CHAPTER 2c

Fauna

CHAPTER 2c: Fauna

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Author Contributions

Company	Author	Qualification	SACNASP	Years Experience
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Disclaimer by specialists

I, Corné Niemandt, declare, that the work presented in this report is our own and has not been influenced in any way by the developer or the EAP. At no point has the developer asked me as specialists to manipulate the results in order to make it more favourable for the proposed development. I consider myself bound to the rules and ethics of the South African Council for Natural Scientific Professions (SACNASP) and the EIA Regulations (2014, as amended). I have the necessary qualifications and expertise in conducting this specialist report.

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Executive Summary

The Namakwa Region Strategic Environmental Assessment (SEA) was conducted to evaluate the potential impacts of the proposed GH2 production coupled with technologies and infrastructure required to create the electricity and water inputs, on regional fauna communities and ecological processes. The assessment considered various environmental factors, including loss of critical ecosystem functioning, fauna species of conservation concern, and broader biodiversity implications including collapsing of key drivers and processes. Given the ecological sensitivity of the regional area, the study aimed to provide a detailed understanding of the potential risks and necessary mitigation measures.

The research methodology included a comprehensive desktop assessment, utilising GIS mapping, literature reviews, and secondary data sources to identify critical biodiversity areas and species at risk. The study revealed that the region falls within three major biomes: the Succulent Karoo, Nama Karoo, and Desert biomes, with high levels of endemism and biodiversity significance and to a smaller degree isolated patches of Fynbos embedded in the Succulent Karoo. Several species of conservation concern, including mammals, reptiles, and amphibians, were identified within the project area, highlighting the ecological importance of the region.

The anticipated environmental impacts include habitat fragmentation, disruption of ecological corridors and migratory pathways, increased predation risks due to infrastructure, and increased roadkill incidents. Additionally, the proposed renewable energy developments may pose risks to avian and bat populations due to wind turbine collisions and altered thermal conditions affecting burrowing species.

To mitigate these impacts, several recommendations have been proposed, including the establishment of wildlife corridors, buffer zones around wetlands, and the implementation of wildlife-friendly infrastructure such as fauna underpasses and overpasses. The strategic placement of wind and solar farms, sustainable water management, and climate adaptation strategies are also crucial to ensuring the long-term ecological sustainability of the region.

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Glossary

Critical Biodiversity Area (CBA): an area that must be maintained in a good ecological condition (natural or semi-natural state) in order to meet biodiversity targets. CBAs collectively meet biodiversity targets for all ecosystem types, as well as for species and ecological processes that depend on natural or semi-natural habitat that have not already been met in the protected area network. CBAs are identified through a systematic biodiversity planning process in a configuration that is complementary, efficient and avoids conflict with other land uses where possible.

Cumulative impact: in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities.

Ecosystem: a dynamic complex of animal, plant and micro-organism communities and their non-living environment interacting as a functional unit.

Ecosystem threat status: A measure of how threatened an ecosystem is, based on how much of the ecosystem's original area remains intact relative to three different thresholds or "tipping points". These thresholds indicate the points at which it is estimated that the ecosystem would undergo fundamental change, either in terms of biodiversity pattern or ecological processes. Ecosystems are categorised as critically endangered, endangered, vulnerable or least threatened.

Endemic: Restricted or exclusive to a particular geographic area, occurring nowhere else. Endemism refers to the occurrence of endemic species.

Extent of occurrence (EOO): the area contained within the shortest continuous imaginary boundary that can be drawn to encompass all the known, inferred or projected sites of present occurrence of a taxon, excluding cases of vagrancy; and in short is the species' contemporary distribution range.

Habitat: The area or environment occupied by a species or groups of species, due to the particular set of environmental conditions that prevails there.

IUCN Red List Categories and Criteria: the threatened species categories used in Red Data Books and Red Lists have been in place for almost 30 years. The IUCN Red List Categories and Criteria provide an easily and widely understood system for classifying species at high risks of global extinction, so as to focus attention on conservation measures designed to protect them.

IUCN Red List status: the conservation status of species, based on the IUCN Red List categories and criteria.

Mitigation: means to anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible.

Range-restricted species: the presence of terrestrial flora, vertebrate and invertebrate fauna with a global population extent of occurrence (EOO) of 10 000 km^2 or less.

Species of conservation concern (SCC): includes all species that are assessed according to the IUCN Red List Criteria as Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Data Deficient (DD) or Near Threatened (NT), as well as range-restricted species which are not declining and are nationally listed as Rare or Extremely Rare [also referred to in some Red Lists as Critically Rare].

Threatened species: species that are facing a high risk of extinction. Any species classified in the IUCN categories CR, EN, VU, is a threatened species.

1. INTRODUCTION

The Transnet National Ports Authority has embarked on the determination of the feasibility for the development, construction, and operation of a deep-water port with associated landside port facilities at Boegoebergbaai, Northern Cape. The proposed new port development is primarily for the enablement of the Northern Cape's Provincial Economic Development strategy including the Green Hydrogen (GH_2) Strategy and expanding the mining and industrial base in the Northern Cape.

Green hydrogen is hydrogen gas (H_2) that is produced using renewable energy sources—typically solar or wind power—through a process called electrolysis. In this process, water (H_2O) is split into hydrogen (H_2) and oxygen (O) using an electric current, and when that electricity comes from renewable sources, the resulting hydrogen is considered "green."

Green hydrogen production, at the scale envisaged, is a diverse and multifaceted process with many direct and indirect impacts, both positive and negative. All programme components (including their interconnected transport corridors) would require vast areas of land surface, as well as other resource intensive inputs, all proposed in a sparsely populated but ecologically sensitive arid region. Existing land uses in the study area include conservation, agriculture, fisheries, tourism, and mining.

A Strategic Environmental Assessment (SEA) has been initiated through a collaboration between the South African National Energy Development Institute (SANEDI), Northern Cape Economic Development Trade and Investment Promotion Agency (NCEDA), and Transnet National Ports Authority (TNPA) (the Project Steering Committee (PSC)). The Council for Scientific and Industrial Research (CSIR) has been appointed to undertake an independent SEA. The overarching purpose of the SEA is to develop an integrated decision-making framework to guide the planning of the proposed Boegoebaai Port, SEZ, and wider Namakwa region in a sustainable manner.

Bios Diversitas Consultants has been appointed to conduct the SEA's faunal component for the proposed Boegoebaai Port and Special Economic Zone (WP1 report dated May 2025) and the wider Namakwa region (WP2 i.e., this report).

2. SCOPE OF THIS STRATEGIC ASSESSMENT – WORK PACKAGE 2 (WP2)

2.1 Study Area

The spatial scope for the WP2 Faunal Assessment is delimited by four local municipalities: the Richtersveld, Nama Khoi, Kamiesberg and Khâi Ma Local Municipalities, including the Boegoebaai port precinct and SEZ (hereafter the 'Regional Area'; Figure 1).

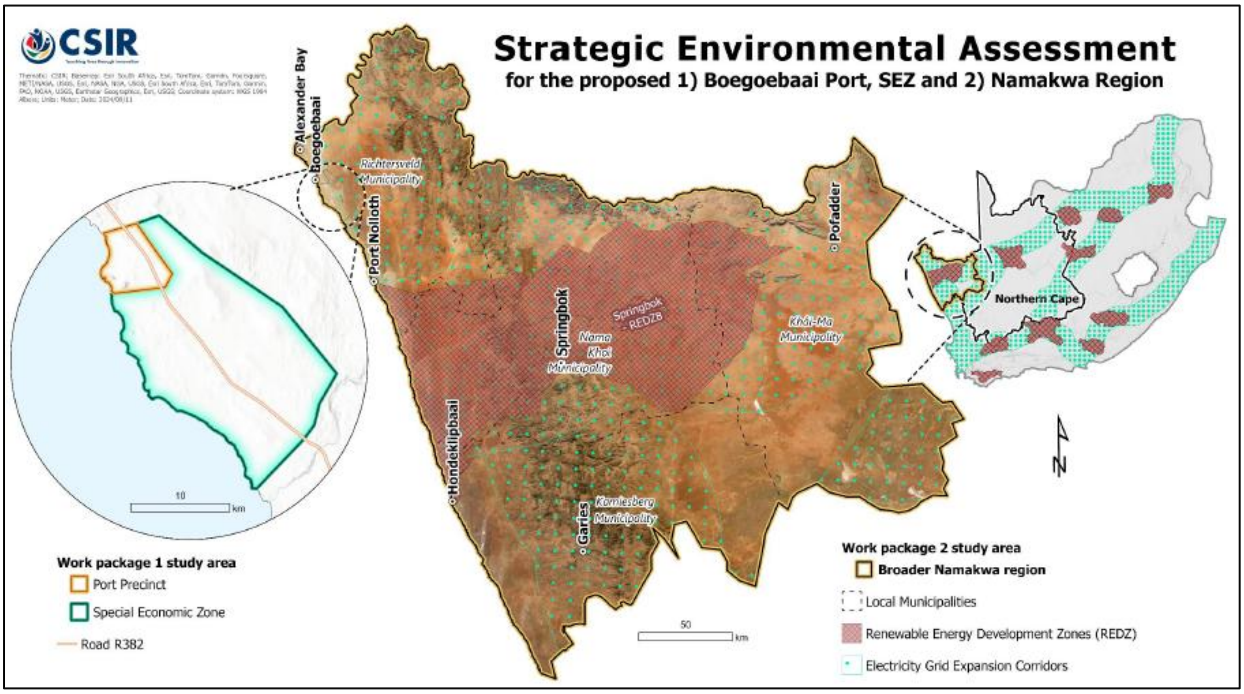

Figure 1: The spatial extent of the two SEA Work Packages with this report focusing on the Work Package 2 study area i.e., the Broader Namakwa Region (*Source*: CSIR, 2025).

The Northern Cape targets include an initial 1.2 GW of electrolyser capacity to be completed by 2028, scaling up to 5 GW by 2030, and reaching 40 GW by 2050. As part of South Africa's ambition to become a player in the globally emerging green hydrogen market, a substantial programme of greenfield infrastructure has been proposed in the Northern Cape consisting of three main components:

i. New deepwater port at Boegoebaai, dry and liquid bulk berths, and multi-purpose terminals.
ii. Mixed-use SEZ located in the region adjacent to the proposed Boegoebaai port.
iii. Expansive regional renewable energy (wind and solar PV) generation and transmission infrastructure.

GH_2 production, at the scale envisaged in the Northern Cape, will be a diverse and multifaceted process with many direct and indirect impacts, both positive and negative. The technologies and infrastructure required to create the electricity and water inputs, such as wind turbines and solar PV panels, seawater desalination plants (plus the hundreds of kilometres of linear infrastructure), are major infrastructure developments (Figure 2), with a complex array of social and environmental impacts. If undesirable impacts are not properly avoided and mitigated in the project planning phases, individually or in accumulation, they could result in unacceptable social and ecological consequences.

The long-term port layout for Phase 1B has been designed with built in flexibility, allowing it to adapt to future shifts in commodity mix, operational requirements, and planning priorities. The masterplan anticipates that exports will continue to focus on Phase 1A commodities, while accommodating potential growth in other GH_2 derivatives such as methanol, naphtha, and e-kerosene.

From 2035, combined exports of green ammonia, methanol, naphtha, and e-kerosene are projected to reach 2.15 Mtpa. Looking ahead to 2050, TNPA intends to extend the breakwater to enable additional multi-purpose and liquid bulk berths. This expansion will include new port infrastructure such as the Boegoebaai Container Terminal (BCT), a ship repair yard, and enlarged stockpiling warehouse capacity.

Enclosed warehouses will be implemented for dust suppression, ensuring manganese remains fully covered during storage and conveyor belt transport. The broader expansion will also require enhanced rail connectivity, road over rail bridges, and upgraded rail marshalling and tippler facilities.

Ancillary infrastructure required in support of the port and the SEZ include:

- Additionally, infrastructure for the disposal and management of chemical and hazardous waste generated by the port and SEZ.
- Domestic water and waste infrastructure throughout the port and SEZ.
- Utility water infrastructure between throughout the port and SEZ.
- Internal roads, pipelines, ICT, security, and office infrastructure.
- Accommodation for workers during the construction and (potentially) operations phases.

All programme components, including their interconnected transport corridors, will require substantial areas of land surface, as well as other resource intensive inputs, all proposed in a sparsely populated but ecologically sensitive region. Existing, and potentially competing, land uses in the region include conservation, agriculture, fishing, tourism, mining, and other subsistence livelihoods.

The scope of the SEA focusses on all the positive and negative social / ecological impacts associated with a regional GH2 economy in the Northern Cape. Two GH_2 development scenarios are considered in relation to (or in addition to) a dynamic baseline which includes other development and change trends in the region over a 25-year time horizon from 2025 to 2050.

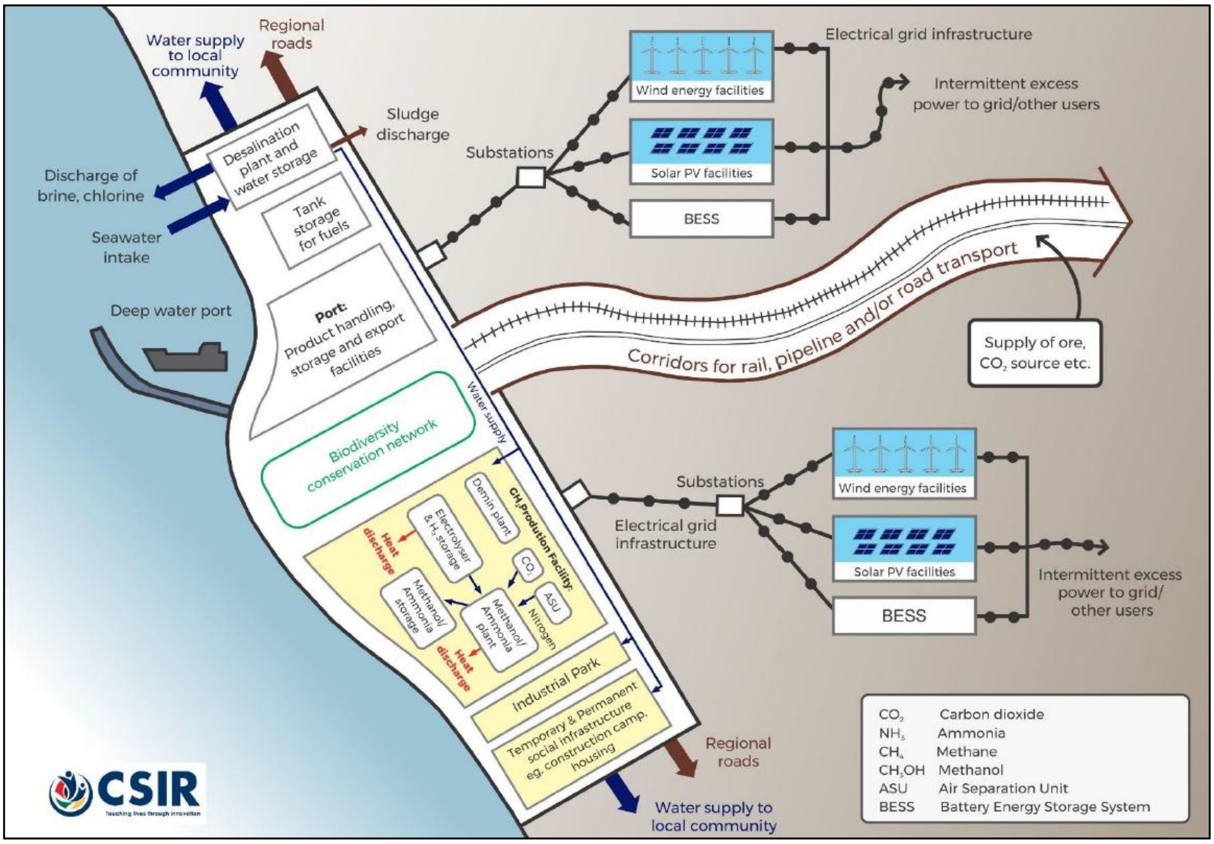

Figure 2: Schematic of the typical main infrastructure components for the Northern Cape regional GH2 programme (notional drawing, not to scale; *source*: CSIR briefing note).

2.2 GH_2 development scenarios for assessment

Two GH_2 development scenarios will be assessed, each compared to an existing dynamic baseline, where no GH_2 development occurs but other anthropogenic and climate changes continue, described as follows:

SCENARIO 0 – DYNAMIC BASELINE (2023 – 2050): Boegoebaai Port and SEZ remains undeveloped. No GH_2 is produced in the Northern Cape. The region proceeds on current social (e.g. migration, unemployment), ecological, climatic (e.g. desertification, storm surges, coastal flooding etc.) and developmental trends, including all other non-GH2 activities (e.g renewable energy development). The Namakwa region's economy proceeds to be shaped by mining (i.e., diamonds, zinc, copper), agriculture (mainly livestock), fishing, and a growing renewable energy sector, alongside seasonal tourism linked to the Namaqualand wildflower displays.

SCENARIO 1 – "SMALL GH_2" (by 2035): The Boegoebaai Port and SEZ are developed and a 5 GW electrolyser producing 0.5 metric tonnes per annum (mtpa) GH_2 and derivatives supported by 10 GW of renewable energy (the scenario assumes 60% solar / 40% wind).

SCENARIO 2 – "BIG GH_2" (by 2050): The Boegoebaai Port and SEZ are developed and GH_2 development is upscaled to a 40 GW electrolyser producing a total of 4 mtpa GH_2 and derivatives supported by 80 GW of renewable energy (assume 60% solar / 40% wind).

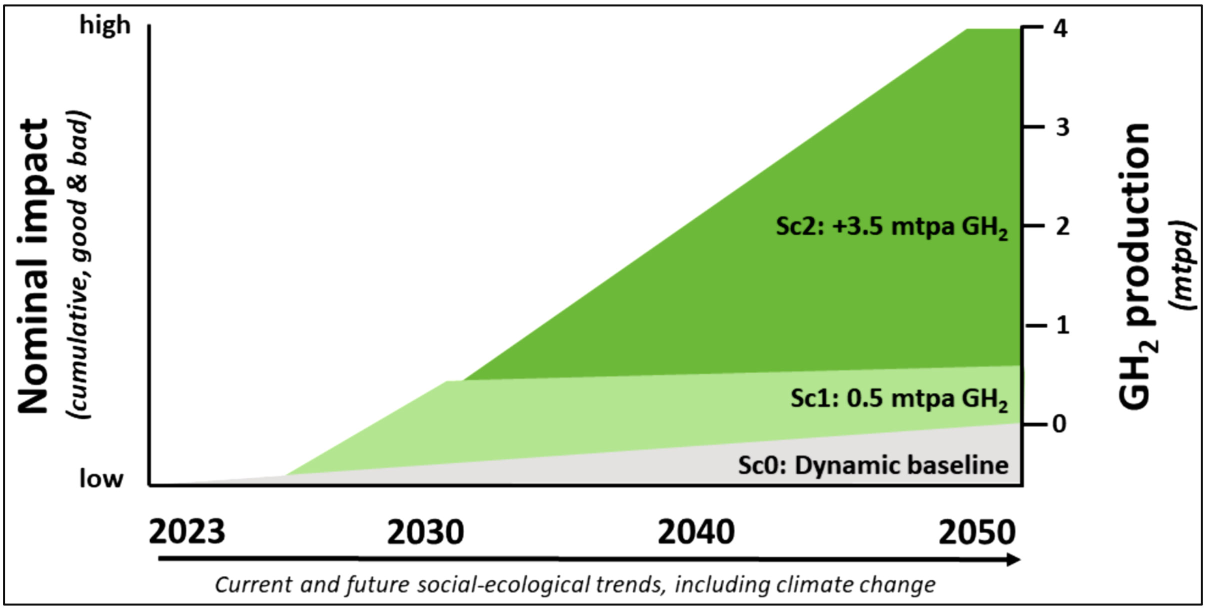

Figure 3: Indicative diagram of the scenarios approach for assessing cumulative impacts (*Source*: CSIR, 2025).

2.3 Infrastructure types impacting animals within the broader Namakwa Region

2.3.1 Renewable energy and electrical grid infrastructure

While some wind and solar PV generation will be located near the SEZ, the sensitivity of the local environment and potential coastal impacts (e.g., corrosion) mean that most power will come from dispersed renewable projects—often several hundred kilometres away—each requiring its own environmental impact assessment (EIA) (**Error! Reference source not found.**). Electricity will be supplied to the GH_2 production plant via a mix of new and existing transmission and distribution infrastructure (**Table 2**).

In these cases, solar PV and wind generation facilities including battery storage systems will be developed and permitted by third parties, meaning the hydrogen developer may not control the entire value chain. The project owner may purchase power from these third parties, acquire and operate the projects directly, and negotiate with the utility to wheel electricity through existing or newly built grids. Permitting will typically be split: the hydrogen developer will secure approvals for the electrolyser, ammonia plant, desalination plant, and, in some cases, export port facilities, while generation and transmission infrastructure will be permitted by other entities such as Independent Power Producers (IPPs) and Eskom.

Table 1: Brief description of the main renewable energy infrastructure aspects.

Renewable energy	Aspect	Description
Wind	Turbines	Rotor with blades, nacelle, tower, sizes 4-8 MW, hub height 150-180 m, blade length ~100 m
	Associated infrastructure	Foundations (~32 m^2), access roads, battery energy storage system (BESS), on-site electrical system, substation, transmission lines, construction camp, operations and maintenance facilities, meteorological masts, communication towers.
Solar PV	Solar panels	Monocrystalline/polycrystalline silicon cells, panel height ~6m, fixed or dual-axis tracking, single or bifacial modules.
	Associated infrastructure	Inverters, mounting structures, BESS, foundations, access roads, electrical system, substations, transmission lines, electrical components, construction camp, operations and maintenance facilities.

Renewable energy—wind and solar—facilities and associated powerline infrastructure can impact animals mainly through habitat loss or alteration from facility footprints; disturbance from noise, lighting, and human activity, alter ecologiocal processes and collision risks with facilities, particularly fences. Poorly sited wind or solar installations can displace sensitive species or increase mortality due to roadkill's in areas of suitable habitat and high-use corridors. Fences may also create barrier effects, disrupting wildlife corridors and migratory routes, and access to key foraging or breeding areas.

2.3.2 Green hydrogen plants

Green hydrogen plants are the core production hubs that turn water and renewable electricity into a storable, transportable, and versatile clean fuel — making them central to both the green hydrogen value chain and the broader renewable energy transition. Green hydrogen plants are the conversion engines that link renewable energy generation to a wide range of low-carbon applications, while also accelerating renewable deployment, enabling deep decarbonisation, and creating new economic opportunities.

Green hydrogen plants themselves don't usually pose the same direct displacement risks to animals such as permanent infrastructure including solar PV panels, wind turbines and hardstands or fences — but they can still have significant, often indirect, impacts because they are rarely stand-alone facilities. They are typically part of a much larger infrastructure footprint that includes renewable generation, transmission, water supply, and export logistics. The green hydrogen plant is often the anchor for a web of associated infrastructure. While the plant's core process is relatively benign to birds, its enabling components — renewable generation, transmission, water supply, and export facilities — can create substantial risks to animals if not carefully sited, designed, and managed.

2.3.3 Desalination plants

Desalination plants are a critical enabling link in many large-scale green hydrogen projects, especially in coastal or arid regions where freshwater is scarce, but renewable energy potential is high. Desalination plants make it possible to turn abundant seawater into the ultra-pure feedstock electrolysers need, unlocking green hydrogen production in water-scarce but renewable-rich regions—while also offering opportunities for community water supply and integrated, low-carbon infrastructure.

Desalination plants can affect animals primarily through habitat disturbance during construction and operation, noise and lighting impacts that may disrupt breeding or foraging behaviour, and direct and indirect effects from associated marine infrastructure. Coastal intakes and brine discharge can alter nearshore ecosystems, potentially reducing prey availability for animals favouring the littoral active zone, while increased human activity and vessel traffic may disturb breeding and foraging sites.

2.3.4 Roads, rail and pipelines

Transport infrastructure such as roads, railways, and gas pipelines can impact fauna through habitat loss and fragmentation, disturbance from noise, vibration, and lighting, and increased collision risk with vehicles, trains, or fencelines. Linear corridors may also create barrier effects, altering wildlife corridors, migration routes, and access to feeding or breeding areas, while construction and maintenance activities can disrupt breeding and foraging. In sensitive habitats, these impacts can be significant, especially for low-manoeuvrability or fossorial species.

The following transport infrastructure is planned in the broader Namakwa Region:

- New pipelines for the bulk transportation of GH_2 to and from Namibia, Saldanha Bay (Scenario 1) and Prieska (Scenario 2).
- New rail between the Boegoebaai Port and Kenhardt connecting to the existing Saldanha-Sishen railway route.
- Upgrade and expansion of roads to and from Alexander Bay.
- Roads associated with the construction, operation and maintenance of new renewable energy facilities, railways and pipelines.

2.3.5 Masts and towers

Masts and towers are the vertical backbone of green hydrogen infrastructure — from capturing the wind that powers electrolysers, to gathering the climate data that underpins investment decisions, to enabling the communications and control systems that keep complex, distributed renewable-hydrogen networks running smoothly.

Masts and towers can impact fauna mainly through habitat loss if placed in sensitive areas, displacement, collision risk, and nocturnal species attracted to or disoriented by lights. Careful siting, design, and proper marking can reduce these risks.

Table 2: GH_2 development scenario quantifications (Scenario 1 and Scenario 2) for the broader Namakwa regional assessment (*Source*: CSIR, 2025).

	Aspect	Unit	Sc1: Small GH_2	Sc2: Big GH_2	*Assumptions*
SEZ	Electrolyser capacity	GW	5	40	Northern Cape Green Hydrogen Master Plan ambition
	Electrolyser footprint	ha	75	600	15 ha per 1 GW
	GH2 volume	mtpa	0,5	4,0	10 GW electrolyser = 1 mpta GH2
	GH2 storage footprint	ha	250	2 000	10 ha per 20 000 tpa (500 ha for 1 mpta)
	Ammonia volume	mtpa	2,8	22,7	1 mt H2 for 5,67 mt NH3 (1Mt of ammonia contains 176.5 kg (just 17.65%))
	Ammonia footprint	ha	57	454	1 ha per 50 000 tpa NH3 (e.g. Enertrag Hendrina) (20 ha for 1 mtpa)
	Ammonia storage footprint	ha	28	227	0,5 ha per 50 000 tpa NH3 (e.g. Enertrag Hendrina) (10 ha for 1 mpta)
	Desalination output volume	Ml/day	36	286	25 kg water per 1 kg GH2 (considering electrolysis and cooling). 1Mtpa GH2 output required 25 Mtpa (=25000 MLpa) water / 350 operational.
	Desalination footprint	ha	7	57	5 Ml/day output needs 1 ha
	Desalination discharge	Ml/day	48	387	Ratio of desalinated water to brine discharge water to be 42.5:57.5. (i.e 42.5% of intake sea water is converted to desalinated water and 57.5% is discharged as brine).
	Pipeline intake volume	Ml/day	84	672	Output + discharge
REGION	RE capacity total	GW	10	80	1 Mt/yr of H2 needs 10 GW electrolyser, that is powered by 20 GW
	RE capacity - solar	*GW*	*6*	*48*	60 % solar : 40 % wind
	RE footprint - solar	*ha*	*12 000*	*96 000*	0,5MW/ha
	RE extent - solar		*12 000*	*96 000*	Footprint = extent
	RE facilities - solar	*no of facilities*	*6*	*48*	Clusters of 1 GW facilities
	RE capacity - wind	*GW*	*4*	*32*	60 % solar : 40 % wind
	RE footprint - wind	*ha*	*4 000*	*32 000*	1 MW/ha
	RE extent - wind	*ha*	*40 000*	*320 000*	0,1 MW/ha
	RE facilities - wind	*no of facilities*	*3*	*21*	Clusters of 1,5 GW facilities
	Road length	km	300	600	New roads and upgrades same distances / routes as pipelines
	Road footprint	ha	1 200	2 400	40 m (Rural class 2 road 40-70 m. TRH26 Road Classification and Access Management)
	Rail length	km	550	550	Boegoebaai – Kenhardt. New rail direction south-east to connect to the existing Saldanha-Sishen route.
	Rail footprint	ha	1 600	1 650	30 m for rail and service track
	Pipeline length	km	300	600	Sc1: NAM<BB>SB (300km); Sc2: BB>Prieska (300km)
	Pipeline footprint	ha	600	1 200	20 m servitude
	Powerline length	km	260	1 387	Assume grid strengthening / shared infrastructure 30 km TX associated with each RE cluster.
	Powerline footprint	ha	1 300	6 933	50 m servitude (TRH 27 South African Manual for Permitting Services in Road Reserves)
	Main infrastructure components footprint	**ha**	**21 082**	**142 240**	
Units: GW = gigawatt; mtpa = million tonne per annum; ha = hectare; Ml/day = million litres per day; km = kilometre					

3. RESEARCH APPROACH AND METHODOLOGY

3.1 Defining the Research Problem

- **Spatial scope (Regional Area):** It's delimited by four local municipalities; the Richtersveld, Nama Khoi, Kamiesberg and Khâi Ma Local Municipalities within the Namakwa District Municipality, including the Boegoebaai port precinct and SEZ.
- **Focus**: The SEA focusses on all the positive and negative social / ecological impacts associated with a regional GH2 economy in the Northern Cape.
- **Scope**: Fauna component as part of the overall Terrestrial Ecological Assessment within the SEA framework, with a strong focus on desktop and spatial data.

3.2 Research Design

The study will adopt a spatially focused assessment to ensure high-resolution environmental sensitivity mapping. The design will include:

- **GIS Mapping**: Integration of spatial data from existing surveys and secondary sources into a Geographic Information System (GIS).
- **Literature review**: Review of existing fauna assessments and databases for the region.

3.3 Data Collection

3.3.1 Primary Data Requirements

No detailed on-site fauna assessments will be undertaken for this SEA.

3.3.2 GIS

Existing data layers from various sources were incorporated into QGIS (open source) to establish how the proposed developments and associated activities interact with important terrestrial biodiversity features. Emphasis was placed on the following spatial datasets:

- Vegetation Map of South Africa, Lesotho and Swaziland (SANBI, 2024).
- Northern Cape Critical Biodiversity Areas (Northern Cape Department of Environment and Nature Conservation, 2016).
- National Protected Area Expansion Strategy (NPAES, 2018).
- Red List of Ecosystems (RLE) for terrestrial realm for South Africa - Original extent (SANBI, 2022[a]).
- RLE for terrestrial realm for South Africa – remnants (SANBI, 2022[b]).
- Protected and Conservation areas of South Africa (South Africa Protected Areas Database-SAPAD; South Africa Conservation Areas Database-SACAD)[1].

[1] http://dea.maps.arcgis.com/apps/MapTools/index.html?appid=2367540dd75148e8b6eaeab178a19d3a

3.3.3 Literature Review and Secondary Data

- Review of existing environmental and ecological datasets, biodiversity databases, and scientific literature.
- Relevant books and publications providing information on distribution ranges and/or conservation status of fauna species was consulted to review predictions of SCC occurrence at local scale.
- Previous SEA and EIA reports related to the PA.
- The National Red List[2] was utilised to provide the most current account of the regional conservation status of fauna species.
- The IUCN Red List of threatened species (IUCN, 2024) for global conservation statuses[3].
- Spatial data from the South African National Biodiversity Institute (SANBI), provincial biodiversity conservation authorities (Northern Cape Department of Environment and Nature Conservation), and related institutions.
- iNaturalist, the Global Biodiversity Information Facility (GBIF), the Virtual Museum (VM) of African Mammals, Frog Atlas of Southern Africa and Reptile Atlas of Africa was used to source observation data in the area to generate expected species lists[4].

3.4 Species of conservation concern

The Red List of threatened species generated by the IUCN provided the global conservation status of mammals, reptiles and amphibians. However, regional conservation status assessments performed following the IUCN criteria are generally the most relevant and sourced for each group as follows:

- Reptiles: Bates *et al.* (2014, as amended).
- Amphibians: Southern African Frog Re-Assessment Group (SA-FRoG) (2015); Du Preez & Carruthers (2017).
- Mammals: Child *et al.* (2016).

Take Note: This version of the report represents the final version in terms of recent information being made available on the unpublished 2025 National Red List. The listing of threatened fauna and/ or fauna SCC are based on information received up until and including 7 May 2025. Any further changes will not be reflected in this report.

The conservation status categories defined by the IUCN (Figure 4), which are considered here to represent species of conservation concern[5] (SCC), are the "threatened" categories defined as follows:

- **Critically Endangered (CR)** - Critically Endangered refers to species facing immediate threat of extinction in the wild.
- **Endangered (EN)** - Endangered species are those facing a very high risk of extinction in the wild within the foreseeable future.

[2] http://speciesstatus.sanbi.org/
[3] https://www.iucnredlist.org/
[4] It must be noted that the VM closed its operations at the end of 2024.
[5] Species of conservation concern have a high conservation importance in terms of preserving South Africa's high diversity and include not only threatened species, but also those classified in the categories Extinct in the Wild (EW), Regionally Extinct (RE), Near Threatened (NT), Critically Rare, Rare, Declining and Data Deficient - Insufficient Information (DDD).

- **Vulnerable (VU)** - Vulnerable species are those facing a high risk of extinction in the wild in the medium-term.

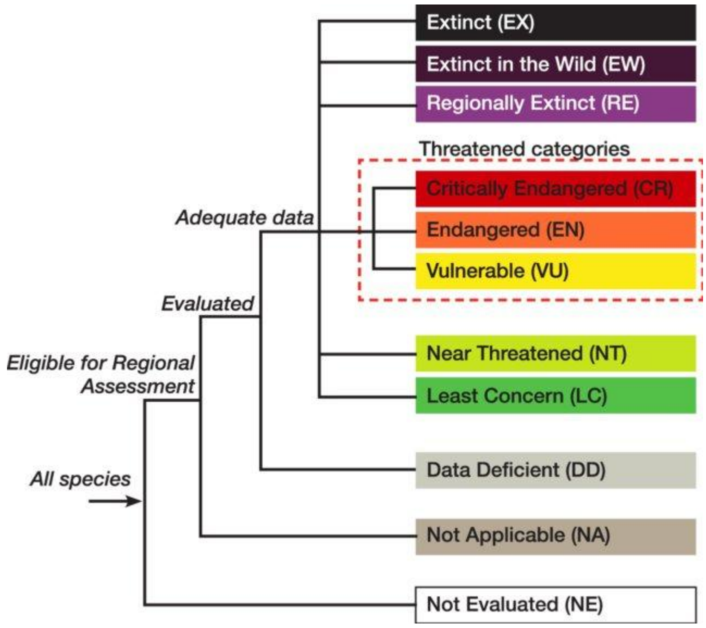

Figure 4: Schematic representation of the structure of the IUCN Red List Categories (IUCN 2012).

Other measures of conservation status include species listed under the following:

- National listed threatened or protected species (TOPS) in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).
- Convention on International Trade in Endangered Species (CITES; International).

3.5 Assumptions and Limitations

Using secondary data for a fauna desktop assessment, especially in remote regions of the Northern Cape involves several limitations and assumptions. These can impact the reliability and applicability of the assessment findings:

General Project Details

- It is assumed that all third-party information acquired is correct (e.g., GIS data and scope of work).
- Focus is on mammals, reptiles and amphibians, and will exclude avifauna, bats and water-dependent marine mammals which are addressed in separate assessments.
- It is assumed the proposed development's scale and scope are unlikely to shift significantly during the study period.

Data Gaps and Incompleteness:

- Access to reliable secondary data sources in the absence of field surveys.

- Available secondary data might not cover all species or habitats in the area, especially lesser-studied or cryptic species.
- Historical data may lack recent trends or population dynamics due to environmental changes or human activities.
- Potential lack of up-to-date or detailed secondary data, particularly for less-studied species or habitats in the region.

Spatial Resolution Issues:

- Full coverage of the regional area is constrained in the databases, particularly in remote areas. Accordingly, there may be gaps in the secondary data.
- Secondary data may have broad spatial scales that do not align with the finer resolution required for site-specific assessments.
- Habitat or species distribution maps may not accurately reflect microhabitats present in the area.

Temporal Limitations:

- Older datasets may not reflect current conditions due to climate change, habitat destruction, or ecological shifts.
- Migration or seasonal variations in species distribution may not be captured in static datasets.

Bias in Data Sources:

- Secondary data may overrepresent certain areas or species due to researcher interest or accessibility.
- Surveys may exclude nocturnal, fossorial, or migratory species, leading to underrepresentation.

Lack of Contextual Information:

- Secondary data often lack behavioural, ecological, or physiological context needed to assess the specific impacts on fauna.

Inconsistency in Data Quality:

- Differences in data collection methods, accuracy, and sampling effort across studies can lead to inconsistencies.

Static Conditions:

- It is assumed ecological and environmental conditions have remained relatively stable since the data were collected.

Species-Habitat Relationships:

- Documented species-habitat relationships are valid for the region at the time of the assessment, despite potential variations in habitat quality or connectivity.

To mitigate against these limitations, it is recommended that the desktop review be complemented with targeted field surveys for site-specific validation based on proposed areas. In addition, cross-check findings with taxa experts with local knowledge as well as recent regional studies. Furthermore, a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions.

4. DESKTOP RESULTS

4.1 Biomes and Biodiversity Hotspot

The Regional Area falls into eleven bioregions in three major biomes, the Succulent Karoo (along the west coast stretching inland), the Nama Karoo (eastern section of the Regional Area) and the Desert (northern section along the lower Orange River), as well as small, isolated sections of the Fynbos embedded in the Succulent Karoo. Almost the entire Desert biome (> 99%) falls within this assessment regional scope, making it a higher priority for protection from development in terms of meeting biodiversity targets and maintaining ecosystem processes.

The Desert Biome are arid ecosystems shaped by climatic, geological, and biological processes. These areas are globally recognised for their high biodiversity, extreme climatic conditions, and unique adaptations of flora and fauna. Within South Africa, it stretches from the Atlantic coast between Alexander Bay (near the mouth of the Orange River) and Visagiesfontein (Buchu / Boegoe Berg twins) and penetrate inland following the course of the lower Orange River as far as the vicinity of Pofadder and Onseepkans in northern Bushmanland. It is characterised by its low and unpredictable rainfall (between >50- and <250 mm), extreme temperatures (high daytime temperatures (often > 40°C in summer) contrast with very cold nights) and both winter- and summer-rainfall areas. This provides for a wide spectrum of adaptations to the arid environment, and high endemism

The Succulent Karoo biome, recognised as one of the world's 34 biodiversity hotspots (the World's only arid hotspot) and one of only three in South Africa. It is known for its high endemism in plants, reptiles, insects and small mammals. This globally significant landscape is a priority for conservation efforts led by both national and international organisations, aiming to protect its unique and highly diverse ecosystems. Namaqualand is recognised internationally as a global centre for both reptile and insect diversity and endemism (Driver et al., 2003) that is particularly vulnerable to climate change where a minimum decline in species richness of 41% is predicted for the Succulent Karoo biome. Understanding the biodiversity and ecology of Namaqualand requires an examination of the physical and biological factors that have shaped its regional biota over time. Additionally, both historical and current patterns of human occupation and land use play a crucial role in influencing contemporary biodiversity dynamics.

4.2 Regional Vegetation and Threatened Ecosystems

The Regional Area is unique as it is located within 69 vegetation types and four biomes (SANBI 2024), and 5 threatened ecosystems listed as Critically Endangered (CR) under the revised Red List of Ecosystems (2021). The five CR threatened ecosystems include:

- AZd 1 Namib Seashore Vegetation
- AZd 2 Namaqualand Seashore Vegetation
- SKs 1 Richtersveld Coastal Duneveld
- Dn 1 Alexander Bay Coastal Duneveld
- Dn 2 Namib Lichen Fields

Namib Seashore Vegetation AZd 1 – Critically Endangered [A3, B1(i), B2(i)]

The Namib Seashore Vegetation occupies a narrow strip along the southern Namib Desert (one of the oldest and most arid deserts of the world), extending into the Northern Cape province of South Africa only marginally where it reaches its southernmost distribution limit on the Holgat River (just south of the PA). This ecoregion is characterised by its unique adaptations to a harsh coastal environment, where the Atlantic Ocean meets one of the driest terrestrial ecosystems on Earth.

The landscape is dominated by slightly sloping sandy beaches and adjacent moving and fixed coastal dunes (Strandveld Formation) and occasional coastal cliffs. Vegetation is dominated by dwarf shrubs up to 1 m tall and spiny grasses on the windblown dunes and small succulent dwarf shrubs dominating exposed rocky cliffs on the seafront. Adaptations such as to obtain moisture from the frequent coastal fogs rather than from rainfall are key in this environment.

The Namib seashore vegetation supports a variety of wildlife adapted to extreme conditions, potentially including:

- Grant's Golden Mole (*Eremitalpa granti granti*): A rare and highly specialised burrowing mammal that navigates through sandy dunes.
- Cape fur seals (*Arctocephalus pusillus pusillus*): Found along the coast, especially near rocky outcrops and beaches.
- Reptiles: Fog-dependent geckos and lizards, including the web-footed gecko (*Pachydactylus rangei*), a desert specialist.

National land cover data show that Namib Seashore Vegetation has experienced extensive spatial declines of approximately 95% since 1750. It is narrowly distributed with high rates of habitat loss in the past 28 years (1990-2018), mainly due to diamond mining and coastal development, placing the ecosystem type at risk of collapse.

Richtersveld Coastal Duneveld SKs 1 – Critically Endangered [B1(i)]

The Richtersveld Coastal Duneveld (SKs 1) is a unique and ecologically significant landscape along the Atlantic Ocean coast from a point between the Boegoe (Buchu) Twins and Alexander Bay to about halfway between Port Nolloth and Kleinzee along a broad belt of 1–12 km within the Northern Cape province of South Africa. The north-south extension is 104 km. It forms part of the globally recognised Succulent Karoo biome, a biodiversity hotspot known for its remarkable array of endemic species. It is characterised as generally flat with some large, gently rolling coastal dunes. On the active dunes, depending on the aspects of the slopes and on the phase of deflation and sedimentation, different plant communities occur.

Despite its arid conditions, the Richtersveld Coastal Duneveld supports an array of fauna uniquely adapted to its challenging environment:

- Namaqua chameleon (*Chamaeleo namaquensis*): A desert-adapted chameleon that thrives in sandy habitats.
- Brown hyena (*Parahyaena brunnea*): An elusive predator that roams the coastal areas, scavenging for food.
- Cape fur seals (*Arctocephalus pusillus pusillus*): Found along the coastal edge, particularly in rocky zones and sand dunes.
- Geckos and lizards: Fog-dependent reptiles like the web-footed gecko (*Pachydactylus rangei*) and desert-adapted skinks inhabit the sandy dunes.

Ecosystems functioning

Similar to other Mole-rats (*Cryptomys hottentotus* and *Georychus capensis*), the Namaqua Dune Mole-rat is an important eco-engineer and plays a role in modifying soil properties and increasing the humic content of the sands in which it occurs.

Threats

Diamond mining is a key pressure on this ecosystem type, with 176.68 km^2 of the ecosystem directly impacted by mining activity. The vegetation unit is narrowly distributed with high rates of habitat loss in the past 28 years (1990-2018), placing the ecosystem type at risk of collapse. Sustained conservation efforts are essential to protect its unique landscapes and species for future generations.

Namaqualand Seashore Vegetation AZd 2 – Critically Endangered B2(i)

The Namaqualand Seashore Vegetation, part of the Succulent Karoo biome, is a distinctive ecological unit located along the coastal fringes of South Africa's Namaqualand region. This vegetation type is characterized by its unique arid landscape with a high diversity of succulent plants, including vygies, stonecrops, and other dwarf shrubs, which bloom spectacularly after winter rains. It is narrowly distributed with high rates of habitat loss in the past 28 years (1990-2018), placing the ecosystem type at risk of collapse.

Landscape and Vegetation Features

The landscape of the Namaqualand Seashore is predominantly composed of coastal dunes, sandy beaches, and rocky shores. The soils are generally sandy, with varying degrees of salinity, influenced by proximity to the ocean and tidal actions. The vegetation is adapted to withstand harsh coastal conditions, including high winds, salt spray, and limited freshwater availability. The vegetation structure is often low-growing and sparse, reflecting adaptations to the challenging coastal conditions.

Potential Habitat for Important Fauna Species

This vegetation type provides critical habitat for various fauna:

- **Birds**: Coastal birds, including migratory species, rely on these habitats for nesting and feeding.
- **Invertebrates**: A diverse array of insects and other invertebrates inhabit the coastal vegetation, playing essential roles in pollination and nutrient cycling.
- **Reptiles**: Certain lizard species are adapted to the sandy and rocky coastal environments.

Important Ecosystem Processes

The Namaqualand Seashore Vegetation supports several key ecosystem processes:

- **Sand Stabilisation**: Vegetation helps stabilize sand dunes, preventing erosion and protecting inland areas.
- **Nutrient Cycling**: Plant and animal interactions contribute to nutrient cycling, maintaining soil fertility. Shell beds on the beach are a by-product of nutrient-rich upwelling coastal waters along the West Coast known for their high biomass productivity.
- **Biodiversity Support**: The unique flora provides habitat and food sources for a variety of species, supporting overall biodiversity.

Understanding and preserving the Namaqualand Seashore Vegetation is vital for maintaining the ecological integrity of South Africa's coastal regions and ensuring the survival of the unique species that depend on this habitat.

Alexander Bay Coastal Duneveld – Critically Endangered A3, B1(i), B2(i)

The Alexander Bay Coastal Duneveld is a distinctive vegetation type located along South Africa's northwestern coastline, specifically near Alexander Bay in the Northern Cape Province. This area is characterized by unique landscape and vegetation features, faces certain environmental threats, holds particular conservation status, supports important fauna species, and maintains critical ecosystem processes.

Landscape and Vegetation Features

The Alexander Bay Coastal Duneveld is situated within the Desert Biome, as classified by Mucina and Rutherford (2006). The landscape is predominantly composed of sandy coastal forelands extending from the mouth of the Orange River to Cap Voltas, south of Alexander Bay. This region features flat sand shields occasionally interrupted by dunes, typically forming broad, flat "whale-back" structures. Steep dune crests and valleys are rare, but where they occur, the vegetation reflects the variation in topography.

The sands in this region are primarily yellow, wind-blown sediments of coastal origin, predating the white dune sands found further west. These sands are remnants of an ancient mobile dune field that stabilized over time due to climatic improvements and increased vegetation cover following the last glaciation. Despite stabilization, the structure of the south-north-oriented dune ridges and associated valley systems remains discernible. Local erosion and sedimentation processes have created saline valleys with silty or loamy soils, enhancing habitat diversity. Currently, wind erosion occurs only minimally.

Vegetation in this area is adapted to the arid, coastal conditions, with species exhibiting xerophytic (drought-resistant) and halophytic (salt-tolerant) traits. The flora includes various succulents and shrubs capable of surviving in sandy, saline soils. Notably, the region supports unique lichen fields, which are sensitive to environmental disturbances.

Known Threats

National land cover data show that Alexander Bay Coastal Duneveld has experienced extensive spatial declines of approximately 92% since 1750. It is narrowly distributed with high rates of habitat loss in the past 28 years (1990-2018), placing the ecosystem type at risk of collapse.

The Alexander Bay Coastal Duneveld faces several environmental threats:

- **Mining Activities**: The extraction of diamonds and other minerals has led to habitat destruction and fragmentation. Mucina et al. (2006) report that a significant portion of the Richtersveld Coastal Duneveld has been transformed by diamond mining, indicating similar pressures may exist in the Alexander Bay area.

- **Climate Change**: Alterations in temperature and precipitation patterns may impact the delicate balance of this desert ecosystem.

- **Human Disturbance**: Activities such as off-road driving and unregulated tourism can damage sensitive habitats, including lichen fields.

Conservation Status

The conservation status of the Alexander Bay Coastal Duneveld is of concern due to the aforementioned threats. The area is recognized for its unique biodiversity, and efforts are underway to mitigate environmental impacts. However, specific conservation measures and the extent of protected areas within this vegetation type require further documentation.

Potential Habitat for Important Fauna Species

This vegetation type provides habitat for various fauna species adapted to arid coastal environments:

- ***Breviceps macrops* (Desert Rain Frog)**: This species has been recorded in the vicinity, relying on sandy habitats for burrowing.

- **Avian Species**: The area supports bird species adapted to desert and coastal conditions, some of which may be endemic or migratory.

- **Invertebrates**: The unique lichen fields and sandy soils provide niches for specialized insects and other invertebrates.

Important Ecosystem Processes

The Alexander Bay Coastal Duneveld supports several critical ecosystem processes:

- **Sand Stabilization**: Vegetation plays a crucial role in stabilizing sand dunes, preventing erosion and maintaining landscape integrity.

- **Microhabitat Formation**: The presence of lichen fields and varied dune structures creates microhabitats that support diverse organisms.

- **Nutrient Cycling**: Despite the arid conditions, nutrient cycling occurs through the decomposition of organic matter, supporting plant growth.

Understanding and preserving the Alexander Bay Coastal Duneveld is vital for maintaining the ecological integrity of South Africa's coastal desert regions and ensuring the survival of the unique species that depend on this habitat.

Namib Lichen Fields Dn 2 – Critically Endangered B1(i), B2(i)

The Namib Lichen Fields, designated as Dn 2, are a unique vegetation type located in the coastal regions of the Northern Cape Province, South Africa, near Alexander Bay. This area is characterized by its distinctive lichen-dominated landscapes, which are integral to the Desert Biome. Namib Lichen Fields is narrowly distributed with high rates of habitat loss in the past 28 years (1990- 2018), placing the ecosystem type at risk of collapse.

Landscape and Vegetation Features

The Namib Lichen Fields are situated on coastal plains with sandy and gravelly substrates. The climate is hyper-arid, with fog being the primary source of moisture, creating ideal conditions for lichen proliferation. The vegetation is predominantly composed of terricolous (ground-dwelling) lichens, forming extensive and diverse communities. These lichen fields are among the most extensive globally, with species adapted to extreme aridity and reliant on fog for hydration.

Known Threats

The Namib Lichen Fields face several significant threats:

- **Mining Activities**: The region has been subjected to diamond mining, leading to habitat destruction and fragmentation.

- **Off-Road Vehicle Disturbance**: Unregulated off-road driving can cause physical damage to the delicate lichen crusts, leading to long-term ecological impacts.

- **Climate Change**: Alterations in fog patterns and increased temperatures may affect lichen vitality and distribution.

Conservation Status

The Namib Lichen Fields are recognized as a South African Heritage Site due to their ecological significance. Despite this designation, they remain one of the most threatened habitats globally, primarily due to mining activities. Conservation efforts are needed to mitigate these threats and preserve this unique ecosystem.

Potential Habitat for Important Fauna Species

While the Namib Lichen Fields are predominantly lichen-dominated, they provide habitat for specialized fauna:

- **Invertebrates**: Various arthropods, including mites and insects, inhabit the lichen fields, contributing to nutrient cycling and soil health.
- **Reptiles**: Certain lizard species may utilize the lichen fields for foraging and shelter.

Important Ecosystem Processes

The Namib Lichen Fields support critical ecosystem processes:

- **Soil Stabilization**: Lichens bind soil particles, preventing erosion by wind and water.
- **Nutrient Cycling**: Lichens contribute to nutrient inputs in these nutrient-poor environments through nitrogen fixation and organic matter accumulation.

4.3 DFFE Screening Tool

The Namakwa Region is classified partially as HIGH, partially as MEDIUM and partially as LOW sensitivity according to the Animal Species Theme of the DFFE Screening Tool (**Figure 5**). The Namakwa Region also contains confirmed habitat for species of conservation concern (SCC) as defined in the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, Government Notice 1150 of 30 October 2020). SCCs are listed on the IUCN Red List of Threatened Species (2025) or South Africa's National Red List (2025) as Critically Endangered, Endangered, Near Threatened or Vulnerable. Refer to Section 4.5 Priority Fauna of Conservation Importance in Namaqualand for more details on animal SCC.

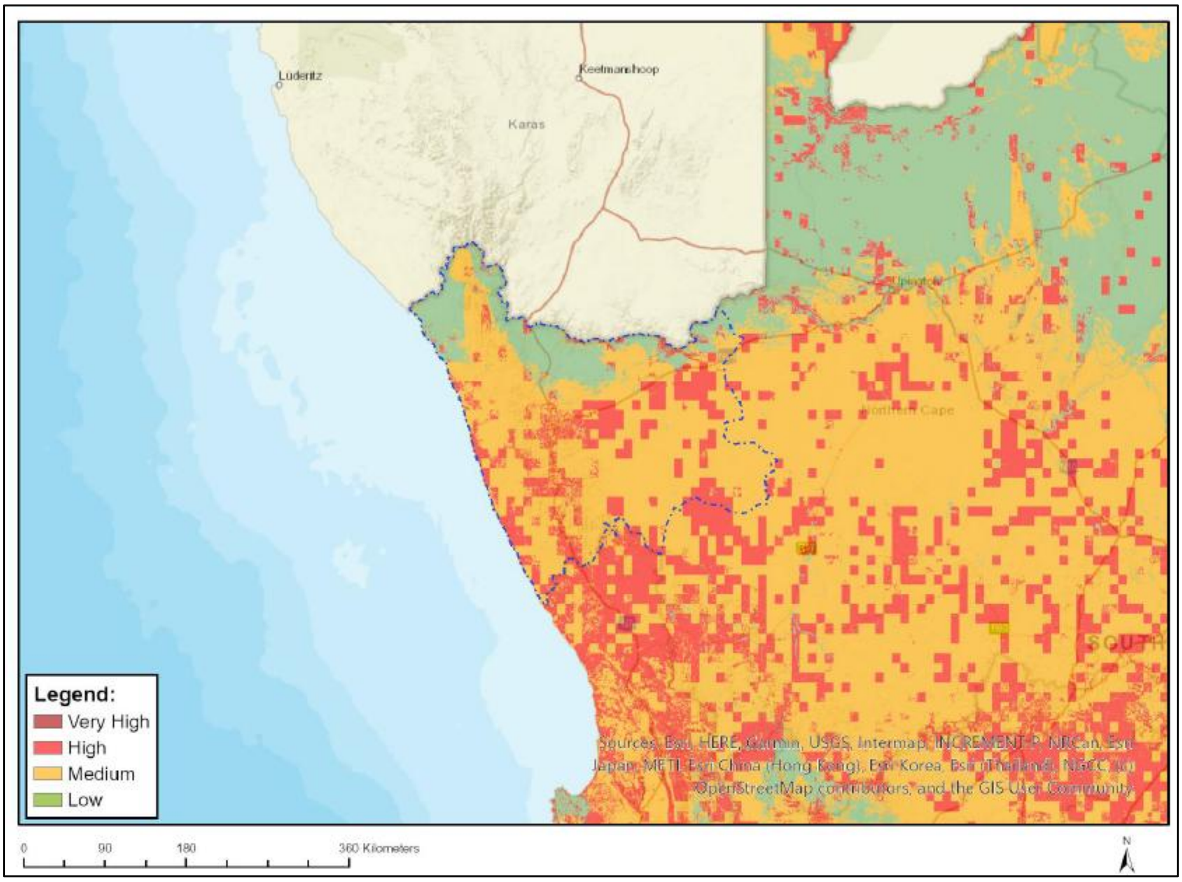

Figure 5: The sensitivity of the Namakwa Region as it relates to the Animal Species Theme (*Source*: DFFE Screening Tool, 2025).

4.4 Faunal Communities and Guilds of Namaqualand: Mammals, Reptiles, and Amphibians

Namaqualand is home to sensitive ecosystems that support a diverse range of fauna communities, including endemic, range-restricted, and migratory species.

In ecological terms, a **community** refers to a group of interacting species within a particular habitat, while a **guild** is a subset of species that exploit similar resources in a similar way. Below is an expanded discussion on the faunal communities and guilds of **mammals, reptiles, and amphibians** in Namaqualand (take note that information at this level of assessment is coarse and detailed impact assessments are required at a species level once projects have been identified for development). Due to the diversity of habitats and environments present, the site has a diverse and rich faunal community.

Namaqualand's faunal communities and guilds play essential roles in ecosystem functioning. While some species show moderate adaptability to human-altered environments, many are highly specialized and sensitive to habitat destruction. Conservation efforts should focus on habitat preservation, mitigation of human-wildlife conflict, and sustainable land-use planning to ensure the survival of these ecologically important communities.

As a crowdsourced species identification system, iNaturalist is an online social network of people sharing biodiversity information to help each other learn about nature. It helps you to identify the plants and animals around you while generating data for science and conservation. It also operates as an organism occurrence recording tool where access to observational data collected by iNaturalist users can be utilised by members. It is not a repository for external data, and as such there are limitations to its use. If the PA is under sampled owing to its location from major cities/towns, accessibility or observer bias, the quality and quantity of data should be considered in this context. Accordingly, a larger area should be searched for to obtain an observed and expected list of species which could intersect the PA.

For this project, the Namakwa Region was selected as the boundary for WP2. Filters applied included selecting amphibians, reptiles, mammals and invertebrates to obtain the distribution map for these taxa groups within the Namakwa Region (**Figure 6**).

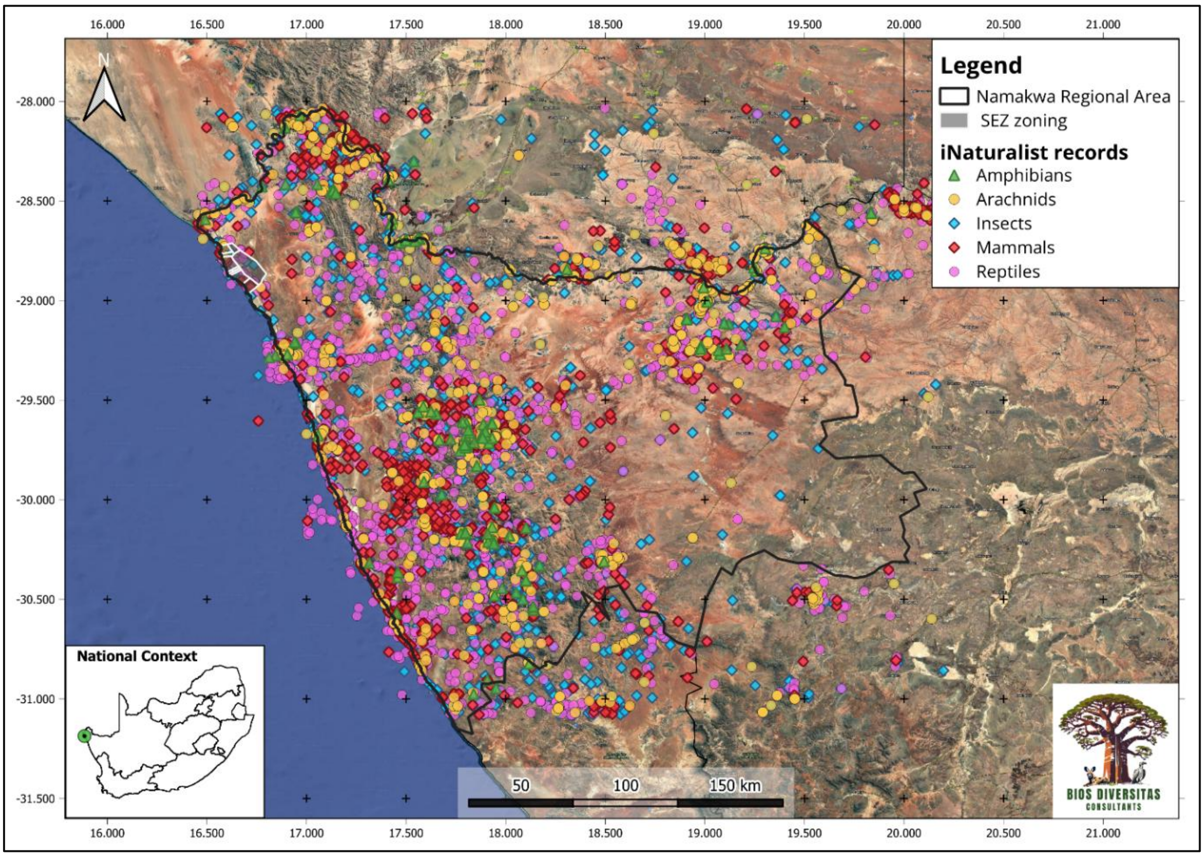

Figure 6: Fauna species records for the regional area (*Source*: iNaturalist).

4.4.1 Mammals

There are roughly 69 mammal species[6] in the Regional Area, including several endemic species such as the Critically Endangered De Winton's golden mole (*Cryptochloris wintoni*), Van Zyl's golden mole (*Cryptochloris zyli*) and the Namaqua dune mole rat (*Bathyergus janetta*). Furthermore, five species are known only from the dunes of the central Namaqualand coast. Some of these species occur in protected areas such as the Namaqua National Park.

Major concentrations of large mammals once roamed the Nama - and Succulent Karoo. These populations have now disappeared with mainly smaller herds of gemsbok (*Oryx gazella*), mountain zebra (*Equus zebra*) and springbok (*Antidorcas marsupialis*) still present today. Within the Namakwa region (Succulent Karoo and adjoining Nama-Karoo / desert systems), the most **ecologically important mammal groups** are those that drive energy flow, soil processes and trophic dynamics rather than just the "big" species.

<u>Small Mammal Guild (Rodents and Shrews)</u>

This group includes striped mice, gerbils, molerats and elephant shrews (sengis). They are major seed predators and dispersers, key prey for carnivores and raptors, and important ecosystem engineers through burrowing, which affects soil aeration, infiltration and nutrient cycling. Research has suggested that the nutrient-rich soil patches around *Parotomys brantsii* burrows may facilitate the re-vegetation of mine dumps. Sengi species are thought to be important ecosystem and cultural services as they are included in San art and are therefore subject to local folklore.

- **Species Examples:** Namaqua Rock Mouse (*Micaelamys namaquensis*), Hairy-Footed Gerbil (*Gerbilliscus paeba*), Brants's Whistling Rat (*Parotomys brantsii*), Western Rock Sengi (*Elephantulus rupestris*), and the Lesser Dwarf Shrew (*Suncus varilla*).
- **Habitat:** Occurs across arid shrublands, rocky outcrops, and sandy plains.
- **Ecological Role**:
  - Seed dispersal for native plant species.
  - Primary prey for mesopredators such as owls, jackals, and small carnivores.
- **Threats & Adaptability:**
  - Moderately adaptable; some species can persist in disturbed landscapes, but habitat fragmentation and agricultural expansion reduce their numbers.

<u>Burrowing Mammal Guild including fossorial insectivores and herbivores</u>

These burrowers are critical for soil turnover and microhabitat creation in coastal dunes and sandy plains, and golden moles in particular are top invertebrate predators below ground.

- **Species Examples:** De Winton's Golden Mole (*Cryptochloris wintoni*), Van Zyl's Golden Mole (*Cryptochloris zyli*), Cape Golden Mole (*Chrysochloris asiatica*), Cape Ground Squirrel (*Xerus inauris*), and Namaqua Dune Mole-Rat (*Bathyergus janetta*).
- **Habitat:** Prefers sandy and semi-arid environments with loose soil for digging.
- **Ecological Role:**
  - Aerates soil, influencing vegetation growth.
  - Creates microhabitats for reptiles, insects, and other small mammals.
- **Threats & Adaptability:**

[6] excluding bats, domestic animals such as dogs and horses, and marine mammals.

- Poorly adaptable to hard surface developments such as roads, mines, and urbanization, which destroy burrow networks.

Carnivore Guild (Small and Medium-Sized Predators)

Because large predators are scarce, mesocarnivores are especially important in Namakwa. Typical species in the Richtersveld–Namaqua system include black-backed jackal, Cape fox, bat-eared fox and leopard as the remaining apex carnivore, with mongooses and suricates (meerkats) also widespread. These mammals regulate small-mammal populations, scavenge, and help control insects (e.g. termites and beetles for bat-eared fox and suricate), maintaining trophic balance in otherwise plant-dominated systems.

- **Species Examples:** Bat-Eared Fox (*Otocyon megalotis*), Cape Fox (*Vulpes chama*), Aardwolf (*Proteles cristata*), Leopard (*Panthera pardus*), Meerkat (*Suricata suricatta*) and African Wildcat (*Felis lybica*).
- **Habitat:** Semi-arid shrublands, rocky terrain, and grasslands.
- **Ecological Role:**
  - Regulates populations of rodents, insects, and small vertebrates.
  - Aardwolves specialize in termite consumption, playing a role in controlling insect populations.
- **Threats & Adaptability:**
  - Some species (e.g., Bat-Eared Fox) adapt well to farmland, but roadkill and habitat degradation pose serious threats.

Herbi-browsers and grazers (antelope and rock specialists)

Open plains and rocky slopes support springbok, gemsbok, red hartebeest (often reintroduced), Hartmann's mountain zebra, klipspringer, steenbok, duiker, and rock hyrax.

As selective grazers and browsers, these mammals shape vegetation structure and productivity, drive nutrient redistribution, and provide carrion and prey for carnivores. On rocky slopes, klipspringer and hyrax link steep, plant-rich microhabitats to higher trophic levels.

- **Species Examples:** Springbok (*Antidorcas marsupialis*), gemsbok (*Oryx gazella*), red hartebeest (*Alcelaphus buselaphus*), Hartmann's mountain zebra (*Equus zebra hartmannae*), steenbok (*Raphicerus campestris*), common duiker (*Sylvicapra grimmia*) and Grey rhebok (*Pelea capreolus*).
- **Habitat:** low, shrub-dominated plains, gravel flats and sandy duneveld, often on gently undulating terrain with sparse grass and dwarf shrubs, as well as rocky escarpments and inselbergs.
- **Ecological role:** Grazers crop grasses and ephemeral forbs, maintaining grazing lawns and influencing the balance between grassy patches and shrub-dominated areas; affect recruitment and growth of particular plant species, especially palatable shrubs and succulents; core prey base for the region's carnivores and raptors.
- **Threats & Adaptability:** habitat loss, overgrazing, fragmentation and climate-related stress. Fencing and artificial water points have altered historic movement patterns.

4.4.2 Reptiles

Reptile diversity is relatively high with approximately 115 species, of which roughly 45 species are endemic including several extremely range-restricted Namaqualand reptiles. Almost all the endemics are geckos and lizards, representing about a quarter of the nearly 60 gecko and lizard species in the Succulent Karoo hotspot. These endemics include seven species of girdled lizards of the genus Cordylus, including the armadillo girdled lizard (*Cordylus cataphractus*), which has a heavily armoured body and spiny tail and is known for rolling into a tight ball when threatened.

Tortoise diversity is very high here, with seven taxa, two of which are endemic: the Namaqualand tent tortoise (*Psammobates tentorius trimeni*) and the Namaqualand speckled padloper (*Homopus signatus signatus*).

Attractive species such as chameleons, lizards and tortoises are also vulnerable to collection for use as pets or illegal trade, and the increased accessibility resulting from the new roads that will be constructed as part of the development would raise the risk for these species.

<u>Arid tortoises (padlopers, angulate & tent tortoises)</u>

Species Examples: Namaqua speckled padloper *Homopus signatus signatus* – the world's smallest tortoise, endemic to the Succulent Karoo. Angulate tortoise *Chersina angulata* and Western tent tortoise *Psammobates tentorius trimeni* recorded in Namaqua National Park.

Ecological role: slow, long-lived herbivores and browsers on succulents, forbs and small shrubs; they move seeds and nutrients across the landscape via dung and track networks and form important prey for larger carnivores and people historically.

Namakwa importance: they're flagship endemics of the Succulent Karoo and good indicators of intact, lightly grazed rocky and sandy habitats. Overgrazing, roadkill and illegal collection for the pet trade are key pressures.

<u>Desert-Adapted Lizard Guild</u>

- **Species Examples:** Namaqua Sand Lizard (*Pedioplanis namaquensis*), Western Three-Striped Skink (*Trachylepis occidentalis*), and Cape Cobra (*Naja nivea*).
- **Habitat:** Arid plains, rocky outcrops, and sandy dunes.
- **Ecological Role:**
  - Predators of insects, spiders, and small vertebrates.
  - Prey for raptors and carnivorous mammals.
- **Threats & Adaptability:**
  - Some species can tolerate modified landscapes, but habitat destruction limits available basking and foraging grounds.

<u>Burrowing and Fossorial Reptile Guild</u>

- **Species Examples:** Karoo Sand Snake (*Psammophis notostictus*), Spotted Sand Lizard (*Meroles suborbitalis*), and Namaqua Dwarf Adder (*Bitis schneideri*).
- **Habitat:** Sandy and loose-soil environments.
- **Ecological Role:**
  - Regulates insect and small vertebrate populations.
  - Important prey for desert-adapted birds and mammals.
- **Threats & Adaptability:**
  - Poorly adaptable; habitat modification that compacts soil prevents burrowing.
  - Increased vehicle activity leads to higher mortality rates.

Rock-Dwelling Reptile Guild

Territorial, site-faithful insectivores that structure arthropod communities on rock outcrops and provide a key food source for snakes, jackals, caracal and cliff-nesting raptors. Their basking and retreat behaviour ties them tightly to the thermal and structural properties of the rock.

- **Species Examples:** Flat Lizard (*Platysaurus broadleyi*), Namaqua Plated Lizard (*Gerrhosaurus typicus*), Peers' girdled lizard (*Namazonurus peersi)*, Karoo girdled lizard (*Karusasaurus polyzonus*), Southern Rock Agama (*Agama atra)* and Common Spiny Agama (*A. hispida)*.
- **Habitat:** Rocky hills, granite outcrops, and cliffs.
- **Ecological Role:**
    - Key insectivores.
    - Prey for raptors and small carnivores.
- **Threats & Adaptability:**
    - Quarrying, mining, and heavy disturbance of outcrops that destroy rocky refuges can cause local collapses.
    - Can persist in undisturbed rocky areas.

Chameleons and other shrub / dune specialists

- **Species examples:** Namaqua chameleon *Chamaeleo namaquensis*, a terrestrial, desert-adapted chameleon of western South Africa that forages across sandy plains and even into intertidal zones.
- **Ecological role:** top-end arthropod predators in low shrubs and dunes, taking large insects and small vertebrates and themselves forming prey for snakes and birds. Because they are visually oriented and slow-moving, they are sensitive to habitat structure (shrub cover, dune integrity).
- **Namakwa importance:** they're a charismatic indicator of healthy duneveld and shrubland and are especially vulnerable to off-road vehicles, collection and intensive tourism in coastal areas.

Snakes (top reptile predators)

- **Species examples:** Cape cobra *Naja nivea*, puff adder *Bitis arietans*, many-horned adder *B. cornuta*, mole snake *Pseudaspis cana*, skaapstekers *Psammophylax rhombeatus* and house snakes *Boaedon capensis*.
- **Ecological role:** apex reptile predators regulating rodents, lizards and sometimes birds, stabilising small-mammal populations and linking below-ground productivity (rodents) to higher trophic levels.
- **Namakwa importance:** snakes are often the main vertebrate predators in more degraded or livestock-dominated parts of Namakwa where large carnivores are scarce. Persecution, road mortality and habitat fragmentation can simplify snake communities and release rodent populations.

4.4.3 Amphibians

Amphibians are poorly represented in the region with just over 15 species. Most of these species are frogs with some toads, including two endemic frogs, the Desert Rain Frog (*Breviceps macrops*) and Branch's Rain Frog (*Breviceps branchi)*, which occurs along the Namaqualand coast of South Africa.

Rain Frog Guild

The most distinctive and ecologically important amphibian group in Namakwa is the burrowing rain frogs (genus *Breviceps*). They are specialised, round-bodied fossorial frogs that live in loose sands of the Succulent Karoo and coastal dunes and emerge mainly during or after rain to feed and breed.

- **Species Examples:** ranch's Rain Frog (*Breviceps branchi),* Namaqua Rain Frog (*Breviceps namaquensis*), Desert Rain Frog (*Breviceps macrops*).
- **Habitat:** Fossorial in sandy shrublands and dunes. Burrows in sandy soils, emerging after rainfall.
- **Ecological Role:**
    - Controls insect populations. Key nocturnal predators of ants, termites and other small arthropods.
    - Important in nutrient cycling in soil ecosystems and soil processes.
- **Threats & Adaptability:**
    - Poorly adaptable to development; soil compaction and habitat destruction limit their breeding areas.
    - Localised habitat loss from agricultural expansion and development.

<u>Seasonal Pool Amphibian Guild</u>

- **Species Examples:** Cape Sand Frog (*Tomopterna delalandii*), Clicking Stream Frog (*Strongylopus grayii*).
- **Habitat:** Ephemeral rain-fed pools and seasonal wetlands.
- **Ecological Role:**
    - Plays a key role in ecosystem nutrient flow.
    - Tadpoles serve as food for birds and reptiles.
- **Threats & Adaptability:**
    - Highly vulnerable to climate change and altered hydrology.
    - Poor adaptability to artificial water sources.

<u>Sand frogs of ephemeral pans and sand rivers</u>

The sand frogs (genus *Tomopterna*) are an ecologically important group, which key into temporary surface water after rain, especially in sandy riverbeds and shallow pans. Tadpoles graze on algae and organic films, helping to process nutrient pulses in ephemeral pools, while adults are active, opportunistic predators of terrestrial and aquatic invertebrates around these waterbodies.

The standout species for Namakwa is the Namaqua sand frog (*Tomopterna branchi)*. This species was only recently described (Wilson & Channing, 2019) and is known from the Buffels River drainage in Namaqualand, where it is associated with Namaqualand Hardeveld vegetation units of the Succulent Karoo biome.

Functionally, *T. branchi* and congeners link episodic rainfall and surface runoff to both aquatic and terrestrial food webs: dense choruses and larval stages follow heavy rains, providing short-lived but intense prey pulses for birds, small carnivores and other predators. Because they depend on ephemeral natural pools and unaltered sand-river hydrology, they are vulnerable to river regulation, groundwater abstraction, overgrazing of catchments and disturbance of sandy channels by mining or roads. Protection of natural flood regimes and avoidance of pan infilling or bulldozing is therefore important for maintaining this amphibian group.

Arid-zone toads in ephemeral terrestrial pools

Small arid-zone toads (e.g. *Poyntonophrynus* and *Sclerophrys* species) that breed in shallow, short-lived depressions after heavy rain form an important ecological group across upland plains and hardveld. They can rapidly colonise muddy puddles and pans, where large numbers of tadpoles strip algal films and organic matter, speeding up decomposition and nutrient cycling, and then metamorphose quickly before pools dry.

These toads are mobile and relatively tolerant of moderate disturbance, so they often dominate amphibian assemblages in grazed or moderately transformed rangelands, providing a resilient insect-control service around settlements, farmsteads and roads. Their main threats are loss of suitable breeding depressions through compaction, paving or cultivation, and exposure to pollutants (herbicides, pesticides, road runoff) in small, rain-fed pools.

4.4.4 Invertebrates (mainly insects, arachnids, mollusks)

Key invertebrate processes and communities in the Namakwa region are best understood as functional guilds that underpin plant reproduction, soil formation, decomposition and food-web dynamics in this arid landscape. Namaqualand is recognised internationally as a global centre for insect diversity and endemism within the broader Succulent Karoo hotspot, alongside its exceptional plant and reptile diversity. Invertebrates are therefore central to how the system works, even if they are often under-represented in EIAs.

In the Namaqualand region, invertebrates play crucial ecological roles in various processes and communities. Invertebrate diversity is quite high and supports on the order of a thousand species (c. 1050 species), and evidence suggests that more than half of the species in some insect groups are local endemics. Of the more than 70 species of scorpions found in the Succulent Karoo, nearly 20 are endemic. The Desert Biome includes an abundant insect fauna which includes many tenebrionid beetles, some of which can utilise fog water.

Perhaps the most unusual invertebrates found in the hotspot are the long-tongued flies (*Memestrinidae*), which can have mouthparts up to 50 millimetres long. The flies are the exclusive pollinators of 28 different plant species in Namaqualand. Below are some key invertebrate processes and communities:

Key Invertebrate Processes

1. **Pollination** – Many plant species in Namaqualand rely on invertebrates for pollination, particularly long-tongued flies (Memestrinidae), which have evolved exclusive pollination relationships with certain plants. The winter–spring wildflower displays of the Namakwa region depend heavily on insect pollinators: bees, pollen wasps, bee flies, butterflies, moths and beetles. A particularly important group is the monkey beetles (Scarabaeidae: Hopliini), which are specialised pollinators of many Aizoaceae and Asteraceae species typical of Namaqualand daisy fields and succulent shrublands. Studies in the Succulent Karoo at Paulshoek show that monkey beetles are major pollinators in both grazed and ungrazed areas, with bees, pollen wasps and bee flies providing complementary pollination services.

2. **Key Ecosystem Engineers** – Below ground and at the soil surface, ants and termites, together with various burrowing beetles and other invertebrates, act as key ecosystem engineers. Harvester ants such as *Messor capensis* build low, conical mounds in Karoo shrublands composed of soil and plant material; through seed harvesting, nest-building and soil transport they create nutrient-rich patches and strongly influence seed banks and micro-topography. Termites play a similar and often larger role; in the Greater Cape Floristic Region (which includes the Succulent Karoo), species such as *Microhodotermes viator* are recognised as keystone engineers that move large quantities of soil and plant material, altering infiltration, nutrient distribution and the development of characteristic "heuweltjie" mounded landscapes.

3. **Decomposition and Nutrient Cycling** – Detritivore communities such as dung beetles, carrion beetles, saprophagous flies, springtails and mites contribute to the breakdown of organic material, aiding in nutrient cycling. Arthropods found in lichen fields assist in soil formation and

decomposition. Dung beetles and other scavengers also link vertebrate herbivore and carnivore assemblages to soil processes by processing faeces and carcasses, reducing parasite loads and creating microsites of enhanced fertility used by germinating plants.

4. **Soil Stabilization** – Many invertebrates, such as burrowing insects and scorpions, contribute to maintaining soil health by aerating the ground and preventing erosion.

Key Invertebrate Communities

1. **Lichen-Associated Arthropods** – The Namib Lichen Fields support various invertebrates, including mites and insects that inhabit the crust-like lichen formations, contributing to ecosystem stability.

2. **Scorpions and Spiders** – Namaqualand hosts at least 70 species of scorpions, with nearly 20 endemics to the region, indicating a high level of specialisation in arid ecosystems.

3. **Beetles and Ants** – These species play a role in seed dispersal and soil turnover. Many desert-adapted beetles exhibit fog-basking behaviours to collect water.

The invertebrate communities of Namaqualand are crucial to the region's ecological integrity, supporting primary productivity, decomposition, and predator-prey dynamics (solifuges (sun-spiders), ground beetle predators and a rich spider fauna, these predators exert strong top-down control on insect and small arthropod populations) in an arid environment. These functions are highly sensitive to land-use change, overgrazing, mining, soil disturbance, pesticide use and hydrological alteration and should therefore be explicitly recognised as core ecological processes in baselines, sensitivity mapping and impact assessment for the Namakwa region.

4.5 Priority Fauna of Conservation Importance in Namaqualand

This section expands on key fauna of high conservation importance in the Namakwa region, focusing on taxa that are endemic, range-restricted, or otherwise sensitive to disturbance expected from GH2-enabling infrastructure. Part of the Namaqualand is an arid global biodiversity hotspot and is recognised as a centre of diversity and endemism for reptiles, amphibians and many invertebrate groups, in addition to its flora. For EIA purposes, “priority fauna” here are those that (i) are listed as threatened or Data Deficient on national or global Red Lists, (ii) are range-restricted to Namaqualand / the Succulent Karoo, and (iii) are closely associated with habitats targeted by development (coastal dunes, sand rivers, rocky outcrops, etc.). Where suitable habitat occurs in or near a local development footprint, these taxa should trigger specific baseline surveys and impact assessment.

4.5.1 Mammals

At least seven (7) mammal SCC occur within the study area, of which *Cryptochloris wintoni, Eremitalpa granti granti* and *Bathyergus janetta* are considered the most sensitive to development and species of high conservation value (refer to **Figure 7**). According to Dr Samantha Theron from the EWT’s Drylands Conservation Programme, a new *Eremitalpa* lineage that was detected near Groenriviermond has not yet been described as further surveys are required before it can properly describe as a species or subspecies and to conduct threat assessment. A survey is being planned for July 2026.

Cryptochloris wintoni – Critically Endangered

The De Winton’s Golden Mole occurs on coastal dunes and adjacent sandy areas in Strandveld of the Namaqualand coastal plain of the Northern Cape (Bronner 2013). The species is known from only the type locality at Port Nolloth, Northern Cape Province and has recently been rediscovered after 86 years. Mynhardt et al. (2024) indicated that this species may be widespread in the area, ranging from Lambert’s Bay in the south to Visagiesfontein (which is part of the study area), beyond Port Nolloth in the north, giving an indication that the species may be more widespread. The species has been recorded by eDNA samples along the coast at Visagiesfontein (Mynhardt et al. 2024). Further surveys are required in order to update the species distribution range (Dr. S. Theron (EWT), personal communication, 11 November 2025).

Accordingly, the presence of the species must be established through appropriate survey techniques during the EIA application phases for the project and the EWT's Drylands Conservation Programme must be consulted for updated information relevant at the time of future assessments. If recorded, the presence of the species likely represents a fatal flaw to projects located along the coast of the Namakwa region (**Figure 7**).

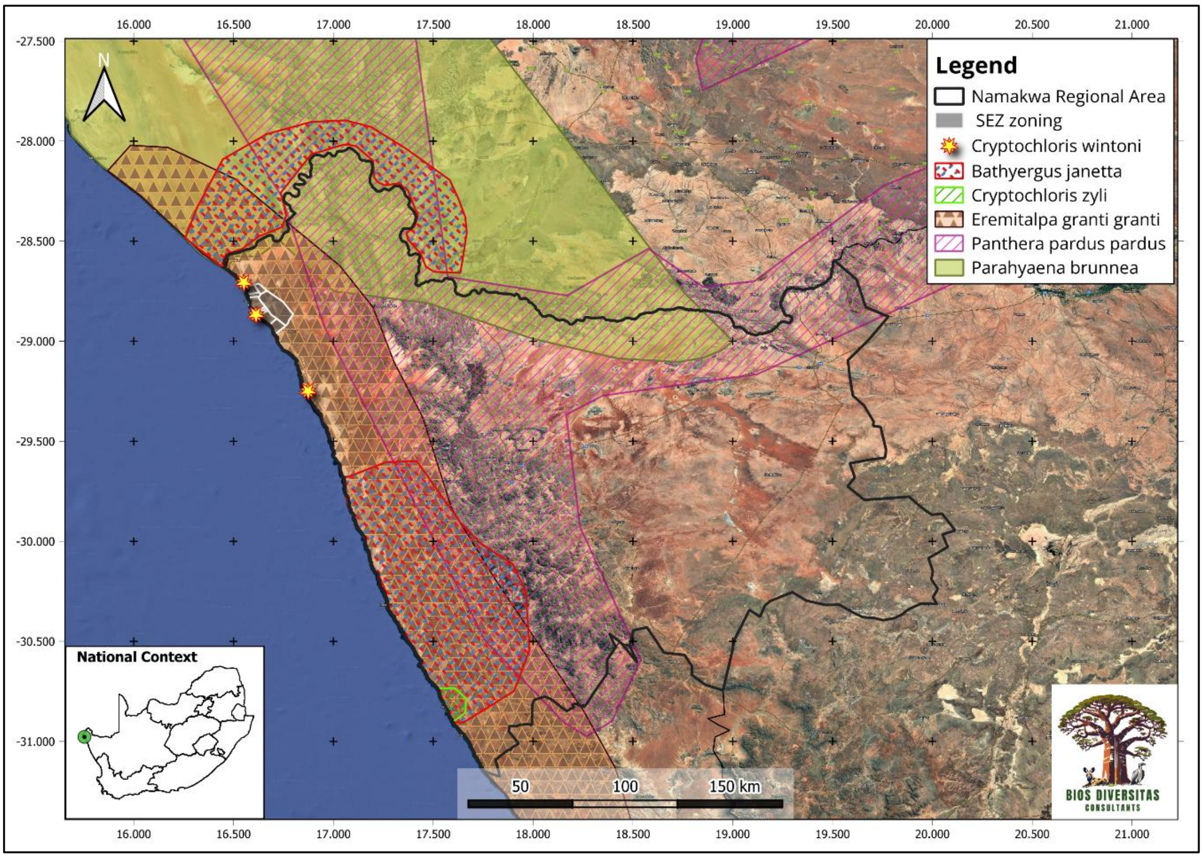

Figure 7: IUCN distribution range for threatened mammal species in relation to the Project Area.

Eremitalpa granti granti **– Vulnerable**

Grant's Golden Mole is endemic to southern Africa, with its distribution primarily focused on the arid and semi-arid regions of the western parts of the Northern Cape and Namibia. Within the Northern Cape, its range is concentrated in the Succulent Karoo Biome and along coastal dunes. Its range overlaps with sandy habitats extending into desert-like environments, including the Namaqualand coastal areas (Port Nolloth and possibly as far north as Alexander Bay). Further surveys are required in order to update the species distribution range (Dr. S. Theron (EWT), personal communication, 11 November 2025).

Grant's Golden Mole is a remarkable example of adaptation to extreme environments, but its narrow habitat requirements and sensitivity make it vulnerable to human and environmental changes. The species has been recorded with eDNA samples along the coast at Visagiesfontein and further south (Mynhardt *et al*. 2024). The presence of the species must be established through appropriate survey techniques during the EIA application phases for the project and the EWT's Drylands Conservation Programme must be consulted for updated information relevant at the time of future assessments. If recorded, the presence of the species likely represents a fatal flaw to projects.

Bathyergus janetta **– Uplisted to Endangered A4(a)**

Namaqua Dune Mole-rat has recently been uplisted to Endangered (2025 National Red List) owing to climate change and the threat of continued habitat destruction of three isolated subpopulations. The species is located along the southern coastline of the Namakwa region between Port Nolloth and Groenrivier. Accordingly, proposed development along this coastline must established the species presence through appropriate survey techniques during the EIA application process and the EWT's Drylands Conservation Programme must be consulted for updated information relevant at the time of future assessments. If recorded, the presence of the species likely represents a fatal flaw to projects.

4.5.2 Reptiles

Psammobates tentorius trimeni – Endangered

Western Tent Tortoise is restricted to the winter-rainfall region dominated by dwarf succulent shrubs and annuals, concentrated in the Namaqualand Sandveld and Richtersveld Bioregions and extends peripherally into the Namaqualand Hardeveld Bioregion. This subspecies is assessed to be Endangered under criterion A4ce (Hofmeyr et al. 2018a) owing to continuous detrimental impacts on its sensitive habitat as discussed below.

The range of P. t. trimeni is small and restricted to a few vegetation units of the western Succulent Karoo, which are under continued pressure from multiple impacts from overgrazing, destructive or illegal mining, and unsustainable land use involving ploughing of natural veld for fodder cropping, uncontrolled harvesting of natural products, and irresponsible tourism activities in sensitive areas (Bourne et al. 2012).

The species occurs mainly towards the interior and western section of the Namakwa region from north to south, covering large sections of land earmarked for development or already developed. The presence of the species must be established through appropriate survey techniques during the EIA application phases for proposed projects. Accordingly, all proposed developments within the species range must established the species presence through appropriate survey techniques during the EIA application process and the EWT's Drylands Conservation Programme must be consulted for updated information relevant at the time of future assessments. If recorded, the presence of the species likely represents a fatal flaw to projects.

Chersobius signatus – Endangered

Speckled Cape Tortoise is a very small tortoise endemic to South Africa, largely restricted to rocky outcrops in the Succulent Karoo of north-western South Africa, including Namaqualand. It is listed as Endangered with ongoing declines and strong pressure from habitat degradation (overgrazing, cultivation, roads, mining) and illegal collection for the pet trade. The species is strongly associated with koppies and rocky ridges where it feeds on small succulents.

The most northerly records are from the Richtersveld (Bauer and Branch 2001; iNaturalist record 507286, May 2018). The species occurs predominantly in the winter rainfall region of the northwestern Succulent Karoo and Fynbos biomes from a few metres above sea level on the West Coast to elevations of around 1,000 m in the interior at Springbok, Loeriesfontein-Calvinia, and the Cederberg Range. It can be found in low to medium-high Namaqualand succulent blomveld and heuweltjieveld, and fynbos and strandveld shrub vegetation. The species shows a particular preference for rocky terrain (Loehr 2002), which includes typical Namaqualand and Hardeveld granite koppies in the north.

Any proposed development within the species range must established the species presence through appropriate survey techniques during the EIA application process and the EWT's Drylands Conservation Programme must be consulted for updated information relevant at the time of future assessments. If recorded, the presence of the species likely represents a fatal flaw to projects.

Bitis schneideri – Near Threatened (Regionally); Least Concern (Globally)

Namaqua Dwarf Adder is endemic to southern Africa and found from the mouth of the Olifants River in the Western Cape, South Africa, northwards to Lüderitz Bay in southwestern Namibia (Branch 1998, Bates et al. 2014). The species is considered well protected, has a moderately sized distribution (15,300 km^2) and a large extent of occurrence (EOO = 27,100 km^2) that shows no evidence of decline in extent.

The species is a habitat specialist with a small distribution across a region of South Africa (**Figure 8**) that is impacted by habitat transformation due to mining and urbanisation, but the habitat loss is relatively small compared to the species overall range. Accordingly, the species is considered Least Concern globally (Tolley et al. 2019). It inhabits semi-vegetated sandy desert areas, mostly close to the coast. These snakes occur at high population densities, experience relatively high annual mortality (Maritz and Alexander 2012), which is counter-balanced by frequent reproduction (Maritz and Alexander 2013). They are generalist predators that consume a wide range of small-bodied vertebrates (Maritz and Alexander 2014).

Proposed developments must established the species presence through appropriate survey techniques during the EIA application process and the EWT's Drylands Conservation Programme must be consulted for updated information relevant at the time of future assessments. If recorded, the presence of the species likely represents a fatal flaw to projects.

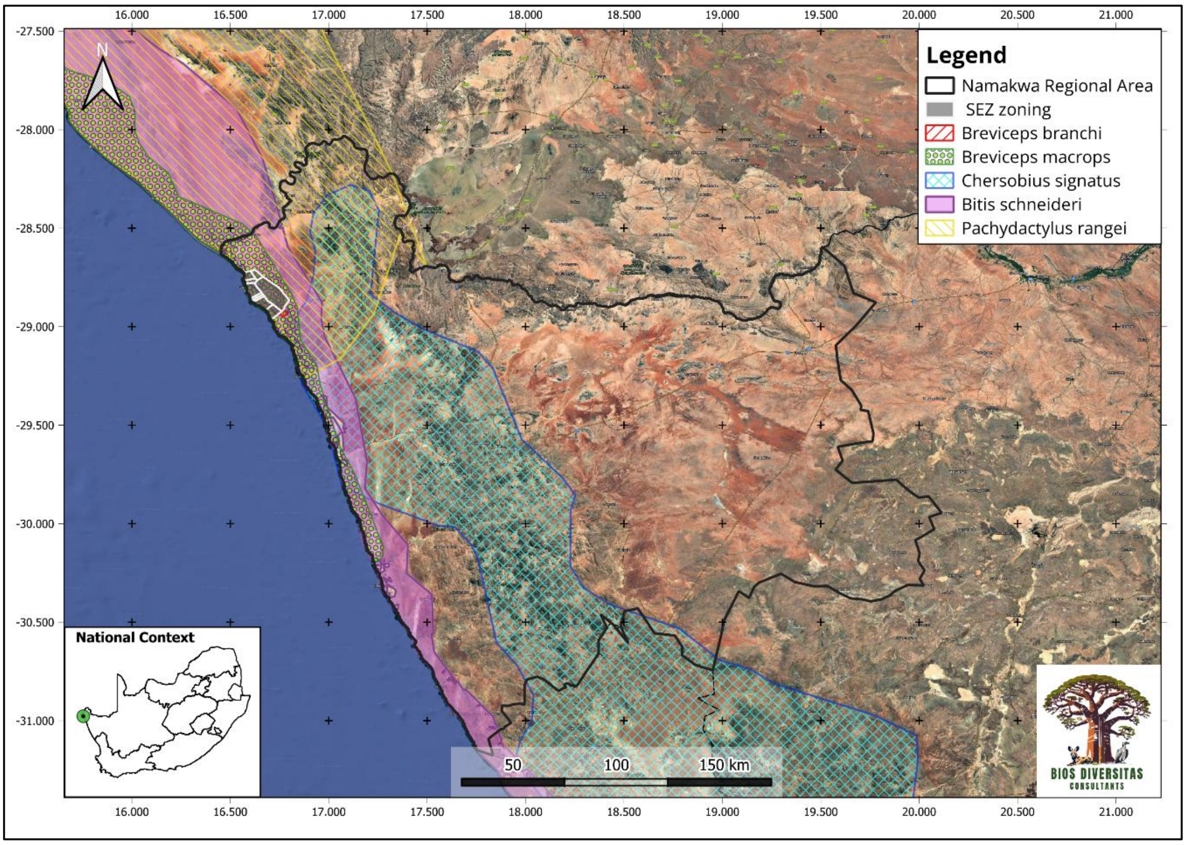

Figure 8: IUCN distribution range for threatened reptile and amphibian species in relation to the Project Area.

4.5.3 Amphibians

Breviceps macrops **– Vulnerable**

Desert Rain Frog has been uplisted from Near Threatened to Vulnerable (SANBI 2025) owing to changes in government policy that will increase approved mining in the region. The species occupies a narrow coastal strip along the northwestern Namaqualand coast, from Alexander Bay (2816CB) southward as far as the farm Skulpfontein north of Koingnaas (3017AB). Distribution data for this species are scarce, as much of the area it occupies lies within diamond-mining concessions and is not easily accessible. The available data are restricted mainly to areas lying outside the mining concessions and are therefore incomplete

Breviceps branchi – not evaluated

Branch's Rain Frog is not evaluated but is a species of high conservation value and endemic. The vegetation is classified as Northern Richtersveld Yellow Duneveld, which is part of the Succulent Karoo Biome. It presumably occupies arid sandy habitats similar to B. *namaquensis*. The breeding ecology and breeding biology has not been recorded but is presumably similar to other *Breviceps* species that deposit eggs in shallow burrows (Channing 2001). The species is fossorial and breeds by direct development and is not associated with water. The species known from a single locality, near the Holgat River on the coast of Namaqualand, Northern Cape Province, South Africa. Since its description from a single specimen (Channing 2012), only three other records have been made in the same proximity of the type locality. Based its occurrence in one locality, its extent of occurrence (EOO) is 10 km^2; however, the true limits of its range are uncertain.

5. THREATS AND ADAPTABILITY TO NEW DEVELOPMENTS

Namaqualand's unique fauna faces several anthropogenic threats due to increasing development pressures, including mining, agriculture, renewable energy projects, urban expansion, and climate change. While some species exhibit adaptability, many are highly specialised and struggle to survive in modified environments. The main threats are indicated below:

- **Mining & Agriculture:** Many endemic species are poorly adapted to large-scale habitat alteration.
- **Renewable Energy (Wind & Solar Farms):** Can disrupt migratory corridors and foraging habitats, especially burrowing animals and species with restricted ranges.
- **Roads and Traffic-Related Mortality:** roads disrupt movement corridors and migration routes of larger mammals and dispersal pathways of smaller species especially burrowing animals, and act as death traps for many animals, especially slow-moving tortoises and smaller mammals.
- **Climate Change:** Many species are highly specialized for Namaqualand's climate, making adaptation difficult.

Future development should prioritise conservation and responsible tourism over industrial activities that could be more appropriately located inland, a strategy for sustainable development that protects natural assets while fostering economic growth. A more strategic approach to land use management and planning is essential to curb coastal sprawl and promote compact, nodal developments.

At the United Nations Biodiversity Conference in 2022, South Africa and other countries committed to the Kunming-Montreal Global Biodiversity Framework (GBF), which aims to conserve at least 30% of the world's terrestrial, inland water, coastal and marine areas by 2030. The agreement, also called 30 x 30 (Thirty by Thirty), specifically respects the rights and involvement of indigenous peoples and local communities. To achieve 30% by 2030 would mean a dramatic growth in South Africa's existing conservation lands: an additional 14 million hectares (equivalent to eight Kruger National Parks) must be added to the 16 million hectares now under formal protection.

Currently, there are several existing or planned renewable energy developments within the Namakwa region, as indicated in **Figure 9** below. Many of these developments already intercept animal SCC ranges and known locations, increasing their risk to future developments.

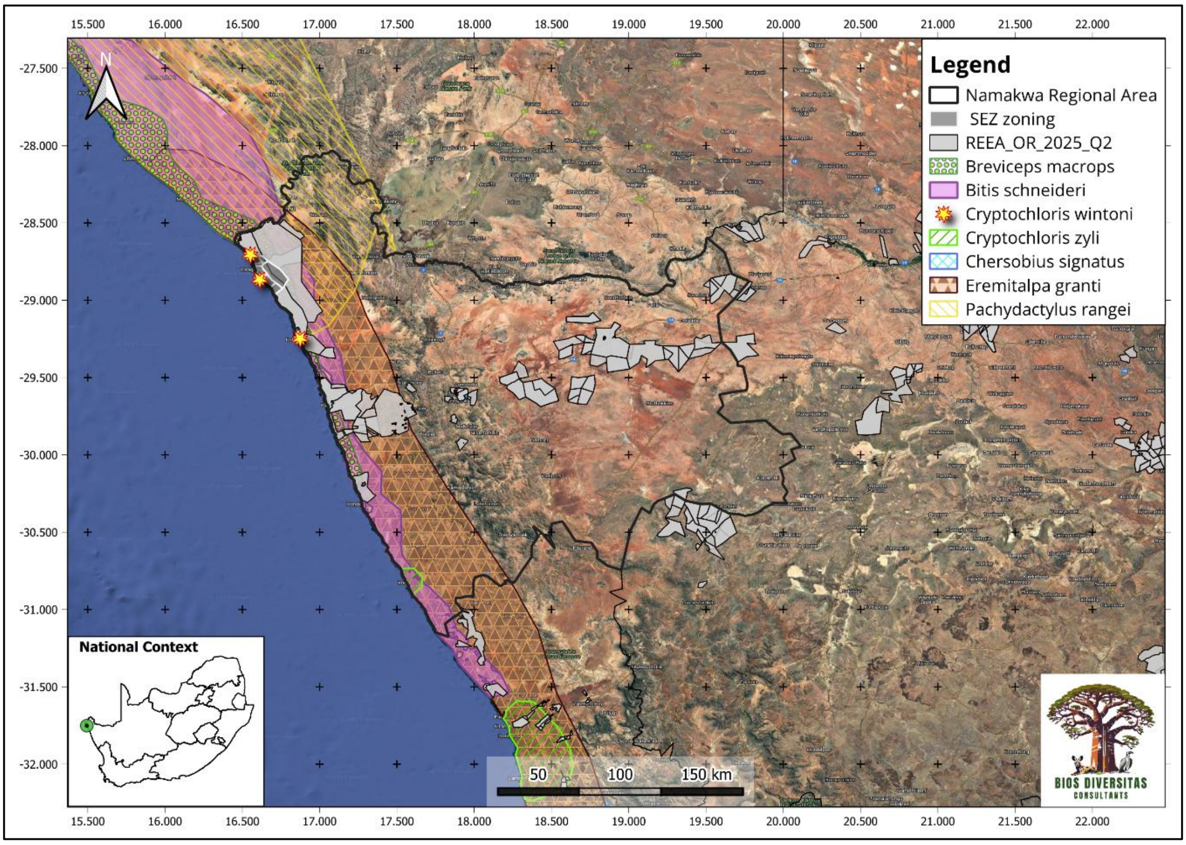

Figure 9: Renewable energy developments in relation to the Project Area.

Below is a breakdown of the key threats and how different faunal communities and guilds respond to them.

5.1 Habitat Destruction and Fragmentation

Threat Overview

- Large-scale land clearing for mining, agriculture, and infrastructure leads to habitat loss.
- Linear infrastructure, such as roads, railways, pipelines, fences, and power lines, disrupt movement corridors and migration routes of larger mammals (such as Brown Hyena, Aardwolf, Caracal, Bat-Eared Foxes) and dispersal pathways of smaller species (such as mole-rats, moles, tortoises and burrowing lizards) especially burrowing animals.
- Open-cast mining and sand extraction destroy critical burrowing and breeding habitats.

Impacts and Adaptability by Faunal Group

Mammals

- Highly mobile species (e.g., Cape Fox, Bat-Eared Fox) can adapt to fragmented landscapes but suffer increased road mortality.
- Small burrowing mammals (e.g., Namaqua Dune Mole-Rat) are highly sensitive as their entire ecosystem is underground-dependent.

Reptiles

- Rock-dwelling lizards and snakes are highly vulnerable, as quarrying removes their habitats entirely.
- Burrowing species (e.g., Namaqua Dwarf Adder) depend on loose sandy soils, which are compacted by land clearing, reducing survival.

Amphibians

- Rain frogs and seasonal breeders rely on specific ephemeral water bodies that can be destroyed or altered by human activities.
- Highly sensitive to habitat loss due to limited dispersal ability.

5.2 Mining and Extractive Industries

Threat Overview

- Namaqualand has rich mineral deposits (diamonds, copper, tungsten, and lithium), making mining a major land-use concern.
- Mining creates dust pollution, alters hydrology, and depletes surface and groundwater resources.
- Toxic runoff and tailings affect water quality in the few seasonal streams that support amphibians and freshwater invertebrates.

Impacts and Adaptability by Faunal Group

Mammals

- Highly mobile species (e.g., jackals, caracals) may shift territories, but mining fences can limit movement.
- Bats suffer loss of roosting caves and disruption of foraging areas due to light pollution.

Reptiles

- Slow-moving species (e.g., tortoises, burrowing lizards) cannot escape destruction during mining operations.
- Destruction of rocky outcrops eliminates microhabitats for skinks and geckos.

Amphibians

Mining alters seasonal water availability, which can cause complete reproductive failure in species that rely on rainfall-triggered breeding events.

5.3 Renewable Energy Developments (Wind and Solar Farms)

Threat Overview

- Wind farms pose collision risks for raptors, bats, and migratory birds.
- Large-scale solar farms require extensive land clearing, altering thermal conditions and affecting ground-dwelling reptiles and amphibians.

Impacts and Adaptability by Faunal Group

Mammals

- Nocturnal predators like Cape Fox and Aardwolf can adapt if habitat loss is minimal, but increased human activity and light pollution affect their behaviour.
- Habitat loss and fragmentation due to large-scale solar farms clearing extensive land, and fences which hinders species movement and potential hazards.

Reptiles

- Large-scale solar farms could change ground temperature, affecting burrowing species like sand lizards and egg incubation in species with temperature-dependent sex determination (e.g., some lizards and snakes).
- Burrowing reptiles may suffer from habitat degradation as land is flattened and compacted.

Amphibians

- Wind and solar farms disrupt natural water runoff, potentially eliminating critical breeding pools.
- Artificial structures can provide shading refuges for some species, but overall impact is negative due to habitat loss.

5.4 Water Abstraction and Drainage Alteration

Impact:

- Reduces availability of seasonal wetlands and ephemeral pools, essential for amphibians, reptiles, and water-dependent mammals.
- Affects vegetation critical for insect populations, which in turn impacts species that rely on them for food.
- Example: The Namaqua Rain Frog relies on moist soil conditions for burrowing; water loss increases desiccation risks.

Most Affected Groups:

- **Amphibians:** Namaqua Rain Frog, Clicking Stream Frog.
- Semi-aquatic reptiles: Karoo Sand Snake.
- **Insectivorous mammals:** Aardwolf (depends on termite availability).

5.5 Agriculture and Overgrazing

Threat Overview

- Expansion of livestock farming and irrigated crops depletes groundwater resources, leading to desertification.
- Overgrazing by sheep and goats reduces plant cover, increasing soil erosion and eliminating small mammal burrows.

- Use of pesticides and rodenticides affects carnivores and scavengers via secondary poisoning.

Impacts and Adaptability by Faunal Group

Mammals

- Rodents and insectivores suffer as ground cover declines.
- Carnivores (e.g., Caracal, Jackal) are often persecuted by farmers due to livestock predation, leading to population declines.

Reptiles

- Herbivorous tortoises struggle due to the loss of plant diversity.
- Overgrazing compacts soil, making it unsuitable for burrowing species like sand lizards.

Amphibians

- Pesticide runoff contaminates seasonal breeding pools, reducing reproduction rates.
- Loss of wetland vegetation decreases protection from predators and desiccation.

5.6 Urban Expansion and Infrastructure Development

Threat Overview

- Small towns in Namaqualand are expanding, leading to increased human-wildlife conflict.
- Road networks fragment habitats, increasing wildlife-vehicle collisions.
- Roads also cause edge effects, increasing exposure to predation and human disturbance.
- Artificial lighting disrupts nocturnal species, affecting hunting, navigation, and breeding.

Impacts and Adaptability by Faunal Group

Mammals

- Some species (e.g., Rock Hyrax, Genets) adapt to urban edges, but larger mammals (e.g., Caracal, Brown Hyena) struggle.
- Leading cause of mortality for many species, especially slow-moving and nocturnal animals (Aardwolf, Bat-Eared Fox, Cape Hedgehog).

Reptiles

- Roadkill is a major threat to slow-moving reptiles like tortoises and adders.
- Increased predation by domestic pets (dogs and cats) impacts lizard and snake populations.
- Species such as the Puff Adder, which relies on thermoregulation by basking on warm roads, is frequently killed by vehicles.

Amphibians

- Artificial drainage systems often fail to support natural breeding cycles.

- Seasonal breeding frogs that migrate to ephemeral pools.
- Urban pollution reduces water quality, making many areas unsuitable for frog reproduction.

5.7 Climate Change

Threat Overview

- Namaqualand is experiencing rising temperatures and decreasing rainfall.
- Droughts and altered seasonal patterns affect water availability, impacting both plants and animals.

Impacts and Adaptability by Faunal Group

Mammals

- Herbivores struggle as drought reduces food availability.
- Insectivores (e.g., bats and aardwolves) suffer as insect populations decline due to extreme heat.

Reptiles

- Temperature-dependent sex determination in reptiles may skew sex ratios, reducing reproductive success.
- Desert-adapted lizards may tolerate some warming, but extreme heat can push species beyond physiological limits.

Amphibians

- Tadpoles may not survive shortened breeding seasons due to rapid drying of temporary water bodies.
- Heat stress affects survival rates of adults.

6. DRIVERS AND PROCESSES

Below are some of the key drivers and processes shaping these regions.

Key Drivers:

Climate (Aridity & Rainfall Patterns)

- The western section towards the coastal region has a winter rainfall regime (100–300 mm annually), which is crucial for its flowering plant diversity.
- Moving more inland eastwards, the regime changes to a summer or perennial rainfall area.
- Namaqualand experiences highly variable and unpredictable rainfall, influencing plant germination and animal activity.
- Coastal fog provides moisture, supporting unique plant and lichen growth.

Geology & Soils

- The region has ancient, weathered soils with low nutrient levels, favouring specialised plants adapted to nutrient-poor environments.
- Quartz patches and varied soil types create microhabitats supporting endemic species.

Fire & Disturbance

- The Fynbos areas require fire but is not a major ecological driver in the rest of the Regional Area.
- Instead, disturbances like grazing, trampling by animals, and human activities influence vegetation patterns.

Biodiversity & Endemism

- The region boasts over 6,000 plant species, with around 40% being endemic.
- Specialized pollination systems (e.g., beetle and fly pollination) play a critical role in plant reproduction.

Herbivory & Land Use

- Historically, springbok and other migratory herbivores shaped vegetation through grazing.
- Today, livestock farming (sheep & goats) is a major land use, affecting plant communities and soil stability.

Climate Change & Desertification

- Rising temperatures and shifting rainfall patterns threaten the fragile ecosystem.
- Desertification due to overgrazing and land degradation is an ongoing concern.

Key Ecological Processes:

Phenology (Seasonal Growth & Flowering)

- Many plants in the region have dormant periods, responding to seasonal rainfall with rapid growth and flowering.

Drought Tolerance & Succulence

- Succulent plants (e.g., Mesembryanthemaceae) store water in fleshy tissues, allowing survival in dry conditions.

Fog and Dew Utilization

Some species, like lichens and certain succulents, absorb water from fog, an essential moisture source in dry years.

Seed Banks & Opportunistic Germination

- Many plants maintain persistent seed banks, germinating only when conditions are favourable.
- Some seeds require specific environmental triggers (e.g., temperature shifts or rain pulses).

Pollination & Seed Dispersal

- Insect pollination, especially by beetles, flies, and bees, is critical for many plant species.

- Rodents, ants, and birds aid in seed dispersal, ensuring plant regeneration.

Soil Crusts & Microbial Activity

- Biological soil crusts (formed by lichens, mosses, and bacteria) help stabilize soil and retain moisture.
- Soil microbes play a role in nutrient cycling and support plant growth in nutrient-poor conditions.

Human Influence & Conservation

- Agriculture, mining, and urban expansion have transformed parts of the landscape.
- Conservation efforts, including protected areas (e.g., Namaqua National Park), aim to safeguard biodiversity.
- Ecotourism and sustainable land-use practices help balance conservation with local livelihoods.

6.1 How Development Hinders Migration Pathways and Movement of Fauna

The Namakwa region has historically supported important migratory routes for fauna, although many have been disrupted due to human activities, roads, fencing, and habitat changes. Some key migratory patterns include:

Antelope Movements, especially Springbok migrations

Historically, massive herds of springbok (*Antidorcas marsupialis*) migrated across Namaqualand and the Karoo in response to rainfall and vegetation changes. These migrations involved hundreds of thousands of animals moving in search of better grazing, much like the great Serengeti migration. While large-scale migrations have largely ceased due to fences and human settlements, some localized seasonal movements still occur.

Species like gemsbok (*Oryx gazella*) and steenbok (*Raphicerus campestris*) have adapted to the arid environment, often deriving moisture from their food and conserving water efficiently. While they do not migrate in the same large-scale manner as springbok, they do move seasonally between different grazing areas.

Cape Porcupine (*Hystrix africaeaustralis*)

While not migratory in the strict sense, Cape porcupines in Namaqualand tend to follow seasonal food availability, often shifting their foraging territories in response to rainfall and plant growth.

Reptile Movements (Tortoises and Snakes)

The Namaqualand speckled padloper (*Homopus signatus*), one of the world's smallest tortoises, shows seasonal movement patterns related to temperature and food availability. Some snake species, like the puff adder, also change locations seasonally.

Habitat Fragmentation and Barriers to Movement

Impact:

- Developments create physical barriers that prevent animals from accessing breeding, foraging, and refuge areas.
- Linear infrastructure (roads, railways, fences, pipelines) disrupts migration routes of larger mammals and dispersal pathways of smaller species.

- Example: Caracals and Bat-Eared Foxes face restricted movement due to fencing and habitat conversion.

Most Affected Groups:

- **Large mammals:** Brown Hyena, Aardwolf, Caracal.
- **Small mammals and burrowers:** Namaqua Dune Mole-Rat, Cape Golden Mole (require connected underground habitats).
- **Reptiles:** Slow-moving tortoises and burrowing lizards that cannot cross developed areas.

Roads and Traffic-Related Mortality

Impact:

- WVCs are a leading cause of mortality for many species, especially slow-moving and nocturnal animals.
- Roads also cause edge effects, increasing exposure to predation and human disturbance.
- Example: The Puff Adder, which relies on thermoregulation by basking on warm roads, is frequently killed by vehicles.

Most Affected Groups:

- Reptiles: Tortoises, Adders, Skinks.
- Nocturnal mammals: Aardwolf, Bat-Eared Fox, Cape Hedgehog.
- Amphibians: Seasonal breeding frogs that migrate to ephemeral pools.

Renewable Energy Developments and Disruption of Flight Paths

Impact:

- Wind farms cause direct mortality for migratory and foraging bats and raptors through collision with turbines.
- Large-scale solar farms alter ground temperatures, affecting burrowing species like sand lizards.
- Example: Wind farms along the West Coast pose a collision risk for migratory raptors like Black Harriers and Pale Chanting Goshawks.

Most Affected Groups:

- Bats: Natal Long-Fingered Bat, Egyptian Free-Tailed Bat.
- Birds of prey: Black Harrier, Lanner Falcon.
- Burrowing reptiles: Namaqua Dwarf Adder, Sand Lizards.

Water Abstraction and Drainage Alteration

Impact:

- Reduces availability of seasonal wetlands and ephemeral pools, essential for amphibians, reptiles, and water-dependent mammals.

- Affects vegetation critical for insect populations, which in turn impacts species that rely on them for food.
- Example: The Namaqua Rain Frog relies on moist soil conditions for burrowing; water loss increases desiccation risks.

Most Affected Groups:

- Amphibians: Namaqua Rain Frog, Clicking Stream Frog.
- Semi-aquatic reptiles: Karoo Sand Snake.
- Insectivorous mammals: Aardwolf (depends on termite availability).

Climate Change and Altered Seasonal Migrations

Impact:

- Rising temperatures affect water availability and plant phenology, altering breeding and migration timing.
- Species that rely on specific seasonal triggers (e.g., rainfall-dependent breeding frogs) are at risk of reproductive failure.
- Example: The Cape Sand Frog depends on ephemeral pools that dry out faster due to climate change, reducing tadpole survival rates.

Most Affected Groups:

- Frogs and amphibians: Breeding cycles depend on rainfall.
- Migratory birds: Raptors and insect-eaters struggle with declining insect numbers.
- Desert-adapted reptiles: Extreme heat pushes some species beyond thermal limits.

6.2 Strategies to Mitigate Impacts on Fauna Migration and Sensitive Ecosystems

Creation of Wildlife Corridors and Buffer Zones

- Establish ecological corridors between habitat patches to allow movement for migratory and wide-ranging species.
- Designate buffer zones around wetlands and ephemeral rivers.
- Example: Identifying and protecting traditional movement corridors used by Brown Hyenas.

Wildlife-Friendly Infrastructure

- Fauna underpasses and overpasses to reduce roadkill.
- Use wildlife-friendly fencing that allows smaller mammals and reptiles to pass through.
- Example: Open-bottom fences allow tortoises and lizards to move between fragmented areas.

Sustainable Water Management

- Maintain natural seasonal wetlands and restrict water abstraction in key breeding areas.
- Example: Protecting ephemeral pools ensures amphibian breeding success.

Strategic Wind and Solar Farm Placement

- Conduct biodiversity impact assessments before approving energy projects.
- Avoid siting wind farms in key raptor migration routes and bat foraging zones.
- Example: Black Harrier conservation measures around wind farms can reduce turbine-related deaths.

Climate Adaptation Strategies

- Artificial water sources for vulnerable species in drought-prone areas.
- Habitat restoration projects to improve climate resilience of ecosystems.
- Example: Replanting native vegetation in degraded areas can support insect populations, benefiting insectivorous species like aardwolves.

7. SENSITIVITY MAPPING

The faunal sensitivity of the Namakwa Region reflects the intersection of exceptional endemism, highly specialised habitat requirements, and intensifying development pressures characteristic of the Succulent Karoo biodiversity hotspot. The sensitivity map (Figure 10) illustrates a clear spatial gradient, with Very High Sensitivity concentrated along the coastal dune belt and lower Orange River corridor, transitioning to High and Medium Sensitivity across the inland plains. These patterns correlate strongly with the distribution of key fauna, particularly range-restricted reptiles, amphibians, invertebrate assemblages, and dune-dependent mammals.

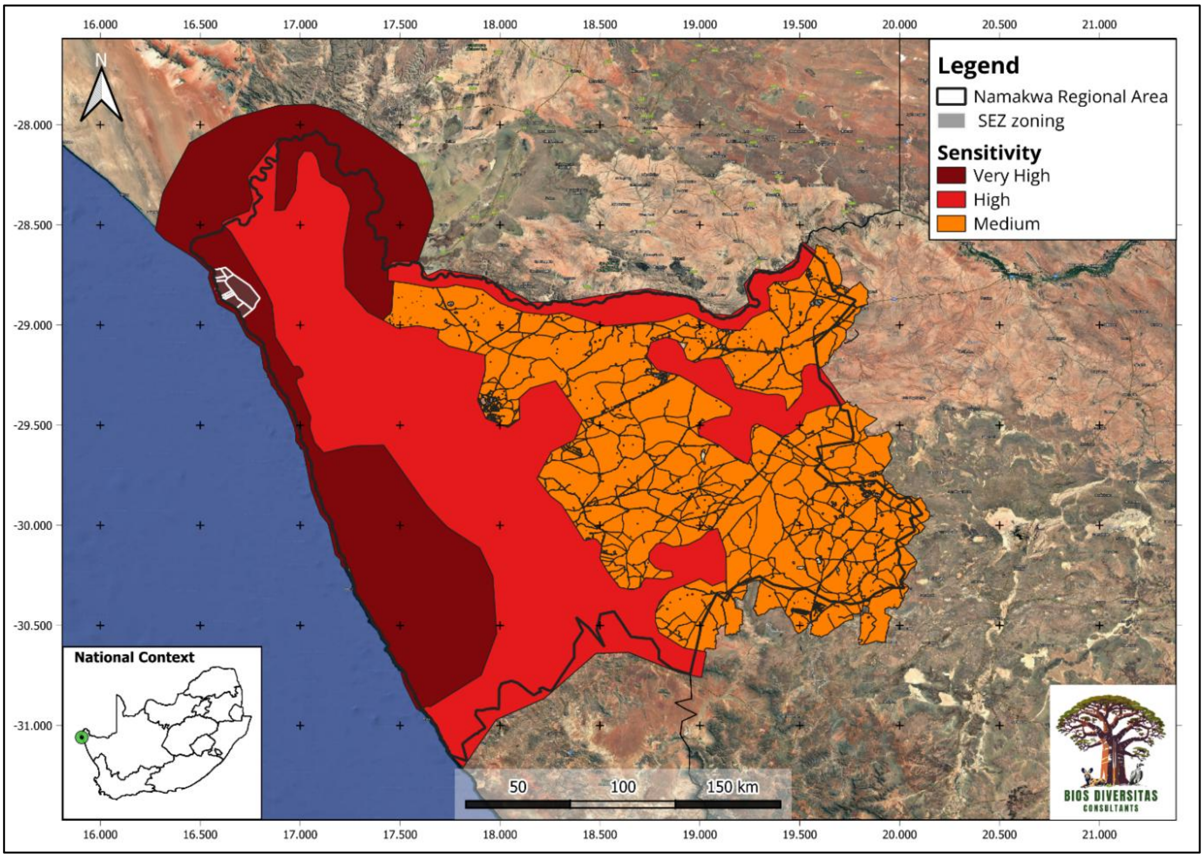

Figure 10: Faunal sensitivity map of the Namakwa Region study area.

Very High Sensitivity Areas

The coastal belt mapped as Very High Sensitivity coincides with the core habitat for several narrowly endemic and Red-Listed species, particularly those associated with loose aeolian sands and fog-dependent dune ecosystems. As such, any development in Very High Sensitivity areas carries a high probability of irreversible biodiversity loss, and EIAs must treat these locations as no-go or strict avoidance zones unless exceptional justification exists.

These include:

- **De Winton's golden mole (*Cryptochloris wintoni*) – Critically Endangered**
  Endemic to northern Namaqualand, dependent on intact coastal dunes. Surveys and Red List assessments highlight severe historic loss from coastal mining, with remaining habitat highly fragmented.

- **Grant's Golden Mole *Eremitalpa granti granti* – Vulnerable**
  Endemic to southern Africa, with its distribution primarily focused on the arid and semi-arid regions of the western parts of the Northern Cape, concentrated along coastal dunes. Its range overlaps with sandy habitats extending into desert-like environments, including the Namaqualand coastal areas (Port Nolloth and possibly as far north as Alexander Bay).

- **Desert rain frog (*Breviceps macrops*) – Vulnerable (IUCN); Near Threatened (National)**
  Restricted to a narrow dune belt between high-water mark and inland ridges. Its survival is tied to undisturbed sandy substrates, which explains the alignment of its predicted habitat with the Very High Sensitivity zone.

- **Branch's rain frog (*Breviceps branchi*) – Data Deficient, Micro-endemic**
  Known only from red sands near the Holgat River. Although the precise range remains unconfirmed, the species is strongly associated with the northern coastal duneveld also classified as Very High Sensitivity.

- ***Bathyergus janetta* – Uplisted to Endangered A4(a)**
  Recently been uplisted to Endangered (2025 National Red List) owing to climate change and the threat of continued habitat destruction of three isolated subpopulations. The species is located along the southern coastline of the Namakwa region between Port Nolloth and Groenrivier.

High Sensitivity Areas

High Sensitivity areas extend inland across Namaqualand Hardeveld, succulent shrublands, and rocky inselbergs, where important faunal SCCs and ecological processes occur.

Key fauna driving High Sensitivity designation:

- **Speckled padloper tortoise (*Chersobius signatus*) – Endangered (IUCN)** Confined to rocky outcrops in the Succulent Karoo. These outcrops align with High Sensitivity polygons, reflecting their irreplaceable microhabitats.

- **Girdled lizards (*Namazonurus* and *Karusasaurus* spp.)**
  Range-restricted rock specialists requiring unbroken koppie habitats.

- **Namaqua sand frog (*Tomopterna branchi*) –** Endemic
  Associated with ephemeral pools and sandy drainage lines in the Hardeveld. These hydrological features fall within the High Sensitivity inland tracts.

- **Ecological processes underpinning High Sensitivity**
  - High pollinator activity in flower-rich shrublands
  - Soil engineering by ants, termites and rodents
  - Seasonal amphibian breeding in natural pans
  - Critical refugia on koppies for reptiles and small mammals

Medium Sensitivity Areas

Medium Sensitivity regions cover much of the inland plains where faunal diversity, while still significant, includes more disturbance-tolerant assemblages. Areas can still be utilised by faunal SCC which are not range restricted and less likely to be impacted on by development.

These areas still support:

- Arid-zone toads
- Widespread sand lizards and skinks
- Mammalian generalists such as steenbok, hares and generalist rodents
- Generalist invertebrate assemblages

While these species are important ecologically, they have broader distributions and better tolerance of moderate habitat modification.

8. RISK ASSESSMENT

8.1 Definition of Consequence / Benefit Categories

For biodiversity and ecological impacts, risk is measured in terms of disruption of ecological processes, loss or degradation of ecosystems, and/or loss of species. The degree of risk (consequence) is assessed against thresholds for maintaining the functioning of all key ecological processes, maintaining a proportion of each ecosystem in good ecological condition, retaining all threatened species, and retaining a representative sample of all endemic or near-endemic species.

Whilst the regional assessment is aware of the total expected development footprint, there is no detail as to the location of the various development components under each scenario. So rather than attempting to articulate consequence in relation to the entire development scenario, it is considered at the site level in terms of what would the consequence be from a single development perspective. Therefore, thresholds of change are interpreted relative to a site and the consequence that the spatial scale of site-level impact would have on biodiversity in the landscape surrounding the site.

8.2 Risk Assessment Table

Given the spatial scale of both scenarios there are differences in the assessed consequence and likelihood between with and without mitigation (**Table 5**). Whilst biodiversity offsets do guarantee that a portion of the biodiversity being lost is placed into formal protection, this does not negate the fact that a significant amount of biodiversity has been permanently lost. The only difference between with and without mitigation comes in the interpretation of the significance of this loss in relation to biodiversity sensitivity categories and their contribution to achieving our biodiversity conservation goals. Areas that that have been identified as being necessary to achieve our conservation goals for biodiversity pattern or ecological processes attract a higher risk rating.

8.2.1 How Risk is Determined

In this SEA, risk is determined by evaluating the likelihood of an impact occurring and the potential effect or consequence of that impact on priority animal species occurring in the broader Namakwa Region (**Figure 11**). For this faunal specialist assessment—undertaken as part of WP2 of the SEA—the potential impacts to animals are considered to be all negative (-) in nature.

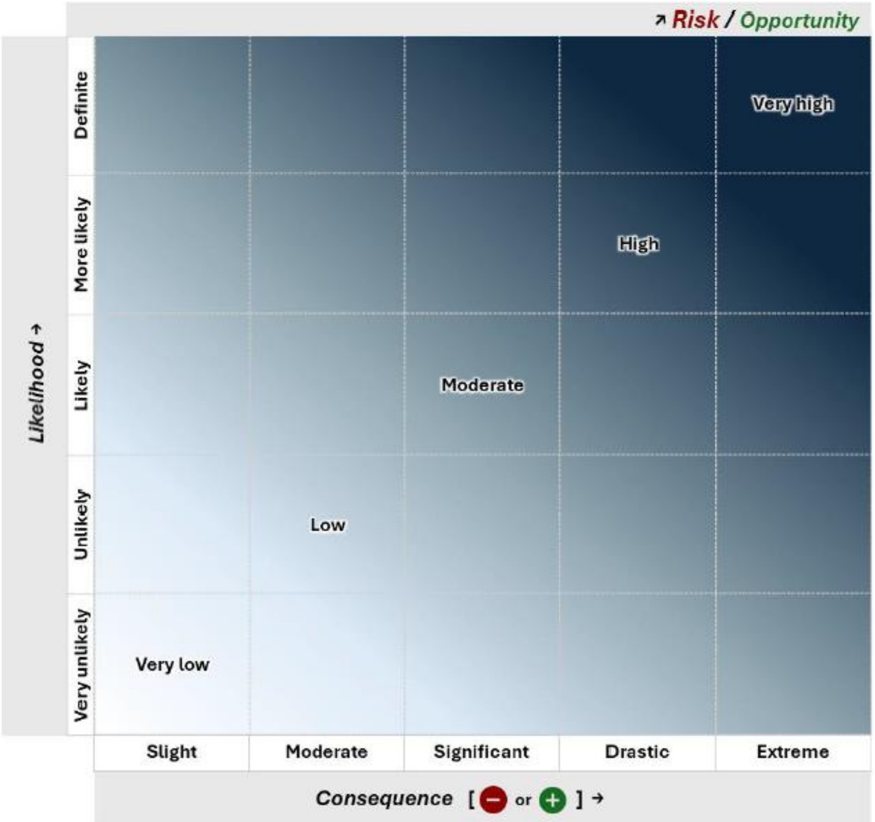

Figure 11: Risk and opportunity is qualitatively measured by multiplying the likelihood of an impact (negative or positive) by the severity of the consequence or benefit (*Source*: CSIR, 2025).

8.2.2 How Consequence is Determined

Consequence, also referred to as severity, refers to the potential outcome or effect if a risk or impact occurs. It is a key component in determining the overall level of risk and is assessed by evaluating the degree of harm or damage that could result.

In South African specialist assessments—particularly those aligned with guidelines stipulated by the Endangered Wildlife Trust, and in accordance with the Animal Species Specialist Protocol (GNR 320 of 2020) in terms of the 2014 NEMA EIA Regulations, as amended—consequence thresholds are generally distinguished along a gradient of magnitude, extent, duration and reversibility of an impact occurring, and resultant conservation importance.

These consequence thresholds (**Table 3**) are often applied in impact significance matrices where consequence is combined with likelihood to determine overall significance ratings. For fauna, the population viability context—including species' Red List status, range size, generation length, and sensitivity to the impact mechanism—is central to assigning the correct threshold.

Table 3: Consequence thresholds defined for determining potential risk of impact to fauna within the Namakwa Region.

Threshold	Consequence levels defined for impact on animals
Slight	Negligible to very low magnitude; localised; short-term; fully reversible; no measurable effect on population viability; affects only common/non-threatened/non-target species.
Moderate	Low to medium magnitude; local or limited regional extent; short- to medium-term; reversible with mitigation; may cause minor, non-sustained reductions in local abundance but no long-term viability risk.
Significant	Medium magnitude; regional extent or affecting key habitats; medium- to long-term; partially reversible; measurable reduction in local population size or productivity; medium risk to one or more animal SCC — Endemic and Near-Endemic species — but unlikely to threaten overall population persistence.
Severe	High magnitude; regional to national extent; long-term or permanent; largely irreversible; substantial reduction in population size or productivity; high risk to one or more faunal species of conservation concern — Vulnerable and Near-Threatened species—potentially affecting viability of local or metapopulations.
Extreme	Very high magnitude; national or global extent; permanent and irreversible; threatens survival of Endangered and Critically Endangered faunal species or leads to local extinction; affects critical habitats for Endangered and Critically Endangered faunal species.

8.2.3 How Risk Categories are Defined

Risk to fauna in the Namakwa Region is assessed for each identified impact, considering the different types of faunal habitat characteristic of the study area and incorporating the fauna SCC selected for this risk assessment. Table 4 outlines the predefined risk categories utilised in this faunal risk assessment.

Table 4: Predefined risk categories applicable to the faunal Risk Assessment for this SEA

Risk (-) level	Category description
VERY LOW	Almost indiscernible negative impact
LOW	Slight negative impact, limited extent, and short duration, well within tolerance levels
MODERATE	Substantial impact, but less than major; within tolerance levels and below limits of acceptable change
HIGH	Major consequences, approaching tolerance and limits of acceptable change
VERY HIGH	Extremely negative impact, persistent/long lasting impact, beyond tolerance and limits of acceptable change

8.2.4 Risk Assessment with and without Mitigation

Table 5 shows the risk associated with the potential negative (-) impacts to priority faunal species determined for each development scenario—S0: Baseline Scenario, S1: Small scale GH_2 development, and S2: Big scale GH_2 development—for each sensitivity criteria, both with and without mitigation management.

Table 5: Assessment of risks associated with the negative impacts of GH2 on biodiversity. Risk with mitigation is assumed to be mitigation without avoidance.

Negative Impact	Scenario	Spatial receiving environment	Without mitigation			With mitigation		
			Consequence (-)	Likelihood	Risk	Consequence (-)	Likelihood	Risk
Displacement due to Habitat loss & fragmentation	S0: Baseline	Very High	Severe	More Likely	HIGH	Significant	More Likely	MODERATE
	S1: Small GH_2		Extreme	Definite	VERY HIGH	Severe	More Likely	HIGH
	S2: Big GH_2		Extreme	Definite	VERY HIGH	Severe	Definite	VERY HIGH
	S0: Baseline	High	Significant	More Likely	HIGH	Moderate	More Likely	MODERATE
	S1: Small GH_2		Severe	Definite	VERY HIGH	Significant	More Likely	HIGH
	S2: Big GH_2		Extreme	Definite	VERY HIGH	Severe	Definite	VERY HIGH
	S0: Baseline	Medium	Moderate	Likely	MODERATE	Moderate	Unlikely	LOW
	S1: Small GH_2		Moderate	More Likely	HIGH	Significant	Likely	MODERATE
	S2: Big GH_2		Significant	More Likely	HIGH	Significant	More Likely	HIGH
	S0: Baseline	Low	Moderate	Likely	MODERATE	Moderate	Unlikely	LOW
	S1: Small GH_2		Significant	More Likely	HIGH	Moderate	Likely	MODERATE
	S2: Big GH_2		Significant	More Likely	HIGH	Significant	Likely	MODERATE
Displacement due to disturbance such as noise, lighting and human activity	S0: Baseline	Very High	Significant	More Likely	HIGH	Moderate	Likely	MODERATE
	S1: Small GH_2		Severe	Definite	VERY HIGH	Significant	More Likely	HIGH
	S2: Big GH_2		Extreme	Definite	VERY HIGH	Severe	More Likely	HIGH
	S0: Baseline	High	Significant	More Likely	MODERATE	Moderate	Likely	MODERATE
	S1: Small GH_2		Severe	Definite	VERY HIGH	Significant	More Likely	MODERATE
	S2: Big GH_2		Severe	Definite	VERY HIGH	Extreme	Definite	HIGH
	S0: Baseline	Medium	Moderate	Likely	MODERATE	Moderate	Unlikely	LOW
	S1: Small GH_2		Significant	More Likely	HIGH	Moderate	Likely	MODERATE

Negative Impact	Scenario	Spatial receiving environment	Without mitigation			With mitigation		
			Consequence (-)	Likelihood	Risk	Consequence (-)	Likelihood	Risk
	S2: Big GH_2		Severe	More Likely	HIGH	Significant	Likely	MODERATE
	S0: Baseline	Low	Slight	Unlikely	LOW	Slight	Very unlikely	VERY LOW
	S1: Small GH_2		Significant	Likely	MODERATE	Moderate	Unlikely	LOW
	S2: Big GH_2		Significant	Likely	MODERATE	Significant	Likely	MODERATE
Changes to Ecological functioning and processes	S0: Baseline	Very High	Severe	More Likely	MODERATE	Moderate	Likely	MODERATE
	S1: Small GH_2		Extreme	Definite	VERY HIGH	Severe	More Likely	HIGH
	S2: Big GH_2		Extreme	Definite	VERY HIGH	Extreme	Definite	VERY HIGH
	S0: Baseline	High	Significant	More Likely	MODERATE	Moderate	Likely	MODERATE
	S1: Small GH_2		Severe	Definite	VERY HIGH	Significant	More Likely	HIGH
	S2: Big GH_2		Extreme	Definite	VERY HIGH	Severe	More Likely	HIGH
	S0: Baseline	Medium	Significant	Likely	MODERATE	Moderate	Unlikely	LOW
	S1: Small GH_2		Significant	More Likely	HIGH	Moderate	Likely	MODERATE
	S2: Big GH_2		Severe	More Likely	HIGH	Significant	Likely	MODERATE
	S0: Baseline	Low	Slight	Unlikely	LOW	Slight	Very unlikely	VERY LOW
	S1: Small GH_2		Moderate	Likely	MODERATE	Slight	Unlikely	LOW
	S2: Big GH_2		Significant	Likely	MODERATE	Moderate	Likely	MODERATE

8.3 Recommended Management Responses for Risk Categories

The sensitivity mapping and risk categories used only provides a broad, strategic overview of the relative suitability and potential for development within and across the broader Namakwa Region. Even in areas of low sensitivity it is important that some form of project-level environmental impact assessment be undertaken to confirm and refine the outputs as presented in this SEA.

It is considered critical that implementation of one and/or more of the following recommended best practice measures be considered—where relevant—for the effective mitigation and management of negative impacts to fauna when GH_2-related development activities are proposed:

- Habitat management and restoration (reduce attractants for species to enter the development footprint).
- Once a preliminary or conceptual layout is available, conduct species specific assessments in optimal conditions for proposed developments.
- Conduct a least path model analysis for linear infrastructure (pipeline, railway, grid connections, roads etc.), especially through sensitive areas to determine the best route options with the lowest impacts on fauna.
- Not all linear infrastructure can avoid high and very high sensitivities, but measures such as making use of existing roads and where possible prioritising development within areas of medium and low sensitivity can reduce impacts significantly.
- Design any overhead cabling with associated pylons within and near (suggested within 1 km) areas of suitable habitat for threatened Tortoises so as to discourage crows from nesting on the structures and preying on them.
- Develop a Fauna Management Plan during the design phase and implement / adhere to the Plan during all phases of the project.
- Establish and implement an ongoing roadkill monitoring programme (inclusive of wildlife collisions record keeping) to inspect roads for injured and deceased fauna (including sensitive species and tortoises) due to the movement of vehicles to and from site.
- Reduce direct mortalities by allowing for fauna to cross the roads and bridges. Where applicable, include fauna underpasses under the roads (large culverts or large open-ended concrete pipes laid into the raised roads) in the design. Use these underpasses in conjunction with "fauna barriers" which prevent the most susceptible small fauna from crossing the roads on the surface by directing them towards the underpasses where they can cross under the roads safely. It is important to note that utilisation of underpasses is strongly dependent on animal body size (larger culverts are more successful) and the surrounding habitat.
- Undertake a detailed cumulative impact assessment for all planned developments.
- Monitoring, mitigation and proactive conservation beyond the facility footprint.

8.4 Mitigation Hierarchy and Policy Standards

- *Avoidance first*: Prioritise site screening to exclude high-risk features (e.g., golden mole habitats along the coast, other sensitive species habitats such as rocky outcrops and watercourses).
- *Design optimisation*: Require technology-specific design standards embedded as SDF/EMF overlays and standard EIA conditions.

- *Minimisation measures*: Implement recommended mitigation measures as included in the Environmental Management Programme (EMPr) for each proposed development application.

- *Offsets as last resort*: If residual impacts remain significant, apply like-for-like offsets with measurable, time-bound outcomes and independent verification (DFFE, 2023).

9. DISCUSSION AND CONCLUSION

The Namakwa Region, located mostly within the Succulent Karoo Biodiversity Hotspot, is of exceptional faunal importance (invertebrates, mammals, reptiles and amphibians) and is home to many threatened, endemic and range restricted faunal species. Spatial sensitivity mapping confirms extensive Very High and High sensitivity zones across the study area, particularly for habitat loss and transformation of natural vegetation related impacts.

The findings of this assessment emphasize the critical need for a balanced approach to development in the Regional Area. While the proposed port and SEZ hold significant economic potential, along with the regional development coupled with this, the ecological sensitivity of the Regional Area demands a robust environmental management strategy. The presence of threatened and endemic species underscores the necessity for targeted conservation efforts to minimize biodiversity loss.

Namaqualand’s fauna relies on sensitive ecosystems and seasonal migration routes for survival. Multiple threats from human activities such as uncontrolled development disrupts pathways, leading to habitat loss, increased mortality, and reduced genetic diversity. While some species show adaptability, many are highly specialised and poorly equipped to survive in built-up and degraded environments. However, sustainable planning, important habitat protection, ecological corridors, climate adaptation strategies and wildlife-sensitive infrastructure can help mitigate these impacts, ensuring the long-term survival of Namaqualand’s unique biodiversity.

The Regional Area extent consist of ~50% CBA 1 and CBA 2, as well as five threatened ecosystems, underscoring the ecological sensitivity of the region. While comprehensive mitigation measures can reduce the severity of some impacts, avoidance of highly sensitive features should be the first and best option. Accordingly, all development activities located within these sensitive areas must undergo environmental impact assessments, and the options of biodiversity offsets including the expansion of existing protected areas, must be considered and investigated upfront.

The project has potential benefits, including renewable energy production and socioeconomic development. These must however be weighed against the irreversible nature of biodiversity loss and the potential loss of ecosystem services provided by important ecosystems and biodiversity hotspots, which are vital for the maintenance of regional biodiversity, maintaining ecological drivers and processes to support local fauna communities, especially range restricted and endemic species.

Accumulating fine-resolution spatial data generated through on-site ground-truthing is strongly suggested as it will play a crucial role in shaping the future planning of any proposed development in the Regional Area as part of future Environmental Impact Assessments.

Given the high ecological sensitivity of the Regional Area, key ecosystem services and processes, the presence of fauna SCC, and high conservation value, large-scale proposed developments pose significant risks to biodiversity and ecosystem processes. While mitigation can reduce some of these risks through careful planning for sustainable development, it cannot fully eliminate the impacts on critical habitats and species, where avoidance is the only option. Accordingly, biodiversity offsets are likely to be a massive component of this Project moving forward.

All components of proposed developments need to consider site and technological alternatives, as well as designs which reduces impacts on the receiving environment. Sites with lower ecological sensitivities can achieve development goals with minimal environmental trade-offs. The Project requires a cautious approach with a strong emphasis on biodiversity conservation and maintaining conservation targets. It should only proceed if it can demonstrate net ecological benefit or neutrality through rigorous mitigation strategies.

The risk assessment shows that without mitigation, both the Small GH_2 and Big GH_2 development scenarios present High to Very High risks to priority faunal species, especially in very high sensitivity areas. The Big GH_2 scenario carries the greatest cumulative risk, with potential severe to extreme consequences for threatened animal species. The Small GH_2 scenario could also have potential severe to extreme consequences for Endangered and Critically Endangered species if located primarily within their restricted habitat along the coast. Even with best practice mitigation, residual impacts remain significant in habitats, especially high and very high sensitivity for the priority faunal species assessed.

Based on the findings of this desktop assessment, scenario 1 (small GH2 by 2035) could be a viable option which requires detailed investigation and careful site selection as it could result in medium to high residual impacts which will require biodiversity offsets, while scenario 2 (big GH2 by 2050) may result in high residual impacts which will require biodiversity offsets. There are already a large number of renewable energy developments within the region, and effort should be made to incorporate some of them privately (not feeding into the national grid) for this project, which could reduce the overall impacts associated with the provision of electricity to the GH2 facility. The full 80 GW does not have to be green site developments.

9.1 Recommendations

To assess baseline studies which should include site sensitivity verification and data collection, the next steps and activities are recommended:

- Comprehensive baseline biodiversity surveys are required for impacted fauna SCC and threatened ecosystems as part of the EIA process.
- Conducting a comprehensive cumulative impact assessment for the region.
- Monitoring faunal populations during and after construction to assess the effectiveness of mitigation measures.
- Modify management practices based on monitoring outcomes and emerging challenges.
- Collaboration with taxa specific specialists and conservation organisations (such as EWT, SANBI) to refine impact assessments and conservation actions.
- Acquisition of all observation data from participating specialists and inclusion into the final complete dataset.
- Review of field reports from other disciplines and in particular, habitat descriptions and delineations of the botanical and soil specialists to more accurately and consistently describe and map fauna habitats.
- Obtain revised infrastructure layout from developer based on all defined habitat sensitivities and logistical considerations – developer is advised to plan infrastructure layout to avoid as much of the sensitive habitats as possible.
- Workshop with all participating specialists and developer to share understanding of project and discuss all potential impacts. Of particular importance is the necessity to understand the requirements of the developer related to SCC and their assumed versus actual occurrences. Should the developer wish to demonstrate a high degree of confidence for the absence of particular species in habitats within the Regional Area then additional surveys will be required and must be included in the impact assessment. At this stage it is recommended that it is better to assume the presence of SCC under the precautionary principle and develop appropriate mitigation and management considerations to limit any anticipated impacts, with avoidance mitigation being the best possible approach.

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