulative thresholds can be managed, ensuring that renewable energy contributes positively to climate objectives without generating unintended environmental degradation.

7.2.4. STRATEGIC IMPLICATIONS FOR SPATIAL PLANNING

From a spatial planning perspective, renewable energy opportunities offer the SDF an opportunity to proactively direct infrastructure investment toward appropriate locations while avoiding conflict with conservation priorities and settlement objectives. By embedding clear exclusion, conditional, and generally permissible zones into the SDF, the municipality can provide certainty to developers, reduce approval delays, and strengthen the defensibility of development control decisions.

Failure to spatially structure renewable energy development would likely result in opportunistic, site-driven proposals that place undue pressure on sensitive landscapes and generate conflict with biodiversity and heritage objectives. The SEA therefore emphasises the importance of integrating renewable energy screening logic directly into the spatial framework.

7.2.5. OPPORTUNITIES, IMPLICATIONS, AND SEA DIRECTIVES MATRIX

TABLE 30: RENEWABLE ENERGY DEVELOPMENT

OPPORTUNITY IDENTIFIED	IMPLICATIONS FOR THE SEA	DIRECTIVES FOR THE SEA AND SDF
Small- to medium-scale renewable energy in modified agricultural landscapes	Generally compatible with low to moderate sensitivity	Generally permissible with controls: Permit renewable energy where it does not fragment corridors or displace productive land; subject to environmental screening
Renewable energy linked to settlement-level energy resilience	Opportunity to support service delivery and climate adaptation	Conditional area: Allow installations subject to infrastructure capacity, visual impact assessment, and environmental authorisation

OPPORTUNITY IDENTIFIED	IMPLICATIONS FOR THE SEA	DIRECTIVES FOR THE SEA AND SDF
Renewable energy within biodiversity corridors or protected area buffers	High risk to ecological connectivity and cumulative impacts	Red-flag area: Prohibit renewable energy infrastructure and associated access roads
Renewable energy on steep slopes or erosion-prone terrain	Elevated environmental and engineering risk	Red-flag area: Exclude development due to instability and irreversible landscape impacts
Incremental renewable energy development across sensitive landscapes	Risk of unassessed cumulative impacts	Conditional area: Require cumulative impact assessment and spatial alignment with SDF before authorisation

7.3. OPPORTUNITIES FOR SUSTAINABLE AGRICULTURE AND AGRO-ECOLOGICAL PRACTICES

7.3.1. LANDSCAPE-SPECIFIC AGRICULTURAL OPPORTUNITY CONTEXT

Opportunities for sustainable agriculture differ markedly across the municipal landscape. In high-value agricultural areas, particularly within commercial farming zones, the primary opportunity lies in intensification without spatial expansion. This includes improving productivity, adopting climate-resilient crop and livestock systems, and integrating agro-ecological practices that reduce dependence on chemical inputs and minimise downstream impacts on water resources and biodiversity.

Within communal land areas, agricultural opportunities are closely linked to traditional land-use practices, grazing systems, and small-scale cultivation. These landscapes present opportunities to strengthen food security and livelihoods through context-appropriate agro-ecological approaches, such as rotational grazing, soil conservation measures, and mixed farming systems. The SEA identifies a key opportunity in supporting agricultural practices that

are compatible with landscape-scale ecological connectivity rather than fragmenting it through fencing, infrastructure expansion, or settlement encroachment.

In river valleys and floodplain-associated landscapes, agricultural opportunity is inherently constrained by hydrological sensitivity and disaster risk. While these areas are often agriculturally productive, the SEA emphasises that sustainable agricultural opportunity lies in practices that maintain riparian buffers, avoid cultivation within flood-prone zones, and reduce erosion and nutrient runoff. Expansion of cultivation into these sensitive areas is identified as a significant environmental risk.

7.3.2. AGRO-ECOLOGICAL PRACTICES AND CLIMATE RESILIENCE

Agro-ecological practices provide a strategic opportunity to align agricultural production with climate change adaptation and environmental management objectives. These practices, which include soil conservation, diversified cropping, water-efficient irrigation, and integration of natural vegetation within farming systems, reduce vulnerability to climate variability while supporting ecosystem services.

From a SEA perspective, the opportunity lies in spatially promoting agro-ecological practices in areas where conventional agricultural intensification would pose unacceptable environmental risk. This is particularly relevant in marginal agricultural areas, steep terrain, and landscapes adjacent to biodiversity corridors or watercourses, where conventional expansion would likely result in erosion, habitat loss, and increased disaster risk.

7.3.3. AGRICULTURAL EXPANSION CONSTRAINTS AND EXCLUSION LOGIC

While agriculture remains a cornerstone of the rural economy, the SEA explicitly identifies limits to spatial expansion. High-sensitivity environments,

including biodiversity corridors, riparian zones, steep slopes, and protected area buffers, are not suitable for agricultural expansion, even where short-term productivity gains may appear attractive. In these contexts, the SEA frames agriculture as a conditional or excluded land use, depending on sensitivity.

Medium-sensitivity landscapes may accommodate agricultural activity subject to strict controls on intensity, infrastructure development, and cumulative impact. The SEA underscores that agricultural opportunity must be assessed not only in terms of production potential, but also in relation to long-term environmental sustainability and landscape stability.

7.3.4. STRATEGIC IMPLICATIONS FOR SPATIAL PLANNING

The identification of sustainable agriculture and agro-ecological opportunities enables the SDF to move beyond a simplistic protection-versus-production narrative. By spatially differentiating where agriculture should be intensified, adapted, constrained, or excluded, the SDF can provide clear guidance that supports both environmental sustainability and rural economic development.

From a SEA perspective, failure to articulate these spatial distinctions would likely result in incremental agricultural expansion into sensitive landscapes, driven by short-term pressures rather than long-term sustainability considerations. The SEA therefore positions spatial planning as a critical instrument for aligning agricultural development with environmental capacity.

7.3.5. OPPORTUNITIES, IMPLICATIONS, AND SEA DIRECTIVES

TABLE 31: SUSTAINABLE AGRICULTURE AND AGRO-ECOLOGICAL PRACTICES

OPPORTUNITY IDENTIFIED	IMPLICATIONS FOR THE SEA	DIRECTIVES FOR THE SEA AND SDF
Intensification of agriculture within existing high-value agricultural areas	Supports food security with manageable environmental risk	Generally permissible with controls: Permit intensification without spatial expansion; require soil and water conservation measures
Agro-ecological practices in communal land agricultural systems	Enhances resilience and livelihoods with low to moderate sensitivity	Conditional area: Support low-impact agriculture compatible with ecological connectivity; restrict infrastructure expansion
Agriculture in riparian and floodplain-associated landscapes	High risk to water quality and disaster resilience	Red-flag area: Prohibit agricultural expansion; allow only controlled, low-impact practices outside buffer zones
Agricultural activity adjacent to biodiversity corridors	Risk of fragmentation and cumulative biodiversity loss	Conditional area: Allow agriculture subject to buffer maintenance and prohibition of corridor narrowing
Expansion of agriculture into steep or erosion-prone terrain	High risk of irreversible land degradation	Red-flag area: Exclude cultivation and grazing intensification

7.4. ENVIRONMENTAL CONSTRAINTS: SENSITIVE ECOSYSTEMS, SPECIES, AND PROTECTED AREAS

7.4.1. SENSITIVE ECOSYSTEMS AND BIODIVERSITY PRIORITY AREAS

Sensitive ecosystems within the municipality include areas identified as Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) through existing environmental planning instruments. These areas perform essential ecological functions, including habitat provision for threatened species, maintenance of ecological processes, and support for ecosystem services such as water regulation and soil stability.

From a SEA perspective, CBAs are inherently incompatible with most forms of development, as any significant land-use change would undermine their ecological function. ESAs, while sometimes more modified, remain critical to sustaining the integrity of the broader ecological network and are therefore subject to strict conditional controls. The SEA explicitly recognises that degradation within ESAs often manifests incrementally, through activities that may appear low-impact in isolation but collectively erode ecosystem functionality.

7.4.2. PROTECTED AREAS AND BUFFER ZONES

Formally protected areas represent the highest level of environmental sensitivity within the municipality and are afforded the strongest protection under environmental legislation. The SEA treats these areas as absolute development exclusion zones for all land uses that are incompatible with conservation objectives.

Equally important from a strategic planning perspective are the buffer zones surrounding protected areas, which mitigate edge effects such as habitat disturbance, invasive species proliferation, increased human-wildlife conflict, and altered hydrological regimes. The SEA identifies these buffer areas as

zones of elevated sensitivity where development must be tightly controlled in terms of location, intensity, and form. Failure to manage these transitional zones effectively would significantly undermine the long-term viability of protected areas.

7.4.3. THREATENED SPECIES HABITATS AND ECOLOGICAL PROCESSES

Beyond formally mapped biodiversity areas, the municipality contains habitats that support threatened or sensitive species, as well as ecological processes that are not easily confined to discrete spatial boundaries. These include movement corridors, breeding areas, and seasonal habitats that may intersect with working landscapes such as agriculture or communal land.

The SEA recognises that these ecological processes are particularly vulnerable to fragmentation and that their loss is often poorly captured at project level. As such, areas supporting threatened species or critical ecological processes are treated as high- to medium-sensitivity zones, depending on the degree of existing modification and the reversibility of potential impacts. Spatial planning must therefore err on the side of caution, prioritising avoidance and prevention over mitigation.

7.4.4. STRATEGIC IMPLICATIONS FOR SPATIAL PLANNING

The identification of sensitive ecosystems, species habitats, and protected areas provides the foundation for a defensible spatial development logic within the SDF. By clearly delineating high-sensitivity and exclusionary environments, the municipality can reduce uncertainty in development decision-making and limit reliance on reactive, project-level mitigation measures.

From a SEA perspective, the failure to clearly signal these constraints would result in cumulative degradation driven by piecemeal approvals, ultimately increasing regulatory conflict, environmental risk, and long-term management

costs. The SEA therefore positions environmental constraints as a proactive spatial planning instrument rather than a reactive environmental safeguard.

7.4.5. CONSTRAINTS, IMPLICATIONS, AND SEA DIRECTIVES

TABLE 32: SENSITIVE ECOSYSTEMS, SPECIES, AND PROTECTED AREAS

CONSTRAINT IDENTIFIED	IMPLICATIONS FOR THE SEA	DIRECTIVES FOR THE SEA AND SDF
Critical Biodiversity Areas (CBAs)	High ecological sensitivity; irreplaceable biodiversity value	Red-flag area: Prohibit all new development except conservation management and essential services
Ecological Support Areas (ESAs)	Essential for maintaining ecosystem functionality and connectivity	Conditional area: Permit only low-impact land uses subject to strict environmental authorisation
Formally protected areas	Absolute conservation priority	Red-flag area: Exclude all incompatible land uses; conservation objectives take precedence
Buffer zones around protected areas	Elevated risk of edge effects and cumulative impacts	Conditional area: Restrict intensity and scale of development; prohibit high-impact land uses
Habitats supporting threatened species	Variable sensitivity with high cumulative risk	Red-flag / conditional area: Avoid development where possible; where unavoidable, require rigorous environmental assessment and avoidance measures

7.5. HAZARDOUS SITES AND DISASTER RISK CONSTRAINTS

7.5.1. FLOOD-PRONE AREAS AND RIVER CORRIDORS

Floodplains, river corridors, and low-lying valley systems represent some of the most significant disaster risk constraints within the municipality. These areas are inherently dynamic, performing critical hydrological functions that include flood attenuation, sediment transport, and groundwater recharge. From a SEA perspective, development within flood-prone areas poses a dual risk: increased exposure of people and assets to flooding, and the loss of natural flood regulation functions that exacerbates downstream impacts.

The SEA therefore identifies flood-prone areas and associated riparian zones as high-sensitivity environments where most forms of development are incompatible. While these areas may be attractive for settlement or agriculture due to water availability and fertile soils, the long-term risk profile renders them unsuitable for permanent structures, intensive land uses, or critical infrastructure. Climate change projections further reinforce the need for conservative spatial buffers and strict avoidance of floodplains.

7.5.2. EROSION-PRONE AND UNSTABLE SLOPES

Steep slopes and areas susceptible to erosion or instability constitute another major category of disaster risk constraint. In these landscapes, development activities such as vegetation clearance, road construction, and inappropriate agricultural practices can rapidly trigger soil loss, slope failure, and downstream sedimentation. The environmental consequences of such processes are often irreversible at a practical scale.

From a spatial planning perspective, the SEA identifies erosion-prone terrain as largely incompatible with settlement expansion and infrastructure development. Even where engineering solutions may appear technically feasible, the long-term maintenance costs, environmental degradation, and

risk to human safety undermine the sustainability of such interventions. These areas are therefore treated as predominantly exclusionary, with only limited, low-impact land uses considered appropriate.

7.5.3. FIRE-PRONE LANDSCAPES AND CLIMATE-RELATED HAZARDS

Fire-prone landscapes, particularly those characterised by certain vegetation types and seasonal climatic conditions, present increasing risk under climate change scenarios. The SEA recognises that the expansion of settlements or tourism facilities into fire-prone areas significantly elevates disaster risk, emergency response costs, and potential loss of life and property.

In addition to wildfire risk, the SEA acknowledges other climate-related hazards, including extreme weather events, prolonged drought, and heat stress, which may not be spatially discrete but nonetheless influence land-use suitability. The opportunity for spatial planning lies in avoiding the concentration of vulnerable land uses in high-risk areas and directing growth toward locations with greater inherent resilience.

7.5.4. HAZARDOUS SITES AND LEGACY RISKS

Certain areas within the municipality may be affected by hazardous sites or legacy risks associated with waste disposal, contaminated land, or obsolete infrastructure. While such sites are often limited in number, their spatial footprint can impose significant constraints on surrounding land uses due to health and environmental risks.

The SEA treats these areas as locally constrained zones, requiring careful screening before any change in land use is contemplated. Development in proximity to hazardous sites must be approached conservatively, with a strong emphasis on avoidance and remediation rather than mitigation through land-use controls alone.

7.5.5. STRATEGIC IMPLICATIONS FOR SPATIAL PLANNING

The identification of disaster risk and hazardous site constraints provides the SDF with a critical evidence base to guide settlement containment, infrastructure investment, and land-use management. By clearly signalling high-risk areas as exclusionary or conditionally constrained, the SDF can reduce future disaster response costs, protect vulnerable communities, and enhance overall spatial resilience.

From a SEA perspective, failure to embed disaster risk constraints into spatial planning would result in avoidable exposure of people and assets to harm, undermining both environmental sustainability and socio-economic development objectives. The SEA therefore positions disaster risk considerations as integral to spatial decision-making rather than as a secondary, reactive concern.

7.5.6. CONSTRAINTS, IMPLICATIONS, AND SEA DIRECTIVES MATRIX

TABLE 33: HAZARDOUS SITES AND DISASTER RISK CONSTRAINTS

CONSTRAINT IDENTIFIED	IMPLICATIONS FOR THE SEA	DIRECTIVES FOR THE SEA AND SDF
Flood-prone areas and river floodplains	High risk to life, property, and ecosystem function	Red-flag area: Prohibit settlement expansion and permanent structures; maintain buffers and natural flood functions
Riparian zones and drainage lines	Increased flood and erosion risk if modified	Conditional area: Allow only low-impact uses; require hydrological assessment and strict buffer protection
Steep, erosion-prone, or unstable slopes	High likelihood of land degradation and slope failure	Red-flag area: Exclude settlement, infrastructure, and cultivation intensification

CONSTRAINT IDENTIFIED	IMPLICATIONS FOR THE SEA	DIRECTIVES FOR THE SEA AND SDF
Fire-prone landscapes under climate stress	Elevated disaster risk to settlements and tourism	Conditional area: Restrict vulnerable land uses; require fire risk management and spatial buffers
Hazardous or contaminated sites	Localised but severe health and environmental risks	Red-flag / conditional area: Avoid development; where unavoidable, require remediation and environmental authorisation

7.6. CONSOLIDATED SYNTHESIS: SPATIAL OPPORTUNITIES, CONSTRAINTS, AND PLANNING LOGIC

The Opportunities and Constraints assessment demonstrates that the environmental characteristics of the Dr. Nkosazana Dlamini Zuma Local Municipality impose clear spatial limits and differentiated development potential across the municipal area. The receiving environment is neither uniformly constrained nor uniformly developable; rather, it is structured by a hierarchy of ecological sensitivity, disaster risk exposure, and landscape capacity that must directly inform spatial planning and land-use decision-making.

At a strategic level, the analysis confirms that conservation corridors, sensitive ecosystems, disaster risk areas, and protected landscapes form the primary spatial structuring elements of the municipality. These elements are not peripheral environmental considerations but foundational determinants of where development should be excluded, constrained, or directed. Their cumulative and often irreversible nature requires a precautionary approach that prioritises avoidance and spatial steering over reliance on project-level mitigation.

Opportunities for economic activity—including eco-tourism, rural tourism, renewable energy, and agriculture—are shown to be highly context-

dependent. Where these activities align with landscape capacity, existing land-use patterns, and environmental sensitivity thresholds, they can contribute positively to local economic resilience and climate adaptation. Conversely, where they encroach into high-sensitivity environments or hazard-prone areas, they represent a significant risk to environmental integrity, human safety, and long-term sustainability.

The synthesis further highlights that cumulative impacts represent the most significant environmental risk facing the municipality. Incremental approvals—each potentially acceptable in isolation—can collectively erode ecological connectivity, increase disaster exposure, and undermine the functional integrity of protected areas and agricultural systems. The SEA therefore emphasises the role of the SDF as a preventative and integrative instrument, capable of managing cumulative risk through clear spatial rules and differentiated land-use guidance.

From a governance perspective, the Opportunities and Constraints framework provides a defensible basis for spatial differentiation within the SDF, enabling consistent decision-making across planning, land-use management, and environmental authorisation processes. By translating environmental sensitivity into explicit spatial rules, the municipality can reduce uncertainty, strengthen regulatory defensibility, and align development outcomes with the principles of sustainable development as required by NEMA.

7.6.1. INTEGRATED SPATIAL RULES MATRIX

TABLE 34: CONSOLIDATED OPPORTUNITIES, CONSTRAINTS, AND SEA DIRECTIVES

SPATIAL CATEGORY	DOMINANT ENVIRONMENTAL CHARACTERISTICS	DEVELOPMENT SUITABILITY CLASSIFICATION	INTEGRATED SPATIAL PLANNING RULES (SEA → SDF)
Protected Areas	Formally protected conservation land	Red-flag / No-go	Exclude all development incompatible with conservation objectives; permit conservation management only
Critical Biodiversity Areas (CBAs)	Irreplaceable ecosystems and species habitats	Red-flag / No-go	Prohibit land-use change, settlement expansion, infrastructure, and intensive agriculture
Ecological Support Areas (ESAs)	Areas supporting ecosystem functionality and connectivity	Conditional	Permit only low-impact land uses; require environmental authorisation and avoidance of further fragmentation
Biodiversity and Conservation Corridors	Landscape-scale ecological connectivity zones	Conditional to Red-flag	Prohibit permanent structures and corridor narrowing; allow only compatible, low-intensity uses
Protected Area Buffer Zones	Transitional areas with high edge-effect risk	Conditional	Restrict intensity and scale of development; prohibit high-impact tourism and infrastructure
Riparian Zones and Floodplains	Hydrologically sensitive and flood-prone areas	Red-flag	Exclude settlement, intensive agriculture, and permanent infrastructure; maintain buffers
Steep, Erosion-Prone Slopes	Geotechnically unstable terrain	Red-flag	Prohibit settlement expansion, cultivation intensification, and infrastructure development
Fire-Prone Landscapes	Elevated wildfire risk under climate change	Conditional	Restrict vulnerable land uses; require fire-risk mitigation and spatial buffers
Communal Land (Semi-Natural Landscapes)	Mixed ecological value with development pressure	Conditional	Allow low-intensity development subject to maintaining ecological connectivity and landscape integrity
Commercial Agricultural Areas (High-Value Land)	Productive land with moderate sensitivity	Generally permissible with controls	Permit agricultural intensification without spatial expansion; prohibit conversion to non-agricultural uses
Agricultural Areas Adjacent to Corridors or Rivers	Elevated cumulative risk	Conditional	Maintain buffers; prohibit expansion into sensitive zones
Rural Tourism and Eco-Tourism Areas	Landscape- and biodiversity-dependent	Conditional	Permit only low-intensity, conservation-led tourism; require EIA and cumulative impact screening
Renewable Energy in Modified Landscapes	Lower ecological sensitivity	Generally permissible with controls	Allow small- to medium-scale installations subject to environmental screening and visual impact control

SPATIAL CATEGORY	DOMINANT ENVIRONMENTAL CHARACTERISTICS	DEVELOPMENT SUITABILITY CLASSIFICATION	INTEGRATED SPATIAL PLANNING RULES (SEA → SDF)
Renewable Energy in Sensitive Landscapes	High ecological and visual sensitivity	Red-flag	Prohibit renewable energy infrastructure and associated access routes
Hazardous or Contaminated Sites	Health and environmental risk	Red-flag / Conditional	Avoid development; where unavoidable, require remediation and environmental authorisation
Existing Rural Towns and Serviced Nodes	Lower environmental sensitivity	Generally permissible	Direct growth and economic activity to minimise pressure on sensitive environments

8. ASSESSMENT OF SDF PROPOSALS AND PROJECTS

8.1. SOCIOECONOMIC AND DEMOGRAPHIC PROPOSALS

This section of the Strategic Environmental Assessment (SEA) evaluates the socioeconomic and demographic proposals contained in the Draft Dr Nkosazana Dlamini-Zuma Local Municipality Spatial Development Framework (SDF) against the municipality's environmental sensitivities and constraints. The purpose is to determine whether the spatial and socioeconomic development logic advanced by the SDF is environmentally appropriate, resilient, and sustainable over the long term, and whether it is likely to give rise to environmental risks or opportunities that require strategic management.

Socioeconomic and demographic proposals are a critical driver of spatial change, as they inform:

- settlement growth and densification patterns,
- location and scale of housing demand,
- pressure on natural resources and infrastructure,
- livelihood strategies linked to agriculture, tourism, and informal economic activity.

At SEA level, the assessment does not evaluate individual projects, but rather examines how population dynamics, settlement restructuring, and economic development intentions interact with biophysical systems, particularly in a predominantly rural and environmentally sensitive municipal context such as Dr NDZ.

8.1.1. SDF SOCIOECONOMIC AND DEMOGRAPHIC STRATEGIES

The Draft SDF advances a set of interrelated socioeconomic and demographic strategies aimed at addressing historical spatial inequality, service backlogs, and economic underperformance. Key strategic intentions include:

- Spatially targeted socioeconomic development, prioritising investment in identified nodes, corridors, and settlement clusters rather than dispersed, unstructured growth.
- Support for sustainable rural livelihoods, particularly through agriculture, agri-processing, tourism, and small-scale enterprise development.
- Accommodation of population growth and demographic change through a differentiated settlement hierarchy, recognising varying levels of service capacity and environmental constraint.
- Improved access to social services and economic opportunities, especially for rural and marginalised communities.
- Promotion of inclusive economic participation, including the informal economy, community-based tourism, and subsistence-to-commercial agricultural transitions.

These proposals are aligned with broader district and provincial development objectives, but their implementation has clear spatial and environmental implications given the municipality's extensive areas of ecological sensitivity.

8.1.2. ENVIRONMENTAL SENSITIVITY CONTEXT

8.1.2.1. ENVIRONMENTAL RELEVANT TO SOCIOECONOMIC DEVELOPMENT

Dr NDZ Local Municipality is characterised by a high degree of environmental sensitivity, including:

- extensive Critical Biodiversity Areas (CBA 1 and CBA 2),
- large tracts of Ecological Support Areas (ESAs) required to maintain ecosystem functioning,

- numerous wetlands, rivers, and NFEPA-aligned freshwater systems,
- steep slopes and erosion-prone landscapes, particularly in communal and rural settlement areas,
- proximity to protected areas and biodiversity corridors, including areas linked to the uKhahlamba–Drakensberg system.

These sensitivities intersect strongly with areas experiencing:

- population pressure,
- service backlogs,
- livelihood dependence on natural resources.

As a result, socioeconomic and demographic strategies are a primary vector through which environmental risk may be either amplified or mitigated, depending on spatial targeting and development form.

8.1.2.2. SETTLEMENT PATTERNS & ENVIRONMENTAL INTERACTION

Much of the population growth and socioeconomic vulnerability in Dr NDZ is concentrated in:

- dispersed rural settlements,
- peri-urban edges of small towns,
- environmentally sensitive landscapes where service provision is difficult and costly.

Unmanaged socioeconomic expansion in these areas has historically contributed to:

- wetland encroachment,
- vegetation loss within CBAs and ESAs,
- increased soil erosion,

- diffuse pollution of watercourses,
- cumulative degradation rather than single-point impacts.

The SDF's emphasis on spatial consolidation and nodal development is therefore environmentally significant and represents a potential strategic opportunity if effectively enforced.

8.1.3. STRATEGIC ENVIRONMENTAL IMPACT ANALYSIS

8.1.3.1. POSITIVE IMPLICATIONS

The socioeconomic and demographic proposals have several positive strategic environmental implications:

- Spatial concentration of growth reduces pressure on environmentally sensitive rural landscapes by limiting scattered settlement expansion.
- Support for localised economies (e.g. agriculture, tourism, informal trade) can reduce long-distance commuting and associated emissions.
- Improved access to services in nodes may reduce reliance on environmentally harmful coping strategies (e.g. fuelwood harvesting, informal waste disposal).
- Alignment with settlement hierarchy principles supports more efficient infrastructure investment, indirectly reducing environmental footprint.

At a strategic level, these proposals support the principle of avoiding unnecessary environmental disturbance through spatial efficiency.

8.1.3.2. NEGATIVE IMPLICATIONS

Notwithstanding the above, several environmental risks arise if socioeconomic and demographic strategies are not carefully managed:

- Increased development pressure within or adjacent to CBAs and ESAs, particularly where rural settlements overlap with high biodiversity value landscapes.
- Expansion of livelihood activities (e.g. subsistence agriculture, informal trading, tourism enterprises) into environmentally sensitive areas without adequate spatial guidance.
- Cumulative impacts arising from multiple small-scale developments that individually fall below EIA thresholds but collectively degrade ecosystems.
- Heightened vulnerability to climate-related hazards, such as flooding and erosion, if settlement growth occurs within flood-prone or unstable areas.

These risks are not inherent to the strategies themselves, but to how and where they are spatially expressed.

8.1.4. NEMA EIA LISTING NOTICE SCREENING

At SEA level, the following NEMA EIA Listing Notices may be triggered at future project level as a result of implementing socioeconomic and demographic strategies, subject to scale and location:

- **Listing Notice 1:** Potentially applicable to small-scale infrastructure and service-related developments associated with settlement consolidation.
- **Listing Notice 2:** May apply where larger housing, mixed-use, or economic development projects are pursued within nodes.

- **Listing Notice 3:** Particularly relevant where development occurs within:
 - CBAs and ESAs,
 - within defined distances of watercourses and wetlands,
 - in protected or environmentally sensitive geographical areas.

These listings are indicative only and do not imply automatic authorisation requirements. Final determinations must be made during project-level screening by the competent authority.

8.1.5. MITIGATION AND SPATIAL MANAGEMENT RESPONSES

To manage the identified risks while enabling socioeconomic development, the following strategic mitigation measures are recommended:

- Strict spatial steering of socioeconomic growth toward identified nodes and corridors, avoiding high-sensitivity areas wherever feasible.
- Conditional support for rural livelihood expansion, requiring alignment with environmental management priorities and avoidance of CBAs and ESAs.
- Use of the settlement hierarchy as a development control tool, not merely a planning concept.
- Integration of environmental sensitivity mapping into land-use decision-making, ensuring early screening before project initiation.
- Phased and sequenced development, prioritising areas with existing infrastructure capacity and lower environmental risk.

These measures reinforce the SDF's role as a preventative planning instrument, reducing the likelihood of downstream environmental authorisation conflicts.

8.2. BUILT ENVIRONMENT PROPOSALS

This section assesses the built environment proposals contained in the Draft Dr Nkosazana Dlamini-Zuma Local Municipality Spatial Development Framework (SDF) from a strategic environmental perspective. The focus is on how proposed changes to settlement form, land use structure, densification, urban expansion, and spatial restructuring interact with environmental sensitivities and long-term sustainability considerations.

Built environment interventions are a primary mechanism through which the SDF translates policy intent into spatial change. As such, they represent a high-leverage point for either mitigating or exacerbating environmental risk. This assessment therefore evaluates whether the SDF's built environment logic:

- supports environmental avoidance and spatial efficiency,
- reinforces settlement consolidation over sprawl,
- minimises encroachment into environmentally sensitive areas, and
- is resilient to climate-related and disaster risks.

The assessment is conducted strictly at SEA level, without reference to site-specific design or engineering solutions.

8.2.1. SDF BUILT ENVIRONMENT STRATEGIES

The Draft SDF advances a coherent set of built environment strategies aimed at restructuring historical settlement patterns and improving functionality and efficiency. Key strategic directions include:

- Consolidation and strengthening of existing towns and nodes (e.g. Bulwer, Creighton, Donnybrook, Underberg, Himeville) as primary locations for urban growth.

- Promotion of densification and infill development within existing urban footprints prior to outward expansion.
- Differentiated settlement typologies, recognising urban, peri-urban, rural village, and dispersed settlement forms.
- Containment of urban sprawl through settlement edges and development prioritisation areas.
- Support for mixed-use development in appropriate locations to improve access and reduce travel demand.
- Improved public realm and urban management within nodes and precincts.

These strategies collectively aim to produce a more compact, efficient, and serviceable built environment, which is environmentally significant in a municipality with limited infrastructure capacity and extensive ecological constraints.

8.2.2. ENVIRONMENTAL SENSITIVITY CONTEXT

8.2.2.1. BUILT AREAS VS ENVIRONMENTAL SENSITIVITIES OVERLAP

The built environment in Dr NDZ frequently overlaps with areas of high environmental sensitivity, including:

- CBAs and ESAs located adjacent to or underlying existing settlements,
- wetlands and river systems running through or near towns,
- flood-prone low-lying areas,
- steep slopes susceptible to erosion and instability.

Several existing towns and rural settlements have historically expanded into such areas due to:

- limited developable land,

- weak enforcement of land use controls,
- incremental, informal development.

The environmental sensitivity context therefore presents a structural constraint on built environment expansion and intensification.

8.2.2.2. IMPLICATIONS OF DENSIFICATION AND INFILL

While densification and infill are environmentally preferable to sprawl, they may still result in:

- loss of urban green spaces and ecological stepping stones,
- increased pressure on stormwater systems discharging into sensitive watercourses,
- intensified flood risk where infill occurs within floodplains.

These risks highlight the need for environmentally informed densification, rather than densification as a purely quantitative objective.

8.2.3. STRATEGIC ENVIRONMENTAL IMPACT ANALYSIS

8.2.3.1. POSITIVE IMPLICATIONS

The built environment proposals generate several strategic environmental benefits:

- Reduced land take through consolidation and infill limits encroachment into CBAs, ESAs, and agricultural land.
- Improved infrastructure efficiency reduces the environmental footprint per household.
- Compact settlement form supports lower transport emissions and more viable public transport.
- Clear settlement hierarchy and edges provide a spatial mechanism for environmental avoidance.

At SEA level, these strategies align strongly with sustainable spatial planning principles and represent a proactive response to environmental constraints.

8.2.3.2. RISKS AND CONSTRAINTS

Notwithstanding the above, the following strategic risks are identified:

- Inappropriate infill or densification within environmentally sensitive urban areas, particularly floodplains and riparian zones.
- Edge expansion pressures where settlement boundaries abut CBAs or ESAs, especially in peri-urban contexts.
- Cumulative impacts from multiple small-scale developments within towns that incrementally degrade water quality and urban ecosystems.
- Legacy development patterns that are difficult to retrofit without strong policy enforcement.

If not carefully managed, these risks could undermine the environmental gains anticipated from consolidation.

8.2.4. NEMA EIA LISTING NOTICE SCREENING

Implementation of built environment strategies may give rise to future project-level activities that trigger NEMA EIA requirements, including:

- **Listing Notice 1:** Applicable to smaller-scale urban infrastructure and service upgrades associated with infill and densification.
- **Listing Notice 2:** Potentially triggered by larger mixed-use, residential, or commercial developments within primary nodes.
- **Listing Notice 3:** Highly relevant where built environment expansion or redevelopment occurs:
 - within CBAs or ESAs,
 - within prescribed distances of watercourses or wetlands,

- in flood-prone or environmentally sensitive geographical areas.

These listings are indicative only and must be confirmed at project level.

8.2.5. MITIGATION AND SPATIAL MANAGEMENT

To ensure that built environment development supports environmental sustainability, the following strategic mitigation measures are recommended:

- Environmental screening as a prerequisite for densification and infill, particularly within existing towns.
- Explicit no-go and conditional development zones within CBAs, ESAs, wetlands, and floodplains.
- Use of settlement edges as enforceable planning instruments, not advisory guidelines.
- Prioritisation of brownfield and underutilised land before greenfield expansion.
- Integration of environmental considerations into precinct plans and urban design frameworks.

These measures strengthen the SDF's role in preventing environmentally inappropriate urban growth.

8.3. INFRASTRUCTURE PROPOSALS

This section assesses the infrastructure-related proposals of the Draft Dr Nkosazana Dlamini-Zuma Local Municipality Spatial Development Framework (SDF) from a strategic environmental perspective. Infrastructure investment is a decisive spatial driver, as it both responds to and shapes settlement patterns, influences development feasibility, and directly interacts with sensitive environmental systems.

The purpose of this section is to determine whether the SDF's infrastructure strategies:

- are spatially and environmentally appropriate,
- support the avoidance of environmentally sensitive areas,
- reduce long-term environmental risk and vulnerability, and
- are aligned with sustainable resource management principles.

The assessment focuses on bulk and reticulation infrastructure systems, including water supply, sanitation, stormwater management, roads and transport infrastructure, electricity and energy systems, and solid waste management. The analysis is conducted strictly at SEA level, without evaluating individual infrastructure projects or designs.

8.3.1. SDF INFRASTRUCTURE STRATEGIES

The Draft SDF advances several interlinked infrastructure strategies intended to support spatial restructuring and service delivery improvement. Key strategic directions include:

- Infrastructure-led spatial prioritisation, aligning service investment with the settlement hierarchy and identified nodes.
- Upgrading and optimisation of existing infrastructure rather than extensive greenfield expansion.
- Targeted bulk infrastructure investment to unlock development potential in priority nodes and corridors.
- Incremental service provision in rural areas, recognising affordability, environmental constraints, and settlement form.
- Improved stormwater and environmental management systems within towns and settlements.
- Strengthening waste management systems, including improved collection coverage and waste minimisation initiatives.

These strategies acknowledge the municipality's limited infrastructure capacity, extensive rural settlement pattern, and high environmental sensitivity.

8.3.2. ENVIRONMENTAL SENSITIVITY CONTEXT

8.3.2.1. WATER RESOURCES, WETLANDS, AND HYDROLOGICAL SYSTEMS

Dr NDZ contains a dense network of:

- rivers and streams,
- wetlands and seep zones,
- NFEPA-aligned freshwater priority areas.

Many settlements and infrastructure corridors intersect with these systems. Infrastructure development therefore poses risks of:

- wetland loss or degradation,
- altered hydrological regimes,
- water quality deterioration from poorly managed sanitation and stormwater systems.

Water-related infrastructure is particularly sensitive given:

- climate variability,
- flood risk in low-lying areas,
- reliance on surface water sources.

8.3.2.2. TOPOGRAPHY, SOILS, AND EROSION RISK

Large parts of the municipality are characterised by:

- steep slopes,
- erodible soils,
- areas prone to gullyng and land instability.

Linear infrastructure (roads, pipelines, powerlines) is especially vulnerable to:

- erosion,
- sedimentation of watercourses,
- long-term maintenance challenges.

Infrastructure placement in such areas represents a high cumulative environmental risk if not strategically managed.

8.3.2.3. BIODIVERSITY SENSITIVITIES

Infrastructure routes and service footprints may intersect with:

- CBAs (CBA 1 and CBA 2),
- ESAs required for ecological connectivity,
- buffer zones around protected areas.

While infrastructure is often unavoidable, its location and alignment are critical in determining environmental impact.

8.3.3. STRATEGIC ENVIRONMENTAL IMPACT ANALYSIS

8.3.3.1. POSITIVE IMPLICATIONS

The infrastructure proposals present several strategic environmental opportunities:

- Infrastructure concentration within nodes reduces the need for extensive network expansion into sensitive rural landscapes.
- Upgrading existing systems lowers the risk of environmental contamination compared to new greenfield infrastructure.
- Alignment with settlement hierarchy supports efficient use of resources and reduces redundant infrastructure.
- Improved waste management coverage reduces illegal dumping and diffuse pollution.

Collectively, these approaches support a shift from reactive service provision to strategic, environmentally informed infrastructure planning.

8.3.3.2. ENVIRONMENTAL RISK AND CONSTRAINTS

Despite these opportunities, several strategic risks are identified:

- Infrastructure-induced development pressure in environmentally sensitive areas once services are extended.
- Encroachment into wetlands and floodplains, particularly for sanitation and stormwater infrastructure.
- Cumulative impacts from linear infrastructure, especially roads and pipelines crossing CBAs and ESAs.
- Climate vulnerability, including flood damage, drought stress, and erosion undermining infrastructure integrity.
- Operational failures (e.g. wastewater spills, landfill leachate) with long-term environmental consequences.

These risks underscore the need for environmental considerations to guide infrastructure routing and phasing, not merely engineering feasibility.

8.3.4. NEMA EIA LISTING NOTICE SCREENING

Infrastructure implementation arising from the SDF may trigger the following indicative NEMA EIA Listing Notices at project level:

- **Listing Notice 1:** Applicable to smaller-scale infrastructure such as pipelines, pump stations, access roads, and service upgrades.
- **Listing Notice 2:** Potentially triggered by major bulk infrastructure, wastewater treatment works, landfills, or regional transport infrastructure.
- **Listing Notice 3:** Particularly relevant where infrastructure is proposed:
 - within CBAs and ESAs,
 - within wetland and watercourse buffers,

- in protected or sensitive geographical areas,
- in areas with steep slopes or flood risk.

These listings are screening-level indicators only and do not imply authorisation requirements without site-specific assessment.

8.3.5. MITIGATIONS AND SPATIAL MANAGEMENT RESPONSES

To reduce environmental risk while enabling service delivery, the following strategic mitigation measures are recommended:

- Environmental sensitivity-led routing and siting of infrastructure, prioritising avoidance of CBAs, ESAs, wetlands, and steep slopes.
- Infrastructure phasing aligned to spatial priorities, preventing premature service extension into environmentally constrained areas.
- Conditional infrastructure provision, linking service upgrades to land use compliance and environmental safeguards.
- Strengthened integration between infrastructure planning and environmental management instruments (e.g. IEMP, IWMP).
- Climate-resilient infrastructure planning, incorporating flood risk, erosion potential, and water scarcity at strategic level.

These measures position infrastructure as a tool for environmental risk reduction, rather than a driver of degradation.

8.4. BIOPHYSICAL AND ENVIRONMENTAL MANAGEMENT PROPOSALS

This section assesses the Draft Dr Nkosazana Dlamini-Zuma Local Municipality Spatial Development Framework (SDF) biophysical and environmental management proposals against mapped and known environmental sensitivities. Unlike other thematic areas, these proposals are

explicitly intended to protect, manage, rehabilitate, and enhance ecological systems and natural resources. The SEA therefore evaluates whether the SDF's environmental management logic is:

- spatially coherent and appropriately targeted to priority ecological assets,
- aligned with accepted biodiversity planning typologies (CBA 1, CBA 2, ESA),
- capable of reducing cumulative environmental degradation, and
- implementable through spatial planning instruments and decision-making.

The section focuses on strategic environmental management measures relating to:

- biodiversity and ecological connectivity,
- protected areas and conservation expansion,
- wetlands and freshwater systems,
- catchment and water resource management,
- land degradation, erosion, and rehabilitation,
- climate resilience as it pertains to ecological systems

8.4.1. SDF BIOPHYSICAL AND ENVIRONMENTAL MANAGEMENT STRATEGIES

The Draft SDF advances several strategic directions that collectively seek to protect the municipal environmental asset base while guiding development away from high-sensitivity areas. Key environmental management proposals include:

- Protection and management of CBAs and ESAs, including explicit spatial differentiation between critical biodiversity core areas

(CBA 1), important biodiversity support areas (CBA 2), and ecological support areas (ESA).

- Maintenance and strengthening of ecological corridors and links, supporting landscape-scale connectivity and ecosystem functioning.
- Protection of wetlands, rivers, and riparian systems, recognising their role in water security, flood attenuation, and biodiversity.
- Land degradation and erosion management, including rehabilitation priorities in vulnerable landscapes and settlement areas.
- Protection of environmentally sensitive landscapes and prioritisation of environmental stewardship in high-value areas.
- Integration of environmental management into land use decision-making, with the intent that environmental categories inform development controls and conditions.

These proposals form the core of an environmentally sustainable SDF and, if implemented effectively, provide the strongest basis for avoiding future project-level environmental conflicts.

8.4.2. ENVIRONMENTAL SENSITIVITY CONTEXT

8.4.2.1. BIODIVERSITY (CBA 1, CBA 2, ESA) AS A STRUCTURING CONSTRAINT

The municipality contains extensive biodiversity value, including:

- areas of very high irreplaceability and vulnerability (CBA 1),
- supporting biodiversity landscapes (CBA 2),
- ecological support areas required for hydrological function, corridors, and resilience (ESA).

These biodiversity categories typically coincide with:

- wetlands and headwater systems,
- steep and high-altitude grassland environments,
- riparian corridors,
- interface zones near protected areas.

Given the municipality’s rural settlement patterns and livelihoods dependent on natural systems, biodiversity sensitivity is not merely a conservation concern—it is a development feasibility constraint and a resilience asset.

8.4.2.2. FRESHWATER SYSTEMS, WETLANDS, AND CATCHMENT FUNCTION

Freshwater systems are central to:

- domestic water supply security,
- agricultural productivity,
- ecosystem services,
- disaster risk reduction (flood attenuation and drought buffering).

These systems are vulnerable to:

- settlement encroachment,
- erosion and sedimentation,
- sanitation failures,
- illegal dumping and diffuse pollution.

The SDF’s biophysical proposals are therefore essential to managing not only biodiversity, but also long-term service delivery sustainability.

8.4.2.3. DEGRADATION AND RISK LANDSCAPES

Key risk drivers in the municipal landscape include:

- soil erosion and gully, particularly in communal lands and disturbed catchments,

- invasive alien plant spread in riparian corridors,
- incremental wetland loss,
- unmanaged grazing and land-use pressure.

The SDF’s environmental management interventions must be capable of addressing these risks strategically through spatial steering and targeted management priorities.

8.4.3. STRATEGIC ENVIRONMENTAL IMPACT ANALYSIS

8.4.3.1. POSITIVE IMPLICATIONS

The biophysical and environmental management proposals offer strong strategic benefits:

- **Proactive avoidance logic:** By identifying and differentiating CBAs and ESAs, the SDF provides a clear spatial basis for directing development away from high-sensitivity areas.
- **Ecosystem services protection:** Protection of wetlands and catchments safeguards water security and reduces climate/disaster vulnerability.
- **Cumulative impact reduction:** Strategic rehabilitation and management reduces ongoing incremental degradation that is not easily addressed at project level.
- **Improved regulatory defensibility:** Where environmental categories are embedded in planning controls, municipal decision-making is more likely to withstand scrutiny.

At SEA level, these proposals are strongly aligned with sustainability and resilience principles and represent a strategic mechanism to protect the municipality’s ecological capital.

8.4.3.2. RISK AND IMPLEMENTATION CONSTRAINTS

The key risks in this theme relate less to the proposals themselves and more to enforceability:

- Weak development control and compliance may result in CBAs and ESAs being treated as advisory rather than binding constraints.
- Competing development pressures (housing, infrastructure, local economic projects) may override environmental priorities without clear conditionality.
- Institutional capacity constraints may limit the municipality's ability to monitor land degradation, wetlands, and biodiversity corridors.
- Cumulative, small-scale land transformation may continue in rural areas unless SDF environmental priorities are translated into actionable land use rules.

Thus, the main SEA finding is that biophysical proposals are strong on intent but require strengthened implementation mechanisms to be effective.

8.4.4. NEMA EIA LISTING NOTICE SCREENING

Because this theme primarily focuses on environmental protection and management, it does not inherently "trigger" EIAs. However, implementation may still result in project-level activities that could require authorisation, for example:

- Rehabilitation works (e.g. wetland rehabilitation, erosion control interventions) may, in certain contexts, intersect with regulated activities depending on scale and location.
- Conservation infrastructure (access roads, fencing, tourism support facilities within conservation areas) may trigger EIA requirements in sensitive areas.

- Clearing of invasive alien vegetation near watercourses may require alignment with water and environmental regulatory requirements.

Indicatively:

- Listing Notice 1 may apply to small-scale physical interventions.
- Listing Notice 3 is particularly relevant where activities occur within defined sensitive geographical areas, including CBAs, ESAs, or wetland buffers.

All listing notice references remain screening-level only and must be confirmed at project level.

8.4.5. MITIGATION AND SPATIAL MANAGEMENT RESPONSES

To ensure the biophysical proposals function as binding spatial guidance, the following strategic measures are recommended:

- Translate CBA/ESA categories into explicit land use management rules, including:
 - strong avoidance directives for CBA 1,
 - conditional, low-impact development principles for CBA 2 and ESA where unavoidable.
- Institutionalise environmental screening in municipal land use approvals and infrastructure siting decisions.
- Prioritise ecological corridor protection as a spatial structuring element equal to roads and settlement systems.
- Embed rehabilitation priorities into municipal implementation programmes, aligning with EPWP and catchment management partnerships.
- Strengthen monitoring and reporting mechanisms for wetland integrity, erosion hotspots, and land transformation trends.

These measures maintain SEA-level focus by enabling prevention and control through spatial governance rather than project mitigation.

8.5. TOURISM DEVELOPMENT FRAMEWORK PROPOSALS

This section assesses the tourism development framework proposals of the Draft Dr Nkosazana Dlamini-Zuma Local Municipality Spatial Development Framework (SDF) from a strategic environmental perspective. Tourism is a priority economic sector for the municipality and is intrinsically linked to the quality, integrity, and resilience of the natural environment, particularly landscapes, biodiversity assets, and freshwater systems.

The purpose of this section is to evaluate whether the SDF's tourism strategies:

- leverage environmental assets without degrading them,
- are spatially aligned with environmental sensitivities and constraints,
- minimise cumulative ecological and landscape impacts, and
- provide a framework for environmentally responsible tourism growth.

The assessment focuses on spatial tourism structuring, nodal development, route-based tourism, and nature-based tourism proposals, rather than individual tourism facilities or projects.

8.5.1. SDF TOURISM DEVELOPMENT STRATEGIES

The Draft SDF tourism framework proposes a diversified, place-based tourism economy, with key strategic directions including:

- Promotion of nature-based and eco-tourism, capitalising on high-quality landscapes, biodiversity, and proximity to protected areas.
- Development of tourism nodes, routes, and clusters, rather than dispersed, ad hoc tourism facilities.

- Support for community-based and rural tourism initiatives, linked to cultural heritage, agri-tourism, and outdoor recreation.
- Integration of tourism development with settlement and infrastructure planning, particularly in identified nodes.
- Strengthening of tourism-related infrastructure and services in appropriate, accessible locations.

These strategies are environmentally consequential, as tourism demand often targets precisely those areas with the highest ecological and landscape sensitivity.

8.5.2. ENVIRONMENTAL SENSITIVITY CONTEXT

8.5.2.1. BIODIVERSITY, LANDSCAPE, AND PROTECTED AREA INTERFACES

Tourism development in Dr NDZ is strongly associated with:

- CBAs and ESAs,
- ecological corridors and high-value grassland ecosystems,
- scenic landscapes and mountain foothills,
- areas adjacent to or functionally linked with protected areas.

These areas are sensitive to:

- habitat fragmentation,
- visual and landscape degradation,
- disturbance of fauna,
- increased pressure on water and waste systems.

Tourism proposals must therefore be carefully located and scaled to avoid undermining the very assets on which the sector depends.

8.5.2.2. FRESHWATER SYSTEMS AND RECREATION PRESSURE

Tourism activities often concentrate around:

- rivers and streams,
- wetlands and dams,
- scenic valleys and catchment areas.

Without strategic controls, tourism-related development can contribute to:

- water abstraction pressure,
- wastewater and solid waste pollution,
- degradation of riparian zones,
- increased flood risk exposure.

This sensitivity is exacerbated by climate variability and peak seasonal tourism demand.

8.5.3. STRATEGIC ENVIRONMENTAL IMPACT ANALYSIS

8.5.3.1. POSITIVE IMPLICATIONS

The tourism development framework presents several strategic environmental opportunities:

- Incentivising environmental conservation, as high-quality ecosystems become economic assets.
- Supporting landscape-scale protection, where tourism viability depends on intact ecological corridors and scenic value.
- Encouraging compact tourism nodes, reducing dispersed development pressure in sensitive rural areas.
- Aligning community livelihoods with environmental stewardship, particularly in eco- and agri-tourism contexts.

At SEA level, these proposals align with sustainable tourism principles and offer a pathway to link economic development with conservation outcomes.

8.5.3.2. ENVIRONMENTAL RISKS AND CONSTRAINTS

However, the following strategic risks are identified:

- Tourism-driven encroachment into CBAs, ESAs, and riparian zones, particularly for accommodation and access infrastructure.
- Cumulative impacts from multiple small-scale tourism developments that individually appear low-impact.
- Infrastructure stress (water, sanitation, access roads) in environmentally sensitive and remote areas.
- Landscape and visual impacts, particularly in high-scenic-value areas.
- Climate vulnerability, including flood risk and water scarcity affecting tourism viability.

These risks highlight the importance of strong spatial guidance and environmental screening at the planning stage.

8.5.4. NEMA EIA LISTING NOTICE SCREENING

Tourism development arising from the SDF may lead to project-level activities that trigger indicative NEMA EIA Listing Notices, including:

- **Listing Notice 1:** Applicable to small-scale tourism facilities, access roads, and service infrastructure.
- **Listing Notice 2:** Potentially triggered by larger resorts, lodges, or tourism precinct developments.
- **Listing Notice 3:** Highly relevant where tourism development occurs:
 - within CBAs and ESAs,
 - within buffer zones of protected areas,
 - within or near wetlands and watercourses,

- in scenic or environmentally sensitive geographical areas.

These listings are indicative only and subject to project-level screening and competent authority determination.

8.5.5. MITIGATION AND SPATIAL MANAGEMENT RESPONSES

To manage environmental risk while enabling tourism development, the following strategic mitigation measures are recommended:

- Spatial clustering of tourism development within defined nodes and routes, avoiding dispersed facilities in sensitive landscapes.
- Strict avoidance of CBA 1 areas and strong conditionality for any tourism-related development in CBA 2 and ESA areas.
- Environmental screening as a prerequisite for tourism development support and approvals.
- Alignment of tourism proposals with infrastructure capacity, particularly water and sanitation.
- Use of landscape and environmental sensitivity mapping to guide tourism product typologies and scale.

These measures ensure tourism growth remains asset-dependent rather than asset-degrading.

8.6. CROSS-CUTTING CLIMATE CHANGE & DISASTER RISK OVERLAY

This section provides a cross-cutting assessment of climate change and disaster risk considerations as they intersect with all Spatial Development Framework (SDF) proposal themes assessed in Sections 1–5. In line with SEA best practice, climate change is not treated as a standalone sector, but as a risk multiplier that intensifies existing environmental sensitivities and development pressures.

The purpose of this overlay is to:

- identify how climate variability and extreme events interact with SDF proposals,
- assess the extent to which the SDF mitigates or exacerbates climate and disaster risks,
- highlight spatial planning implications for long-term resilience.

This assessment draws on the municipality's climate vulnerability profile, disaster risk trends, and the spatial distribution of sensitive environmental systems.

8.6.1. KEY CLIMATE AND DISASTER RISK DRIVERS IN DR NDZ

The Dr Nkosazana Dlamini-Zuma Local Municipality is exposed to several interrelated climate-related risks, including:

- Increased frequency and intensity of extreme rainfall events, resulting in flooding, erosion, and infrastructure damage.
- Drought and water scarcity, affecting domestic supply, agriculture, tourism, and ecosystem health.
- Land degradation and soil erosion, particularly in steep, communal, and overgrazed landscapes.
- Settlement exposure to hazards, where development has historically occurred within floodplains, unstable slopes, or riparian areas.

These risks are spatially concentrated and closely aligned with:

- wetlands and river systems,
- CBAs and ESAs,
- marginal rural settlement areas,
- infrastructure corridors.

8.6.2. INTERACTION WITH SDF PROPOSAL THEMES

8.6.2.1. SOCIOECONOMIC AND DEMOGRAPHIC PROPOSALS

Socioeconomic strategies that promote settlement consolidation and nodal development have a positive climate-resilience effect by:

- reducing exposure of dispersed households to flood and erosion risks,
- improving feasibility of climate-resilient infrastructure provision,
- reducing dependency on environmentally degrading coping strategies.

Conversely, unmanaged demographic growth in hazard-prone rural areas would increase vulnerability and disaster response costs.

8.6.2.2. BUILT ENVIRONMENT PROPOSALS

Built environment strategies that prioritise densification, infill, and containment support climate resilience by:

- limiting development in flood-prone and unstable landscapes,
- reducing impervious surface expansion into sensitive catchments,
- enabling more efficient stormwater management.

However, densification without environmental screening may intensify flood risk where infill occurs within existing floodplains.

8.6.2.3. INFRASTRUCTURE PROPOSALS

Infrastructure is both highly vulnerable to climate impacts and a key adaptation tool. Strategic risks include:

- flood damage to roads, pipelines, and sanitation systems,
- drought stress on water supply infrastructure,
- erosion undermining linear infrastructure.

The SDF's emphasis on upgrading existing infrastructure and aligning investment with settlement hierarchy reduces exposure and supports adaptation, provided climate risk informs routing and phasing decisions.

8.6.2.4. BIOPHYSICAL AND ENVIRONMENTAL MANAGEMENT PROPOSALS

Biophysical proposals play a central role in climate adaptation by:

- protecting wetlands and floodplains that provide natural flood attenuation,
- maintaining ecological corridors that support ecosystem resilience,
- reducing land degradation and erosion.

Failure to enforce environmental management measures would significantly increase disaster risk and climate vulnerability.

8.6.2.5. TOURISM DEVELOPMENT FRAMEWORK PROPOSALS

Tourism development is climate-sensitive due to:

- reliance on water availability,
- exposure of tourism facilities to flood and erosion risk,
- sensitivity of landscapes to extreme weather events.

The SDF's spatial clustering of tourism activities reduces risk, while dispersed tourism development in sensitive areas would exacerbate vulnerability.

8.7. SYNTHESIS OF SDF PROPOSALS AND THEIR IMPACT ON THE ENVIRONMENT

TABLE 35: SYNTHESIS OF SDF PROPOSALS AND THEIR IMPACT ON THE ENVIRONMENT

SDF THEME	STRATEGY / INTERVENTION	KEY ENVIRONMENTAL SENSITIVITIES	STRATEGIC RISK / OPPORTUNITY	NEMA EIA LISTING NOTICES	MITIGATION / SPATIAL RESPONSE
Socioeconomic & Demographic	Settlement consolidation and nodal growth	CBAs, ESAs, wetlands, floodplains	Opportunity to reduce sprawl; risk of pressure in sensitive rural areas	LN 1, LN 3	Direct growth to nodes; avoid CBAs; apply environmental screening
	Rural livelihood support	CBAs, ESAs, erosion-prone land	Risk of cumulative degradation	LN 1, LN 3	Conditional support; align with environmental priorities
Built Environment	Densification and infill	Floodplains, riparian zones, urban wetlands	Reduced land take; localised flood risk	LN 1, LN 3	Screen infill sites; protect buffers; prioritise brownfields
	Settlement edge containment	CBAs, ESAs, agricultural land	Opportunity for avoidance	LN 3	Enforce settlement edges; restrict expansion
Infrastructure	Bulk and reticulation upgrades	Wetlands, rivers, steep slopes	Service improvement vs. linear impact risk	LN 1, LN 2, LN 3	Sensitivity-led routing; phased provision
	Roads and access infrastructure	CBAs, erosion-prone slopes	Habitat fragmentation	LN 1, LN 3	Avoid CBAs; align with existing corridors
Biophysical & Environmental	CBA and ESA protection	High biodiversity value areas	Strong conservation opportunity	LN 3 (where physical works occur)	Treat as no-go/conditional areas
	Wetland and catchment protection	Wetlands, floodplains	Flood risk reduction	LN 1, LN 3	Maintain buffers; integrate into land use controls
Tourism	Nature-based tourism nodes	CBAs, ESAs, protected area buffers	Economic opportunity with high risk	LN 1, LN 2, LN 3	Cluster tourism; strict avoidance of CBA 1
	Community-based tourism	Rural landscapes, watercourses	Livelihood opportunity; cumulative impacts	LN 1, LN 3	Environmental screening; scale control

8.8. SCREENING OF NDZ SDF PROJECTS AGAINST ENVIRONMENTAL SENSITIVITIES

8.8.1. STRATEGIC PLANNING PROJECTS

TABLE 36: ENVIRONMENTAL SENSITIVITY SCREENING FOR STRATEGIC PLANNING PROJECTS

PROJECT	CONSTRAINTS	CUMULATIVE IMPACTS	STRATEGIC MITIGATION / SDF DECISION GUIDANCE	POTENTIAL EIA LISTING NOTICE TRIGGERS
Rural Settlement Development Strategy	<ul style="list-style-type: none"> - Mountain catchments: avoid headwater wetlands, steep slopes, biodiversity corridors, WHS-related sensitivities. - River valleys: manage floodlines/riparian buffers; water quality sensitivity. - Commercial agriculture: protect high-value/irreplaceable agricultural land. - Communal areas: manage dispersed settlement expansion into sensitive commons. 	Sets growth logic that can induce widespread incremental land transformation across many small sites; increases demand for roads, borrow pits, water abstraction, sanitation—all compounding triggers and fragmentation.	Codify a settlement hierarchy + service thresholds tied to environmental overlays; establish no-go (red flag) and conditional areas; direct growth to nodes/serviced precincts; require precautionary setbacks from watercourses/wetlands and slope-risk overlays; use sequencing (infrastructure-first in least sensitive areas).	Not a listed activity itself, but implementation likely triggers LN1 Act 27/28 and/or LN2 Act 15 (vegetation clearance/development thresholds). Apply LN3 where proposals occur in CBAs/ESAs, WHS/protected areas, EMF sensitive areas and manage phased/cumulative risk (LN3 Act 26).
Farmworker Housing Development Strategy	<ul style="list-style-type: none"> - Commercial farms: risk of converting productive land; potential proximity to riparian areas and farm dams; cumulative on-farm service demands. - Forestry landscapes: fire risk interfaces and habitat fragmentation. 	Adds distributed rural housing demand, compounding with rural settlement strategy → more access roads, service extensions, cumulative habitat loss and water quality pressures.	Prioritise on-farm accommodation upgrades within existing transformed footprints; require locational screening against agricultural capability + biodiversity/wetland buffers; promote clustered accommodation near existing service points; integrate fire risk & slope overlays in siting rules.	Implementation may trigger LN1 Act 28 (development on land used for agriculture etc.) and LN1 Act 27 / LN2 Act 15 (vegetation clearance thresholds). LN3 applies in sensitive locations (CBAs/ESAs, within protected/WHS-related areas).
Agriculture Sector Plan/Strategy	<ul style="list-style-type: none"> - River valleys: irrigation expansion can stress ecological flows/wetlands. 	Could drive incremental expansion of cultivation/irrigation and agri-processing nodes,	Delineate agri-protection zones vs biodiversity/wetland buffers; apply catchment-based limits and promote climate-resilient, water-smart agriculture;	Implementation may trigger clearance/development activities LN1 Act 27/28 or LN2 Act 15 (depending on scale), and LN2 Act 11 if large inter-basin/works

PROJECT	CONSTRAINTS	CUMULATIVE IMPACTS	STRATEGIC MITIGATION / SDF DECISION GUIDANCE	POTENTIAL EIA LISTING NOTICE TRIGGERS
	<ul style="list-style-type: none"> - Uplands: erosion-prone slopes; rangeland degradation risk. - Biodiversity corridors/CBAs: conflict with expansion/intensification. 	compounding water abstraction, nutrient loading, and habitat fragmentation across multiple farms/catchments.	target agri-processing to existing nodes/industrial land; embed no-go rules for conversion of CBAs/ESA and wetlands.	transfers are pursued. Sensitive-area triggers under LN3 where expansion intersects CBAs/ESAs/protected/WHS-related contexts.
Review of Local Economic Development Strategy	Strategy can unlock projects in sensitive landscapes (tourism in mountains; agro-processing near rivers; new servitudes across corridors).	Acts as an enabler for multiple sectors; cumulative risk is indirect but significant via induced development, particularly when paired with transport/infrastructure plans.	Require the LED strategy to adopt SEA/EMF spatial rules as “development filters”; set green economy priorities that reduce land take; define environmental screening gateways for project pipelines.	Not directly listed; downstream projects may trigger LN1/LN2 activities. Require early identification of LN3 sensitive-area risks and phased/cumulative thresholds.
Tourism Sector Plan	<ul style="list-style-type: none"> - Mountain/WHS influence zone: high biodiversity/heritage sensitivity; visual/landscape constraints; slope stability. - River corridors: riparian setbacks; water quality. 	Could compound with transport upgrades and TSMPs to increase visitor pressure, disturbance, incremental resort/road footprints, and cumulative impacts on sensitive catchments.	Apply a tourism carrying-capacity lens via zoning/overlays; direct tourism to already-transformed nodes; require strict no-go for wetlands/CBAs; establish scenic/heritage corridors with development intensity limits; sequence tourism growth with waste/water capacity.	Likely triggers LN1 Act 28 (tourism/commercial development on agricultural land outside urban areas >1 ha) and LN1 Act 27 / LN2 Act 15 for vegetation clearance; LN3 triggers in/hear WHS/protected areas/CBAs and within watercourse setback contexts.
Integrated Transport Plan	<ul style="list-style-type: none"> - River valleys: bridge/culvert and floodplain constraints; wetlands. - Mountain passes: steep slopes, erosion, habitat fragmentation. - Communal areas: multiple small access routes proliferate. 	Strong cross-cutting cumulative driver: repeated road upgrades + new links can fragment habitat, induce ribbon development, and cumulatively exceed thresholds via phased works.	Define an avoid-first route hierarchy using environmental overlays; prioritise upgrading existing alignments; apply slope/wetland buffers as hard constraints; require corridor-level cumulative screening (not project-by-project only).	Road development may trigger LN1 Act 24 (road development) and clearance LN1 Act 27 / LN2 Act 15; location-based triggers under LN3 in sensitive areas; manage phased/cumulative exceedance under LN3 Act 26.
Infrastructure Investment Plan (non-capital)	Determines where future infrastructure will be prioritised—risk if it channels bulk services into sensitive landscapes (headwaters/wetlands).	Compounds impacts by sequencing investment that unlocks development across multiple sectors (housing, tourism, agriculture, transport).	Align infrastructure prioritisation to least-sensitive, best-serviced nodes; embed “infrastructure as growth boundary” logic; require that all high-risk corridors be subjected to cumulative threshold checks before inclusion in pipeline.	Not directly listed; downstream infrastructure may trigger LN1 Act 25 (sewage treatment), LN2 Act 6/11, and LN3 sensitive-area triggers.

PROJECT	CONSTRAINTS	CUMULATIVE IMPACTS	STRATEGIC MITIGATION / SDF DECISION GUIDANCE	POTENTIAL EIA LISTING NOTICE TRIGGERS
Environmental Management Framework (EMF)	EMF is the key tool to formalise sensitivity categories (red/amber/green) across typologies.	If weakly applied, cumulative risk persists; if robust, EMF reduces cumulative and phased impacts by providing consistent rules.	Integrate EMF into SDF + Land Use Scheme overlays; define explicit development conditions and buffers; require that all other projects adopt EMF categories as decision gates.	Not a listed activity; but EMF will specifically manage LN3 sensitive-area risks and guide early identification of LN1/LN2 triggers.
Amakuze TSMP	Traditional settlement structuring may intersect sensitive ridgelines, wetlands, and communal grazing lands; service routing may cross riparian zones.	TSMP set collectively increases settlement consolidation pressure in communal areas; cumulative vegetation loss, erosion, and water quality impacts when multiple TSMPs advance simultaneously.	Define settlement edges, no-go environmental commons, and servicing corridors that avoid wetlands/steep slopes; prioritise infill and consolidation within least-sensitive footprints; adopt standardised buffers for watercourses.	Implementation may trigger LN1 Act 27/28, and LN3 where in sensitive areas (CBAs/ESAs, protected/WHS influence, EMF sensitive areas), incl. phased/cumulative (LN3 Act 26).
Amangwane TSMP	As above; additionally, upland catchment sensitivity may be high where settlement expansion approaches headwaters.	As above (TSMP bundle effects).	As above; ensure catchment protection rules and runoff/erosion management via land-use controls (not EMPr detail).	LN1 Act 27/28; LN3 sensitive-area triggers; manage LN3 Act 26 cumulative phasing.
Basotho TSMP	Communal land settlement expansion risk into wetlands/riparian buffers and biodiversity corridors.	TSMP bundle effects; incremental road/track proliferation.	Set movement/access hierarchy; prevent ad hoc tracks; focus on serviced clusters and protect ecological corridors.	LN1 Act 27/28, LN3 sensitive-area triggers, LN3 Act 26.
Bhidla TSMP	Potential valley-bottom development pressure (flood risk) plus slope constraints in adjacent uplands.		Apply flood-aware settlement structuring and enforce riparian buffers via overlays/conditions.	LN1 Act 27/28; LN3 (watercourse/protected/CBAs as applicable); LN3 Act 26.
Isibonelo Esihle TSMP	Sensitive communal ecosystems and possible proximity to wetlands/streams in settlement clusters.		Protect wetlands/streams with minimum buffer rules and direct growth to least-sensitive terraces/benches.	LN1 Act 27/28; LN3 sensitive-area triggers; LN3 Act 26.
Madzikane-Bhaca TSMP	Settlement consolidation may require new access and services through sensitive topography.		Infrastructure-first sequencing and “no-go corridor” rules for steep slopes and wetlands.	LN1 Act 27/28; LN3; LN3 Act 26.
Maguswa TSMP	Commercial agriculture interface: risk of encroachment onto productive land; biodiversity corridor pinch-points.		Establish agri-protection edges and compact settlement form; apply corridor protection.	LN1 Act 28 (+ clearance triggers LN1 Act 27/LN2 Act 15 depending on scale) and LN3 where sensitive.

PROJECT	CONSTRAINTS	CUMULATIVE IMPACTS	STRATEGIC MITIGATION / SDF DECISION GUIDANCE	POTENTIAL EIA LISTING NOTICE TRIGGERS
Sizanani TSMP	Watercourse/wetland and slope constraints typical of dispersed rural settlements.		Standardise buffers and consolidate growth to serviced nodes.	LN1 Act 27/28, LN3, LN3 Act 26.
uMacala-Gwala TSMP	Similar TSMP constraints; potential corridor impacts where access routes expand.		Corridor-based avoidance; restrict new routes; consolidate service lines.	LN1 Act 27/28, LN3, LN3 Act 26.
Vezakuhle TSMP	Similar TSMP constraints.		As above.	LN1 Act 27/28, LN3, LN3 Act 26.
Zashuke TSMP	Similar TSMP constraints; may intersect productive agricultural land and riparian corridors.		Compact settlement edges; protect riparian corridors.	LN1 Act 27/28, LN3, LN3 Act 26.
Review of Municipal Ward-Based Plans	If ward priorities are translated into dispersed projects without screening, risk of localised encroachment into wetlands/steep slopes and sensitive commons.	Compounds cumulative effects by expanding the number of small projects (roads, community facilities, minor services) that collectively exceed thresholds.	Hardwire SEA/EMF rules into ward planning templates; require ward-level “avoid/conditional/permissible” statements and cumulative accounting across wards/catchments.	Not directly listed; downstream works may trigger LN1/LN2 activities; manage phased/cumulative exceedance under LN3 Act 26 where location-sensitive.
Municipal Waste Diversion Plan	Potential siting constraints for MRFs/transfer areas: avoid floodplains, wetlands, and visually sensitive tourism landscapes; manage proximity to settlements.	Positive cumulative effect (reduced landfill) but risk of multiple small facilities increasing traffic, dust, and nuisance cumulatively; can compound with transport plan corridors.	Prioritise one/few strategically sited facilities in low-sensitivity, serviced nodes; require buffer-based siting rules; align with climate mitigation and circular economy to reduce overall waste footprint.	May trigger authorisations under waste legislation and potentially LN2 Act 6 if permits/licences for pollution/effluent/emissions are required; apply LN3 if any facilities are proposed in sensitive areas (CBAs/ESAs/protected/WHS-related/EMF sensitive areas).
Review of Municipal Housing Sector Plan	Housing pipeline choices: avoid steep slopes, floodplains, wetlands; protect high-value agricultural land; sensitivity varies by node (valley towns) vs rural/traditional settlements.	Major cumulative driver: housing + infrastructure + transport plans together can accelerate land transformation, water demand, sanitation loads, and cumulative LN triggers.	Require the HSP to adopt SDF nodal logic + environmental overlays; set “least-sensitive land first” sequencing; constrain new greenfield housing outside nodes; define minimum servicing thresholds that prevent leapfrog sprawl.	Downstream housing may trigger LN1 Act 28 (development on agricultural land), LN1 Act 27/LN2 Act 15 (vegetation clearance), and LN3 sensitive-area triggers; manage phased/cumulative risk via LN3 Act 26.

PROJECT	CONSTRAINTS	CUMULATIVE IMPACTS	STRATEGIC MITIGATION / SDF DECISION GUIDANCE	POTENTIAL EIA LISTING NOTICE TRIGGERS
Feasibility: Waterborne Sanitation – Bulwer	River valley context: high water quality sensitivity; wetlands and riparian buffers; flood risk to pump stations/WWTW siting.	Across 7 towns, cumulative risk of multiple discharge points and increased effluent loads; also cumulative servitude impacts for trunk sewers and access roads.	Apply catchment-based receiving environment limits; prioritise upgrades where assimilative capacity exists; require avoidance of wetlands/floodlines in siting rules; enforce strategic alternatives (e.g., decentralised systems where rivers are sensitive).	Potential triggers include LN1 Act 25 (effluent/wastewater/sewage treatment 2,000–15,000 m ³ /day) and/or LN2 Act 6 (licence/permit for emissions/pollution/effluent). Clearance for pipelines/works may trigger LN1 Act 27 / LN2 Act 15; LN3 if in sensitive areas or within watercourse setback contexts; manage cumulative thresholds via LN3 Act 26.
Feasibility: Waterborne Sanitation – Creighton	Similar; ensure WWTW siting avoids floodplain/wetland constraints.	Same cross-town cumulative issues.	As above; integrate with housing/infrastructure sequencing so sanitation enables compact growth rather than sprawl.	As above (LN1 Act 25, LN2 Act 6, clearance triggers, LN3 sensitive-area triggers, LN3 Act 26).
Feasibility: Waterborne Sanitation – Underberg	Mountain/WHS influence zone risk: high biodiversity/heritage/tourism sensitivity; stricter landscape constraints and potentially high sensitivity of receiving waters.	Particularly high cumulative sensitivity if tourism growth increases wastewater volumes; compounding with tourism plan.	Strong avoid-first siting and conservative discharge standards via planning rules; prefer upgrading/optimising existing disturbed footprints; ensure growth is tied to sanitation capacity to prevent uncontrolled sprawl into sensitive areas.	As above; plus heightened likelihood of LN3 triggers due to proximity to protected/WHS-related sensitivities and EMF sensitive areas.
Feasibility: Waterborne Sanitation – Donnybrook	River/wetland buffers and flood risk; routing of trunk infrastructure may affect agricultural land and riparian corridors.	Cross-town cumulative issues; also cumulative road/servitude fragmentation.	Corridor planning to co-locate infrastructure in least-sensitive servitudes; set riparian setbacks as non-negotiable.	As above (LN1 Act 25, LN2 Act 6, clearance triggers, LN3, LN3 Act 26).
Feasibility: Waterborne Sanitation – Himeville	Explicit heritage constraint noted; plus high landscape sensitivity (gateway tourism).	Cumulative with Underberg tourism/housing growth; risk of cumulative impacts on scenic/heritage resources and rivers.	Include heritage-sensitive no-go and visual landscape controls in SDF overlays; growth tied to capacity; avoid heritage precinct disruption through routing alternatives at planning stage.	As above; plus strong LN3 sensitivity where in protected/WHS/EMF sensitive contexts.
Feasibility: Waterborne Sanitation – Kilmun	Rural settlement cluster context: dispersed infrastructure raises footprint and may intersect wetlands/streams.	Compounds dispersed rural servicing impacts.	Evaluate appropriate technology pathways that minimise land take in sensitive rural landscapes; prioritise clustered service solutions near existing settlements.	As above; with strong emphasis on clearance triggers (LN1 Act 27 / LN2 Act 15) if servitudes are extensive.

PROJECT	CONSTRAINTS	CUMULATIVE IMPACTS	STRATEGIC MITIGATION / SDF DECISION GUIDANCE	POTENTIAL EIA LISTING NOTICE TRIGGERS
Feasibility: Waterborne Sanitation – Pholela	Rural service standards; likely proximity to streams/wetlands and dispersed settlement pattern.	Same cumulative sanitation issues.	Apply conservative receiving environment rules and siting buffers; link sanitation decisions to rural settlement structuring to reduce cumulative footprint.	As above (LN1 Act 25, LN2 Act 6, clearance triggers, LN3, LN3 Act 26).

8.8.2. TOURISM PROJECTS

TABLE 37: ENVIRONMENTAL SENSITIVITY SCREENING FOR TOURISM ACTION PLAN PROJECTS

PROJECT	KEY ENVIRONMENTAL CONSTRAINTS	CUMULATIVE ENVIRONMENTAL IMPACTS (INTER-PROJECT)	STRATEGIC MITIGATION & SPATIAL GUIDANCE (SDF-LEVEL)	POTENTIAL EIA LISTING NOTICE TRIGGERS (LN1/LN2/LN3)
Missions MTB Trail Network (Centocow–Riverside–Donnybrook–Bulwer)	Mission settlements/rural valleys: riparian crossings, wetlands, erosion-prone slopes; communal landscapes: biodiversity corridors and sensitive commons; route may traverse multiple catchments.	Trail networks + hiking trails + viewpoint programme can cumulatively expand linear disturbance, informal path proliferation, and riparian edge impacts; can also induce additional tourism infrastructure demand at nodes.	Apply a route hierarchy (upgrade/regularise existing tracks first); enforce watercourse/wetland buffers as hard constraints; require cumulative corridor screening across all trail projects before final alignment confirmation; concentrate trailheads at existing disturbed nodes.	Likely LN1 Act 19 (watercourse excavation/works at crossings); LN1 Act 27 (clearance 1–<20 ha) or LN2 Act 15 (≥ 20 ha, if extensive); LN3 Act 4 if sections constitute roadworks in sensitive areas; LN3 Act 12(a) where clearance occurs in sensitive areas.
Gerard Bhengu Art Gallery (Centocow)	Rural mission settlement context: likely on/near land with agricultural history; services/parking may increase footprint; local stormwater and visual/heritage setting sensitivities.	With Mission Route heritage upgrades + signage + visitor nodes, can cumulatively intensify visitor pressure and public realm hardening at heritage nodes.	Site within already transformed footprints; limit new land take; require heritage/landscape sensitivity overlays for mission nodes; align with parking/stormwater rules for valley settings.	If on agricultural/afforestation land: LN1 Act 28 (threshold dependent on inside/outside urban area); LN1 Act 27 if indigenous clearance required; LN3 Act 12(a) if in sensitive areas.
Tourism Signage Upgrade Programme (municipality-wide routes)	Road reserve constraints; sensitive scenic corridors (Drakensberg foothills) and heritage route	Cumulatively supports tourism growth across the municipality (indirect), reinforcing pressure	Adopt a scenic route signage code (limits, materials, placement); prioritise signage within existing road reserves;	Generally low-trigger if within existing reserves; if new footprint/clearance in sensitive areas: LN3 Act 12(a) (≥ 300 m ²) may apply.

PROJECT	KEY ENVIRONMENTAL CONSTRAINTS	CUMULATIVE ENVIRONMENTAL IMPACTS (INTER-PROJECT)	STRATEGIC MITIGATION & SPATIAL GUIDANCE (SDF-LEVEL)	POTENTIAL EIA LISTING NOTICE TRIGGERS (LN1/LN2/LN3)
	contexts; avoid clutter in high-amenity landscapes.	from gateway/viewpoints/trails and access roads.	link to a tourism carrying-capacity approach at sensitive gateways.	
Tourism Offices (new / relocation / refurbishment) – Underberg/Himeville/Creighton/Bulwer/Donnybrook	Node-based development: manage flood risk where nodes sit in valleys; manage heritage character (notably Himeville/Underberg tourism setting); avoid siting that induces sprawl.	Combined with visitor safety infrastructure and precinct public realm upgrades, can intensify nodal consolidation (positive) but also increase servicing/traffic and pressure on valley rivers.	Direct to existing town centres; integrate with nodal spatial rules (no new greenfield “tourism office campuses”); apply floodline/riparian constraints and heritage precinct design controls.	If new land take on agricultural land: LN1 Act 28; if clearance required: LN1 Act 27 / LN3 Act 12(a) in sensitive areas.
Ticketing Offices / Visitor Nodes at Filling Stations & Bus Stops (multiple sites)	Small, dispersed footprint but risk of poor siting near wetlands/watercourses in valley towns; cumulative visual clutter and access safety issues.	Multiple kiosks can cumulatively increase minor hardstanding, lighting, and traffic movements across routes—especially when paired with signage + safety infrastructure.	Standardise a siting protocol: existing transformed footprints only; no-go within riparian buffers; consolidate where possible to reduce proliferation; apply scenic route controls.	Usually low-trigger; if any kiosk works occur within/near watercourses (unlikely but possible): LN1 Act 19; if clearance in sensitive areas: LN3 Act 12(a).
Upgrade/Renovation of Underutilised Nature & Adventure Tourism Infrastructure (Sani/Drakensberg foothills; forests – sites TBC)	High-sensitivity landscapes: Drakensberg foothills/possible WHS influence; steep slopes, headwaters, biodiversity corridors; forest edge fire risk.	With trails/viewpoints/gateway facilities, can cumulatively intensify disturbance in sensitive catchments, trail density, and access control pressures.	Apply “least additional footprint” rule: refurbish within existing disturbed areas first; cap the number of sites upgraded concurrently; require a single cumulative screening across all nature-adventure upgrades + trail programmes before selecting sites.	Likely LN1 Act 27 (clearance) if expansion occurs; LN1 Act 19 if river/wetland works; LN3 Act 6 if expanded facilities constitute tourism accommodation sleeping ≥ 15 in sensitive areas; LN3 Act 12(a) for clearance in sensitive areas.
Upgrade/enable Kilmun racecourse precinct (capital works)	Potential expansion of track/precinct footprint; stormwater and erosion controls; manage proximity to watercourses (typical valley settlement patterns).	Adds an “event-anchor” that can compound with rural access roads + visitor nodes (traffic, parking expansion) and cumulative hardening of open land.	Confine upgrades to existing disturbed precinct; apply event/traffic management through spatial design (parking limits, shuttle-based access); avoid new access routes unless justified by cumulative corridor screening.	If upgrades include new/expanded tracks/routes for motorised outdoor use in sensitive areas: LN3 Act 11 (tracks/routes for motor-powered vehicles in sensitive areas). Vegetation clearance: LN1 Act 27 or LN3 Act 12(a) in sensitive areas.

PROJECT	KEY ENVIRONMENTAL CONSTRAINTS	CUMULATIVE ENVIRONMENTAL IMPACTS (INTER-PROJECT)	STRATEGIC MITIGATION & SPATIAL GUIDANCE (SDF-LEVEL)	POTENTIAL EIA LISTING NOTICE TRIGGERS (LN1/LN2/LN3)
Bulwer nature walk / trail (tourism product)	Bulwer valley setting: riparian buffers, wetlands and flood risk; avoid steep unstable slopes and erosion-prone soils.	Together with MTB trails + hiking programme + Bulwer tourism node upgrades, can cumulatively intensify foot traffic, informal path braiding, and riparian disturbance.	Formalise a single integrated trail plan for Bulwer (avoid duplicate alignments); protect riparian zones via exclusion buffers; locate trailheads/amenities in already transformed areas.	LN1 Act 19 (watercourse excavation at crossings); LN1 Act 27 / LN3 Act 12(a) for clearance in sensitive areas.
Sani Pass Gateway & Visitor Orientation Facility (NDZ side) – Underberg/Himeville	Very high sensitivity: Drakensberg foothills/WHS-related setting; headwaters and steep slopes; high scenic/heritage value; avoid wetland/floodplain siting and excessive parking footprint.	Gateway + viewpoints + hiking/trails can cumulatively “lock in” a high-intensity tourism corridor, escalating disturbance and infrastructure demand.	Apply strict intensity thresholds at the gateway (cap parking footprint; phased expansion only after monitoring/threshold review); require avoid-first siting (no-go for wetlands/headwaters); integrate with a corridor-scale cumulative impact test for the Sani route.	Likely LN1 Act 28 (institutional/commercial development thresholds, depending on land history and urban status); LN1 Act 27 if clearance; LN3 Act 6 if any accommodation component sleeping ≥ 15 is introduced in sensitive areas; LN3 Act 12(a) for clearance in sensitive areas.
Mountain Viewpoints & Scenic Lay-bys Programme (multiple small sites)	Road-edge works in steep terrain; avoid unstable cut/fill and locations within riparian buffers; visual sensitivity is high along scenic corridors.	Multiple small sites can cumulatively exceed thresholds for clearance/earthworks and can materially increase the “development feel” of a scenic route.	Use a site selection sieve: least sensitive viewpoints first; standardise small-footprint typologies; require a single cumulative authorisation strategy (bundle sites) to manage phased/cumulative risk.	Road/lay-by works may trigger LN1 Act 24 (road reserve/width thresholds) and LN1 Act 27 clearance; earthworks near watercourses may trigger LN1 Act 19; LN3 Act 4 where roadworks occur in sensitive areas.
Mission Route Heritage Infrastructure (Centocow–Donnybrook–Bulwer)	Heritage precinct constraints at mission sites; avoid riparian encroachment (many missions are valley-linked); manage cumulative small facilities/trailheads.	With MTB trail + art gallery + public realm upgrades, can cumulatively intensify physical interventions in heritage nodes and expand visitor infrastructure footprints.	Adopt heritage node development envelopes (cap footprint; reuse existing structures first); consolidate facilities per node; apply riparian and slope overlays as hard constraints.	If new buildings/amenities occur on agricultural land thresholds: LN1 Act 28; clearance: LN1 Act 27 or LN3 Act 12(a) in sensitive areas.

PROJECT	KEY ENVIRONMENTAL CONSTRAINTS	CUMULATIVE ENVIRONMENTAL IMPACTS (INTER-PROJECT)	STRATEGIC MITIGATION & SPATIAL GUIDANCE (SDF-LEVEL)	POTENTIAL EIA LISTING NOTICE TRIGGERS (LN1/LN2/LN3)
Donnybrook Tourism Precinct Public Realm Upgrade (town centre)	Urban drainage constraints; manage works near rivers/low-lying zones (valley towns); protect mature trees/green infrastructure.	Together with tourism offices + safety infrastructure, can cumulatively increase hard surfaces and stormwater runoff if not managed strategically.	Require a “blue-green public realm” standard (runoff reduction via planning/design rules); prioritise reuse of existing surfaces; integrate with flood-risk overlays and non-motorised movement.	Usually low-trigger if within existing urban transformed footprint; if works extend into watercourse buffers: LN1 Act 19 may apply.
Bulwer Heritage & Nature Tourism Node Upgrade	Bulwer valley and nature/heritage interface: avoid riparian and wetland areas; manage slope stability and scenic character.	Compounds with Bulwer nature trail + mission route heritage infrastructure and can intensify visitor pressure at a single sensitive node.	Cap footprint; concentrate new amenities in already transformed areas; adopt node-specific carrying capacity guidance and parking limits; protect riparian corridors with exclusion buffers.	LN1 Act 28 (if thresholds met on agricultural land); LN1 Act 27 / LN3 Act 12(a) clearance; LN1 Act 19 if watercourse works.
Rural Tourism Access Roads (tourism-serving only)	High sensitivity to wetland/river crossings, steep slopes, erosion; avoid fragmenting CBAs/ESAs and scenic landscapes; risk of induced ribbon development.	Major cumulative driver with viewpoints/trails/gateway projects: road upgrades can unlock new development pressure in sensitive catchments and multiply LN triggers over time.	Apply a route prioritisation framework: upgrade existing alignments first; prohibit new routes through high-sensitivity overlays; require corridor-scale cumulative assessment and link road upgrades to strict land-use control to prevent induced sprawl.	Likely LN1 Act 24 (road thresholds), plus LN1 Act 27 / LN2 Act 15 clearance; LN1 Act 19 at watercourse works; LN3 Act 4 where roads occur in sensitive areas.
Community-Based Tourism Facility Programme (multiple rural settlements)	Dispersed facilities risk encroaching into wetlands/riparian zones and sensitive commons; services/parking can expand footprint.	Many small facilities can cumulatively exceed clearance and land transformation thresholds and increase pressure on sensitive attraction sites.	Set a facility siting rulebook: only in least-sensitive settlement clusters; reuse transformed sites; consolidate facilities rather than proliferate; require cumulative accounting across the programme (bundle roll-out).	Potential LN1 Act 28 (development on agricultural land thresholds) + LN1 Act 27 clearance; LN3 Act 6 if any facilities include accommodation sleeping ≥ 15 in sensitive areas; LN3 Act 12(a) for clearance in sensitive areas.

PROJECT	KEY ENVIRONMENTAL CONSTRAINTS	CUMULATIVE ENVIRONMENTAL IMPACTS (INTER-PROJECT)	STRATEGIC MITIGATION & SPATIAL GUIDANCE (SDF-LEVEL)	POTENTIAL EIA LISTING NOTICE TRIGGERS (LN1/LN2/LN3)
Hiking & Trail Infrastructure (non-MTB) – Drakensberg foothills/rural nodes	High sensitivity in foothill catchments: headwaters, slopes, biodiversity corridors; boardwalks/bridges risk watercourse triggers.	With MTB trails + nature upgrades, can cumulatively intensify linear disturbance and increase access into previously low-disturbance areas.	Develop a single integrated trails hierarchy (avoid duplicate networks); enforce no-go buffers around wetlands/headwaters; concentrate infrastructure in already impacted corridors; corridor-scale cumulative screening.	Likely LN1 Act 19 (watercourse works), LN1 Act 27 or LN3 Act 12(a) clearance in sensitive areas.
Visitor Safety & Support Infrastructure (lighting, call points, ranger posts, signage)	Manage visual intrusion in scenic corridors; avoid riparian buffers and ecologically sensitive nodes; lighting impacts near sensitive habitats.	Cumulative “hardening” of tourism corridors when combined with signage/viewpoints and node upgrades; can increase night-time disturbance if expanded.	Apply context-specific standards: minimal footprint, focus on existing nodes, avoid expansion into undeveloped scenic stretches; ensure alignment with protected-area/heritage landscape sensitivities.	Typically low-trigger; if any works occur in sensitive areas with clearance: LN3 Act 12(a) may apply.

8.8.3. ENVIRONMENTAL PROJECTS

TABLE 38: ENVIRONMENTAL SENSITIVITY SCREENING FOR ENVIRONMENTAL PROJECTS

PROJECT	KEY ENVIRONMENTAL CONSTRAINTS	CUMULATIVE ENVIRONMENTAL IMPACTS	STRATEGIC MITIGATION & SPATIAL GUIDANCE (SDF-LEVEL)	POTENTIAL EIA LISTING NOTICE TRIGGERS (LN1/LN2/LN3)
Afforestation / Reforestation of Mzimkhulu & Mkomazi Catchments (Long-term; muni-wide sites TBC; R100m)	Catchment typology sensitivity: In upper catchments/foothills, avoid altering natural grassland/wetland ecosystems and headwater hydrology; in river valleys, avoid riparian habitat conversion. Risk if “afforestation” becomes	If implemented as widespread planting, can cumulatively alter streamflow, baseflow, fire regimes, and biodiversity composition, especially when combined with corridor fencing and	In SDF, define this explicitly as ecological restoration (indigenous re-vegetation, alien clearing, erosion control) rather than commercial plantations; prioritise degraded/eroded areas and riparian buffers;	Potential triggers depend on approach: large-scale vegetation change may invoke LN1 (vegetation clearance thresholds) or LN2 if extensive. If works occur in sensitive areas (CBAs/ESAs, protected/WHS-influenced, wetlands/watercourse buffers), LN3 location-based

PROJECT	KEY ENVIRONMENTAL CONSTRAINTS	CUMULATIVE ENVIRONMENTAL IMPACTS	STRATEGIC MITIGATION & SPATIAL GUIDANCE (SDF-LEVEL)	POTENTIAL EIA LISTING NOTICE TRIGGERS (LN1/LN2/LN3)
	plantation-style land-use change rather than ecological restoration.	riverbank works. Conversely, if focused on alien clearing + indigenous restoration, cumulative benefits are high.	apply a hydrology safeguard (no planting in wetlands/headwater seeps; maintain grassland mosaics); sequence sub-catchments to manage cumulative change.	triggers may apply. (Project-level screening required once sites/extent are defined.)
Constructed Wetlands / Vegetated Swales / Infiltration Trenches (Nature-based stormwater) (Medium; Underberg/Bulwer/Creighton/Donnybrook + villages; R60m)	Settlement typology: Valley towns and rural villages often sit close to rivers/wetlands—risk of poorly sited systems increasing disturbance in sensitive riparian zones. Mountain catchments: higher erosion risk; avoid destabilising slopes.	Across multiple towns, cumulative effect can be strongly positive (reduced runoff/erosion), but also can cumulatively increase watercourse works, earthworks footprints, and disturbance if repeatedly placed in/near wetlands/streams.	Use an SDF rule: locate systems in already transformed stormwater corridors and upstream attenuation areas (not in intact wetlands); standardise a no-net-loss wetland approach; adopt catchment-level stormwater plans per town to avoid piecemeal interventions; prioritise sites with maximum flood/erosion reduction benefit.	Where excavations/works interact with watercourses/wetlands, LN1 watercourse-related activities may be triggered; if in listed sensitive areas, LN3 triggers may apply. If vegetation clearance exceeds thresholds, LN1/LN2 vegetation clearance could apply.
Bulwer nature walk / trail development (Short; Bulwer; R3.5m)	Bulwer valley setting implies riparian buffers, possible wetlands, and erosion-prone slopes; avoid routing that causes path braiding and sediment into streams.	With other tourism/trail projects, cumulative risk of linear disturbance and progressive widening of informal paths, especially near watercourses.	Consolidate into a single Bulwer trails hierarchy (avoid duplicate alignments); apply firm riparian setbacks; concentrate trailheads/amenities within existing transformed public nodes; adopt a municipal-wide trail standard limiting footprint in sensitive habitats.	Potential LN1 watercourse works if crossings/boardwalks require excavation; potential LN1/LN2 vegetation clearance depending on footprint; LN3 if in sensitive areas (e.g., within regulated buffers/CBAs/ESAs).
Memorial Park upgrade (Bulwer) (Medium; R0.3m)	Generally low sensitivity if within existing urban park footprint;	Minimal alone, but cumulatively (with multiple public realm upgrades)	Require blue-green park standards (stormwater infiltration, tree retention,	Typically low likelihood; if works extend into a watercourse buffer or require watercourse excavation,

PROJECT	KEY ENVIRONMENTAL CONSTRAINTS	CUMULATIVE ENVIRONMENTAL IMPACTS	STRATEGIC MITIGATION & SPATIAL GUIDANCE (SDF-LEVEL)	POTENTIAL EIA LISTING NOTICE TRIGGERS (LN1/LN2/LN3)
	watch for proximity to rivers/low-lying flood-prone areas.	can increase impervious surfaces and stormwater runoff if not "blue-green" designed.	permeable paths) and avoid park expansion into riparian buffers.	LN1 watercourse activities may apply; LN3 if in sensitive areas.
Riverbank Stabilisation & Rehabilitation Programme (priority rivers) (Short-Medium; Mzimkhulu/Mkomazi + tributaries near Bulwer/Donnybrook/Underberg; R20m)	Riverbanks are inherently sensitive: disturbance can worsen turbidity, destabilise banks, or impact riparian habitats. Settlement-edge interfaces heighten risk (access tracks, informal sand mining, livestock pressure).	Cumulatively positive if coordinated (reduced erosion/flood damage), but risk of cumulative hard engineering (gabions) degrading river ecology if used everywhere.	Apply an SDF rule: nature-based first, hard engineering only where necessary; prioritise hotspots at settlement interfaces; ensure riverbank works integrate with floodplain buffer implementation and access control; treat interventions as corridor-scale programmes (not isolated point fixes).	High likelihood of LN1 watercourse-related triggers where excavation/placement occurs within watercourses and riparian zones; LN3 may apply where rivers fall within mapped sensitive areas/regulated buffers; cumulative/phased work must be screened as a programme.
Floodplain Setback & Green Buffer Implementation (Medium; Bulwer/Donnybrook/rural edges; R5m)	Requires accurate floodplain delineation; buffers must not displace risk downstream or encourage settlement shift into other sensitive areas (e.g., wetlands/steep slopes).	Positive cumulative effect: reduces long-term flood exposure and limits encroachment; but multiple buffers can cumulatively convert land use along rivers (fencing/planting) affecting access patterns.	Formalise floodplain buffers as SDF development-control overlays; integrate with riverbank rehab and stormwater attenuation; ensure buffers are paired with land-use enforcement logic and alternative sites for displaced uses (grazing/access).	Usually low-trigger if implemented via fencing/planting in transformed edges; if significant indigenous vegetation clearance or watercourse works occur, LN1/LN3 may apply depending on sensitive-area status.
Catchment-Based Stormwater Attenuation Ponds (Nature-Based Solutions) (Medium; Underberg/Creighton/Bulwer; R25m)	Upstream pond siting must avoid intact wetlands, sensitive headwaters, steep unstable slopes; must not create new flood risks or barriers to ecological connectivity.	Across several towns, cumulative benefits to flood reduction, but cumulative risk of repeated earthworks and encroachment into wetlands if mis-sited.	Use a catchment siting sieve: degraded upstream gullies/eroded corridors first; prohibit placement in natural wetlands/headwater seeps; standardise a municipal approach to keep ponds	Likely LN1 watercourse/earthworks triggers if ponds interact with drainage lines/wetlands; LN1/LN2 vegetation clearance if thresholds exceeded; LN3 if in sensitive areas.

PROJECT	KEY ENVIRONMENTAL CONSTRAINTS	CUMULATIVE ENVIRONMENTAL IMPACTS	STRATEGIC MITIGATION & SPATIAL GUIDANCE (SDF-LEVEL)	POTENTIAL EIA LISTING NOTICE TRIGGERS (LN1/LN2/LN3)
			multifunctional (attenuation + biodiversity + water quality).	
Landscape & Gateway Rehabilitation at Key Settlement Entrances (Medium; Underberg/Donnybrook/Bulwer; R15m)	Gateway works often occur on steep road embankments and may affect drainage lines; visual landscape sensitivity is high in tourism-oriented towns (Underberg).	Cumulative effect could be positive (stabilised slopes, reduced erosion), but cumulative risk of incremental road-edge widening and vegetation removal across multiple gateways.	Keep works within existing disturbed road reserves; apply slope-stability and drainage safeguards; standardise a “small footprint gateway” typology and avoid new lay-bys or access spurs unless cumulatively justified.	Potential road-related and vegetation clearance triggers depending on scope; LN3 if gateways fall within sensitive area categories.
Ecological Corridor Protection Infrastructure (priority CBAs/ESAs) (Long; corridors across NDZ; R45m)	Corridors are biodiversity priorities: fencing/boardwalks can fragment movement if poorly designed; access management must respect communal land use patterns and avoid conflict.	Strong positive cumulative outcome if coherent; cumulative risk is mainly from piecemeal, uncoordinated fencing creating barriers and shifting pressure elsewhere.	Implement as part of an EMF-aligned corridor plan: specify where fencing is appropriate vs where stewardship/land management is preferable; prioritise pinch-points and high-threat interfaces; ensure corridor protection supports both biodiversity and sustainable livelihoods (access design).	Works within CBAs/ESAs elevate likelihood of LN3 location-based triggers; boardwalks near wetlands/watercourses may invoke LN1 watercourse activities; vegetation clearance thresholds may invoke LN1/LN2.

8.8.4. BIOPHYSICAL & ENVIRONMENTAL MANAGEMENT PROJECTS

TABLE 39: ENVIRONMENTAL SENSITIVITY SCREENING FOR BIOPHYSICAL & ENVIRONMENTAL MANAGEMENT PROJECTS

PROJECT	KEY ENVIRONMENTAL CONSTRAINTS	CUMULATIVE ENVIRONMENTAL IMPACTS (INTER-PROJECT)	STRATEGIC MITIGATION & SPATIAL GUIDANCE (SDF-LEVEL)	POTENTIAL EIA LISTING NOTICE TRIGGERS (LN1/LN2/LN3)
Bulwer Waste Disposal Site Closure & Conversion Prep (closure licensing + transition) (Medium-Long; Bulwer; R40m)	Bulwer valley setting: avoid mobilisation impacts on nearby watercourses/wetlands; manage slope stability and erosion on capped surfaces; ensure post-closure land use doesn't create a new sensitive receptor (e.g., housing) adjacent to residual risk.	If not properly rehabilitated, cumulative risk includes long-term leachate generation, episodic contamination during heavy rainfall/flooding, and ongoing nuisance that undermines tourism/public realm initiatives. Also cumulative with informal dumping closures (risk of displacement to new sites).	Treat as a high-priority environmental risk reduction project; require an SDF post-closure land use envelope (low-intensity, compatible uses only); embed buffer/setback rules around the closed site; integrate with municipal waste diversion and enforcement so closure does not shift dumping elsewhere.	Closure/rehabilitation activities can trigger EIA screening depending on scope and location; potential LN1 watercourse-related triggers if works affect drainage lines; potential LN1/LN2 if extensive clearance/earthworks; LN3 if in/near listed sensitive environments. (Confirm via site screening during closure design.)
Recycling Facility Upgrade / Expansion (Himeville transfer/recycling) (Short-Medium; Himeville; R10m)	Tourism/heritage-sensitive node: manage visual/nuisance impacts; ensure siting avoids riparian/flood-prone areas; traffic safety and stormwater control within valley settlement context.	Cumulatively positive (reduces landfill demand and informal dumping), but multiple waste facilities plus access-road upgrades can cumulatively increase traffic, noise, dust, and hardstand runoff if not managed strategically.	Apply an SDF siting rule: expansions only within existing transformed footprints at the transfer station; adopt buffer-based conditions to protect adjacent sensitive receptors; align with a municipal waste network plan (avoid proliferation of small sites).	Potential triggers if expansion requires permits/licences (waste-related) and/or if clearance exceeds thresholds; LN3 may apply if located within a listed sensitive area; LN1 if watercourse/earthworks interactions occur.
Wetland rehabilitation & erosion control works (Kilmun) (Short-Medium; Kilmun; R8m)	Wetlands are highly sensitive: works can cause short-term disturbance, turbidity, and habitat disruption if poorly sequenced; access tracks can fragment wetland margins.	Together with gully rehabilitation, alien clearing, and stormwater attenuation projects, cumulative effect can be strongly positive, but cumulative risk is repeated earthworks in/near wet systems, increasing disturbance footprints and	Adopt a "no-net-loss wetland" planning rule: rehabilitation must improve ecological function; prohibit conversion of intact wetland areas; require a catchment-based prioritisation (degraded wetlands first); avoid new access tracks except where essential and controlled.	High likelihood of LN1 watercourse-related triggers where excavation/infilling occurs in a wetland/watercourse; LN3 likely if wetland falls within mapped sensitive categories; manage phased/cumulative exceedance risk where multiple wetland works occur as a programme.

PROJECT	KEY ENVIRONMENTAL CONSTRAINTS	CUMULATIVE ENVIRONMENTAL IMPACTS (INTER-PROJECT)	STRATEGIC MITIGATION & SPATIAL GUIDANCE (SDF-LEVEL)	POTENTIAL EIA LISTING NOTICE TRIGGERS (LN1/LN2/LN3)
		potential for “mission creep” into intact wetlands.		
Alien Invasive Plant Clearing Programme (priority catchments) (Short–Long; river corridors/wetlands/slopes; muni-wide; R10m)	Risk of bank destabilisation and erosion if clearing is not staged; biomass disposal can pollute watercourses; access tracks can increase disturbance on steep slopes.	Cumulative benefits (improved flows, reduced fire risk, biodiversity recovery) are high, but cumulative negative risk comes from expanded access tracks, repeated disturbance of riparian zones, and disposal impacts across many sites.	Treat as a single municipal programme with standard operating spatial rules: staged clearing, protect riparian buffers, minimise/standardise access routes, and define approved biomass disposal sites; prioritise headwaters and high-risk invasion fronts.	Generally low EIA triggering if strictly “clearing” within existing disturbed riparian corridors, but LN1 watercourse-related activities may arise where works entail excavation/reshaping; LN3 may apply due to sensitive-area location (riparian/wetlands).
Gully Erosion Rehabilitation Programme (Short–Medium; rural settlements/agricultural land; R20m)	Gullies often connect to drainage lines; hard structures (gabions) can alter geomorphology; high risk on steep slopes and where gullies are near settlements/roads.	Cumulatively positive (reduced sedimentation, infrastructure risk), but cumulative risk is many earthworks sites across catchments, potentially increasing borrow material demand and access impacts; repeated stabilisation can shift erosion downstream if not catchment-led.	Prioritise gullies threatening settlement safety/roads; require catchment logic (treat upstream drivers); standardise “nature-based first” designs; link to land management rules (grazing control, stormwater source control) via SDF guidance.	Likely LN1 watercourse/earthworks-related triggers if works occur within drainage lines/watercourses; LN1/LN2 vegetation clearance depending on footprint; LN3 where gullies occur in sensitive mapped areas.
Firebreak Construction & Maintenance (strategic interfaces) (Short–Medium; urban–rural/forestry-adjacent; R15m)	Risk of biodiversity fragmentation if firebreaks cut across CBAs/ESAs; soil exposure can increase erosion (especially on slopes); avoid unnecessary widening.	Cumulative risk is high if multiple firebreaks proliferate: habitat fragmentation, invasive spread along cleared lines, and erosion; also cumulative with alien clearing (access lines can merge and expand).	Apply an SDF rule: firebreaks only where justified by risk interfaces; use existing tracks/edges where possible; cap widths; avoid CBAs/ESAs unless no alternatives and then apply strict conditionality; integrate with municipal spatial fire-risk overlays.	Potential clearance triggers LN1 Act 27 / LN2 Act 15 if indigenous vegetation removal exceeds thresholds; LN3 if in sensitive areas (CBAs/ESAs/protected context).
Rehabilitation of Degraded Municipal Open Spaces (Medium;	Generally low sensitivity if within existing transformed urban open	Cumulatively positive (improved urban ecological function, reduced erosion/runoff), but	Require “blue-green” standards: permeable surfaces, drainage correction, re-grassing/tree	Typically low likelihood; LN1 may apply if works extend into watercourses (excavation/infilling) or

PROJECT	KEY ENVIRONMENTAL CONSTRAINTS	CUMULATIVE ENVIRONMENTAL IMPACTS (INTER-PROJECT)	STRATEGIC MITIGATION & SPATIAL GUIDANCE (SDF-LEVEL)	POTENTIAL EIA LISTING NOTICE TRIGGERS (LN1/LN2/LN3)
Bulwer/Creighton/Donnybrook; R10m)	space; watch flood-prone low-lying parks and riparian edges.	cumulative risk is increased hardscape and runoff if upgrades are overly “grey.”	retention; avoid expansion into riparian buffers; integrate with town stormwater nature-based programme.	trigger vegetation clearance thresholds.
Closure & Rehabilitation of Informal Dumping Sites (Short-Medium; settlement edges/rural villages; R5m)	High risk of being located near drainage lines and wetlands (common at settlement edges); risk of contaminated soils and runoff; access control challenges in communal areas.	Cumulatively positive (reduced diffuse pollution), but risk of displacement—closure without alternatives can shift dumping to new sensitive sites, compounding impacts across catchments.	Link closures to a waste service/access plan (collection points, transfer network); use buffer-based prioritisation (close sites near watercourses first); enforce no-go dumping areas through spatial rules and community stewardship.	Potential LN1 triggers if rehabilitation entails significant reshaping/excavation near watercourses; LN3 likely if sites occur within sensitive riparian/wetland contexts; cumulative programme roll-out should be screened for phased threshold risks.

8.8.5. INFRASTRUCTURE PROJECTS

TABLE 40: ENVIRONMENTAL SENSITIVITY SCREENING FOR BUILT ENVIRONMENT PROJECTS

PROJECT	KEY ENVIRONMENTAL CONSTRAINTS	CUMULATIVE ENVIRONMENTAL IMPACTS (INTER-PROJECT)	STRATEGIC MITIGATION & SPATIAL GUIDANCE (SDF-LEVEL)	POTENTIAL EIA LISTING NOTICE TRIGGERS (LN1/LN2/LN3)
Creighton Town Stormwater & Traffic Control Works (incl. pedestrian walkways, bus stops/shelters) (Short-Medium; R60m)	River valley town context: high sensitivity to stormwater outfalls, erosion, and discharge to nearby watercourses/wetlands; avoid works within riparian buffers and flood-prone areas. Road reserve constraints: ensure upgrades do not expand footprint into sensitive verge vegetation or drainage lines.	With Underberg/Himeville stormwater upgrades, cumulative risk of increased hardening (more impervious surfaces) unless “blue-green” design is embedded; repeated outfalls across towns can cumulatively degrade water quality and increase	Apply an SDF rule: stormwater upgrades must prioritise attenuation + infiltration (nature-based where feasible) before conveyance; standardise outfall protection and prohibit direct discharge into intact wetlands; require town-level stormwater plans aligned to flood-risk and riparian overlays; keep pedestrian/public transport facilities within existing disturbed footprints.	Potential triggers where works intersect a watercourse or require excavation/infilling in a drainage line/wetland (commonly captured under LN1 watercourse-related activities); vegetation clearance triggers may apply if indigenous vegetation removal exceeds thresholds (LN1/LN2) and LN3 if within listed sensitive areas (e.g., riparian buffers/CBAs/ESAs as applicable).

PROJECT	KEY ENVIRONMENTAL CONSTRAINTS	CUMULATIVE ENVIRONMENTAL IMPACTS (INTER-PROJECT)	STRATEGIC MITIGATION & SPATIAL GUIDANCE (SDF-LEVEL)	POTENTIAL EIA LISTING NOTICE TRIGGERS (LN1/LN2/LN3)
		channel incision downstream.		
Underberg Gravel-to-Asphalt Road Upgrades + Stormwater Drainage Upgrades (Short-Medium; R120m)	Mountain foothill / high amenity tourism setting: steep slopes, erosion-prone soils, and high sensitivity of receiving catchments; strong need to avoid altered runoff peaks into headwaters/tributaries. Heritage/scenic constraints: avoid widening beyond necessity that degrades sense-of-place.	High cumulative risk with Himeville/Creighton stormwater works: widespread surfacing can increase runoff volumes and velocities, compounding flood peaks and downstream erosion; also cumulative with tourism access upgrades by inducing higher traffic and development pressure.	SDF guidance: prioritise safety + drainage performance without unnecessary widening; require runoff management (attenuation, energy dissipation) as a primary design objective; apply a “no new erosion burden” rule for all road surfacing; ensure sequencing aligns with settlement consolidation (avoid enabling leapfrog growth into sensitive foothill catchments).	Road and drainage works commonly create exposure to LN1 road-related activities (depending on widening/reserve/length) and LN1 watercourse-related activities at culverts/drainage line crossings; LN1/LN2 vegetation clearance thresholds may apply; LN3 triggers likely if any works occur in listed sensitive areas typical of the Underberg/Himeville environment (e.g., within buffers to protected areas/WHS-influenced settings, CBAs/ESAs, sensitive drainage lines).
Himeville Stormwater System Upgrade + Road Resurfacing (Medium; R60m)	Heritage-sensitive settlement: protect heritage townscape character and avoid extensive road-edge alteration; valley drainage sensitivity (outfalls/culverts affecting nearby rivers/wetlands).	Cumulative with Underberg upgrades: the two settlements function as a linked system—combined surfacing/stormwater changes can cumulatively increase runoff to shared downstream catchments; also cumulative with tourism node/gateway projects increasing traffic volumes and demand for further road hardening.	Embed heritage-sensitive street typologies (minimal widening; context-appropriate materials) and require stormwater upgrades to prioritise capture/attenuation; enforce riparian buffers; tie upgrades to a broader “tourism-carrying capacity” approach (do not design road capacity that encourages unmanaged growth).	Potential LN1 watercourse-related triggers where works affect drainage lines/outfalls; LN1 road-related activities if roadworks extend beyond routine resurfacing into widening/new road elements; LN3 if works occur in sensitive landscape/heritage/protected-area influenced contexts; vegetation clearance triggers if verge vegetation removal exceeds thresholds.
Additional Waste Collection Fleet for Bulwer Service Area	Environmental constraints are indirect: increased haul distances intensify transport	Cumulative with landfill closure/rehabilitation actions: if fleet capacity	Treat as an enabling measure to prevent secondary environmental harm (illegal dumping). SDF guidance: consolidate	Generally unlikely to trigger EIA Listing Notices because it is procurement/operations rather than

PROJECT	KEY ENVIRONMENTAL CONSTRAINTS	CUMULATIVE ENVIRONMENTAL IMPACTS (INTER-PROJECT)	STRATEGIC MITIGATION & SPATIAL GUIDANCE (SDF-LEVEL)	POTENTIAL EIA LISTING NOTICE TRIGGERS (LN1/LN2/LN3)
(to haul to Creighton) (Short; R25m)	emissions, road wear, spill/leachate risk along route; operational risk around OHS and nuisance at loading/transfer points.	fails, illegal dumping increases (diffuse watercourse pollution). With multiple waste-related interventions, transport-related impacts can accumulate (traffic, emissions, noise) on the Bulwer–Creighton corridor.	collection routes, ensure sealed containment (spillage prevention), and align fleet investment with waste diversion and transfer facility optimisation to reduce haul demand over time.	land transformation; however, any associated expansion of depots/transfer areas or new loading infrastructure could create triggers (then screened under LN1/LN3 depending on location and footprint).

8.8.6. BUILT ENVIRONMENT PROJECTS

TABLE 41: ENVIRONMENTAL SENSITIVITY SCREENING FOR BUILT ENVIRONMENT PROJECTS

PROJECT	KEY ENVIRONMENTAL CONSTRAINTS	CUMULATIVE ENVIRONMENTAL IMPACTS (INTER-PROJECT)	STRATEGIC MITIGATION & SPATIAL GUIDANCE (SDF-LEVEL)	POTENTIAL EIA LISTING NOTICE TRIGGERS (LN1/LN2/LN3)
Underberg CBD Public Park (Erf 17 / rail precinct) incl. ablutions (Medium; Underberg CBD)	Valley town context: stormwater and flood-risk sensitivity (parks often sit on low-lying land); avoid riparian encroachment if near watercourses. Rail/Transnet land: legacy contamination risk cannot be excluded at planning stage. High-amenity tourism node: visual/landscape quality constraints.	With other Underberg–Himeville public realm and tourism projects, can cumulatively increase hard landscaping, lighting and runoff unless blue-green standards apply; can also concentrate visitors (generally positive if it reduces dispersed pressure).	Apply blue-green public realm standards (infiltration/attenuation, permeable surfacing); confirm park footprint is within already transformed land; apply precautionary buffers to drainage lines; treat ablution servicing as a capacity check (tie to sanitation planning).	Likely low if wholly within transformed CBD footprint. If earthworks affect a drainage line/watercourse: LN1 watercourse-related activities may apply. If vegetation clearance in sensitive areas occurs: LN3 location-based triggers may apply.
Underberg Multipurpose / Indoor Sports Centre (IDP)	Siting constraint: ensure location avoids flood-prone land and steep/slope-risk edges; manage stormwater discharge. Traffic/parking footprint can be	Together with new high school + park + tourism upgrades, may cumulatively increase impervious surface area and stormwater volumes in Underberg–Himeville	Direct to existing urban footprint with bulk services; require stormwater attenuation as a planning condition; cap parking footprint and prioritise	If developed on land historically used for agriculture and exceeds thresholds: LN1 (Activity 28) may apply (context-dependent). Clearance thresholds (LN1 Act 27 / LN2 Act 15) apply if indigenous

PROJECT	KEY ENVIRONMENTAL CONSTRAINTS	CUMULATIVE ENVIRONMENTAL IMPACTS (INTER-PROJECT)	STRATEGIC MITIGATION & SPATIAL GUIDANCE (SDF-LEVEL)	POTENTIAL EIA LISTING NOTICE TRIGGERS (LN1/LN2/LN3)
Project No.1) (Short; Underberg)	large—avoid pushing into sensitive open land at settlement edge.	catchments; induced growth pressure if sited on the edge.	walkable access from CBD to limit land take.	vegetation removal is required; LN3 if site falls within listed sensitive areas.
Himeville Sports Field Upgrade (Short–Medium; Himeville)	Generally lower risk if confined to existing sports field; however, valley drainage and potential proximity to watercourses require stormwater control and setbacks.	With multiple facility upgrades, can cumulatively increase lighting and hardstand if expansions occur; generally limited if refurbishment-focused.	Keep works within existing disturbed footprint; apply a municipal standard for stormwater and lighting controls to protect amenity and biodiversity (esp. near riparian corridors).	Usually low-trigger if refurbishment only. If expansion triggers land transformation/clearance thresholds or affects watercourses, LN1/LN3 may apply.
Creighton Town Park Upgrade (Medium; Creighton)	Ensure upgrades do not extend into riparian buffers (if near river/low-lying); manage stormwater and tree retention.	In combination with taxi rank + government precinct, cumulative risk is increased CBD hardening and runoff unless blue-green standards are applied.	Blue-green park upgrade standard; avoid expansion into flood-prone edges; integrate with town stormwater planning.	Typically low; if works affect watercourses/drainage lines, LN1 watercourse-related activities may apply.
Creighton Taxi Rank + Informal Trade Facility (Medium; Creighton)	Taxi ranks typically require large hardstand areas—manage runoff, oil/contaminant wash-off, and avoid siting on flood-prone/riparian land. Nuisance (noise/dust) constraints near sensitive receptors.	Cumulatively with government services precinct and other upgrades, can increase traffic concentration, runoff and solid waste volumes; can be positive if it consolidates informal trade into managed space and reduces dispersed impacts.	Prioritise CBD / already transformed land; include stormwater quality controls as a planning condition; integrate waste management and public realm design (avoid spillover into river corridors).	If development occurs on agricultural land (or outside urban edge) and exceeds thresholds: LN1 Act 28; if clearance required: LN1 Act 27 / LN2 Act 15; LN3 if within listed sensitive areas.
Government Services Precinct (Clinic, Home Affairs, SASSA, related offices) – Creighton (Medium; Creighton)	Large clustered precinct (R250m) implies significant land take—avoid siting that expands into sensitive edges (river valleys, wetlands) or productive agricultural land near town. Ensure stormwater and traffic impacts managed.	Major cumulative driver: combined with taxi rank and other Creighton upgrades, can intensify CBD pressure and impervious surfaces; also can induce adjacent private development.	Use as a CBD consolidation anchor (infill, not edge expansion); apply stormwater attenuation and parking footprint limits; require locational screening against flood risk and biodiversity buffers.	Potential LN1 Act 28 (development on agricultural land thresholds depending on context); clearance thresholds LN1 Act 27 / LN2 Act 15; LN3 if sensitive-area location applies.
Construction of 5 Crèches (Zwelisha, Khubeni, Siyathuthuka, Hlane, Ekupholeni)	Dispersed rural/communal settings: risk of siting in flood-prone valley bottoms, near wetlands/streams, or on steep slopes; limited services can drive incremental additional infrastructure footprint.	Many small facilities cumulatively increase incremental land transformation across multiple villages and may cumulatively exceed vegetation clearance	Adopt a standard ECD siting protocol: prefer already transformed community land; enforce riparian/wetland setbacks; avoid steep slopes; link siting to settlement	Individually may be below thresholds, but cumulative roll-out can increase risk. Where on agricultural land above thresholds: LN1 Act 28; if indigenous clearance occurs: LN1 Act 27 / LN2 Act 15; in sensitive areas

PROJECT	KEY ENVIRONMENTAL CONSTRAINTS	CUMULATIVE ENVIRONMENTAL IMPACTS (INTER-PROJECT)	STRATEGIC MITIGATION & SPATIAL GUIDANCE (SDF-LEVEL)	POTENTIAL EIA LISTING NOTICE TRIGGERS (LN1/LN2/LN3)
(Short; wards 2,3,5,6,11 – site specific)		thresholds if not standardised and sited carefully.	hierarchy (prioritise larger service centres).	(riparian/CBAs/ESAs): LN3 location-based triggers and phased/cumulative considerations.
Centocow Taxi Rank – Phase 3 (Short; Centocow)	Mission/communal settlement context: avoid siting on drainage lines; manage runoff and waste; minimise expansion beyond existing disturbed transport node.	Along with other taxi rank and public facility upgrades, can cumulatively increase hardstand runoff and waste loads across nodes.	Confine to existing rank footprint; require stormwater quality management as a planning condition; integrate with pedestrian safety and refuse management to prevent riparian dumping.	If expansion triggers clearance/development thresholds: LN1 Act 28 and/or LN1 Act 27; LN3 if located in sensitive-area contexts.
Maintenance / Refurbishment of Community Halls and Sportfields (Seaford, Mlidel, Okhetheni, Khethokuhle; Buyani Madlala Sportfield; Bethlehem Sportfield) (Short; multiple wards)	Mostly within existing footprints; main constraints are stormwater/drainage (valley settings), sanitation servicing, and avoiding incremental sprawl of facility footprints into sensitive edges.	Cumulative issue is programme-wide: multiple small refurbishments can cumulatively increase hardscape/lighting and maintenance waste streams; generally manageable if footprint is controlled.	Apply a municipal standard: refurbishment = no net expansion into undeveloped land unless justified; require stormwater and sanitation adequacy checks; prioritise upgrades that reduce environmental health risks.	Usually low-trigger if purely refurbishment. If expansions lead to clearance or sensitive-area interaction: LN1/LN3 may apply.
Proposed New High School (Underberg–Himeville area) (Long; Underberg–Himeville)	Potentially large footprint—high sensitivity if greenfield: valley flood risk, riparian buffers, and high-amenity landscape setting; avoid siting on productive agricultural land and near biodiversity corridors.	High cumulative driver with sports centre + public park + tourism upgrades: increases demand for roads, stormwater, sanitation, and can induce residential expansion around the school.	SDF guidance should be explicit: site as infill or edge-adjacent within serviced envelope (not leapfrog); require flood-risk avoidance and riparian setbacks; tie to bulk water/sanitation capacity; protect scenic/heritage setting through development intensity controls.	If greenfield on agricultural land and above thresholds: LN1 Act 28 is likely relevant; if indigenous vegetation clearance exceeds thresholds: LN1 Act 27 / LN2 Act 15; LN3 if any sensitive-area location applies (common in Underberg–Himeville landscape contexts).

8.8.7. ECONOMIC DEVELOPMENT PROJECTS

TABLE 42: ENVIRONMENTAL SENSITIVITY SCREENING FOR ECONOMIC DEVELOPMENT PROJECTS

PROJECT (ROW)	KEY ENVIRONMENTAL CONSTRAINTS (BY NDZ TYPOLOGY/CONTEXT)	CUMULATIVE ENVIRONMENTAL IMPACTS (INTER-PROJECT)	STRATEGIC MITIGATION & SPATIAL GUIDANCE (SDF-LEVEL)	POTENTIAL EIA LISTING NOTICE TRIGGERS (LN1/LN2/LN3)
Creighton Agricultural Warehousing Facility (Medium; Creighton expansion area; R20–80m)	Creighton expansion edge: risk of pushing logistics/industrial land take into river valley flood-prone land, wetlands/drainage lines, or productive agricultural land. Stormwater + operational runoff risks (hardstand areas). Traffic and dust/noise constraints near sensitive receptors.	Combined with agro-processing site development and expanded markets, can cumulatively intensify agri-logistics traffic, expand impermeable surfaces, and increase stormwater pollutant loads. If sited on the periphery, may also induce adjacent land conversion (secondary cumulative land take).	Apply an SDF rule: locate warehousing only in pre-screened, low-sensitivity industrial/service precincts within the town's serviced envelope; enforce flood-risk avoidance and riparian setbacks; require a freight/route management logic that avoids sensitive corridors and supports nodal consolidation (not ribbon growth).	Likely exposure to LN1 Activity 28 (development on land used for agriculture/afforestation thresholds) if on such land (common at "expansion areas"). If indigenous vegetation clearance is needed: LN1 Activity 27 (1–<20 ha) or LN2 Activity 15 (≥ 20 ha). If in a listed sensitive area (e.g., within buffers/CBAs/ESAs/watercourse-adjacent): LN3 location-based triggers may apply, including cumulative/phased considerations.
Creighton Skills Training Centre (multi-skill facility) (Medium; Creighton; R25–100m)	Low biophysical risk if infill in existing town footprint; key constraints are siting (avoid flood-prone/low-lying land) and servicing capacity (sanitation/stormwater).	Cumulative effect mainly via enabling function: skills centre supports economic growth, potentially increasing demand for warehousing/agro-processing and associated land transformation if not spatially contained.	Use as a CBD consolidation anchor (infill), not an edge facility; apply standard stormwater/sanitation capacity checks; pair with SDF land-use controls that channel growth to approved nodes/precincts.	Generally low likelihood if built on already transformed urban land. If on agricultural land or requires indigenous clearance above thresholds: LN1 Act 28 and/or LN1 Act 27 / LN2 Act 15 may apply; LN3 applies if sensitive-area location is relevant.
Underberg Farmers Market Facility (Short-Medium; Underberg; R8–30m)	High-amenity valley town context: avoid siting in riparian/flood-prone areas; manage waste (organic waste), stormwater runoff, and traffic/parking footprint to prevent spillover into sensitive edges.	Together with agro-processing site development and the agricultural college, can cumulatively intensify agri-economy clustering in Underberg–Himeville, increasing traffic, service loads, and hardstanding unless contained.	Locate in/adjacent to existing CBD or established service node; enforce parking footprint caps and "blue-green market" standards (stormwater, waste handling as planning requirements); link to waste diversion plan to avoid cumulative organic waste impacts.	Potential LN1 Act 28 if developed on agricultural land thresholds (depending on exact site); clearance thresholds LN1 Act 27 / LN2 Act 15 if indigenous vegetation is removed; LN3 if in sensitive locations (common risk in the Underberg setting).

PROJECT (ROW)	KEY ENVIRONMENTAL CONSTRAINTS (BY NDZ TYPOLOGY/CONTEXT)	CUMULATIVE ENVIRONMENTAL IMPACTS (INTER-PROJECT)	STRATEGIC MITIGATION & SPATIAL GUIDANCE (SDF-LEVEL)	POTENTIAL EIA LISTING NOTICE TRIGGERS (LN1/LN2/LN3)
Underberg Site Development for Agro-Processing (Medium; Underberg; R30–150m)	Platforming and internal roads imply earthworks and potential drainage-line impacts; Underberg foothill catchments are erosion-sensitive. Avoid siting that increases risk to headwater systems or scenic/heritage setting.	Strong cumulative driver with farmers market + agricultural college: can expand industrial land take, increase effluent/waste volumes, and induce further development (housing/roads) around the site—raising cumulative threshold exceedance risk over time.	Require pre-identification of a preferred agro-processing precinct based on least-sensitive land, existing services, and transport access; prohibit “opportunistic” site rollout outside that precinct; include SDF conditions requiring stormwater attenuation, flood-risk avoidance, and buffers from watercourses/CBAs/ESAs at planning stage.	Likely exposure to LN1 Act 28 (development on agricultural land thresholds) and LN1 Act 27 / LN2 Act 15 (vegetation clearance depending on extent). If any drainage lines/wetlands are affected, watercourse-related LN1 triggers may arise. LN3 likely if the site falls within sensitive area categories (frequent in Underberg landscape context).
Agricultural College (facility development) (Long; Underberg–Himeville area; R250m–R1bn)	Potentially very large footprint (campus + workshops + possible accommodation): high risk if greenfield. Constraints include floodplains/riparian buffers, sensitive foothill catchments, scenic/heritage setting, and potential proximity to biodiversity corridors/CBAs/ESAs.	Major cumulative “anchor” effect: could induce housing demand, road upgrades, service expansions, and additional commercial activity—compounding land transformation and water/sanitation loads across the Underberg–Himeville system.	Treat as a strategic nodal investment with strict spatial conditions: (i) site only within a serviced, least-sensitive envelope; (ii) require phased development tied to service capacity; (iii) protect scenic/heritage setting with intensity controls; (iv) ensure the SDF designates explicit no-go catchment and biodiversity constraints around the campus.	High likelihood of EIA screening once a site is defined. Potential triggers include LN1 Act 28 (large-scale development on agricultural land), LN1 Act 27 / LN2 Act 15 (indigenous vegetation clearance), and LN3 location-based triggers given sensitivity of Underberg–Himeville landscapes. Phased roll-out elevates cumulative threshold risk (multiple phases/associated infrastructure).

8.8.8. CAPITAL WORKS PROJECTS

TABLE 43: ENVIRONMENTAL SENSITIVITY SCREENING FOR CAPITAL WORKS PROJECTS

PROJECT	KEY ENVIRONMENTAL CONSTRAINTS	CUMULATIVE ENVIRONMENTAL IMPACTS (INTER-PROJECT)	STRATEGIC MITIGATION & SPATIAL GUIDANCE (SDF-LEVEL)	POTENTIAL EIA LISTING NOTICE TRIGGERS (LN1/LN2/LN3)
Upgrade street lighting (side streets) (Short-term; Bulwer CBD; R2.5m)	Low direct biophysical impact; constraints relate to visual intrusion, heritage townscape sensitivity, and installation near drainage lines/road verges.	With multiple CBD upgrades, contributes to cumulative urban hardening and visual intensity, but generally positive if it consolidates	Confine works to existing road reserves and transformed areas; apply heritage-sensitive lighting standards; avoid new pole placement within riparian buffers or drainage swales.	Unlikely to trigger EIA. If trenching occurs within watercourse buffers or sensitive areas, LN3 location-based

PROJECT	KEY ENVIRONMENTAL CONSTRAINTS	CUMULATIVE ENVIRONMENTAL IMPACTS (INTER-PROJECT)	STRATEGIC MITIGATION & SPATIAL GUIDANCE (SDF-LEVEL)	POTENTIAL EIA LISTING NOTICE TRIGGERS (LN1/LN2/LN3)
		activity into the CBD and improves safety.		triggers could apply (context-specific).
Pedestrian-vehicle separation along R617 (Short-term; Bulwer CBD; R1m)	Valley town / trunk road context: avoid narrowing flood conveyance paths or encroaching into riparian/drainage corridors; manage stormwater capture along kerbs.	Cumulatively with resurfacing, sidewalks, crossings and lighting, increases impervious surface area, potentially increasing runoff peaks unless mitigated.	Apply a “no net increase in runoff” rule for R617 upgrades; integrate kerbing/channelisation with infiltration or attenuation; keep all works within existing disturbed road reserve.	May trigger LN1 road-related activities if widening or new kerbing materially alters the road footprint; LN1 watercourse-related triggers if works affect drainage lines; LN3 if within sensitive mapped areas.
Resurfacing + stormwater along local distribution roads (Short-term; Bulwer CBD; R5m)	High relevance of stormwater management in low-lying CBD; avoid direct discharge to rivers/wetlands; manage erosion at outfalls.	Along with other Bulwer CBD works, cumulative risk of increased runoff volumes and velocities, degrading downstream channels if attenuation is not integrated.	Require blue-green street standards: infiltration trenches, energy dissipation at outfalls, and no direct discharge into intact wetlands; coordinate with CBD-wide stormwater plan.	Likely LN1 watercourse-related triggers where outfalls or culverts interact with drainage lines; vegetation clearance thresholds could invoke LN1/LN2; LN3 if in sensitive areas.
Upgrade R617 (stormwater, surface, sidewalks) (Medium-term; Bulwer CBD; R4m)	R617 is a provincial route through a valley settlement; constraints include stormwater discharge, pedestrian safety, and avoidance of unnecessary widening that affects verges/drainage.	Acts as a cumulative spine project: combined with crossings, sidewalks, lighting and resurfacing, can materially change runoff dynamics and urban intensity along the corridor.	Apply corridor-wide design logic: limit widening; require attenuation and water-quality controls; integrate pedestrian facilities without expanding the road reserve into sensitive edges; link upgrades to CBD consolidation (avoid inducing ribbon development).	Potential LN1 road-related activities and LN1 watercourse-related triggers; LN3 location-based triggers may apply given valley and riparian sensitivity typical of Bulwer.
Improved pedestrian crossing over R617 (Medium-term; Bulwer CBD; R1.5m)	Minimal biophysical constraint if within existing road footprint; ensure raised tables/refuges do not impede stormwater flow.	Small individually, but cumulatively contributes to road hardening along R617; generally positive if it reduces informal crossings and disturbance elsewhere.	Keep entirely within existing road reserve; integrate with stormwater design so crossings do not create ponding or erosion.	Generally unlikely to trigger EIA; only if works materially affect drainage lines or sensitive areas would LN1/LN3 be relevant.
Public ablution facilities (CBD) (Medium-term; Bulwer CBD; R1m)	Sanitation and effluent management is key: avoid siting near watercourses/flood-prone land; ensure adequate connection to sanitation system.	With other CBD upgrades, cumulative risk relates to sanitation load and potential pollution if facilities are poorly	Require ablutions to be located on least-sensitive, elevated sites within the CBD; tie approval to confirmed sanitation capacity; enforce buffers to drainage lines and rivers via SDF overlays.	Potential LN1 Act 25 exposure only if ablutions link to or expand wastewater treatment capacity (unlikely at this scale); LN3 if

PROJECT	KEY ENVIRONMENTAL CONSTRAINTS	CUMULATIVE ENVIRONMENTAL IMPACTS (INTER-PROJECT)	STRATEGIC MITIGATION & SPATIAL GUIDANCE (SDF-LEVEL)	POTENTIAL EIA LISTING NOTICE TRIGGERS (LN1/LN2/LN3)
		serviced or overflow during floods.		sited in sensitive riparian contexts.
New paving + pedestrian walkways on P429 & D1201 (Short programme; Kilmun; R8m)	Rural node context: roads often follow drainage lines; risk of increasing runoff and erosion; avoid widening into wetlands or communal grazing land.	With taxi rank upgrade and telecoms infrastructure, cumulative effect is node consolidation (positive), but risk of increased runoff and informal sprawl if not controlled.	Apply rural node street standards: narrow footprints, infiltration where feasible, strict avoidance of wetland/riparian edges; link walkways to a defined node boundary to prevent linear sprawl.	Potential LN1 road-related activities and LN1 watercourse-related triggers if drainage lines are affected; LN3 if works occur in sensitive mapped areas.
Upgrade taxi rank (Kilmun node) (Short programme; Kilmun; R1m)	Taxi ranks require large hardstands—manage runoff, waste, and oil contamination; avoid siting on flood-prone or riparian land common in rural nodes.	Cumulatively with walkways and paving, can increase impervious surfaces and activity intensity; positive if it consolidates transport activity and reduces dispersed impacts.	Confine to existing disturbed node footprint; require stormwater quality controls and waste management as planning conditions; integrate with pedestrian routes to limit additional land take.	If expansion triggers land transformation thresholds: LN1 Act 28; vegetation clearance may invoke LN1/LN2; LN3 if sensitive-area location applies.
Telecommunications infrastructure (node enabling) (Short programme; Kilmun; R2m)	Visual and landscape sensitivity (towers); avoid ridgelines, wetlands, and biodiversity corridors; manage access tracks.	With other node upgrades, cumulative risk is incremental infrastructure creep into surrounding sensitive rural landscapes if not spatially constrained.	Apply SDF rules: collocate infrastructure where possible; avoid ridgelines and sensitive habitats; confine enabling infrastructure to defined node/service areas; require access via existing tracks.	Depending on form (towers, masts, access roads), may trigger LN1 or LN3 activities if in sensitive areas or if clearance thresholds are exceeded (site-specific screening required).

8.8.9. PUBLIC FACILITIES AND CIVIC & SETTLEMENT CAPITAL PROJECTS

TABLE 44: ENVIRONMENTAL SENSITIVITY SCREENING PUBLIC FACILITIES AND CIVIC & SETTLEMENT CAPITAL PROJECTS

PROJECT (ROW)	KEY ENVIRONMENTAL CONSTRAINTS (BY NDZ TYPOLOGY/CONTEXT)	CUMULATIVE ENVIRONMENTAL IMPACTS (INTER-PROJECT)	STRATEGIC MITIGATION & SPATIAL GUIDANCE (SDF-LEVEL)	POTENTIAL EIA LISTING NOTICE TRIGGERS (LN1/LN2/LN3)
Construct pedestrian & vehicle bridge linking Bulwer	Valley settlement / watercourse sensitivity: bridges typically intersect river corridors, floodplains, and riparian buffers; hydraulic capacity and scour	With Bulwer road/stormwater upgrades (Table 121) this can cumulatively change hydrology and flood conveyance, increase hardening,	Apply a “river corridor protection” rule: bridge siting and approaches must avoid riparian encroachment; keep approaches within transformed	High likelihood of LN1 watercourse-related triggers (works in/adjacent to watercourse; excavation/infilling) and potentially road-related triggers for

PROJECT (ROW)	KEY ENVIRONMENTAL CONSTRAINTS (BY NDZ TYPOLOGY/CONTEXT)	CUMULATIVE ENVIRONMENTAL IMPACTS (INTER-PROJECT)	STRATEGIC MITIGATION & SPATIAL GUIDANCE (SDF-LEVEL)	POTENTIAL EIA LISTING NOTICE TRIGGERS (LN1/LN2/LN3)
CBD to social precinct (Short; Bulwer; R8m)	risk are critical. Biodiversity/river ecology: riparian habitat disturbance.	and induce more development/traffic across the corridor.	land; integrate with floodplain setback logic; treat the bridge as a spatial integration tool that supports compact CBD growth rather than opening new edge expansion fronts.	new/expanded approach works. LN3 may apply if the river corridor is within mapped sensitive areas (riparian buffers, CBAs/ESAs, etc.).
Youth centre (new build) (Short; Bulwer; R3m)	Low–moderate constraints if infill in CBD; avoid siting on flood-prone low-lying land or within riparian buffers; ensure sanitation/stormwater capacity.	With municipal offices + ablutions + CBD upgrades, cumulative risk is service load (sanitation/stormwater) and increased impervious footprint, but benefits accrue if it consolidates civic functions in the CBD.	Direct to existing transformed CBD land; apply flood-risk avoidance and stormwater attenuation as standard planning conditions; ensure the facility strengthens CBD consolidation.	Usually low-trigger if in transformed area. If greenfield or on agricultural land thresholds: LN1 Act 28 may apply; if indigenous vegetation clearance is needed: LN1 Act 27 / LN2 Act 15; LN3 if in sensitive areas.
Municipal / administration offices (new build) (Short; Bulwer; R4m)	Similar to youth centre: siting must avoid flood-prone and riparian-adjacent land; manage traffic and parking footprint to prevent edge encroachment.	Combined civic investment can reinforce Bulwer as an administrative node (positive) but cumulatively increases built footprint and runoff unless blue-green standards apply.	Use as a CBD anchor (infill first); cap parking footprint; integrate with pedestrian network and stormwater plan; apply strict avoidance of sensitive edges.	As above: generally low in transformed CBD; LN1 Act 28 and LN1 Act 27/LN2 Act 15 if greenfield/clearance thresholds; LN3 if sensitive-area location applies.
Cemetery upgrade & expansion (incl. servicing and access) (Short–Medium; Bulwer; R6m)	High constraint project: cemeteries are sensitive to groundwater, soils, slope stability, and proximity to watercourses/wetlands (pollution and leachate risk). Avoid floodplains and high water-table valley bottoms.	If expansion occurs in sensitive valley land, cumulative risk is long-term water quality and groundwater contamination, compounded by stormwater upgrades and flood events.	Require an SDF rule: cemetery expansion only on hydrogeologically suitable land (outside floodplains, away from rivers/wetlands, stable soils); protect buffers to watercourses; treat access upgrades as secondary to environmental suitability (do not “force” expansion via new roads into sensitive land).	Depending on location/scale: potential LN1 Act 28 (land development on agricultural land thresholds), LN1 Act 27/LN2 Act 15 for clearance, and LN3 if within sensitive mapped areas (notably riparian/wetland buffers). If earthworks interact with drainage lines, LN1 watercourse-related triggers may apply.
Multi-purpose community centre (new build) (Short programme; Kilmun; R2m)	Rural node constraints: avoid siting on drainage lines/wetlands common in valley-bottom settlement clusters; manage servicing and runoff to prevent erosion.	With Kilmun walkways/taxi rank/telecoms (Table 121) and housing (below), cumulative effect is node consolidation (positive) but increases impervious footprint and service demand.	Site strictly within the defined Kilmun node / transformed footprint; require stormwater attenuation and sanitation capacity checks; ensure the centre supports compact node growth rather than linear expansion along road corridors.	Generally low if infill. If it requires indigenous clearance or is in sensitive areas: LN1 Act 27 and/or LN3 location-based triggers may apply; LN1 Act 28 if developed on agricultural land above thresholds.

PROJECT (ROW)	KEY ENVIRONMENTAL CONSTRAINTS (BY NDZ TYPOLOGY/CONTEXT)	CUMULATIVE ENVIRONMENTAL IMPACTS (INTER-PROJECT)	STRATEGIC MITIGATION & SPATIAL GUIDANCE (SDF-LEVEL)	POTENTIAL EIA LISTING NOTICE TRIGGERS (LN1/LN2/LN3)
Low-income housing development (500 units) (Short programme; Kilmun; R55m)	Highest-risk: 500-unit housing implies substantial land take. Key constraints: floodplains/wetlands, steep slopes/erosion-prone soils, proximity to CBAs/ESAs, and the capacity of water/sanitation systems. In communal/rural nodes, the risk of siting on sensitive commons and drainage lines is elevated.	Major cumulative driver: housing + walkways/taxi rank + telecoms can induce rapid settlement expansion, increased runoff/erosion, increased wastewater load, and incremental encroachment into sensitive land if not contained. Also raises cumulative LN trigger likelihood (threshold exceedance and phased expansions).	Require explicit SDF conditions: (i) site as infill/edge-adjacent within a pre-screened, least-sensitive housing envelope; (ii) prohibit wetland/floodplain development; (iii) tie development phasing to confirmed bulk service capacity; (iv) set a hard settlement edge and protect CBAs/ESAs via overlays; (v) require compact layout and stormwater attenuation as planning requirements.	High likelihood of EIA screening depending on site context: LN1 Act 28 (development on agricultural land thresholds) and likely LN1 Act 27 / LN2 Act 15 (vegetation clearance, depending on extent). If located in sensitive areas (riparian buffers, CBAs/ESAs, etc.), LN3 triggers are likely; cumulative/phased expansion must be treated as a programme (cumulative threshold risk).

8.8.10. TRADITIONAL SETTLEMENT MASTER PLANS PROJECTS

TABLE 45: ENVIRONMENTAL SENSITIVITY SCREENING FOR TRADITIONAL SETTLEMENT MASTER PLAN PROJECTS

PROJECT TYPE / LOCATION	KEY ENVIRONMENTAL CONSTRAINTS (BY NDZ TYPOLOGY/CONTEXT)	CUMULATIVE ENVIRONMENTAL IMPACTS (INTER-PROJECT)	STRATEGIC MITIGATION & SPATIAL GUIDANCE (SDF-LEVEL)	POTENTIAL EIA LISTING NOTICE TRIGGERS (LN1 / LN2 / LN3)
Multi-purpose civic facility cluster / service hub (Vezakuhle; short-term; ±R30m)	Communal rural context: avoid siting on drainage lines, wetlands, flood-prone valley bottoms; manage sanitation and stormwater in areas with limited bulk services.	With SMME hubs, commercial nodes, and access upgrades, can cumulatively anchor settlement consolidation (positive) but also intensify service demand and impervious surfaces in sensitive catchments.	Require siting within pre-defined TSMP service nodes on already transformed land; enforce riparian/floodplain buffers; require confirmation of water/sanitation capacity before implementation.	If on agricultural land above thresholds: LN1 Act 28; if indigenous vegetation clearance required: LN1 Act 27 / LN2 Act 15; LN3 if within sensitive mapped areas (riparian buffers, CBAs/ESAs).
SMME hub infrastructure (Vezakuhle; short-medium; ±R40m)	Platforming, access, and market stalls imply earthworks and hardstand; avoid erosion-prone slopes and wetland margins common in traditional settlements.	Along with commercial/mixed-use servicing, can cumulatively expand informal trading footprints and traffic, increasing runoff and waste loads.	Confine to a single consolidated node; cap hardstand extent; require internal drainage and waste management as planning conditions; prevent ribbon development along access routes.	LN1 Act 28 likely if on agricultural land; LN1 Act 27 / LN2 Act 15 if clearance thresholds exceeded; LN3 in sensitive areas.

PROJECT TYPE / LOCATION	KEY ENVIRONMENTAL CONSTRAINTS (BY NDZ TYPOLOGY/CONTEXT)	CUMULATIVE ENVIRONMENTAL IMPACTS (INTER-PROJECT)	STRATEGIC MITIGATION & SPATIAL GUIDANCE (SDF-LEVEL)	POTENTIAL EIA LISTING NOTICE TRIGGERS (LN1 / LN2 / LN3)
Commercial & mixed-use node servicing (Vezakuhle; short-medium; ±R25m)	High risk of incremental expansion into communal grazing land, riparian zones, or wetlands if node boundaries are not fixed.	Multiple TSMP commercial nodes across NDZ cumulatively increase land transformation, traffic, and service pressure across rural catchments.	Define hard node boundaries in SDF/TSMP; prohibit leapfrog servicing outside nodes; apply flood-risk and biodiversity overlays as no-go constraints.	LN1 Act 28; vegetation clearance triggers LN1/LN2; LN3 where nodes overlap sensitive environments.
Light-industry / agri-processing serviced sites (Vezakuhle; medium; ±R100m)	High-impact project: platforming, access roads, and utilities pose erosion and drainage risks; avoid headwater catchments and CBAs/ESAs.	Together with similar sites in uMacala-Gwala and Masguswa, creates cumulative industrialisation pressure in rural landscapes and increased heavy-vehicle traffic.	Pre-identify least-sensitive agri-processing precincts; prohibit ad hoc site rollout; require stormwater attenuation and buffers to watercourses as SDF rules.	High likelihood of LN1 Act 28 and LN1 Act 27 / LN2 Act 15; LN3 very likely where sites intersect sensitive rural landscapes; cumulative/phased risk must be assessed.
Eco-tourism enabling infrastructure packages (multiple TAs; medium-long; ±R5-60m)	Trails, access, ablutions, viewpoints often intersect steep slopes, wetlands, and biodiversity corridors; high sensitivity near protected/WHS-influenced landscapes.	With tourism spines and access roads, cumulative effect is linear disturbance, habitat fragmentation, and increased access into previously low-disturbance areas.	Apply a municipal tourism carrying-capacity and routing framework; avoid duplication of trails; enforce no-go buffers around wetlands/headwaters; concentrate facilities at existing disturbed nodes.	Likely LN1 watercourse-related activities (crossings), LN1 Act 27 / LN3 Act 12(a) (clearance in sensitive areas); LN3 location triggers common.
Cooperative agriculture / agricultural support infrastructure (multiple TAs; short-medium; ±R5-10m)	Fencing, packhouses, water points can fragment landscapes and affect drainage; water abstraction points must avoid sensitive headwaters.	Across multiple settlements, cumulative risk is incremental agricultural intensification, fencing proliferation, and increased water demand.	Prioritise degraded land; cluster infrastructure; protect riparian corridors; align with catchment-level water availability and land capability rules.	LN1 Act 28 if development thresholds exceeded; LN1 Act 27 / LN2 Act 15 for clearance; LN3 where located in sensitive areas.
Local access & mobility upgrades / activity spines (Vezakuhle; short; ±R60m)	Roads often follow drainage lines; high erosion and sedimentation risk; avoid widening into wetlands and steep slopes.	Along with development corridor and connector spine upgrades, cumulative effect is road-led settlement expansion and fragmentation of CBAs/ESAs.	Upgrade existing alignments only; apply corridor-scale cumulative screening; require erosion control and strict settlement edge enforcement.	Likely LN1 road-related activities and LN1 watercourse-related triggers; LN3 if corridors traverse sensitive areas.
Development corridor road upgrades (Amakhuze; medium; ±R200m)	Major linear infrastructure through communal land: wetlands, rivers, steep slopes, biodiversity corridors.	One of the strongest cumulative drivers—corridor upgrades + node servicing can rapidly transform large	Treat as strategic corridors with controlled access; prohibit ribbon development; require cumulative	High likelihood of LN1 road activities, LN1 watercourse activities, LN1/LN2 vegetation

PROJECT TYPE / LOCATION	KEY ENVIRONMENTAL CONSTRAINTS (BY NDZ TYPOLOGY/CONTEXT)	CUMULATIVE ENVIRONMENTAL IMPACTS (INTER-PROJECT)	STRATEGIC MITIGATION & SPATIAL GUIDANCE (SDF-LEVEL)	POTENTIAL EIA LISTING NOTICE TRIGGERS (LN1 / LN2 / LN3)
		rural areas and induce secondary development.	corridor-level environmental screening before implementation.	clearance, and LN3 sensitive-area triggers.
Tourism spine enabling works (Amakhuze; medium-long; ±R25m)	Scenic and ecological sensitivity; avoid ridge-lines, wetlands, and protected-area buffers.	With eco-tourism packages elsewhere, cumulative risk of over-accessing sensitive landscapes.	Route consolidation; strict siting hierarchy; node-based tourism development only.	LN1 watercourse, LN3 location-based triggers likely.
Household relocation from constrained areas (Amakhuze & Zashuke; short; ±R10m)	New sites must avoid replicating risk (floodplains, steep slopes, CBAs); risk of opening new sensitive land for settlement.	If repeated across TSMPs, cumulative risk is incremental settlement spread into previously undeveloped land.	Pre-screen relocation sites via SEA/EMF rules; enforce compact layouts; tie relocation strictly to closure/rehabilitation of vacated sites.	LN1 Act 28; LN1 Act 27 / LN2 Act 15; LN3 if relocation sites fall in sensitive areas.
Public transport / development corridor upgrades (Sizanani & Bhidla; short-medium; ±R150m)	Similar to other corridor upgrades: drainage lines, wetlands, slope stability.	Strong cumulative effect with other road projects: settlement expansion, erosion, habitat fragmentation.	Corridor-level planning; upgrade stops within nodes only; avoid new spur roads.	LN1 road activities, LN1 watercourse, LN3 likely.
FPSU / service point facilities & civic facility nodes (Zashuke, Masguswa; short; ±R10-30m)	Moderate if infill; high if edge-based; sanitation and stormwater constraints in rural nodes.	Multiple civic nodes cumulatively increase service demand and impervious surfaces across rural catchments.	Strict node consolidation; confirm servicing capacity; apply no-go buffers to sensitive land.	LN1 Act 28, LN1 Act 27 / LN2 Act 15, LN3 where applicable.
Connector spine / residential linkage upgrades (Masguswa; short-medium; ±R150m)	Linear works through communal land; high erosion and induced development risk.	Adds to cumulative road-led sprawl risk across TSMP areas.	Upgrade existing alignments only; enforce settlement edges; apply cumulative corridor screening.	LN1 road, LN1 watercourse, LN3 triggers likely.

8.9. ALTERNATIVES AND MITIGATION STRATEGIES

Within a Strategic Environmental Assessment, the consideration of alternatives is not limited to technical design variations or site-specific layouts. Instead, alternatives function as strategic decision levers that influence *where*, *how*, and *in what sequence* development is enabled across the municipal space economy. For the Dr Nkosazana Dlamini-Zuma Local Municipality, the alternatives analysis therefore focuses on spatial logic, settlement structuring choices, corridor versus node-based investment, and development intensity management across environmentally sensitive rural and valley landscapes.

The SEA uses alternatives to test whether the Spatial Development Framework (SDF) can achieve its developmental objectives without locking in avoidable environmental risk, particularly cumulative impacts on watercourses, wetlands, biodiversity corridors, steep slopes, and climate-vulnerable catchments. Alternatives are thus evaluated against their ability to reduce irreversible impacts, avoid threshold exceedance under NEMA EIA Regulations, and maintain long-term ecological resilience while still enabling inclusive growth.

8.9.1. RELATIONSHIP BETWEEN ALTERNATIVES AND MITIGATION

At the strategic level, alternatives are the primary form of mitigation. Avoidance through spatial choice is prioritised over downstream mitigation measures. Where avoidance is not feasible, conditional or adaptive alternatives are applied, followed by mitigation through planning controls, sequencing, and institutional rules. This hierarchy is consistent with the mitigation hierarchy embedded in NEMA and the SEA Guidelines, and it informs the structure of mitigation strategies discussed later in this section.

8.9.2. STRATEGIC DEVELOPMENT ALTERNATIVES CONSIDERED

8.9.2.1. SPATIAL FORM ALTERNATIVES: DISPERSED GROWTH VERSUS STRUCTURED CONSOLIDATION

A fundamental alternative tested through the SEA is the distinction between dispersed, project-by-project development and structured spatial consolidation. Dispersed growth—particularly in traditional authority areas and rural valleys—was found to significantly elevate cumulative environmental risk. Incremental road upgrades, multiple small service facilities, and scattered housing or economic projects collectively increase vegetation clearance, watercourse crossings, erosion, and the likelihood of phased EIA triggers.

By contrast, a consolidation-based alternative—focusing development into defined nodes, service hubs, and pre-screened precincts—demonstrates substantially lower cumulative risk. Concentrated development reduces the total length of infrastructure corridors, limits the number of watercourse interactions, and allows bulk services to be upgraded in fewer, better-managed locations. The SEA therefore identifies structured nodal consolidation as the environmentally preferable alternative across all project categories, including traditional settlement master plans, economic development initiatives, and public facility investments.

8.9.2.2. LOCATION ALTERNATIVES: LEAST-SENSITIVE LAND FIRST

Across multiple project types, the SEA tested an alternative approach based on “least-sensitive land first”. This alternative prioritises development on already transformed land, degraded areas, or sites with lower ecological and hydrological sensitivity before considering greenfield expansion. In the NDZ context—characterised by valley bottoms, headwater catchments, and high biodiversity connectivity—this approach materially reduces risk to wetlands, rivers, and steep slopes.

The alternative contrasts sharply with opportunistic siting driven by land availability or short-term delivery pressure, which often pushes projects into floodplains, riparian buffers, or sensitive communal grazing land. The SEA concludes that adopting a least-sensitive-land sequencing rule at SDF level is a critical mitigation measure, particularly for housing, agri-processing, civic facilities, and road upgrades.

8.9.2.3. INFRASTRUCTURE ALIGNMENT ALTERNATIVES: UPGRADING EXISTING CORRIDORS VERSUS NEW ALIGNMENTS

For transport, service, and development corridors, the SEA assessed alternatives between upgrading existing alignments and introducing new routes or spines. New alignments, particularly in rural and traditional authority areas, were shown to carry disproportionately high environmental risk due to fresh disturbance of intact landscapes, additional river crossings, and induced ribbon development.

The environmentally preferable alternative is the upgrade and rationalisation of existing corridors, combined with strict access management and settlement edge enforcement. This alternative reduces habitat fragmentation, limits erosion risk, and lowers the probability of cumulative EIA Listing Notice triggers linked to phased road development.

8.9.2.4. PROGRAMMATIC ALTERNATIVES: PHASED ROLLOUT VERSUS BUNDLED IMPLEMENTATION

Another strategic alternative considered is whether projects are implemented individually, on an ad hoc basis, or bundled and sequenced as coordinated programmes. The SEA finds that uncoordinated rollout significantly increases cumulative risk, particularly for road upgrades, eco-tourism infrastructure, and agricultural support projects that repeat similar interventions across multiple settlements.

A programmatic alternative—where projects are grouped by corridor, catchment, or node and subjected to upfront cumulative screening—allows impacts to be managed collectively and thresholds to be anticipated. This approach also improves regulatory efficiency by reducing the likelihood of repeated, fragmented EIA processes.

8.9.3. STRATEGIC MITIGATION FRAMEWORK

8.9.3.1. AVOIDANCE AS THE PRIMARY MITIGATION STRATEGY

Avoidance is applied through spatial exclusion and red-flagging. The SEA identifies wetlands, riparian buffers, floodplains, CBAs/ESAs, steep slopes, and high-risk climate zones as areas where development should be prohibited or severely constrained. Embedding these exclusions into the SDF and Land Use Scheme ensures that mitigation is proactive rather than reactive.

Avoidance is particularly critical for high-impact project categories such as housing expansion, agri-processing sites, development corridors, and large civic facilities. In these cases, avoidance through spatial choice is far more effective than attempting to mitigate impacts post-approval.

8.9.3.2. CONDITIONAL DEVELOPMENT AND SPATIAL THRESHOLDS

Where avoidance is not feasible, the SEA recommends conditional development as a second-order mitigation strategy. Conditions operate at planning level and include requirements such as maximum development footprints, density thresholds, buffer enforcement, and service capacity confirmation prior to implementation.

Spatial thresholds are also applied to manage cumulative impacts. These include limits on the number of new road kilometres per catchment, caps on impervious surface expansion within valley settlements, and restrictions on

repeated vegetation clearance within defined planning units. These measures reduce the likelihood of cumulative Listing Notice triggers and long-term ecological degradation.

8.9.3.3. SEQUENCING AND PHASING AS MITIGATION TOOLS

Sequencing is a critical mitigation strategy in the NDZ context, where infrastructure and settlement growth often precede environmental controls. The SEA recommends reversing this pattern by requiring environmental and service readiness before development rollout. For example, housing or economic projects should only proceed once stormwater, sanitation, and access infrastructure are confirmed to meet capacity and environmental standards.

Phasing also allows environmental thresholds to be monitored and adjusted over time, particularly in sensitive catchments. This adaptive approach aligns with precautionary principles and reduces the risk of irreversible impacts.

8.9.3.4. CONSOLIDATION OF INFRASTRUCTURE AND SERVICE FOOTPRINTS

A recurring mitigation theme is the consolidation of infrastructure. Shared service hubs, multi-purpose facilities, and co-located economic infrastructure reduce land take and service duplication. Consolidation is particularly important in traditional settlement areas, where dispersed facilities can rapidly fragment landscapes and strain limited bulk services.

8.9.4. MITIGATION BY PROJECT CATEGORY

8.9.4.1. TRADITIONAL SETTLEMENT MASTER PLAN PROJECTS

For TSMP projects, mitigation focuses on node discipline, strict settlement edges, and avoidance of linear sprawl along access routes. Roads, civic

facilities, and economic nodes should reinforce compact settlement patterns rather than open new development fronts. Relocation projects must be tied to the rehabilitation of vacated sites to avoid net spatial expansion into sensitive land.

8.9.4.2. TRANSPORT AND CORRIDOR INFRASTRUCTURE

Mitigation for transport projects emphasises upgrading existing alignments, minimising road width expansion, and applying corridor-level cumulative screening. Drainage and stormwater controls are essential to prevent downstream erosion and water quality degradation, particularly in valley towns and foothill areas.

8.9.4.3. ECONOMIC DEVELOPMENT AND AGRI-PROCESSING

Economic infrastructure should be limited to pre-identified, least-sensitive precincts. The SEA discourages dispersed agri-processing and warehousing sites, recommending instead consolidated hubs with strict buffers to watercourses and biodiversity features. This approach reduces both biophysical risk and regulatory uncertainty.

8.9.4.4. TOURISM AND ECO-TOURISM INFRASTRUCTURE

Tourism mitigation focuses on carrying capacity, route rationalisation, and avoidance of sensitive headwaters and ridge lines. Trails, viewpoints, and access infrastructure should be consolidated and designed to limit linear disturbance. Tourism development should be phased and monitored to prevent cumulative over-use of sensitive landscapes.

8.9.5. INTEGRATION INTO SDF DECISION-MAKING

8.9.5.1. EMBEDDING MITIGATION INTO SPATIAL RULES

For mitigation to be effective, it must be embedded into the SDF as binding spatial rules, not discretionary guidance. This includes red-flag areas,

conditional development zones, and clearly articulated sequencing requirements. These rules provide certainty to both regulators and developers and reduce the risk of ad hoc decision-making.

8.9.5.2. ROLE OF THE SEA IN DOWNSTREAM AUTHORISATIONS

The SEA positions itself as an upstream decision-support tool that informs EIA screening and project-level authorisation. By identifying preferred alternatives and strategic mitigation early, the SEA reduces conflict at later stages and supports more efficient, defensible environmental governance.

9. STRATEGIC ENVIRONMENTAL MANAGEMENT FRAMEWORK

9.1. PURPOSE OF THE ENVIRONMENTAL MANAGEMENT OBJECTIVES

The environmental management objectives articulated in this Strategic Environmental Management Framework (SEMF) establish the normative environmental outcomes that must guide spatial planning, land use management, and development decision-making within the Dr Nkosazana Dlamini Zuma Local Municipality (NDZ LM). These objectives are explicitly forward-looking, spatially responsive, and decision-supportive, and are intended to operate alongside existing environmental instruments by translating their intent into clear planning and development signals.

Unlike project-level mitigation objectives, the objectives defined in this SEMF operate at a municipal and sub-municipal spatial scale. They are designed to shape the form, location, sequencing, and intensity of development over the SDF planning horizon (2026–2046), and to guide officials in consistently applying environmental considerations in development control, precinct planning, and capital investment prioritisation.

9.2. STRATEGIC FRAMING OF ENVIRONMENTAL OBJECTIVES

The environmental management objectives are structured to reflect the primary environmental risk drivers and spatial pressures evident within NDZ LM, including:

- High ecological sensitivity associated with upland catchments, river systems, wetlands, and biodiversity corridors
- Increasing development pressure within communal land and traditional authority areas
- Ongoing transformation and fragmentation of commercial agricultural landscapes

- Exposure to climate-related hazards, including flooding, erosion, drought, and slope instability
- Incremental and cumulative impacts arising from dispersed settlement growth, linear infrastructure, and service expansion

Each objective therefore responds not only to environmental sensitivity, but also to how land is used, governed, and transformed spatially.

9.3. STRATEGIC ENVIRONMENTAL MANAGEMENT OBJECTIVES

9.3.1. OBJECTIVE 1: SAFEGUARD ECOLOGICALLY SENSITIVE AND IRREPLACEABLE ENVIRONMENTAL ASSETS

Protect, maintain, and where necessary rehabilitate critical ecological systems—including mountain catchments, wetlands, riparian corridors, biodiversity corridors, and areas supporting threatened ecosystems—so that their ecological functioning, connectivity, and resilience are retained over the long term.

This objective establishes a clear avoidance-based planning principle, recognising that certain environmental assets cannot be offset or substituted once lost. It requires spatial planning and development control to prioritise no-go and highly restricted areas, particularly where cumulative impacts would compromise system integrity.

9.3.2. OBJECTIVE 2: DIRECT DEVELOPMENT AWAY FROM HIGH ENVIRONMENTAL RISK AND HAZARD-PRONE AREAS

Reduce environmental risk to people, infrastructure, and ecosystems by steering development away from flood-prone areas, unstable slopes, erosion-

prone landscapes, and environmentally constrained terrain, particularly within river valleys and steep upland areas.

This objective reinforces the principle that spatial planning must function as a risk avoidance tool, rather than relying on downstream engineering or remedial interventions. It explicitly links environmental management to disaster risk reduction and climate resilience, requiring that environmental constraints be treated as binding development considerations.

9.3.3. OBJECTIVE 3: MANAGE LAND TRANSFORMATION TO PREVENT CUMULATIVE AND IRREVERSIBLE ENVIRONMENTAL DEGRADATION

Limit the cumulative environmental impacts of incremental land transformation—particularly settlement expansion, infrastructure roll-out, and agricultural intensification—by enforcing spatial thresholds, containment principles, and sequencing rules.

This objective recognises that the most significant environmental impacts in NDZ LM arise not from single large developments, but from multiple small-scale, uncoordinated interventions over time. It therefore prioritises strategic control of development patterns rather than isolated project mitigation.

9.3.4. OBJECTIVE 4: PROTECT AND SUSTAIN PRODUCTIVE AGRICULTURAL LANDSCAPES AND ECOSYSTEM SERVICES

Safeguard high-value agricultural land and associated ecosystem services, including soil fertility, water regulation, and landscape connectivity, to support long-term rural livelihoods and food security while preventing environmentally harmful land use conversion.

This objective establishes agriculture as both an economic and environmental asset, requiring spatial planning to balance agricultural productivity with

ecological integrity, particularly where farming landscapes overlap with sensitive catchments and biodiversity corridors.

9.3.5. OBJECTIVE 5: PROMOTE CLIMATE-RESILIENT AND ENVIRONMENTALLY RESPONSIVE SETTLEMENT PATTERNS

Guide settlement growth and densification in a manner that enhances climate resilience, reduces environmental exposure, and limits resource inefficiency, particularly in rural and peri-urban settlement contexts.

This objective supports compact, well-located settlement patterns that align with service capacity and environmental constraints and discourages dispersed expansion into environmentally sensitive or high-risk areas.

9.3.6. OBJECTIVE 6: EMBED ENVIRONMENTAL CONSIDERATIONS INTO SPATIAL DECISION-MAKING AND DEVELOPMENT CONTROL

Ensure that environmental considerations are systematically integrated into spatial planning instruments, land use management decisions, precinct plans, and capital investment programmes, rather than treated as post-hoc compliance issues. This objective positions the SEMF as an active decision-support framework, enabling consistent interpretation of environmental priorities across departments and decision-making forums.

9.4. IMPLICATIONS FOR SPATIAL PLANNING AND DEVELOPMENT CONTROL

Collectively, these objectives establish a clear hierarchy of environmental priorities for NDZ LM. They require that:

- Environmental sensitivity and risk be treated as primary structuring elements of the spatial framework
- Avoidance and precaution take precedence over mitigation

- Development rights be considered conditional in environmentally constrained contexts
- Spatial planning plays a central role in managing long-term environmental sustainability

These objectives form the foundation for the strategic environmental strategies, desired environmental states, and development management directives articulated in subsequent sections of this framework.

9.5. STRATEGIC ENVIRONMENTAL STRATEGIES

The strategic environmental strategies articulated in this section translate the environmental management objectives into spatially differentiated, policy-level guidance that directly informs land use management, development control, precinct planning, and infrastructure sequencing within the Dr Nkosazana Dlamini Zuma Local Municipality (NDZ LM). These strategies are not intended to function as project-specific mitigation measures, but rather as a strategic planning instrument that shapes where, how, and under what conditions development may occur across the municipal landscape.

The strategies operate at a spatial and policy scale, prioritising avoidance of unacceptable environmental impacts, conditional management of development in sensitive contexts, and proactive direction of growth toward areas with greater environmental capacity. In doing so, they establish a consistent decision-making framework that addresses cumulative impacts, climate risk, and long-term environmental sustainability.

9.5.1. SPATIAL DIFFERENTIATION FRAMEWORK

The SEMF applies a differentiated environmental management approach that recognises the heterogeneous biophysical, ecological, and settlement characteristics of NDZ LM. Rather than applying uniform environmental controls across the municipality, the framework distinguishes between broad

spatial typologies that exhibit distinct sensitivities, risks, and development pressures.

These typologies include mountain and upland catchment areas, river valleys and associated wetlands and floodplains, communal land and traditional authority areas, commercial agricultural landscapes and high-value farmland, and areas adjacent to protected areas, Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs), and biodiversity corridors. This differentiation enables context-specific, proportionate, and spatially defensible environmental management responses that are better aligned with actual environmental conditions on the ground.

9.5.2. STRATEGIC ENVIRONMENTAL STRATEGIES

STRATEGY #1 – MOUNTAIN & UPLAND CATCHMENT AREAS: Mountain and upland catchment areas within NDZ LM perform a critical ecological and hydrological function, regulating water flows, supporting biodiversity, and reducing downstream disaster risk. The strategic intent in these areas is therefore to maintain ecological functioning and catchment integrity over the long term.

Strategic environmental management in upland catchments prioritises avoidance of land transformation that would compromise slope stability, runoff regulation, and ecosystem connectivity. New settlement expansion and land-intensive development are strongly discouraged, particularly where such activities would exacerbate erosion, increase sedimentation, or undermine downstream water security. Linear infrastructure development is to be highly restricted and permitted only where there is a clear strategic justification, with route alignment and cumulative impacts carefully considered. Where disturbance has already occurred, spatial planning should prioritise rehabilitation and stabilisation rather than additional development. Overall, upland catchments are treated as predominantly no-go areas for development, with only very limited and highly conditional exceptions.

STRATEGY #2 – RIVER VALLEYS, WETLANDS, AND FLOODPLAINS: River valleys, wetlands, and floodplains represent some of the most environmentally sensitive and hazard-prone areas within the municipality. These systems provide essential ecosystem services, including flood attenuation, water purification, and biodiversity support, while also posing significant risk to development due to flooding and erosion.

The strategic approach in these areas is one of strict protection and risk avoidance. Wetlands, riparian buffers, and flood-prone zones are to be excluded from most forms of development, with spatial planning reinforcing their role as ecological and hydrological infrastructure. Settlement intensification and infrastructure investment within floodplains are discouraged, particularly where incremental encroachment has already increased risk exposure. River corridors are to be maintained as continuous ecological systems, with restoration of degraded riparian areas actively promoted as a spatial priority. Development within these areas is generally prohibited, with only low-impact, water-compatible uses considered under tightly controlled conditions.

STRATEGY #3 – COMMUNAL LAND & TRADITIONAL AUTHORITY

AREAS: Communal land and traditional authority areas experience significant development pressure in the form of dispersed settlement growth and incremental land transformation. The strategic intent in these areas is to manage growth in a manner that reduces cumulative environmental degradation while supporting sustainable livelihoods and equitable access to services.

Environmental strategies in communal areas emphasise spatial structuring and consolidation, directing settlement growth toward defined nodes and prioritised development areas rather than allowing unchecked expansion into environmentally sensitive landscapes. Environmental thresholds are to be applied to incremental land transformation, particularly in relation to wetlands, steep slopes, and biodiversity corridors. Local area plans and traditional

settlement frameworks must explicitly integrate environmental constraints to guide land allocation decisions. Development in communal areas is therefore treated as conditional, with environmental considerations embedded into spatial planning and land management processes.

STRATEGY #4 – COMMERCIAL AGRICULTURE & HIGH VALUE

FARMLAND: Commercial agricultural landscapes and high-value farmland play a dual role as economic assets and providers of ecosystem services. The strategic intent in these areas is to protect long-term agricultural productivity while preventing environmentally harmful intensification and irreversible land use conversion.

Environmental management strategies discourage fragmentation of agricultural land and conversion to non-agricultural uses that would undermine farming viability. Agricultural practices and associated infrastructure are expected to align with soil conservation, water protection, and biodiversity connectivity objectives. Development proposals that would permanently compromise agricultural potential or ecosystem services are to be restricted, while agricultural expansion and investment are to be aligned with environmental carrying capacity. These areas are generally compatible with development, provided that agricultural protection and environmental performance conditions are met.

STRATEGY #5 – AREAS ADJACENT TO PROTECTED AREAS, CBAS, ESAS,

& BIODIVERSITY CORRIDORS: Areas adjacent to protected areas, CBAs, ESAs, and biodiversity corridors are critical for maintaining ecological connectivity and preventing edge effects that erode conservation value. The strategic intent in these areas is to ensure that surrounding land uses do not undermine conservation outcomes.

Environmental strategies in these contexts apply buffer-based planning principles, restricting land uses that introduce disturbance, fragmentation, or pollution risks. Development proposals must demonstrate ecological

compatibility and account for cumulative edge effects. Priority is given to land uses that support conservation objectives, such as conservation-compatible agriculture, eco-tourism, or low-intensity activities that maintain landscape permeability. Development in these areas is therefore highly conditional, with strong emphasis on compatibility and long-term ecological integrity.

9.5.3. CROSS-CUTTING STRATEGIC THEMES

Across all spatial typologies, a set of cross-cutting strategic themes applies. Cumulative impact management is central, requiring decision-makers to consider the additive effects of multiple developments over time rather than assessing proposals in isolation. Climate resilience is treated as a core spatial planning concern, with strategies aimed at reducing exposure to climate hazards and enhancing adaptive capacity. An avoidance-first logic underpins all environmental decision-making, particularly in high-risk or highly sensitive areas, while spatial sequencing principles ensure that development and infrastructure investment follow environmental capacity rather than precede it.

9.5.4. STRATEGIC IMPLICATIONS FOR PLANNING AND DECISION-MAKING

Taken together, the strategic environmental strategies establish a graduated spatial response framework for NDZ LM that clearly differentiates between areas where development should be prohibited, areas where it may be permitted subject to conditions, and areas where it is broadly compatible with environmental objectives. These strategies provide a direct bridge between high-level environmental objectives and the Desired Environmental State, development management directives, and monitoring framework articulated in subsequent sections of the SEMF.

9.6. DESIRED ENVIRONMENTAL STATE (DES)

9.6.1. PURPOSE AND FUNCTION OF THE DESIRED ENVIRONMENTAL STATE

The Desired Environmental State (DES) defines the intended long-term environmental outcomes that spatial planning, land use management, and development decision-making within the Dr Nkosazana Dlamini Zuma Local Municipality (NDZ LM) must collectively achieve. The DES functions as a forward-looking planning benchmark, translating strategic environmental objectives and strategies into measurable, time-bound expressions of environmental condition and performance.

Rather than prescribing project-level targets, the DES uses quantitative and semi-quantitative proxies that are appropriate to a municipal planning scale. These proxies provide clear directional signals to decision-makers while avoiding false precision or unrealistic monitoring burdens. The DES is structured across short-, medium-, and long-term time horizons, aligned with the SDF planning period, to reflect both immediate priorities and long-term environmental resilience.

9.6.2. TEMPORAL FRAMEWORK FOR THE DESIRED ENVIRONMENTAL STATE

The DES is articulated across three interrelated time horizons. The short-term DES (0–5 years) focuses on halting further environmental degradation, strengthening avoidance-based decision-making, and embedding environmental considerations into spatial planning instruments and development control processes. The medium-term DES (5–15 years) emphasises stabilisation, consolidation, and gradual improvement of environmental conditions through managed land use patterns and rehabilitation interventions. The long-term DES (15–30 years) reflects the

intended steady-state environmental condition toward which spatial planning and development management should converge, characterised by resilient ecosystems, reduced environmental risk, and environmentally appropriate settlement patterns.

9.6.3. SPATIAL DIFFERENTIATION OF THE DESIRED ENVIRONMENTAL STATE

The DES is spatially differentiated to reflect the diverse environmental contexts within NDZ LM. Desired outcomes vary between upland catchments, river systems, communal land areas, agricultural landscapes, and biodiversity priority areas. This differentiation ensures that the DES remains sensitive to local environmental capacity and risk, while still providing a coherent municipal-wide vision of environmental sustainability.

9.6.4. DESIRED ENVIRONMENTAL STATE MATRIX

The table below sets out the Desired Environmental State for key environmental components across different spatial contexts and time horizons, together with the core planning implications arising from each desired outcome.

TABLE 46: DESIRED ENVIRONMENTAL STATE MATRIX

ENVIRONMENTAL COMPONENT	SPATIAL CONTEXT / TYPOLOGY	SHORT-TERM DES (0–5 YEARS)	MEDIUM-TERM DES (5–15 YEARS)	LONG-TERM DES (15–30 YEARS)	KEY PLANNING IMPLICATIONS
Catchment integrity and slope stability	Mountain and upland catchments	No further expansion of settlement or land-intensive development; active identification of erosion hotspots	Stabilisation of erosion-prone areas and rehabilitation of degraded slopes	Functionally intact catchments with minimal anthropogenic disturbance	Upland areas treated as no-go for development; strong avoidance and rehabilitation focus
Wetlands and riparian systems	River valleys, wetlands, floodplains	No net loss of wetlands and riparian buffers; halt encroachment	Progressive rehabilitation of degraded wetlands and river corridors	Fully functioning aquatic systems providing flood regulation and ecosystem services	Strict development exclusion zones; river corridors protected as green infrastructure
Flood risk and hazard exposure	Flood-prone and low-lying areas	No increase in development exposure to flood risk	Gradual reduction in existing exposure through avoidance and spatial restructuring	Settlements largely located outside high-risk flood zones	Flood risk treated as binding constraint in spatial planning and development control
Settlement footprint and land transformation	Communal land and rural settlements	Containment of dispersed settlement expansion; prioritisation of nodal growth	Consolidation of settlement patterns within defined growth areas	Stable, structured settlement system aligned with environmental capacity	Settlement growth subject to spatial thresholds and consolidation rules
Biodiversity connectivity	CBAs, ESAs, biodiversity corridors	No further fragmentation of priority biodiversity areas	Improved ecological connectivity through compatible land uses	Continuous, resilient biodiversity networks across the municipality	Buffer-based planning; high compatibility thresholds for adjacent development
Agricultural land and soil resources	Commercial agriculture and high-value farmland	No significant conversion of high-value agricultural land	Stabilised agricultural footprint with improved environmental performance	Long-term agricultural viability with maintained ecosystem services	Agricultural protection embedded in land use decision-making
Climate resilience and environmental risk	Municipal-wide	Avoidance of new development in high-risk areas; climate risk integrated into planning	Reduced vulnerability through spatial restructuring and ecosystem-based adaptation	Climate-resilient settlement and land use patterns	Climate risk mainstreamed into SDF, precinct plans, and investment decisions

9.6.5. PLANNING AND DECISION-MAKING IMPLICATIONS OF THE DES

The Desired Environmental State provides a clear benchmark against which planning proposals, land use applications, and strategic investments must be assessed. Development that would move environmental conditions away from the DES—particularly where it results in irreversible loss, increased risk, or cumulative degradation—should be regarded as fundamentally misaligned with the SDF and SEMF intent.

Conversely, development and spatial interventions that demonstrably contribute toward achieving the DES, whether through avoidance, consolidation, rehabilitation, or improved spatial efficiency, should be prioritised. Over time, the DES serves as a mechanism for adaptive spatial governance, enabling the municipality to track progress, identify emerging risks, and recalibrate strategies where necessary.

9.7. ENVIRONMENTAL INDICATORS, MONITORING AND EVALUATION FRAMEWORK

The Monitoring and Evaluation (M&E) framework provides the mechanism through which the Strategic Environmental Management Framework (SEMF) is translated from a policy and planning instrument into an adaptive management tool. Its primary purpose is to enable the Dr Nkosazana Dlamini Zuma Local Municipality (NDZ LM) to track progress toward the Desired Environmental State (DES), identify emerging environmental risks, and inform corrective action through spatial planning, development control, and policy review.

The M&E framework is intentionally strategic rather than operational. It does not function as a compliance checklist for individual developments, nor does it replace statutory environmental monitoring requirements. Instead, it focuses on municipal-scale trends, spatial patterns, and cumulative outcomes,

ensuring that environmental performance is assessed in relation to planning intent and spatial transformation over time.

9.7.1. PRINCIPLES UNDERPINNING THE M&E FRAMEWORK

The M&E framework is underpinned by a set of guiding principles that reflect both best practice and the practical realities of municipal governance. Indicators are designed to be decision-relevant, directly linked to environmental objectives, strategies, and the DES, and capable of informing spatial planning reviews and development management decisions. While the framework adopts an aspirational, best-practice orientation, it explicitly acknowledges institutional and data limitations and distinguishes between indicators that can be implemented immediately and those that require progressive capacity development.

A further principle is the prioritisation of trend-based monitoring over absolute measurement. This approach recognises that incremental change and cumulative impacts are the primary environmental risks facing NDZ LM, and that early identification of negative trajectories is more valuable for planning intervention than precise quantification.

9.7.2. INSTITUTIONAL INTEGRATION AND USE OF THE M&E FRAMEWORK

The SEMF M&E framework is intended to be integrated into existing municipal planning and governance processes, rather than operating as a standalone reporting exercise. Monitoring outputs should inform periodic SDF reviews, precinct planning processes, land use management decision-making, and strategic IDP alignment. Responsibility for monitoring is distributed across relevant municipal functions, with coordination required to ensure consistency and institutional learning.

Importantly, the framework is designed to support adaptive planning, allowing strategies and development management directives to be refined where monitoring indicates misalignment with the DES or emerging environmental pressures.

9.7.3. ENVIRONMENTAL INDICATORS AND MONITORING MATRIX

The table below sets out the core environmental indicators associated with the SEMF objectives and strategies, linked to the Desired Environmental State and spatial planning processes.

9.7.4. ENVIRONMENTAL MONITORING AND EVALUATION

TABLE 47: ENVIRONMENTAL MONITORING & EVALUATION

ENVIRONMENTAL OBJECTIVE / STRATEGY	INDICATOR	SPATIAL SCALE	DATA SOURCE	MONITORING FREQUENCY	RESPONSIBLE FUNCTION	USE IN DECISION-MAKING
Protection of upland catchments	Extent of new development approvals within upland catchment areas	Catchment / municipal	Land use approvals; GIS layers	Annual	Planning & Environmental Functions	Identify inappropriate approvals; inform refusal and rehabilitation priorities
Wetland and riparian protection	Net change in mapped wetland and riparian extent	Municipal / river systems	Existing environmental datasets; land use records	3–5 yearly	Environmental Planning	Trigger stricter controls where loss or encroachment is detected
Flood risk avoidance	Number of new developments approved within flood-prone areas	Municipal / floodplains	Disaster management records; planning approvals	Annual	Planning & Disaster Management	Inform spatial exclusion zones and development control conditions
Settlement containment	Rate of settlement expansion outside defined growth areas	Settlement / nodal	GIS settlement footprint analysis	3–5 yearly	Spatial Planning	Assess effectiveness of consolidation strategies; adjust growth boundaries
Biodiversity connectivity	Degree of fragmentation within CBAs and corridors	Municipal / biodiversity areas	Biodiversity layers; land use change analysis	5 yearly	Environmental Planning	Strengthen buffer policies and compatibility requirements
Agricultural land protection	Area of high-value agricultural land converted to non-agricultural use	Municipal / agricultural areas	Land use approvals; agricultural datasets	3–5 yearly	Planning & LED	Inform land use refusal and agricultural protection policies
Climate risk exposure	Trends in development exposure to climate-related hazards	Municipal	Disaster risk assessments; planning data	3–5 yearly	Disaster Management	Adjust spatial risk avoidance and resilience strategies
Cumulative land transformation	Overall rate and spatial pattern of land use change	Municipal-wide	GIS change detection	5 yearly	Spatial Planning	Inform SDF review and strategic spatial realignment

9.7.5. CAPACITY CONSTRAINTS AND PROGRESSIVE IMPLEMENTATION

While the M&E framework reflects best-practice principles, it is acknowledged that full implementation may be constrained by data availability, technical capacity, and institutional coordination. These constraints should not dilute the intent of the framework, but rather inform a phased approach to implementation, where priority indicators are monitored first and additional indicators are progressively introduced as capacity improves.

Where primary data is unavailable, the use of proxy indicators and qualitative trend assessment is considered acceptable, provided that such limitations are transparently acknowledged in decision-making processes.

9.7.6. FEEDBACK LOOPS AND ADAPTIVE MANAGEMENT

Monitoring outputs must feed back into planning and decision-making processes in a structured manner. Where indicators reveal deviation from the Desired Environmental State, the municipality should respond by tightening development controls, revising spatial strategies, or prioritising rehabilitation and consolidation interventions. Conversely, positive trends should reinforce existing approaches and inform the scaling up of effective strategies.

In this way, the M&E framework ensures that the SEMF remains a living instrument, capable of responding to changing environmental conditions, development pressures, and institutional learning over the SDF planning horizon.

9.8. DEVELOPMENT MANAGEMENT DIRECTIVES

This section consolidates the Strategic Environmental Management Framework (SEMF) into a single, coherent set of development management directives that translate environmental objectives, strategies, and the Desired Environmental State into clear spatial planning and land use decision rules. The

directives are explicitly designed to guide day-to-day development control, precinct planning, and infrastructure sequencing, while remaining at framework level rather than functioning as statutory zoning or scheme clauses.

The directives provide clarity on where development is prohibited, where it may be conditionally permissible, and where it is generally compatible, thereby reducing discretionary inconsistency and strengthening defensibility of municipal decisions. They also ensure that environmental considerations are applied upstream in spatial planning, rather than retrospectively at project approval stage.

9.8.1. CORE DEVELOPMENT MANAGEMENT LOGIC

Across the municipality, environmental decision-making must be guided by an avoid–condition–direct hierarchy. Areas of high ecological sensitivity or environmental risk are treated as binding constraints where development avoidance is the default position. Moderately sensitive areas are subject to conditional development, where land use rights may be exercised only if spatial thresholds, performance requirements, and compatibility tests are met. Areas of lower environmental sensitivity are generally compatible with development, provided that cumulative impacts and infrastructure capacity are adequately managed. This hierarchy applies irrespective of land tenure or settlement type and must be applied consistently across communal land, commercial farmland, urban settlements, and rural areas.

9.8.2. SPATIAL PLANNING AND DEVELOPMENT CONTROL SYNTHESIS

The table below provides a single, integrated synthesis of SEMF rules for application in planning and development management.

TABLE 48: CONSOLIDATED DEVELOPMENT MANAGEMENT DIRECTIVES

SPATIAL CONTEXT / TYPOLOGY	DEVELOPMENT STATUS	PRIMARY DIRECTIVES	DECISION-MAKING IMPLICATIONS
Mountain and upland catchments	No-go / Highly restricted	Prohibit new settlement expansion and land-intensive uses; restrict linear infrastructure to strategic necessity; prioritise rehabilitation	Applications generally refused; only exceptional, demonstrably unavoidable proposals considered
River valleys, wetlands, floodplains	No-go (except low-impact uses)	Exclude development from wetlands, riparian buffers, and flood-prone areas; protect river corridors as ecological infrastructure	Flood and wetland constraints treated as binding; avoidance preferred over engineering solutions
Biodiversity priority areas (CBAs, ESAs, corridors)	Highly conditional	Prevent further fragmentation; apply buffers; require ecological compatibility and cumulative impact consideration	Strong conditions or refusal where connectivity or integrity is compromised
Communal land and traditional authority areas	Conditional	Direct growth to nodes; limit dispersed expansion; apply environmental thresholds and spatial structuring	Land use approvals contingent on alignment with spatial frameworks and environmental capacity
Commercial agriculture and high-value farmland	Generally compatible (with limits)	Discourage fragmentation and conversion; protect soil, water, and ecosystem services	Non-agricultural uses subject to strict scrutiny; agricultural viability prioritised
Existing urban and nodal settlements	Generally compatible	Promote consolidation and infill; avoid expansion into sensitive or high-risk areas	Development supported where aligned with spatial intent and environmental limits

9.8.3. SEQUENCING, THRESHOLDS, AND TRIGGERS

Development approvals must be informed by sequencing and threshold logic, ensuring that growth follows environmental capacity and infrastructure readiness. Where cumulative impacts approach or exceed acceptable thresholds—such as loss of wetlands, increased flood exposure, or settlement encroachment into sensitive landscapes—decision-makers are required to tighten controls, defer approvals, or redirect development to more suitable locations. Triggers for additional scrutiny, refusal, or spatial review include:

- Repeated development pressure within environmentally constrained areas
- Incremental loss of ecological or agricultural assets
- Increased exposure to climate-related hazards
- Misalignment between proposed development and the Desired Environmental State

9.8.4. APPLICATION IN DEVELOPMENT CONTROL AND PRECINCT PLANNING

These directives must be applied consistently across:

- Land use change and subdivision applications
- Consent uses and departures
- Precinct and local area plans
- Infrastructure and capital investment decisions

The SEMF should be explicitly cited in decision records where environmental considerations influence approval, conditioning, or refusal, thereby strengthening transparency and defensibility.

9.9. IMPLEMENTATION AND INSTITUTIONAL ALIGNMENT (SDF INSERTION)

This subsection provides concise guidance for integrating the SEMF into the implementation machinery of the Spatial Development Framework (SDF). Its purpose is to ensure that the SEMF informs not only policy intent, but also the operational decisions through which spatial outcomes are realised.

9.9.1. ALIGNMENT WITH SDF INSTRUMENTS AND PROCESSES

The SEMF must be applied as a cross-cutting reference framework across all SDF-related instruments and processes. This includes informing the interpretation of spatial concepts, the delineation of growth areas, and the application of spatial policies within precinct plans and nodal strategies. Where there is ambiguity in spatial policy interpretation, SEMF directives should guide the environmental reading of spatial intent.

9.9.2. INSTITUTIONAL RESPONSIBILITIES AND COORDINATION

Implementation of the SEMF requires coordinated action across municipal functions, particularly spatial planning, environmental management, disaster risk management, and infrastructure planning. While no new institutional structures are required, clear internal alignment is necessary to ensure that environmental considerations are consistently applied at all decision points.

Environmental planning functions should play a supporting and advisory role in development control, while spatial planning functions retain responsibility for final decision-making within the SPLUMA framework.

9.9.3. INTEGRATION WITH CAPITAL INVESTMENT AND PHASING

The SEMF must inform capital investment prioritisation by identifying areas where infrastructure investment would exacerbate environmental risk or

induce unsustainable development patterns. Conversely, investment should be prioritised in areas that support settlement consolidation, environmental rehabilitation, and long-term resilience. This alignment ensures that public investment reinforces, rather than undermines, environmental and spatial objectives.

9.9.4. ADAPTIVE REVIEW AND UPDATING

The SEMF is intended to be a living framework, reviewed and refined through periodic SDF updates and informed by monitoring outcomes. Where environmental indicators demonstrate divergence from the Desired Environmental State, the municipality must respond through tighter development controls, revised spatial strategies, or targeted rehabilitation initiatives.

10. INTEGRATION WITH MUNICIPAL AND DISTRICT PLANNING

The integration of environmental considerations into municipal and district planning instruments is a statutory and strategic requirement in terms of the Spatial Planning and Land Use Management Act (SPLUMA), the Municipal Systems Act (MSA), and the National Environmental Management Act (NEMA). Collectively, these frameworks require that spatial planning promote sustainability, cooperative governance, spatial justice, environmental protection, and intergovernmental alignment.

Within the Dr. Nkosazana Dlamini Zuma (NDZ) Municipality, the Strategic Environmental Assessment (SEA) functions as the environmental mainstreaming mechanism that strengthens the Spatial Development Framework (SDF). Its role is not to duplicate sector plans, but to ensure that environmental sensitivities, climate risks, biodiversity assets, and infrastructure constraints are spatially embedded in long-term development decision-making.

10.1. ALIGNMENT WITH MUNICIPAL AND DISTRICT PLANNING INSTRUMENTS

10.1.1. INTEGRATED DEVELOPMENT PLAN (IDP)

The Integrated Development Plan (IDP) is the municipality's principal strategic planning instrument and guides budgeting, infrastructure investment, and service delivery priorities. The IDP identifies key challenges including infrastructure backlogs (water, sanitation, electricity), unemployment, dispersed rural settlements, and environmental vulnerability.

10.1.1.1. AREAS OF ENVIRONMENTAL ALIGNMENT

The IDP recognises:

- The need for protection of natural resources
- Climate change as a cross-cutting risk
- Backlogs in water and sanitation infrastructure
- Disaster risk exposure in rural settlements

The SEA strengthens this alignment by spatially translating these priorities into land-use directives. For example:

- Infrastructure upgrades are directed toward existing nodes and serviceable settlements rather than reinforcing dispersed growth.
- Environmentally sensitive areas (CBAs, ESAs, wetlands, flood-prone areas) are spatially excluded from expansion zones.
- Infrastructure sequencing is aligned with environmental carrying capacity.

10.1.1.2. GAPS AND RISKS

While the IDP identifies environmental concerns, it does not always spatially differentiate between suitable and constrained land. There is a risk that infrastructure-led expansion may occur in environmentally sensitive areas if spatial controls are weak.

10.1.1.3. SEA STRATEGIC RESPONSE

The SEA introduces:

- Risk-sensitive land-use steering mechanisms.
- Infrastructure-first growth consolidation policies.
- Climate and disaster overlays to guide investment prioritisation.

- A spatial hierarchy that links environmental capacity with capital investment planning.

The SEA therefore operationalises environmental sustainability within IDP implementation.

10.1.2. LOCAL ECONOMIC DEVELOPMENT (LED) STRATEGY

The LED Strategy promotes agriculture, agro-processing, tourism, SMMEs, and rural economic development as primary growth drivers. NDZ's economic profile is heavily reliant on agriculture and tourism, particularly in the Drakensberg region.

10.1.2.1. AREAS OF ENVIRONMENTAL ALIGNMENT

The LED Strategy aligns with environmental sustainability in the following ways:

- Promotion of agri-value chains and local beneficiation.
- Expansion of tourism linked to natural landscapes.
- Recognition of green economy potential.

The SEA supports these objectives by:

- Identifying agricultural land capability and protecting high-value soils.
- Safeguarding biodiversity corridors essential for eco-tourism.
- Directing tourism expansion toward areas with environmental resilience and infrastructure capacity.

10.1.2.2. ENVIRONMENTAL RISKS

Unmanaged agricultural expansion may:

- Encroach on Critical Biodiversity Areas (CBAs).
- Increase soil erosion on steep slopes.

- Impact river systems and water quality.

Tourism growth may increase pressure on sensitive ecosystems if not spatially managed.

10.1.2.3. SEA STRATEGIC RESPONSE

The SEA introduces:

- Agricultural protection zones.
- Slope and erosion risk thresholds.
- Biodiversity corridor protection.
- Eco-tourism zoning aligned with conservation frameworks.
- Green economy promotion (renewables, sustainable agriculture).

Through this integration, economic diversification is spatially conditioned by ecological sustainability.

10.1.3. CLIMATE CHANGE RESPONSE STRATEGY

The municipal and district climate strategies identify:

- Increased flood risk.
- Drought vulnerability.
- Veldfire exposure.
- Infrastructure fragility.
- Socioeconomic vulnerability in dispersed rural settlements.

10.1.3.1. AREAS OF ALIGNMENT

The SDF integrates climate considerations by:

- Avoiding expansion in flood-prone areas.
- Directing growth toward resilient nodes.

- Recognising the Drakensberg catchment as a strategic water resource area.
- Promoting compact settlement patterns.

10.1.3.2. GAPS AND RISKS

Climate policy is often strategic and non-spatial. Without spatial overlays, adaptation measures may not influence land-use decisions effectively.

10.1.3.3. SEA STRATEGIC RESPONSE

The SEA strengthens climate mainstreaming by:

- Embedding hazard overlays (flood, fire, slope instability).
- Prioritising densification over peripheral expansion.
- Protecting ecological infrastructure (wetlands, rivers).
- Aligning infrastructure investment with resilience principles.

This ensures climate change adaptation is not treated as a sector issue but as a spatial structuring determinant.

10.1.4. DISASTER MANAGEMENT FRAMEWORK

The Disaster Management Framework identifies:

- Flood hazard zones.
- Lightning risk.
- Fire-prone rural areas.
- Vulnerable housing typologies.
- Inadequate emergency infrastructure.

10.1.4.1. AREAS OF ALIGNMENT

The SDF recognises that:

- Dispersed settlements increase response time and vulnerability.
- Infrastructure backlogs exacerbate disaster exposure.
- Environmental degradation increases hazard severity.

10.1.4.2. SEA STRATEGIC RESPONSE

The SEA introduces:

- Risk avoidance as a primary spatial principle.
- Development exclusion in high-risk zones.
- Settlement consolidation to reduce vulnerability.
- Infrastructure sequencing tied to hazard mitigation.

The SEA thereby shifts disaster management from reactive to preventative spatial planning.

10.1.5. KWAZULU-NATAL PROVINCIAL SPATIAL DEVELOPMENT FRAMEWORK (PSDF)

KwaZulu-Natal Provincial Spatial Development Framework

The KZN PSDF establishes:

- Provincial node hierarchy.
- Development corridors.
- Integration zones.
- Biodiversity protection sub-frames.
- Cross-border alignment directives.

10.1.5.1. AREAS OF ALIGNMENT

NDZ is identified as:

- A rural service region.
- A tourism and agricultural zone.
- A gateway to Lesotho.
- A strategic ecological area.

The NDZ SDF aligns by:

- Reinforcing nodal development (Underberg, Himeville, Bulwer, Donnybrook).
- Protecting ecological corridors.
- Avoiding ribbon development.
- Supporting productive rural landscapes.

10.1.5.2. RISKS

Potential inconsistencies may arise if local economic pressures override provincial environmental priorities.

10.1.5.3. SEA STRATEGIC RESPONSE

The SEA ensures:

- Provincial biodiversity sub-frames are embedded locally.
- Corridor development avoids ecological fragmentation.
- Node expansion respects environmental carrying capacity.

This secures vertical spatial coherence.

10.2. CROSS-BORDER ENVIRONMENTAL LINKAGES: LESOTHO

NDZ Municipality functions as a gateway to Lesotho and shares:

- The Drakensberg mountain system.
- Strategic water catchments.
- Biodiversity corridors.
- Climate vulnerability patterns.

Shared Environmental Systems

- The Maloti-Drakensberg system is a transboundary ecological asset.
- Rivers originating in Lesotho feed downstream systems in KZN.
- Climate shifts affect both sides of the border simultaneously.

Risks of Uncoordinated Development

- Catchment degradation upstream impacts downstream water security.
- Tourism pressure may fragment biodiversity corridors.
- Road expansion could accelerate erosion in steep terrain.

Opportunities for Cooperation

- Joint catchment management.
- Transboundary eco-tourism circuits.
- Biodiversity corridor alignment.
- Climate adaptation collaboration.

SEA Strategic Directives

- Recognise cross-border catchments as strategic ecological infrastructure.
- Align tourism development with conservation zoning.

- Strengthen corridor continuity across municipal and national boundaries.
- Advocate for coordinated monitoring frameworks.

10.2.1. STRATEGIC ENVIRONMENTAL INTEGRATION ANALYSIS

The integration assessment indicates:

10.2.1.1. VERTICAL INTEGRATION

Strong alignment exists between:

- Provincial PSDF ecological frameworks.
- District climate and disaster strategies.
- Municipal SDF structuring principles.

The SEA ensures these are spatially operationalised rather than conceptually acknowledged.

10.2.1.2. HORIZONTAL INTEGRATION

Environmental sustainability intersects with:

- Economic development (green agriculture, eco-tourism).
- Infrastructure investment (resilience-first planning).
- Human settlements (risk-sensitive consolidation).

10.2.1.3. ADDED VALUE OF THE SEA

The SEA:

- Translates sector policy into spatial controls.
- Introduces environmental thresholds.
- Identifies risk overlays.
- Links infrastructure sequencing to environmental capacity.

11. MITIGATION AND ADAPTATION MEASURES

This section translates the environmental sensitivities, risk overlays, and strategic findings of the Strategic Environmental Assessment (SEA) into a consolidated framework of mitigation and adaptation measures to guide the implementation of the Spatial Development Framework (SDF). Consistent with the SEA's strategic orientation, the measures articulated herein operate at plan level and are intended to shape spatial logic, land use management, infrastructure sequencing, and development control rather than prescribe project-level Environmental Impact Assessment (EIA) conditions.

The mitigation and adaptation framework is structured around three interrelated themes identified as critical determinants of long-term environmental sustainability and municipal resilience:

- Biodiversity Protection
- Climate Change Resilience and Green Infrastructure
- Ecosystem-Based Disaster Risk Reduction (Eco-DRR)

These themes reflect the SEA's core finding that environmental constraints within Dr Nkosazana Dlamini Zuma Local Municipality (NDZ LM) are not isolated conservation concerns but fundamental structuring elements of spatial planning.

11.1. BIODIVERSITY PROTECTION

11.1.1. BIODIVERSITY AS A SPATIAL STRUCTURING CONSTRAINT

The SEA identifies extensive areas of Critical Biodiversity Areas (CBA 1 and CBA 2), Ecological Support Areas (ESAs), wetlands, riparian systems, upland catchments, and conservation landscapes across NDZ LM. These areas are described as irreplaceable or near-irreplaceable for achieving biodiversity

conservation targets and for maintaining ecological processes such as hydrological regulation, species migration, and climate resilience.

From a strategic perspective, CBAs and ESAs function as non-negotiable environmental constraints rather than discretionary overlays. The SEA explicitly indicates that development within CBA 1 areas represents a high-risk activity likely to trigger environmental authorisation requirements under Listing Notice 3 and Listing Notice 1 where vegetation clearance or infrastructure development is involved.

The spatial overlap between dispersed rural settlements, agricultural expansion, linear infrastructure, and mapped CBAs is identified as a cumulative impact risk. Incremental fragmentation of ecological corridors threatens long-term ecological functioning even where individual developments appear minor in scale.

11.1.2. STRATEGIC MITIGATION MEASURES

In response, the SEA establishes an avoidance-led mitigation hierarchy:

1. **Strict No-Go Areas (CBA 1, core protected areas, high-altitude upland catchments):** These areas must be treated as spatial exclusion zones for new settlement expansion and land-intensive development.
2. **Conditional Development Zones (CBA 2 and ESAs):** Development may only proceed where ecological integrity, connectivity, and hydrological function are demonstrably maintained.
3. **Ecological Corridor Protection:** The SDF must maintain and strengthen biodiversity corridors aligned with river systems, wetlands, and intact vegetation.

4. **Buffer Reinforcement Around Protected Areas:** Incompatible land uses adjacent to protected areas must be limited to avoid edge effects and habitat disturbance.
5. **Integration into Land Use Management Schemes:** Environmental categories must be embedded into development control instruments to prevent CBAs and ESAs from being treated as advisory only.

These measures shift biodiversity protection from reactive project screening to proactive spatial steering.

11.2. CLIMATE CHANGE RESILIENCE AND GREEN INFRASTRUCTURE

11.2.1. CLIMATE CHANGE AS A RISK MULTIPLIER

The SEA identifies climate change as a compounding risk driver amplifying flood risk, drought vulnerability, snow hazards, land degradation, and infrastructure fragility. Climate hazards intersect with settlement patterns, degraded catchments, and dispersed rural development to increase exposure and reduce adaptive capacity.

Flood risk is concentrated along river corridors and floodplains, where settlement encroachment reduces natural flood attenuation capacity. Drought risk interacts with water scarcity, agricultural dependency, and degraded catchments.

11.2.2. ADAPTATION MEASURES

The SEA embeds climate resilience through spatial planning mechanisms rather than sectoral policy alone:

- **Floodplain Exclusion and Hazard Overlays:** Explicit no-go and conditional zones within floodplains, wetlands, and high-risk areas.
- **Settlement Consolidation:** Directing growth toward resilient nodes reduces exposure of dispersed households and improves feasibility of climate-resilient infrastructure.
- **Catchment Protection:** Avoiding development in headwater areas and riparian zones protects water security and reduces climate-disaster vulnerability.
- **Water-Sensitive Spatial Planning:** Limiting development in water-stressed areas and prioritising efficient land use patterns.
- **Infrastructure Sequencing Linked to Risk Reduction:** Infrastructure investment must align with hazard mitigation principles.

Green infrastructure in NDZ LM is conceptualised as ecological infrastructure—wetlands, rivers, upland catchments, and corridors—that perform regulatory functions central to resilience.

11.3. ECOSYSTEM-BASED DISASTER RISK REDUCTION (ECO-DRR)

11.3.1. ECOLOGICAL SYSTEMS AS RISK BUFFERS

The SEA highlights wetlands, riparian systems, upland catchments, and intact grasslands as ecological assets providing flood attenuation, erosion control, drought buffering, and slope stabilisation. Catchment degradation, soil erosion, invasive alien spread, and wetland loss are identified as key risk drivers.

Upland catchments are treated as predominantly no-go development areas due to their hydrological and slope-stability functions.

11.3.2. ECOSYSTEM-BASED MITIGATION MEASURES

Eco-DRR measures include:

- Protection and rehabilitation of degraded wetlands and riparian corridors.
- Avoidance of development in floodplains and unstable slopes.
- Strategic erosion control and land rehabilitation in communal landscapes.
- Integration of ecological infrastructure into spatial development proposals and precinct plans.

These measures recognise that ecosystem degradation increases hazard severity, while ecosystem restoration reduces long-term disaster exposure.

11.4. MITIGATION AND ADAPTATION FRAMEWORK

TABLE 49: MITIGATION AND ADAPTION FRAMEWORK

ENVIRONMENTAL THEME	IDENTIFIED RISK / SENSITIVITY	SPATIAL DRIVER (SDF PROPOSAL)	MITIGATION / ADAPTATION MEASURE	IMPLEMENTATION MECHANISM	MONITORING INDICATOR
Biodiversity Protection	CBA 1 & irreplaceable habitats	Settlement expansion & infrastructure corridors	Declare CBA 1 as no-go zones	Embed in SDF land use scheme	% of CBA 1 converted
Biodiversity Protection	ESA & corridor fragmentation	Dispersed rural growth	Maintain ecological connectivity	Corridor overlays in SDF	Corridor continuity index
Protected Areas	Edge effects & incompatible land uses	Tourism & agriculture	Reinforce buffer zones	Precinct plan controls	Buffer compliance rate
Climate Resilience	Flood risk in river valleys	Settlement encroachment	Exclude development in floodplains	Hazard overlays	Dwellings in flood zones
Climate Resilience	Drought & water scarcity	Agricultural expansion	Water-sensitive spatial planning	Water constraint mapping	Water demand vs capacity
Climate Resilience	Infrastructure fragility	Greenfield expansion	Infrastructure-led nodal prioritisation	Infrastructure sequencing	Infrastructure in high-risk areas
Eco-DRR	Catchment degradation	Settlement in headwaters	Avoid development in headwaters	Catchment overlays	Headwater disturbance
Eco-DRR	Wetland loss & erosion	Land transformation	Wetland protection & rehabilitation	Environmental management zones	Wetland area retained
Eco-DRR	Upland slope instability	Linear infrastructure	Restrict slope-intensive development	Slope thresholds in SDF	Erosion incidence rate