TSISEB COMMUNAL CONSERVANCY

SCOPING/ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REPORT AND ENVIRONMENTAL MANAGEMENT (EMP)

Construction and operation of a Private Air-strip for Leisure Aircraft (Non-military) Operations at Brandberg White Lady Lodge, Daures Constituency, Erongo Region, Namibia

Prepared on behalf of

TSISEB COMMUNAL CONSERVANCY

Operating in a Joint Venture with

BRANDBERG WHITE LADY LODGE

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Construction and operation of a Private Air-Strip for Leisure Air-craft (Non-military) Operations at Brandberg White Lady Lodge, Daures Constituency, Erongo Region, Namibia

Prepared

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28 September 2022

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ACRONYM

BID	Background information document
BWLL	Brandberg White Lady Lodge
CBNRM	Community based natural resources management
EAPs	Environmental Assessment Practitioners
EC	Environmental Commissioner
ECC	Environmental Clearance Certificate
ECD	Early Childhood Development
ECO	Environmental Co-ordinator
EIA	Environmental Impact Assessment
EMP	Environmental management plan
ENSO	El Nina Southern Oscillation
GRN	Government Republic of Namibia
IAPs	Interested and affected parties
ITCZ	Intertropical Convergence Zone
IUCN	International Union for Conservation of Nature
MEFT	Ministry of Environment, Forestry and Tourism
NEMA	Namibia's Environmental Management Act
NSA	Namibia Statistical Agency
ONI	Oceanic Nino Index
RE	Resident Engineer
SEA	Strategic Environmental Assessment
SHE	Safety health & environment
WMO	World Meteorological Organization

NAME OF CONSULTING COMPANY

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COMPANY REGISTRATION NUMBER

Registration no.: cc/2013/06105

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LIST OF PROJECTS

Since establishment in 2013, ECUTS had completed more than 20 projects across various economic sectors including the following:

1. **Waste management/maritime transport** (EIA/scoping to perform in-water cleaning for Ufudu Marine Namibia cc, September-November 2022).
2. **Maritime pollution** (Development of a national oil dispersant use policy for Namibia on behalf of the Ministry of Works. Transport, May-December 2022).
3. **Tourism/aviation transport** (EIA/scoping to construct and operate a private airstrip for Brandberg White Lady Lodge, September-November 2022).
4. **Mariculture** (Full EIA/Baseline Environment specialist study to construct and operate a cage finfish farm for Benguela Blue Aqua Farm, Lüderitz, 2022).
5. **Waste management/maritime transport** (EIA/scoping to perform under-water cleaning for Walvis Bay Diving & Salvage cc, Walvis Bay, 2021).
6. **Mineral exploration** (EIA/scoping for Exploration Activities on EPLs 7795, 7796, 7797, 7798, 7799 and 7800 for Mangroove PTY LTD, Omaheke and Hardap regions, 2021).
7. **Tourism** (EIA/scoping for upgrading of Rhino campsite for Brandberg White Lady Lodge, Erongo region, 2019).
8. **Agriculture** (Climate resilience readiness country study in Namibia on behalf of the Technical Centre for Agricultural and Rural Co-operation, Windhoek, 2016).
9. **Training** (Strategic coastal management training for NACOMA/Ministry of Environment and Tourism, Erongo region, 2015).
10. **Off-shore mining** (Benthic baseline study for Deb-marine, Windhoek, 2014).
11. **Waste management/tourism** (EIA/scoping for the Mudumu National Park/Ministry of Environment and Tourism, Kongola, Zambezi region, 2013).

PROJECT DETAILS

1. PROJECT TITLE

Development of a Private Airstrip for Leisure (non-military) Aircraft operations, Erongo region, Dâures Constituency, Namibia

2. ENTITY REPRESENTING GOVERNMENT REPUBLIC OF NAMIBIA (GRN)

Ministry of Environment, Forestry and Tourism (MEFT).
Ministry of Works and Transport (MWT)
Daures Constituency office
Damaran Traditional Authority

3. KEY LEGAL INSTRUMENTS

Environmental Management Act (No. 7 of 2007) and EIA regulations of 2012.
Civil Aviation Act (No. 6) of 2016.

4. FUNDING SUPPORT

Namibia National Parks (NAMPARKS) programme (Ministry of Environment, Forestry and Tourism (MEFT)).

5. PROPONENTS

Tsiseb Communal Conservancy and Brandberg White Lady Lodge.

6. TARGET ECONOMIC SECTORS

Tourism and Civil aviation (transport).

7. EIA PROCESS AND TIMELINES

AUGUST 2022 (phase I):

- *1 x advert in the Namib Times newspaper: 12 August 2022 and 19 August 2022.*
- *1 x advert in the Confidente newspaper: 12 August 2022 and 19 August 2022.*
- *Release of BID to registered IAPs: 29 August 2022*

SEPTEMBER 2022 (phase II):

- *Public meeting (Uis Town Hall): 02 September 2022.*
- *Release of draft EIA and EMP Reports and availability to IAPs for review*

OCTOBER

- *Project registration and upload BID on EIA portal.*
- *Request for consent letters.*
- *Upload all outstanding documents on the EIA portal.*

30 NOVEMBER 2022 (phase III):

- *Waiting period for GRN/MEFT and the EC to issue a Record Decision.*

8. OPERATIONAL WINDOW

- Construction of BWLL airstrip (phase IV): 01 November 2022.
- Commissioning & operation of BWLL airstrip (phase V): 15 December 2022.
- Renewal of ECC (end of phase V): December 2025.

EXECUTIVE SUMMARY

Background – *Tsiseb Communal Conservancy and Brandberg White Lady Lodge (the proponents) intend to develop an Airstrip for operation of leisure aircraft at a site near the Brandberg White Lady Lodge located along the Ugab River in Dâures Constituency. Dâures Constituency is one of the rural Constituency in Erongo region that is poorly developed and highly dependent on farming. Unfortunately, the farming system which is tied to the mono-modal rainfall regime is no longer supporting farmers due to climate change and variability. The drought of 2013-2021 negatively affected local agricultural production. Although rainfall was good in the 2021/22 season, it is possible that this drought will re-occur soon. Due to climate change and variability, the drought climate risk is expected to increase in frequency and amplitude and local farmers need to rapidly respond and adapt. Interestingly, over the past years, farmers had adopted new livelihoods strategies focusing on other economic sectors especially tourism and this effort need to be supported and strengthened.*

Project motivation *– Despite, a higher potential for tourism locally, residents have not benefited from the tourism sector. The tourism sector is one of the few sectors in Namibia that is sustainable and resilient to economic externalities because value of Namibia's landscapes, wildlife and cultural diversity is intrinsic. Even depreciation of Namibian dollar against international strong currencies does not affect the tourism sector; but rather increases revenues as more international tourists visiting Namibia find it cheaper.*

Furthermore, the tourism sector is relatively easy to penetrate and would most likely benefit rural youths, women, and poor farmers. However, this will depend much on the tourism products availed to tourists to attract more tourists and avoid concentration of the tourism sector on few tourism products. The increase in tourist packages involving ecotourism, desert or rural tours, cultural village tours, gastronomy and entertainment will add value to the tourism sector.

Detailed project description*- The proposed private airstrip will consist of one brick-paved runaway and only one building to provide basic facilities. The airstrip will be 1.5 km long and 45 m wide. BWLL airstrip will only handle single-engine aircrafts and small private jets. The proposed hangar will be used to provide basic facilities. In total the area required will be <1 ha and due to limited flights, the ecological footprint is expected to be low.*

Baseline environmental conditions and biological diversity*- Although the project area is found in the savannah and desert transition zone, conditions are strongly influenced by the Benguela current upwelling system, more characterised by low air temperatures. When low air temperature cools the overlying atmosphere, the resulting stable temperature inversion layer prevents moist air that originates from the Atlantic Ocean from rising higher to form rainfall clouds. Favourable conditions in the Brandberg and its surrounding inselbergs support 66% of Namibian endemic plants. Endemic species in the project area is a vital sign that necessary precautionary measures are needed to ensure that endemic species are protected. Even more important the absence of alien plant species is a good indication of an ecosystem in a pristine or near pristine state. Fauna diversity, include the free roaming desert dwelling Black Rhinoceros (Diceros bicornis) and African Elephant (Loxodonta Africana). The black rhinoceros (Diceros bicornis) is considered the most important in terms of conservation status (critically endangered). In the area, is also influenced by tropical climate regime present north-east of the region and this perhaps affects more mobile taxa such as mammals and birds.*

Project impacts*- Among others, many project activities will negatively affect grasses and other herbaceous cover, reptiles, insects, and amphibians. Impacts on the water table will also be a critical concern due to current water shortage. Although, environmental impacts of dust as well as noise will be common, they will be more localised, short-lived, and insignificant as they are caused more by construction activities than operation activities. All properties will be build using locally occurring building materials as much as possible and no building will be taller than tree heights. In mitigating environmental impacts, the emphasis will be on monitoring and evaluation; first by carrying out baseline survey before construction and continuously monitoring throughout the project cycle.*

Conclusions and recommendations*- Extreme harsh climatic conditions are a critical threat to livestock production locally. There is an observed change, locally, from a livelihood strategy dependent on farming and natural resources harvesting to a livelihood strategy which depends on other sectors such as tourism, mining, horticulture, aquaculture, etc. Explicitly, there is a need to diversify to other economic activities as farming is no longer an economically viable option.*

Given a higher potential for tourism as well as demand or visitation rate, it will be unfair to local people if the area is not developed to generate needed revenues. This will violate the principle of sustainable that states development should be promoted if it meets needs of the people. However,

it is important at the same time to document and monitor environmental impacts of each development project. Therefore, it is recommended that the ECC should be granted on conditions that the proponents:

- *Prepares and submits an EMP along with the EIA/Scoping report,*
- *Should carry out, prior to construction, a baseline biodiversity and environmental survey,*
- *Should continue to monitor the environment during construction phase, and*
- *Continue to monitor the environment during the operation phase.*

1 INTRODUCTION AND BACKGROUND

1.1. Project location

Tsiseb Communal Conservancy and Brandberg White Lady Lodge (BWLL) (Proponent) intend to develop a private airstrip for leisure (non-military) aircraft operations. The proposed site is located near the Ugab River in north-western Namibia in the Dâures Constituency, Erongo region. The north-western Namibia loosely stretches from north of the Ugab River (northern Erongo region) to Kunene River mouth in Kunene region.

Figure 1: Erongo region consists of five (5) constituencies.

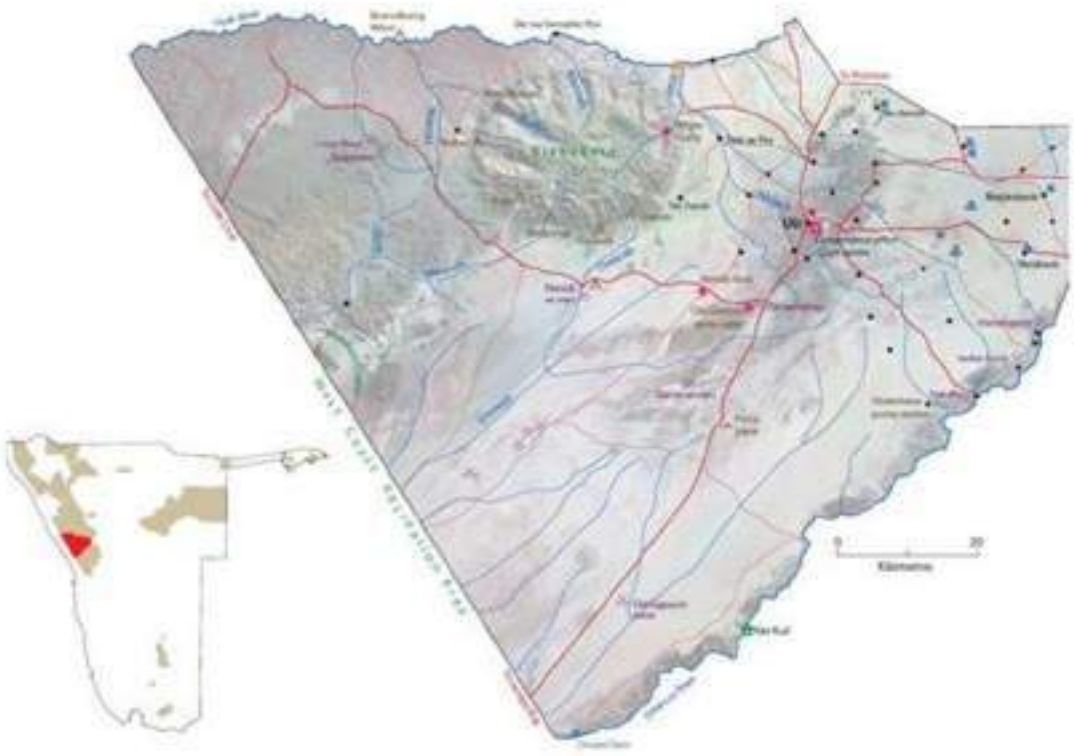


Figure 2: Tsiseb Communal Conservancy

1.2. Project motivation

Driven by cultural, ecosystem and biological diversity, the project area has a potential for tourism of higher value and higher impact. Tourism is resilient to externalities and has the potential to benefit local communities for improved livelihoods and prosperity. This is in line with local, regional, and national development goals, including NDPs (national development plans), Harambee Prosperity Plan and vision 2030. As mentioned earlier, harsh climatic condition in the area negatively affects farming and farmers are no longer succeeding in farming. Critically, if tourism is not used to benefit the local community in the Tsiseb Communal Conservancy, this will undermine achievements of national development goals.

Unfortunately, the local tourism sector is currently undeveloped and tourism products are not diversified locally to maximize benefits to all members of the community. For example, visitations to BWLL and surrounding areas is currently by road transport and there are no facilities that allow tourists to reach this destination by air transport. There is a huge interest in aircraft operators to transport tourists by air to BWLL from local

airports such as Eros, Ondangwa, Walvis Bay, Swakopmund and others. Tourists will then travel by road to nearby destinations such as Etosha National Parks, etc. To address this challenge, Tsiseb Communal Conservancy and BWLL intend to construct and operate a private airstrip for landing and taking-off of light leisure aircrafts.

The Conservancy understands the importance of preserving ecosystem and biological diversity so that the tourism sector could continue to satisfy needs of the present and future generations. The Conservancy aspires to ascribe to principles of sustainable development as prescribed by Namibian environmental legislations.

Hence, to achieve this, the Conservancy intends to make use of sustainable development instruments such as environmental legislations, environmental impact assessments, management plans, monitoring and evaluation. It is for this reason that the proponent approached Envirodu Consulting & Training Solutions to carry out EIA study and prepare the EMP on their behalf.

1.3. Terms of references and study tasks

Appointed EAPs (Environmental assessment practitioners) has proposed TORs (terms of reference) to be:

- Conduct an EIA/Scoping study for the proposed development project as per the Environmental Management Act (NEMA) no. 7 of 2007 and its regulation of 2012;
- Prepare adverts for placement in the newspapers as part of the I & APs (interested & affected parties) consultation process;
- Prepare BID and communicate BID to I & APs;
- Attend, and administer a meeting in consultation with the Client;
- Visit the proposed development project site;
- Carry out baseline biodiversity and environmental surveys;
- Compile the EIA/scoping and EMP reports for submission to relevant authority, and
- Assist the proponent to apply for environmental clearance licence.

1.4. Deliverables

Deliverable of this project are:

- Inception report;
- Background information document (BID);
- EIA/screening Report;

- Draft EIA/scoping and EMP Reports;
- Final EIA/scoping and EMP Reports, and
- Environmental clearance licence.

1.5. Objectives

The main objective of this task is to draft an EIA/Scoping report and an environmental management plan (EMP). Specific objectives are to launch application for environmental clearance licence with the Environmental Commissioner/Ministry of Environment & Tourism.

2. LEGAL FRAMEWORK

2.1. The Namibian constitution

The Namibian Constitution is the highest legal document in the country. Its relevancy to natural resources management is two-fold, first it is indirectly interpreted in the Bill of Rights (chapter 3, Article 8) and secondly, it is directly interpreted under the Principles of State Policy (chapter 11, Article 95).

Worldwide, the Bill of Rights in any Constitution is very critical as it contains fundamental human rights. Indirectly, article 8 in the Bill of Rights of the Namibian Constitution can be interpreted as protection of human health against environmental degradation (Bill of Rights 1990). Directly, Article 95(l) specifically is interpreted as promotion of human welfare by protecting the environment and ecological function and integrity.

The Namibian Constitution sets a legal foundation for environmental management and sustainable development upon which the following Acts and policies are based.

2.2. Environmental Management Act No. 7 Of 2007

The EMA (Environmental Management Act No. 7 of 2007) was endorsed by the head of state in December 2007. This legislation is exclusively dedicated to protecting Namibia's precious environment. It is based on the 12 Principles, which in summary seek to (NEMA no. 7 2007):

- Promote use of renewable resources to benefit present and future generations;
- Involve community in natural resources management;
- Protect functional integrity of ecological systems;
- Encourage developers to choose options that cause least damage to the environment;
- Undertake impact assessment to mitigate negative impacts and enhance benefits;

- Consider concerns and interests of affected and interested parties in development, and
- Prevent damage to the environment.

2.3. EMA REGULATIONS (GN 30 OF 2012)

This legal document guides on how the EMA (no. 7 of 2007) should be implemented. In summary it:

- Lists and describes all activities that require EAs;
- Explains in details duties of proponents and general requirement of EAPs (environmental practitioners);
- Clarifies the public consultation process in details, which specifically requires:
    - Placements of public notices at public places,
    - Written notices to owners of land, local authority, regional councils, or organs of state, and
    - Adverts in 2 local newspapers once a week for 2 consecutive weeks.
- Provide format of the EIA/scoping report which follows the public consultation process,
- Guides the application process to obtain the ECC (environmental clearance certificate).

2.4. CIVIL AVIATION ACT

Among others, this Act:

- Control and regulate and promote civil aviation safety and security.
- Oversee the implementation of, and compliance with, the national aviation security program.
- Oversee the functioning and development of the civil aviation industry in an efficient and economical manner with due regard given to the maintenance of standards in the civil aviation industry.
- Monitor and ensure compliance with this Act and the Chicago Convention and other international civil aviation agreements applicable to Namibia; and
- Perform its functions in the most efficient and effective manner to ensure the preservation of safety and security of civil aviation in a way that contributes to the aim of achieving an integrated, safe, responsive, and sustainable transportation system.

2.5. Namibia's Environmental Assessment Policy

Among others, this policy:

- Promotes sustainable development;

- Underscores the need to undertake Environmental Assessments (EAs) for all policies, programmes and development projects in Namibia;
- Encourages developers to practice “reduction-at-source” in pollution control and waste management;
- Describes the EAs process, and
- Stresses on the need to incorporate international accepted norms.

3. METHODOLOGY AND APPROACH

3.1. Desk studies and literature review

Desk studies and literature reviews were undertaken to gather facts, relevant background documents and information from literature and previous works about the site, people, current and past land use. Key documents reviewed included, Namibia population Census report, Erongo region population Census report, biological biodiversity of Namibia, booklet of the conservancy and others. Institution such as the information centre at the Save Rhino Trust also provided crucial information about the specific project site.

Legal documents reviewed included the Namibian Constitution, NEMA no. 7 of 2007 (and its regulations of 2012), Namibia’s Environmental Assessment Policy for Sustainable Development, Nature Conservation Amendment Act no. 6 of 1996, Pollution Control and Waste Management Bill, Water Act and Water Resources and Management Act, Communal Land Reform Act, Public Health Act and Customary Law (Bill of Rights 1990; Principles of State Policy 1990; MET 1995; MET 2013).

3.2. Public consultation process

The role of I & APs in the public consultation process is extremely significant. NEMA regulations (regulations of 2012), and specifically section 21 is explicit in guiding the public consultation process. According to section 21(2), notices were given as explained below.

3.2.1. Public notices at public places

Public notices were placed at BWLL and in Uis town at: NAMPOST, supermarket, service station, China shop, shops, secondary school, and various public places.

3.2.2. Request for concern letters

Concern letters were requested from Daure Damaran Traditional Authority and Daures Constituency office.

3.2.3. Advert in newspapers

Notices were placed in 2 (two) local newspapers, namely Confident and Namib Times newspapers once a week for 2 consecutive weeks on 12 and 19 August 2022.

3.2.4. Public meeting

The public meeting was held in Uis Town Hall on the 02 September 2022.

3.3. Release of draft EIA/Scoping report

This was important as part of providing feedback to IAPs about the project progress since the last public meeting was held. The draft EIA/scoping report was distributed to all registered IAPs by email. In addition, the hard copies were availed for public access at Tsiseb Conservancy office as well as the library in Uis. The time to view the report was from 8:30-13:00 and 14:00 and 14:00-17:00 from Monday (19 September 2022) to Friday (23 September 2022). Since no comments were received by the due date of 8 March the period to review the report was extended to 30 September 2022.

3.4. Environmental impact assessment method

3.4.1. Leopold matrix method

The Leopold matrix assessment was used in the evaluation of impacts. This is a qualitative environmental impact assessment method, and it involved a series of stages including impacts prediction, description, and assessment as described below.

3.4.2. Valued ecosystem components

Project activities to be undertaken will have impacts on the essential biological, physical and human components of the environment. These environmental components are also well known as VECs (valued ecosystem components). The first requirement in the Leopold matrix was the identification of VECs as illustrated in the table below.

Impacts were evaluated using the Leopodt Matrix by looking at environmental resource sensitivity and the scope and coverage of impact as well as their magnitude, probability and significance.

2.7.1. *Sensitivity of environmental resources*

SENSITVITY RATING		CRITERIA
1	Negligible	The environmental resource is resistant to impacts or has less environmental value.
2	Low	The environmental resource could either absorb impacts or is able to rebound its original state after the impacts, or is of low environmental or social value or is of local importance.
3	Medium	The environmental resource is either unable to absorb impacts or after impacts is unable to rebound to original state, or is of high environmental or social value, or is of national importance.
4	High	The environmental resource has moderate capacity to absorb impacts, has some environmental or social value, or is of regional importance.
5	**Very high**	The environmental resource has little or no capacity to absorb change without fundamentally altering its present character, is of very high environmental or social value, or is of international importance.

2.7.2. *Magnitude of impacts*

0	No observable impact
1	Low impact
2	Tolerable impact
3	Medium high impact
4	High impact
5	Very high impact

2.7.3. *Duration of impacts*

T	Temporary
P	Permanent

2.7.4. *Geographic coverage*

L	Localized impacts or limited to location
O	Impact of importance to municipality
R	Regional impacts
N	National impact
I	International

2.7.5. *Probability*

LP	**Low** probability (possibility of impact occurring is low, below 25%).
P	**Probable** (there is a distinct possibility that it will occur, approximately 50%).
HP	**Highly probable** (the impact is most likely to occur, 75%).
D	**Definite** (the impact will occur, 100%).

2.7.6. Significance

	ENVIRONMENTAL RESOURCE CHARACTERISTICS				
IMPACT SEVERITY [Magnitude, duration, extent, probability]	**Very high 5**	**High 4**	**Medium 3**	**Low 2**	**Negligible**
Very high 5	**Major [5/5]**	**Major [4/5]**	Moderate [3/5]	Moderate [2/5]	Minor [1/5]
High 4	**Major [4/5]**	**Major [4/4]**	Moderate [3/4]	Moderate [2/4]	Minor [1/4]
Medium 3	**Major [3/5]**	Moderate [3/4]	Moderate [3/3]	Minor [2/5]	None [1/3]
Low 2	Moderate [2/5]	Moderate [2/4]	Minor [2/5]	None [322]	None [1/2]
Negligible 1	Minor [2/5]	Minor [2/5]	None [3/1]	None [2/1]	None [1/1]

2.7.7. Mapping of significant impacts

The last stage was to provide a detailed evaluation of impacts as well as their summary evaluation, combining magnitude and importance. This summary evaluation highlighted significant impacts that should receive a higher priority during impacts mitigation and was the basis for developing a sound EMP.

This was a critical stage during which EAPs were to probe issues in detail, for example by asking the following questions:

- Which impact is most significant?
- Which impact should be prioritised during mitigation?
- Which impacts should be monitored?
- Which activity is critical during which phase?
- Which receiving environment is vulnerable during which phase?
- What is the long-term impacts worth monitoring during the operation phase?

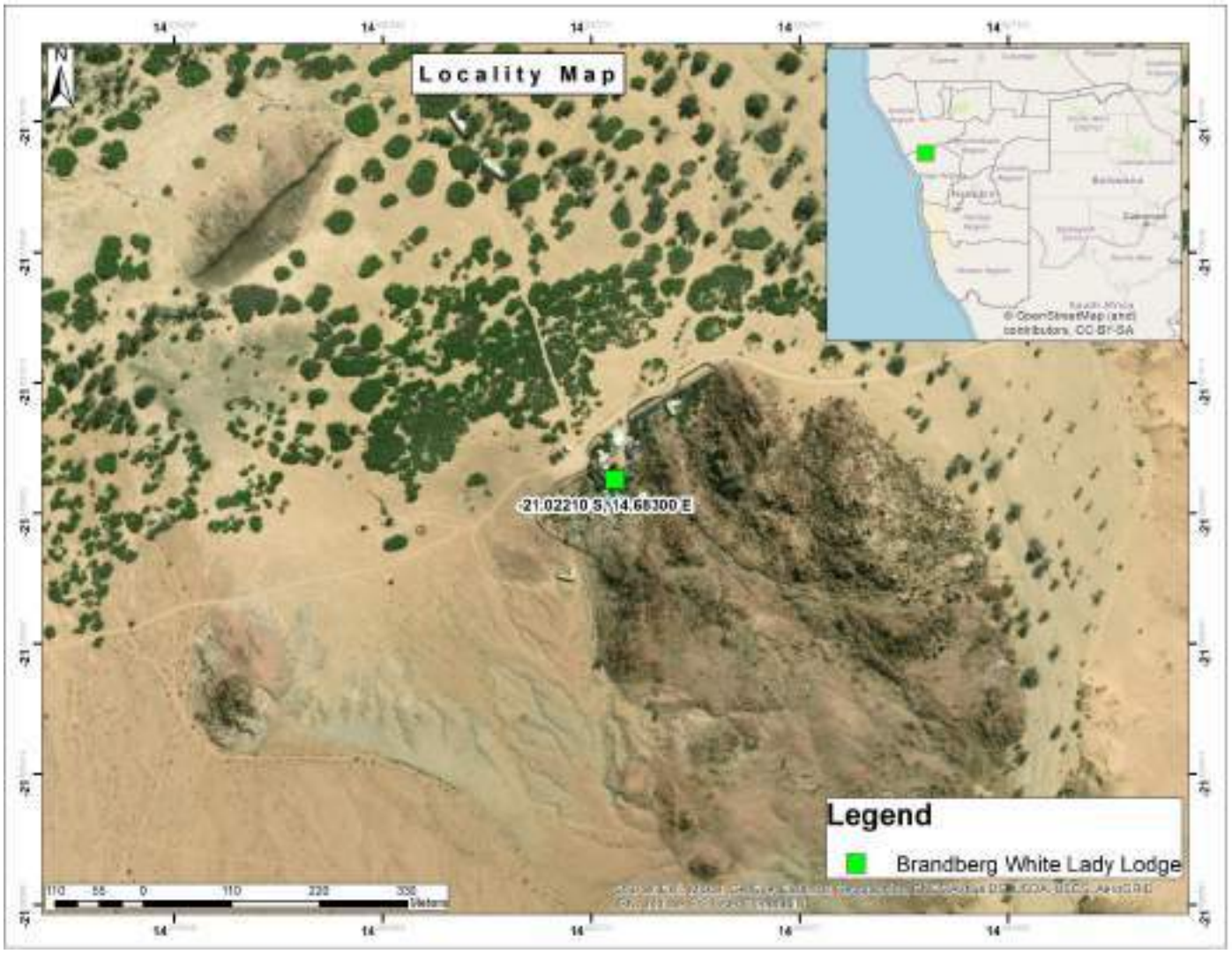
3.4.5. Environmental Management Plan and Monitoring & Evaluation Plan

The above questions are very important in the designing an effective EMP and implementation of the environmental monitoring & evaluation plan. As often argued in literature EIA as a tool for sustainable development is not sufficient in evaluating development projects because it has its weaknesses. These weaknesses include the fact that its scope is limited when measured on a temporary scale. It merely provides a snapshot overview of baseline conditions of a development project and fail to consider indirect environmental impacts or cumulative impacts that may result as result of a development.

Therefore, to make up for this the NEMA (no. 7 of 2007) and its regulations (of 2012) sometimes require preparations of the EMP and environmental monitoring & evaluation plan.

4. PROJECT DETAILS

4.1. Locality



4.2. Construction

The proposed activities will take place at an identified site with a size of 67.5 m^2 (1.5 km x 45 m) located southwest of the BWLL. The air-strip will be 45 m long and 1.5 m wide. Additional space required for air traffic to park and turn off will have a size of (900 m^2) and for a building a size of 300 m^2.

Construction activities will begin with excavation works involving removal of topsoil and vegetation (grass and shrubs) cover. There are no trees at the proposed site so cutting and removal will not be necessary. The cleared area will be measuring 1.5 km long and 45 m wide running in west-east direction. At the eastern end, there will a circular area (20 m^2) which will used by air traffic to park and turn off.

The cleared area will be compacted and levelled in order to prepare it for the foundation. The foundation depth will be at least 50 cm below the natural ground level. Once foundation is completed, pouring of concrete will follow. After concrete had dried, the foundation surface will be ready for laying with interlock bricks to finish with paved surface and complete the air-strip. Construction materials such as cements, concrete, bricks and sand will be acquired from a local brick factory in Uis. Water for preparation of the foundation and concrete mixing will be sourced from a local borehole.

4.2.1. Run-away and basic facilities

The proposed private airstrip will consist of one brick-paved runaway and only one building to provide basic facilities. BWLL air-strip will only handle single-engine aircrafts and small private jets. Due to limited flights (traffic) expected, impacts on various VECs (valued environmental components) will not be significant.

Figure 2: The proposed private airstrip will consist of one (1) paved runaway. Aircrafts will land and take-off at point A and stop (or start) at point B. Point C will be used as a hangar to park aircrafts and provide basic facilities.

Figure 3: landing area west of the proposed site (A).

Figure 4**:** area east of the proposed site (B).

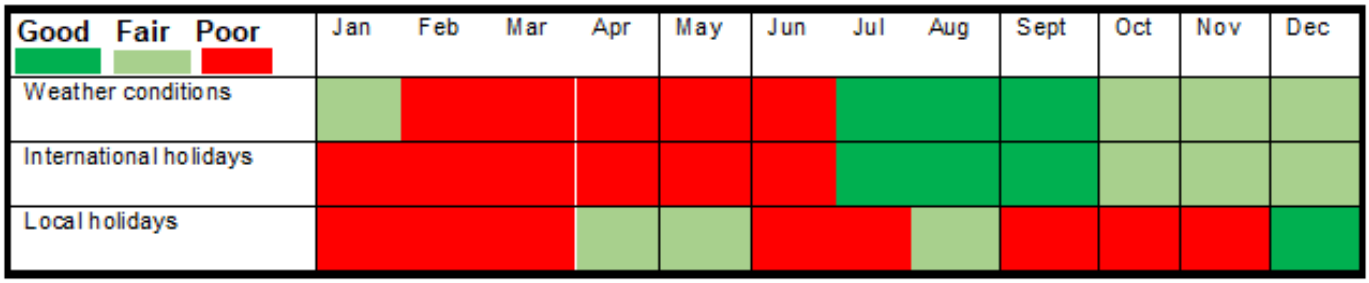
***Figure 5*:** The proposed site marked with letter A and B each indicating where aircrafts will land/take-off (A) and stop (B). The area marked C, is reserved for a building which will be used to provide basic facilities. Tourists will be transported by vehicle to and from the lodge.

4.3. Operation

Only single-engine aircrafts and small private jets will be expected. Flights will fluctuate between 2-3 flights per week during peak holiday season. Arrival and departure times will be scheduled once confirmed with aircraft operators. Aircrafts will bring tourists from local airports such as Eros, Walvis Bay, Ondangwa and Swakopmund. After arrivals tourists could either drive by vehicle to surrounding tourist destinations such as Etosha National Park (inland), Swakopmund (at the coast) or they can simply just stay at the lodge and enjoy spectacular views.

4.3.1. Operational window

Therefore, based on the factors above, the optimal window for implementing this project will be December 2022; although preparations had started already for environmental permitting and certification purposes.



5. BASELINE ENVIRONMENT

5.1. Namibia climate in general

Although the project area is found in the savannah and desert transition zone, climatic conditions are more strongly influenced by the Benguela current upwelling system than by the tropical climate. Locally, low air temperature cools the overlying atmosphere, resulting in a stable temperature inversion layer. This layer prevents moist air that originates from the Atlantic Ocean from rising higher and only form fog clouds giving rise to a temperate climate regime (Mann and Lazier, 1996).

Apart from local influence of the cold Benguela current upwelling system, at a large scale the north-eastern part of project area is sub-tropical/tropical being influenced by the global ENSO (El Niña Southern Oscillation). Therefore, it will be biased if the sub-tropical/tropical climate regime is ignored merely because the project area is located in the transition zone. Even more important some highly mobile taxa such as birds and mammals are directly affected by both climate regimes. The sub-tropical to tropical regime also affect a larger part of Namibia.

5.1.1. El Niña Southern Oscillation

The global ENSO (El Niña Southern Oscillation) depicts a rise and fall trend expressed as Oceanic Niño Index (ONI) as shown in ***figure 9.*** In 2008-2010 and 2011-16 the Oceanic Niño Index (ONI) was negative (blue) and positive (red), respectively, and in southern Africa this indicated wetter and drier than normal conditions, respectively. The flood (2007-2010) and drought (2013-16) events that took place during similar periods coincided with negative and positive ONI values, respectively.

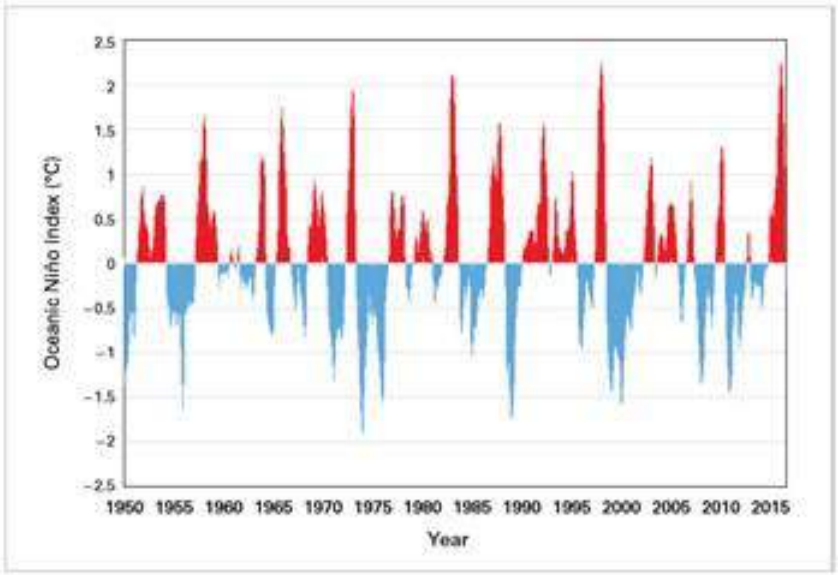


Figure 9: *Oceanic Nino index (Source: World Meteorological Organization, 2018).*

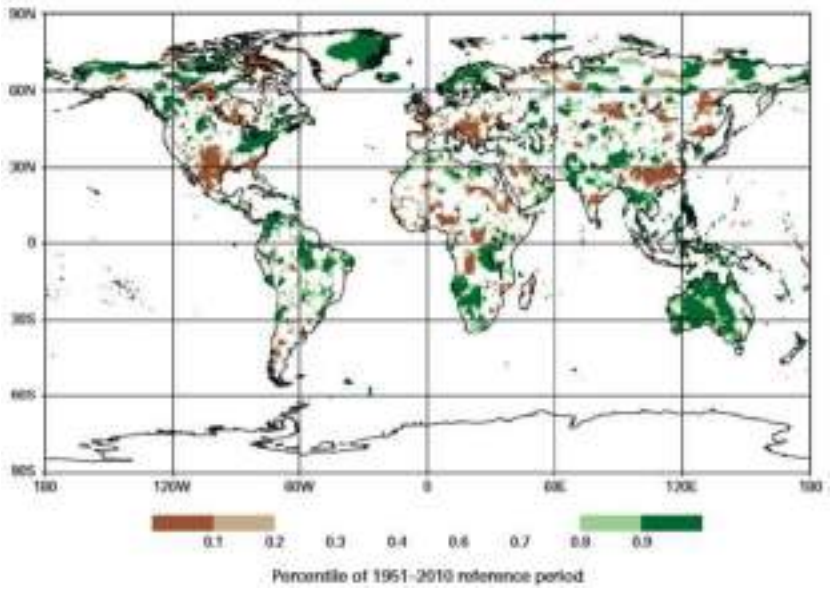


Figure 10: *the graph shows yearly total rainfall expressed in percentile with reference to the 1951–2010 time series. Southern Africa is marked in a pale to dark green colour, indicating a wetter than normal conditions during the referenced time series for 2011 (Source: World Meteorological Organization, 2018).*

Each year, prior to La Niña year, La Niña precursor conditions begins to develop in early October when the ITCZ (intertropical convergence zone) shifts south of the equator. Average temperature anomalies drop significantly to a lowest average and by December, low air pressure system would have fully developed and La Niña conditions could be easily predicted.

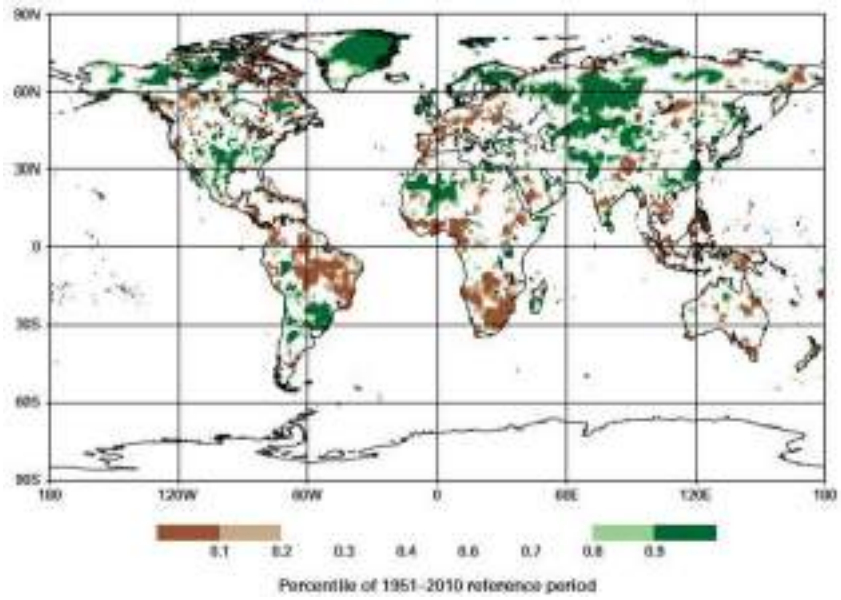


Figure 11: *The graph shows yearly total rainfall expressed in percentile with reference to the 1951–2010 time series. Southern Africa is marked in a pale to dark brown color, indicating drier than normal conditions during the referenced time series for 2015. (Source: World Meteorological Organization, 2018).*

La Niña conditions cause above average rainfall conditions in southern Africa which spread further across south-west of the southern Africa sub region. In some year record of floods could be observed as early as December in Malawi, Mozambique and Zimbabwe and by mid-January wet conditions would have advanced further south-west of the southern Africa sub region. In contrast, the El Niña conditions causes drought in Namibia and the southern African region.

5.1.2. Tropical storms and cyclones

The main source of rainfall in Namibia and southern Africa is the southwest Indian Ocean where the tropical storms and sometimes cyclones develop during each tropical storm season. The annual tropical storm season in the southwest Indian Ocean is approximately between October and May. Cyclone *Dineo* occurred in the 2016/17 season in mid-February 2017. Compared to 2016/2017 season, no cyclones were recorded during the 2017/2018 tropical cyclone season.

This means all 8 tropical storms recorded between November 2017 and May 2018 never developed into cyclones.

In the November 2018, the following weak tropical storms were recorded: Bouchra, Kenanga and Cilida. This was followed in January 2018 by Ava, Irving and Bergutta. In March 2018 only 2 tropical storms (Eliakim and Dumazile) developed. This shows that the 2017/18 tropical storms were stable; being spread out throughout the season and generally weaker (World Meteorological Organization, 2018). However, the 2018/19 season was relatively different as seen from development of cyclone *Idai* that suddenly developed much later than anticipated.

5.1.3. Climate change and variability

For 11 years, beginning in 2007 until 2018, a climatic trend in Namibia was characterized by a rainfall regime marked by: flood (in 2007-10) and a quiescent period (in 2011-12) of normal rainfall; drought (in 2013-16), followed by another quiescent period of below average rainfall (in 2017 and 2018). The 2017-2018 quiescent period was of particular interest or concern as it was an indicator of continuation of drought period during 2019/2021 rainfall season.

The 2021/2022 rainfall season was better compared to the previous season but the it is difficult to predict the 2022/2023. Whatever, the impacts are there is a need for preparedness to avoid the element of surprise. Unfortunately, the biggest challenge is the inability to predict these risks which is exacerbated by climate change and variability.

5.2. ECOSYSTEM DIVERSITY

Namibia's biomes can be loosely divided into five categories comprised of: coastal/marine, desert, Karoo, Broad-leafed and shrub savannah Acacia savannah, and wetlands savanna (MET, 2010). Ecosystem diversity in the project area is extremely variable and shows larger differences at micro-climate level. These differences are due to influences of the tropical to subtropical conditions from inland and the cold Benguela current upwelling system from the coast.

Seemingly, the project area is found in a transitional zone between at least the savannah and desert biomes. When approaching from the eastern part of the area there is a rapid transition from mopane savanna into gravel plains of the Namib Desert. The most dominating habitats locally are Brandberg Mountain and inselbergs, rocky ridges, Rivers, catchments, gravel plains and sand dunes. Biological diversity and richness in each habitat change with distance from the coast showing that climate plays an extremely important role in community structures of both plants and animals. Brandberg mountain and the surrounding inselbergs are important as a

biodiversity ‘hotspots’ of higher endemism and the biological diversity seem to be independent of local climatic setting.

Figure 12: biomes in Namibia (MET, 2010).

5.2.1. Desert climate regime

According to long term climatic trend, the project area receives >100 mm rainfall and has up to 5 fog days annually. Rainfall shows a distinct gradient with more rain in the north-eastern areas (up to 150 mm annually) which decreases to as low as 50 mm per year in the south-west of the area. This decrease in rainfall is mainly due to influence of cold Benguela current upwelling current, which is a source of dry cold air masses, with limited precipitate in the form of fog.

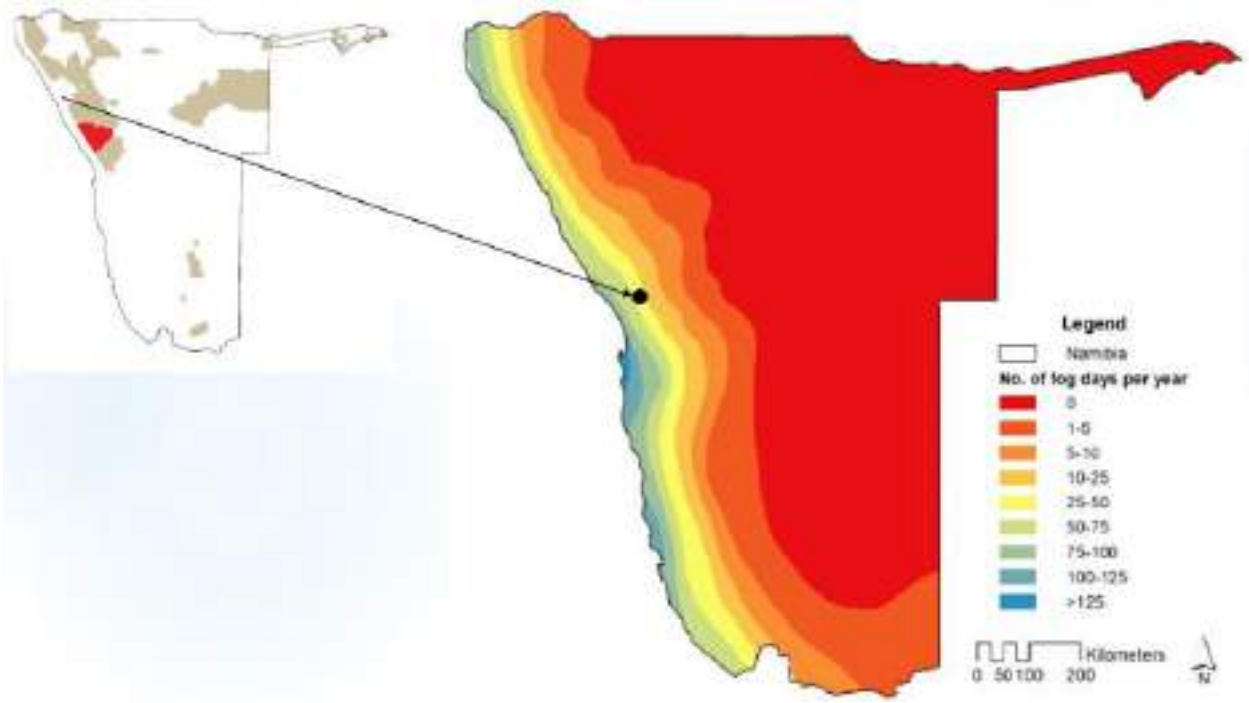


Figure 7: Number of fog days per year (modified from: University of Cologne 2003).

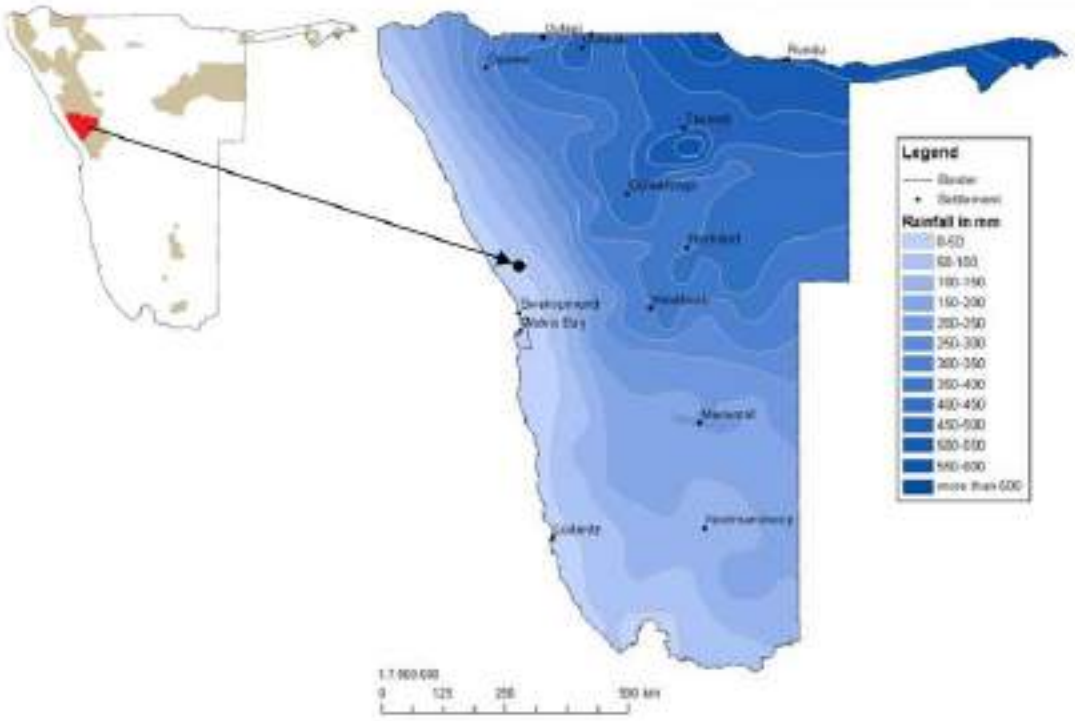


Figure 8: Erongo rainfall data map (modified from: University of Cologne 2003).

5.2.2. Coastal climatic zones

Coastal conditions are characterised by:

- Precipitation in the form of fog.
- Low temperatures.
- Higher humidity, and
- Low evaporation rate.

These conditions predominate throughout the year at the coast and is now a steady macroclimatic force that has been acting on the Namib Desert for millions of years. Macroclimatic forces mean the biome can be subdivided into microclimatic zones. The Namib Desert is plain flat without any elevated landscapes. As such, there are no elevated landscapes to disrupt influence of the cold Benguela current.

The following climatic zones are distinct as one approaches the coast from the east:

- Eastern zone (70-90 km from the coast): 5 fog days.
- Middle zone (50-70 km): up to 25 fog days.
- Cool foggy coastal zone (20-60 km): 50-100 fog days.
- Foggy interior zone (20 km): >125 fog days.

5.3. Flora diversity

A list of plants that occur or are reasonably expected to occur in the project area is provided in appendix A (***table 1.1 to 1.3***).

The microclimatic regime is strikingly unique resulting in rare floristic diversity. Locally, endemism is higher, compared to the rest of the central Namib Desert area. There are no exotic species recorded in the area and this extremely critical because the project is expected to increase anthropogenic activities in the project area. Anthropogenic activities are not only associated with introduction of exotic plants but more with local establishment and expansion of exotic species (Lozon & MacIsaac, 1997). Absence of exotic species recorded in the project area, however, does not necessarily mean that the area is immune to exotic species. There it is important to, during

the project life cycle, to prevent growth of exotic species and when this occurs the problem should be mitigated immediately.

5.3.1. Conservation status

This section provides a brief analysis of species diversity in terms of conservation status. The dominating vegetation of shrubs include a wide variety of species, but their IUCN conservation status is either not evaluated or of least conservation concern.

Based on desk studies and literature review there were no alien plant species in the project area. Furthermore, no plant species was endangered, threatened or of any conservation concern. However, project activities will have significant impacts on grass and herbaceous vegetation. More emphasis in this report was give on grass species as discussed in the next section.

Grass is important as food to grazers (e.g., zebras, antelopes, springboks, locusts, etc), small mammals (e.g., rats, hares, etc). Apart from food, grass also provide shelter to other animals such reptiles, amphibians, and birds. The project area is blessed with a wide variety of grasses, many of which are endemic to the area. During construction, removal of grasses and other herbaceous vegetation cover will be inevitable. Grasses and other herbaceous are well adapted to disturbances (removal, cutting, grazing, or burning). Grasses and other herbaceous store reserve nutrients in their roots and culm bases and this allows them to regrow rapidly after disturbances.

5.3.2. Endemism

In the project area, Brandberg Mountain and surrounding inselbergs are the biodiversity 'hotspots' that are perhaps worth considering in this report. Favourable conditions in the Brandberg and its surrounding inselbergs support 66% of Namibian endemic plants (Craven, 1997; Maggs et al., 1998). There are more several endemic plant species namely, herbs (*Nicorella nordenstamii* and *Hermannia merxmuelleri*), succulents (*Lithops gracilidelineata brandbergensis*), shrubs (*Pentzia tomentosa, Plumbago wissii, Ruellia brandbergensis*, *and Felicia guneliae*).

In addition, there are other endemic plants species that may not exclusively occur within the Brandberg mountain habitat but confined within its immediate surroundings and inselbergs. These include: *Othonna brandbergensis, Cucumella clavipetiola, Eragrostis aristida, Nicotiana Africana* and *Euphorbia monteiroi brandbergensis.*

Endemic species in the project area is a vital sign that necessary precautionary measures will need to be undertaken to ensure that endemic species are protected. Even more important the absence of alien plant species is a good indication of an ecosystem in a pristine or near pristine

state. Again, this call for this project monitoring activities to avoid introduction of alien species into the project area to preserve or improve the current conservation state. Environmental awareness to visitors, contractors and employees will most likely be used to achieve this. In addition, when landscaping, care should be taken not to introduce alien plants.

5.4. Fauna diversity

An important feature in the surrounding project area and in the proposed area. Apart from being the highest Mountain in Namibia it is the only highly elevated landscape in the central Namib Desert area. Cold and moist air mass from the cold Benguela upwelling current that reach it is trapped by the mountain and when mixed with the warm air mass they contribute to a unique micro-climate regime in the Brandberg Mountain and surrounding inselbergs. This microclimate which is different from the rest of the central Namib Desert area and is also different from the tropical climate regime inland. It therefore, supports a rare faunal diversity of higher endemism especially reptiles, insects and amphibians.

Higher endemism is higher among fauna species that are less mobile than those with higher mobility. Reptiles and insects show higher endemism rate (both at 24%) than amphibians (12%) and mammals (7%). Lower endemism rates of birds (3%) and fish (2%), are due their higher mobility and this suggest that they tend to be less vulnerable to ecological disturbances. Impact assessment during this project should give a higher priority on less mobile taxa viz. reptiles, insects, amphibians and mammal species of conservation concern as the probability is higher that they will be significantly affected.

Although many reptiles live in rocky habitats where construction and other activities may not take place; it is important to note possible impacts on their feeding and breeding habitats.

5.4.1. Reptiles

Table 1.4 provides a list of reptiles that occur or are reasonably expected to occur in the project area. Reptiles are of particular concern as they show higher endemism rate (24%). Due to immobility their distributions are restricted and localised. During construction, habitats of reptiles will be destroyed and this will have significant impacts on their population.

The Brandberg Gecko (*Pachydactylus gaiasensis*) is a medium sized gecko which is only found in the Brandberg Mountain and nowhere else in the world (Griffin 2003). This gecko is however not evaluated in terms of conservation status and this is similar to all other reptiles locally recorded.

Seven reptile species that are strictly endemic to the Brandberg area and are expected to be present in the project area according to literature reviewed. The Albert's burrowing skunk

(*Pepsina alberti*) is a light, green skink with a bright tail that is found in the northern area of the Tsiseb Conservancy. Other reptile species in the area are the Husaben sand lizard (*Pedioplanis husabensis*), Namaqua spinytail lizard (*Cordylus namaquensis*), Campbell's spinytail lizard (*Cordylus pustulatus*), Albert's skink, and Nama padloper *(Homopus sp.nov*) (Griffin 2003).
There are a lot of lizards scurrying around. They're tricky to photograph since they don't sit still for long, but the colours on some of them were really impressive like for the one in the figure below:

5.4.2. Insects

Generally, insects are important as indicator species mainly due to their short carbon turnover as well as rapid response to pollution, habitat modification and a wide range of other ecological disturbances. Unlike mobile taxa, insects are biogeographically limited and tend to be highly endemic.

Spiders – about 11 species of spiders had been recorded in the Brandberg and inselbergs area, many of which are endemic and only two species occur elsewhere in Namibia. These are: *Aelurillus mirabilis Evarcha acuta Habrocestrum namibicum Heliophanus montanus Langona pilosa Langona vitiosa Pseudicius adustus Mashonams brandbergensis Pellenes tharinae Phlegra karoo Phlegra fenelle*

Scorpions – the only species that is endemic or near endemic locally is the *Brandbergia haringtoni* named after the Mountain. A list of scorpions that occur or are reasonably expected to occur locally is provided in ***table 1.6.***

Table 4: **scorpion diversity.**

Scientific names	**Common names**	**Namibian conservation status**
Bothriuridae Brandbergia haringtoni	-	-
Parabuthus brevimanus	Sand combs	
Parabuthus gracilis	-	-
Parabuthus granulatus	Granulated thick- tailed scorpion	Endemic
Parabuthus kraepelini	-	Endemic

Parabuthus namibensis	-	Endemic
Parabuthus villosus	Black hairy thick tailed scorpion	Near endemic
Uroplectes gracilior	Less thick-tailed scorpion	Near endemic
Uroplectes otjimbinguensis	Less thick-tailed scorpion	Near endemic
Uroplectes planimanus	Less thick-tailed scorpion	Near endemic
Hadogenes hahni	-	Near endemic, not evaluated
Opistophthalmus carinatus	Robust burrowing scorpion	Near endemic, not evaluated
Opistophthalmus coetzeei	-	endemic, not evaluated
Opistophthalmus gibbericauda	-	Near endemic, not evaluated
Opistophthalmus jenseni	-	Near endemic, not evaluated
Opistophthalmus lamoral	-	endemic, not evaluated
Opistophthalmus ugabensis	-	Near endemic, not evaluated

5.4.3. Amphibians

A list of species that locally occur or reasonably expected to occur are provided in ***table 5***. The special marbled rubber frog (*Phrynomantu annectans*) is found in the Brandberg Mountain and inselbergs. The other frog species are found in the Ugab riverbed. Only two amphibian species are known to be endemic to the project area namely, the Okahandja toad (*Bufo hoeschi*) and the Mossamedes toad (*B. grandsonae*) (Griffin 2003).

During the dry season frogs dig themselves into the substratum below the pools and could be vulnerable to any activities that reduce the water levels for longer periods than their tolerance limit. In addition, activities during construction are expected to destroy breeding and feeding habitats of frogs.

Table 5: **Amphibian diversity**

Species Name	Common name	Namibian conservation and legal status
Phrynomantus annectan	Marbled rubber frog/ Okahandja toad	Endemic, secure
Bufo hoeschi	Damara dwarf toad:	Endemic, secure
Bufo grandisonae	Mossamedes toad	Endemic, secure
Tomopterna cryptotis	Sand frog	not endemic, secure

5.4.4. Mammals

A list of the mammals that occur or are reasonably expected to occur in the area is presented in appendix B. The data provided in appendix A (***table 1.7***) is for the general north-western area of Namibia, of which the project area is a small part of and therefore it is a general representation of the project area. This means it is possible that not all mammals presented in ***table 1.7*** may be found in the project area.

Many mammals are endemic locally, especially small mammals which are less mobile when compared to large mammals. Mammals are ecologically important as grazers, browsers and predators. They control populations of plants and other animals in the ecosystem. Mammals also have an intrinsic value that significantly contribute to tourism. Negative impacts on mammal populations include poaching and risks of climate. Poaching was a serious threat between the 1980s and early 1990s and accounted for a greater loss of mammal diversity. The situation had been improving since the early 2000s due to implementation of the CBNRM concept; resulting in stable or growing population trends for most species between 2003 and 2012. Unfortunately, the risks of climate particularly longer drought spells contributed to a steady decline in populations of many mammals.

Successes of the above interventions are difficult to observe due to risks of climate experienced over the years, for example the drought spells between 2013 and 2019 resulted in loss or shifts of mammals away from drought prone areas. However, when years of drought are excluded in

the analysis there is a clear increasing trend in mammal populations between 2003 and 2010 as compared to a steady decline in mammal populations.

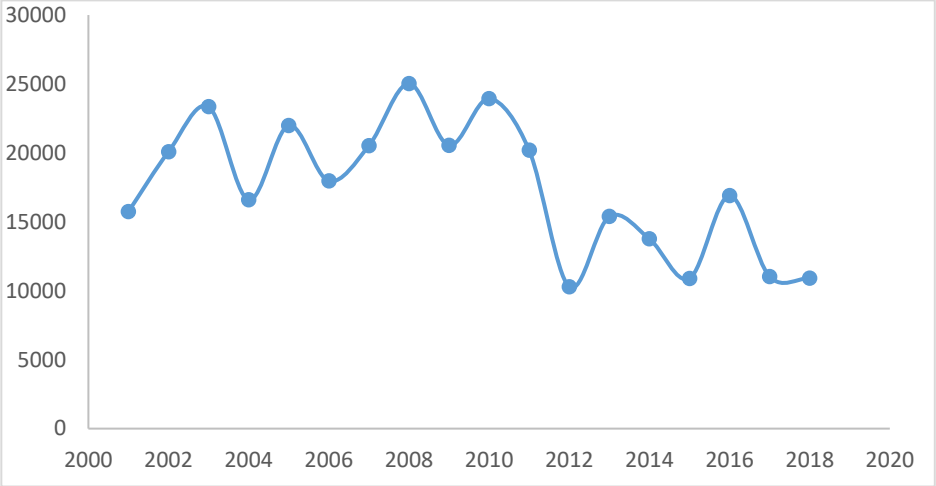


Figure 18: mammal population trend.

Figure 19: population trend of species of conservation concern (data was only available for cheetah, elephant and H. zebra).

Generally, mammals are highly mobile species with a wider habitat range and based on this they are less vulnerable to these project's activities.

Figure 20: Mighty hyrax (Source: thirstyjourneys.com).

5.4.5. Birds

The Brandberg inselberg and the Ugab River are home to a number of bird species. The flat plains below the Brandberg Mountain are home to about five bird species including the *Ardeotis kori* (Kori bustard) which is the largest flying bird native to southern Africa. Some species that are near endemic to Namibia are found in the gorges and valleys around the Brandberg Mountain such as the *Francolinus Hartlaub* and *Agapornis roseicollis* (Bernard 1998).

Birds are highly mobile species with a wider habitat range and based on this they are less vulnerable to this project's activities.

Table 6: **Avian diversity that occur or expected to occur in the surrounding project area.**

Common names	**Scientific name**	**Namibian conservation and legal status**
Southern Pale Chanting Goshawk	*Melierax canorus*	Common resident. Near-endemic. Least concern.
Common Kestrel	*Falco tinnunculus*	Least concern
Kori bustard	*Ardeotis kori*	Near threatened

Ludwigs bustard	*Nestis ludwigii*	Endangered
Ruppell's korhaan	*Eupodotis rueppelli*	Least concern
Double- banded courser	*Rhinoptilus africanus*	Least concern
Grays lark	*Ammomanopsis gray*	Least concern
Starks lark	*Eremalauda starki*	Least concern

5.5. Surface water and hydrology

Due semi-aridity and aridity described above, locally the hydrological cycle is unpredictable; being characterized by irregular flow of the ephemeral Ugab River due to low and variable rainfall and higher evaporation, among others. There are no perennial Rivers in the central Namib area and surface water sources are very limited. This means higher dependence on groundwater as a main source of water.

The proposed project will depend on ground water sources in the Ugab River. Ugab River is the borderline between Erongo and Kunene region and the longest River in the Namib central area, stretching for 486 Km from Otavi highland mountains to the Atlantic Ocean. Although, the Otavi highland mountains are one of the higher rainfall areas in Namibia, it does not necessarily contribute to continuous flow of the Ugab River even during periods of higher rainfall, mainly due to various abstraction activities upstream, and to a lesser extent due to a long distance of the river, as well as the effect of altitude. Upstream developments are located on both sides of the river including farms, lodges and settlements. Anthropogenic activities (mining, tourism, domestic use, urban water supply farming, irrigation, etc) along the Ugab River compete with ecological water demand needed to maintain biodiversity such as Acacia trees, which are crucial dry season food reserve for game and livestock animals (NEPRU, 2000).

Table 5: characteristics of Rivers in the central Namib area (NEPRU, 2000).

River	Size of catchment area, Km^2	Total length of River, Km	Size in the Namib area, Km^2	Namib area in % of total catchment	Length of River in the Namib area, Km	Mouth
Kuiseb	16,200	440	3,350	2.5	140	Delta
Swakop with Khan	31,000	420	5,000	16	120	Funnel shaped
Omaruru	14,050	315	3,200	23	115	Funnel shaped
Ugab	15,400	486	2000	13	110	Funnel shaped

5.5.1. Underground water sources

In the central Namib area, underground water is the main source of water. Water is availed through boreholes, wells, and springs. Factors that influence the quantity and quality of underground water are:

- Geology of the water bearing strata;
- Depth of water from the surface;
- Yield of the borehole, spring or well;
- Recharge rate;
- Chemical composition of the water course, and
- The risk of pollution.

Wet (1999) classified the following ground aquifers in Namibia: alluvial (sand), Kalahari, fracture, Karst and artesian. Water resources in alluvial aquifers are stored in the intergranular pore spaces of sand deposits in river beds. Alluvial aquifers have limited storage capacity but rapid recharge rate due to their permeability. Water chemical composition in alluvial aquifers is largely influenced by regular infiltration of water during recharge which in turn depend on the origin of water during runoff.

All aquifers in the Ugab River are alluvial type and are of particular importance in supporting biodiversity and water supply to local farmers. Currently, due to low rainfall in the last few years the ground water table level is of particular concern. However, it is important to note that alluvial

aquifers recharge faster, and one heavy run-off event could easily restore underground water resources to normal level.

The proposed project is a small-scale tourist operation and influent waste will be temporarily stored and discarded at a waste disposal facility in Uis.

4.6.2. Water consumption

It is difficult to accurately determine the total volume of water abstracted from local boreholes in the general proposed area. Even for the entire country this is not easy due to lack of water licencing and data that exist is a mere estimate. It is important to note that the main source (55.6%) of water supply in Namibia is underground sources, while the remaining (44.4%) is supplied from surface and Ephemeral Rivers. In addition, it is also important to note that tourism is the lowest in terms of water consumption in Namibia. Although this is data from 1996 and given the tourism sector has grown, the fact is tourism is a seasonal and sustainable sector. This could imply that this figure has perhaps increased but perhaps still lower relative to other sectors.

Table 6: *water consumption per sector* (NEPRU, 2000).

Sector	**% Consumption**
Urban (all inclusive)	21.1
Human (rural)	1.9
Agriculture (irrigation)	45.8
Agriculture (stock)	26
Mines	4.5
Tourism	0.8
Total	**100**

5.6. Socio-economics

Many rural areas in Erongo region are in the north of the region in the Dâures constituency. Dâures constituency is the largest constituency in Erongo region with a total surface area of 13, 490 km^2. The population is 11,350 people more densely populated in Uis town. For easy geographical reference, the Dâures constituency is roughly bordered to the north and south by the Ugab River and the B2 higher way, respectively (see ***figure 1*** and ***2***).

Generally, the Dâures population pyramid has a wide base and a narrow, rapidly falling top. This shows a younger population with a higher birth rate (and perhaps low gender equality) and higher death rate or short life expectancy.

This type of population pyramid implies a growing population, more dominated by youths (15-34 years old) and children (under 14 years old). About 35% of the population in the Conservancy are youths (15-34 years old) and given an unemployment rate of 37%, there is a larger 'pool' of unutilised human resources. Critically, the tourism sector has the potential to create jobs and generate incomes. Unfortunately, resident in the Conservancy rarely benefits from tourism opportunities partly because information and knowledge tourism are not easily accessible and more because the processes involved in the setup of tourism facilities is complex to residents.

Other development characteristics in the region are summarized below (NSA, 2014):

- ***Education.*** At constituency level, the highest proportion of the population aged 0-4 years old who attend ECD programmes are in Swakopmund (30.8%) and Walvis Bay urban (27.8%). Karibib (14.5%) and Dâures (10%) constituencies rank the lowest. Literacy rates for the population above 15 years is low in rural areas in Dâures (65.8%), Karibib (70.9%) and Omaruru (91.6%). Labor force is low in many parts of the region but more in rural areas (70.4%), specifically in the Dâures constituency (65.8%).
- ***Impacts of climate change and other externalities***. Climatic factors limit agriculture, and the effects are more on small holder farmers in rural areas. Livestock farming depends heavily on the rainy season, with the average rainfall varying from below 100 mm in the far west to about 300 mm in the far eastern part of the region. Higher annual average temperatures contribute to surface water loss due to evaporation. With proximity to the Atlantic Ocean underground freshwater sources are susceptible to contamination by seawater and this effect could be exacerbated by sea level rising, which is again linked to climate change. These difficult climatic conditions are expected to increase due to climate change and variability. In the last 3-4 years (2018-2021) Namibia experienced a period of extremely low rainfall. This was followed by economic downturn which negatively affected the major economic sectors such mining and fishing in Erongo region in general. However, despite these shocks the tourism sector has remained relatively resilient. This is perhaps more because depreciation of the Namibian dollar against the global currencies is in favor of international tourists as they find it cheaper to travel in Namibia.

6. BRANBERG MOUNTAIN NATIONAL MONUMENT

6.1. Description

The Brandberg mountain is a National Monument that is situated approximately 30 km north west 21°10' S and 14°25' E of the small town of Uis and it is the highest mountain in Namibia. The Brandberg mountain stands out as an imposing feature in flat gravel plains of the central Namib Desert as a large, almost circular inselberg that is visible from space since it rises more than 1800 m above the surrounding plains and its highest peak is 2573 m. The Brandberg mountain as a National Monument in Namibia has an exceptionally rich palaeo-archaeological heritage with a high concentration of prehistoric rock arts that are more than 43 000 paintings and 900 sites. The two genres of rock art which are engravings and paintings are found in close association in the Brandberg and more than 120 archaeological sites have been recorded. The Brandberg is home to the famous rock art painting, the "White Lady" as well as other numerous

paintings of exceptional quality. The mountain forms part of numerous destinations along prehistoric migration routes of people who migrated seasonally between the coast and the interior. Excavations revealed intensive and repeated human occupation on the higher elevations of the Brandberg mountain from about five thousand years ago. Adequate water and shelter may have served as aggregation areas for otherwise dispersed groups of hunter-gatherers or herders at the onset of increased aridity in the region at that time. Increased social ritual activity associated with human aggregation probably resulted in the accumulation of rock art, and thus the rock art is evidence of an intricate social and environmental fabric (Namibia National Commission for UNESCO, 2002).

6.2. Geological formation

According to the Namibia National Commission for UNESCO, 2002, the Brandberg was clearly an important focus of culture and socio-economic activity for the indigenous people of Namibia. The Brandberg is one of a series of ring complexes of the Etendeka volcanic succession which intruded into the surrounding bedrock of the current Namib peneplain, composed of mica schists of the Damara sequence and sedimentary rocks of the Karoo sequence, at the breakup of western Gondwanaland into the African and South American continents more than 130 million years ago. The Brandberg mountain itself is composed of a circular series of granitic intrusions which marks the remains of an enormous volcano which was reduced by a hundred million years of erosion following the establishment of the South Atlantic Ocean and uplift associated with the new continental margins.

6.3. Ecological importance

Ecologically, the Brandberg lies in the transition zone between the Namib Desert and the Savannah regions of the central Namibian interior. Its close proximity to a coast with almost permanent high pressure conditions causes weather fronts, originating from the South Atlantic anticyclone, to sweep much further during the austral winter, resulting in the climatically unique occurrence of winter rainfall within the tropical zone on the high plateau of the Brandberg. As a result, the site is endowed with a rich biological diversity which represent 40% o of the mammal and reptile species and 10% of plant species recorded from Namibia. The 480 vascular plant species include 7 species endemic to the Brandberg and another 100 species endemic to Namibia, while the fauna includes 82 species of mammals, 128 species of birds, 86 species of reptiles, 5 species of amphibians, at least 89 species of spiders, and more than 2000 species of insects. More than 50% of the mammal, reptile, and amphibian species are endemic to Namibia, while more than 200 endemic insect species have been recorded from the Brandberg alone. Endemic animal species to the Brandberg included a new order of insect to the world, as well as

a new tribe of insect to Africa, which illustrates the ecological importance and uniqueness of the site. The Brandberg is a gazetted national monument with an area of more than 450 square kilometers. The local community still exploits the rich resources of the area and thus derives a living from it. Community participation in the managing of the site is in place as the local population organized themselves into a community-based tourism project (Namibia National Commission for UNESCO, 2002).

6.4. Rock paintings

The rock art in the Brandberg National Monument Area of Namibia is astonishing. The Brandberg has a high concentration of prehistoric rock arts. There are about 900 sites featuring over 43,000 paintings and engravings. It is commonly known this rock art was painted by bushmen about 2,000 years ago. The most noticeable rock art is the White Lady rock painting which is located on a rock face with other art work in the Tsisab Ravine at the foot of the mountain. The ravine contains more than 1,000 rock shelters, as well as more than 45 000 rock paintings.

Figure 21: a zebra painting (Source: thirstyjourneys.com)

Figure 21: a herd of cattle and a calf painting. (Source: thirstyjourneys.com)

Some of the paintings may go as far back as 5,000 years. These are monochromatic, using shades of red and brown. The polychromatic paintings, such as that of the White Lady, are more recent, around 2,000 years old. There's a lot to explore in the Brandberg, and it's definitely a worthwhile excursion. The rock art is just one draw, as the unique landscape is also enjoyable on its own.

6.5. Heritage significance

A historic site or heritage site is an official location where pieces of political, military, cultural, or social history have been preserved due to their cultural heritage value. Historic sites are usually protected by law, and many have been recognized with the official national historic site status. Heritage sites are recognized as being of outstanding international importance and therefore as deserving special protection. Sites are nominated to and designated by the World Heritage Convention.

The Brandberg National Monument Area was added to the United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Tentative List on October 2002 in the Mixed Cultural as well as Natural category.

Although the proposed development is far from the Brandberg mountain, during construction and operation a representative from the National Heritage Council of Namibia will be needed to observe and ensure that proposed activities will not affect rock and the heritage sites.

7. PUBLIC PARTICIPATION PROCESS

As provided in the EMA (no. 7 of 2007) the public participation process forms a critical component of any EIA process and for this project this stage was important in completing this EIA/Scoping report.

7.1. Public notices

Notices were placed in 2 (two) local newspapers, namely Confident and Namib Times newspapers once a week for 2 consecutive weeks on 12 August 2022 and 19 August 2022.

7.2. Public invitations

The following institutions and organizations were specifically invited to participate in the public participation process: Rhino Trust Fund, Uis town village, Dâures Constituency, Erongo Regional Council, and Damaraland traditional authority. In addition, the BID was prepared and delivered to registered stakeholders as well as institutions and organizations that were invited.

7.3. Public meeting and consent letters

Registered IAPs attended a public meeting on 02 September 2022. Since no one showed up for the meeting, a field assistant was assigned to inform potential IAPs about the project from door to door.

Consent letters were obtained from the Damaran Tradional Authority and Daures Councilor.

8. PREDICTION OF ENVIRONMENTAL IMPACTS

Project activities during each phase are predetermined and described in the table below. Each project activity has impacts on the VECs (valued ecosystem components) as explained in the ***table 7.***

9. IMPACTS ASSESSMENT

9.1. Impacts prediction

Impacts were listed in ***table 8*** and according to this each activity will have a few impacts on the receiving environment. The increased level of noise as well as dust and gaseous emissions were common because each construction activities is expected to generate noise and dust. Additionally, the machineries and construction vehicles used will emit gases resulting from fuel

combustion. Although these impacts are not significant as they are temporary and localised, they will still need to be mitigated and monitored throughout this project cycle.

9.2. Mapping of significant impacts

During impact assessment (***table 9***) the following impacts came out quite strongly as explained in ***table 10*** and ***11***:

Loss of reptile and amphibian diversity. Geographically, less mobile taxa tend to be aggregated in a narrower range and they show a higher rate of endemism. In Namibia, reptiles and amphibians have a higher rate of endemism recorded at 24% and 12%, respectively. This in comparison to other taxa (plants 17%, insects 24%, insects 12%, mammals 7%), fish 3% and birds 2%). This could mean that reptiles and amphibians are at the higher risk of extinction than species with higher mobility. Certain activities during construction are expected to destroy habitats of reptiles and amphibians including destruction of their shelter as well as feeding, breeding, and nursing habitats.

Table 7: prediction of impacts and their effects on VECs.

Activity	**Description**	**Receiving environment or VECs**
Site selection and clearing	Suitability of a specific site within the project area takes into consideration the existing man-made and natural structures, cost, soil and vegetation type. Also considered are other factors that may increase cost of construction or cause negative environmental impacts. This activity is necessary to prepare the site for construction. It involves removal and disposal of bushes, grass, loose boulders, and topsoil. Topsoil removal is necessary because topsoil has a higher concentration of roots, decaying materials and animal burrows that cause instability to concrete structures.	***Air and climate:*** dust maybe localised and temporary reduction in air quality may be a result of dust and particulate generation. ***Land:*** removal of topsoil could affect local geology and landform but could be restored during landscaping. Solid waste resulting from site preparation include tree stumps and rubble. ***Ecology and biodiversity:*** herbaceous destroyed such as grass, bush or shrubs during these activities negatively influence biodiversity. The main concern are less mobile diversity of reptile, amphibians, and small mammals. Birds may be affected but less because they are more mobile. Before construction it is important to estimate the population of reptile, amphibians and small mammals and monitor them during all phases of the project. ***Human environment:*** employees may suffer from dust and exhaust emissions, and it is important that personal protective gear is provided for safety reasons.

Cutting of trees	Depending on the suitability of the site, this activity may not always be necessary, but it is important to consider it a different activity mainly because removal of trees is costly both financially and environmentally. Trees are difficult to remove and increase the cost of construction; improper removal of their roots could cause cracks on concrete structures. Even more important trees contribute to biodiversity, provide several valuable ecosystem services and the natural beauty.	***Air and climate:*** trees regulate atmospheric composition as sinks of carbon dioxide and sources of oxygen and when cut this function cease to exist. This activity may not be necessary as the number of trees in the project site are limited and will be needed for shading. ***Land:*** soil and wind erosion, deforestation and land degradation may result as trees are removed. ***Human environment:*** reduced ecosystem services provided by trees.
Construction of access roads, excavation backfill and compaction for utilities	This activity will lead to temporary air borne transport of particulate (increased dust). Furthermore, heavy equipment such bulldozers and other construction equipment will produce exhaust emissions from diesel engines leading to temporary increase in Sulphur dioxide, Nitrogen oxides, Carbon dioxides, and Carbon monoxide concentrations. Emissions may also occur in the event of emergency. Increased concentration of these gases depends on the content of fuel used and emissions from engines could be reduced by using unleaded fuel for machineries. The proponent should instruct contractor to use unleaded fuel. These gases contribute to air pollution and human health	**Air and climate:** dust will be temporary but a definite environmental impact. This could be reduced by watering the ground or road surfaces. ***Land:*** impacts on landforms resulting from earthworks and excavation are low because they could be mitigated when backfilling or levelling. Also, solid waste such as plastics, bottles, building rubbles and others. ***Water:*** freshwater needed for construction will be extracted from underground water sources in the Ugab river. Water is a scarce commodity and precautionary measures will be implemented to ensure wise us of this resource. Where possible and necessary use of saline water will be encouraged (e.g. for cleaning, watering roads, etc). **Ecology and biodiversity:** when in excess concentration, harmful emissions of Sulphur dioxide, nitrogen oxides, Carbon dioxides, and Carbon monoxide is known to

		negatively affect flora diversity by damaging foliage and inhibit growth. **Artefacts, archaeological high value components:** Destruction or affecting paleontological and archaeological artefacts
Waste generation	Construction waste consist of unwanted materials produced directly or indirectly including insulation, nails, electrical wiring, shingle, and roofing. Such waste may contain lead, asbestos, or other hazardous waste. Many constructions waste consist of bricks, concrete and wood.	**Land:** littering. **Water:** leaching.
Testing, installation, and commissioning	It will be necessary to run tests before commission to ensure functioning of facilities. This will reduce accidents and increase safety. The final activities are clean up and make the facilities ready for use by consumers in this case tourists.	**Air and climate:** dust and exhaust will be definite but for a short period. **Human environment:** noise will also be minimal and short-lived.
Airstrip operation and management of facilities.		**Land:** littering is probable if not properly mitigated. Under normal conditions, solid waste is not expected to im pact the environment if properly disposed. The application of prevention measures, in addition to proper handling of hazardous wastes will be mandated to each employee or contractor working at the project site. **Water:** increased water demand will be one of the main concerns as underground water in the proposed project area is a scarce commodity. This expected water demand will put pressure on underground water sources especially during times of low rainfall.

		Another critical concern is the vulnerability of underground water to pollution through leaching from waste as the water table is shallow. However, it is important to note that the local type of aquifer is alluvial. Underground water is stored in alluvial aquifers in the intergranular pore spaces of sand deposits in the Ugab Riverbed. Alluvial aquifers have limited storage capacity but recharge fast during the rainy season. **Ecology and biodiversity:** terrestrial ecology and biodiversity maybe affected by accidental (non-routine) events such as fire, spills, and leaks. **Avifauna**: aircraft avifauna kills. **Aviation safety:** Aircraft accidents.
Borehole operation and maintenance	Operation of the freshwater intake may negatively affect several VECs.	Appropriate pipe design (for water intake) should eliminate/reduce associated impacts.
Waste generation	Solid waste and liquid waste have the potential of contaminating the surrounding soil and water resources on site. Solid waste may ruin the aesthetics of the area and portray an environmentally unfriendly area therefore negatively impacting on the neighbourhood ambiance. Liquid waste may be associated with the generation of foul odours and may even pose a health hazard. Pests, such as flies and rodents, may also be attracted to the area	***Land:*** littering and aesthetics pollution. ***Water:*** contamination of surface and underground water resources.

	via the odour and collection of waste, to scavenge on the solid or liquid waste if it is not disposed of in the correct manner. Solid and liquid waste will be generated from campsites and ablution facilities on-site. The most common waste being produced will be domestic waste and garden refuse from the site. Wastewater will be generated from the kitchen, showers, and staff ablution facilities.	
Energy consumption	Energy scarcity in Namibia means unavailability of power supply in isolated areas such as the project site. This could also be to the advantage because conventional power supply using powerlines have negative environmental impacts on VECs.	**Air and climate:** there is no electricity at the project site thus operation may opt to use of generators. This option in the long run will increase emissions of Sulphur dioxide, nitrogen oxides, Carbon dioxides, and Carbon monoxide. **Ecology and biodiversity:** when in excess concentration gaseous emissions could negatively affect flora diversity by damaging foliage and inhibit vegetation growth. Therefore, the option to use solar as already used at the Brandberg White Lady Lodge will be an environmentally friendly option.
Purchase of supplies, deliveries, and transportation	The project site is remotely located and therefore supplies will need to be transported from nearby town of Uis, Omaruru, Henties Bay or even Swakopmund. Tourists will also need to be transported to the campsite either in their rented or own vehicle or vehicle of tourism operators.	**Ecology and biodiversity:** during transportation of supplies, accidents (non-routine) could occur and cause animal deaths, especially of concern are reptile, Amphibia, small mammals, and birds. Though this will not be common, with increased traffic this has the potential to increase.

		Human environment: local sourcing of supplies, deliveries and transportation could increase economic activities associated for locals.
Tourism and hospitality	Currently, local are not efficiently benefiting from tourism. The impacts of climate change and variability pose a major threat to agriculture and farmers are finding difficult to survive these difficult climatic conditions. Tourism has the potential to contribute to socio-economic development in the Tsiseb Communal Conservancy; however, it is not without environmental impacts.	**Air:** dust and gaseous emission by or from vehicles carrying or used by tourists. **Land:** littering. **Ecology and biodiversity:** effects of dust and gaseous emissions on biodiversity*.* **Human and environment:** effects of noise, dust and gaseous emissions public health*.*

Table 8: sensitivity of environmental resources.

IMPACTS	CLIMATE, LAND AND WATER RESOURCES					BIODIVERSITY RESOURCES										HUMAN ENVIRONMENT				
SENSITVITY RATING 1 Negligible 2 Low 3 Medium 4 High 5 Very high	i. Air quality	ii. Soil	iii. Grazing land	iv. Water quality	v. Land scenery	vi. Aves	vii. Amphibians	viii. Anthropoda	ix. Fish	x. Small mammals	xi. Large mammals	xii. Reptiles	xiii. Grasses	xiv. Shrubs and bushes	xv. Trees	xvi. Palaeo-rchaeological rock paintings	xvii. Heritage sites	xviii. Tourism sector	xix. Food production	xx. Human welfare
1. Dust																				
2. Dust from aircraft landing and takeoff																				
3. Noise from construction																				
4. Noise from aircraft																				

5. Release of GHGs from fuel combustion																				
6. Exclusion from grazing land																				
7. Water contamination																				
8. Waste pollution																				
9. Removal of grasses																				
10. Bird striking																				
11. Habitat modification																				
12. Loss of endangered or protected species																				
13. Accident road kills by vehicles																				
14. Destruction of rock paintings																				
15. Disturbance of holy sites																				
16. Limited access to holy sites																				
17. Traffic and safety																				

Table 9: magnitude.

IMPACTS	CLIMATE, LAND AND WATER RESOURCES					BIODIVERSITY RESOURCES										HUMAN ENVIRONMENT				
0 No observable impact 1 Low impact 2 Tolerable impact 3 Medium high impact 4 High impact 5 Very high impact	i. Air quality	ii. Soil	iii. Grazing land	iv. Water quality	v. Land scenery	vi. Aves	vii. Amphibians	viii. Anthropoda	ix. Fish	x. Small mammals	xi. Large mammals	xii. Reptiles	xiii. Grasses	xiv. Shrubs and bushed	xv. Trees	xvi. Palaeo-rchaeological rock paintings	xvii. Heritage sites	xviii. Tourism sector	xix. Food production	xx. Human welfare
1. Dust																				
2. Dust from aircraft landing and takeoff																				
3. Noise from construction																				
4. Noise from aircraft																				
5. Release of GHGs from fuel combustion																				
6. Exclusion from grazing land																				

7. Water contamination																				
8. Waste pollution																				
9. Removal of grasses																				
10. Bird striking																				
11. Habitat modification																				
12. Loss of endangered or protected species																				
13. Accident road kills by vehicles																				
14. Destruction of rock paintings																				
15. Disturbance of holy sites																				
16. Limited access to holy sites																				
17. Traffic and safety																				

Table 9: Duration.

IMPACTS	CLIMATE, LAND AND WATER RESOURCES					BIODIVERSITY RESOURCES										HUMAN ENVIRONMENT				
T Temporary P Permanent	i. Air quality	ii. Soil	iii. Grazing land	iv. Water quality	v. Land scenery	vi. Aves	vii. Amphibians	viii. Anthropoda	ix. Fish	x. Small mammals	xi. Large mammals	xii. Reptiles	xiii. Grasses	xiv. Shrubs and bushed	xv. Trees	xvi. Palaeo-rchaeological rock paintings	xvii. Heritage sites	xviii. Tourism sector	xix. Food production	xx. Human welfare
1. Dust																				
2. Dust from aircraft landing and takeoff																				
3. Noise from construction																				
4. Noise from aircraft																				
5. Release of GHGs from fuel combustion																				
6. Exclusion from grazing land																				
7. Water contamination																				
8. Waste pollution																				
9. Removal of grasses																				

10. Bird striking																				
11. Habitat modification																				
12. Loss of endangered or protected species																				
13. Accident road kills by vehicles																				
14. Destruction of rock paintings																				
15. Disturbance of holy sites																				
16. Limited access to holy sites																				
17. Traffic and safety																				

Table 9: Geographical coverage.

IMPACTS	CLIMATE, LAND AND WATER RESOURCES					BIODIVERSITY RESOURCES										HUMAN ENVIRONMENT				
L Localized impacts or limited to location O Impact of importance to municipality R Regional impacts N National impact I International	i. Air quality	ii. Soil	iii. Grazing land	iv. Water quality	v. Land scenery	vi. Aves	vii. Amphibians	viii. Anthropoda	ix. Fish	x. Small mammals	xi. Large mammals	xii. Reptiles	xiii. Grasses	xiv. Shrubs and bushed	xv. Trees	xvi. Palaeo-rchaeological rock paintings	xvii. Heritage sites	xviii. Tourism sector	xix. Food production	xx. Human welfare
1. Dust from construction																				
2. Dust from aircraft landing and takeoff																				
3. Noise from construction																				
4. Noise from aircraft																				
5. Release of GHGs from fuel combustion																				
6. Exclusion from grazing land																				
7. Water contamination																				
8. Waste pollution																				

9. Removal of grasses																				
10. Bird striking																				
11. Habitat modification																				
12. Loss of endangered or protected species																				
13. Accident road kills by vehicles																				
14. Destruction of rock paintings																				
15. Disturbance of holy sites																				
16. Limited access to holy sites																				
17. Traffic and safety																				

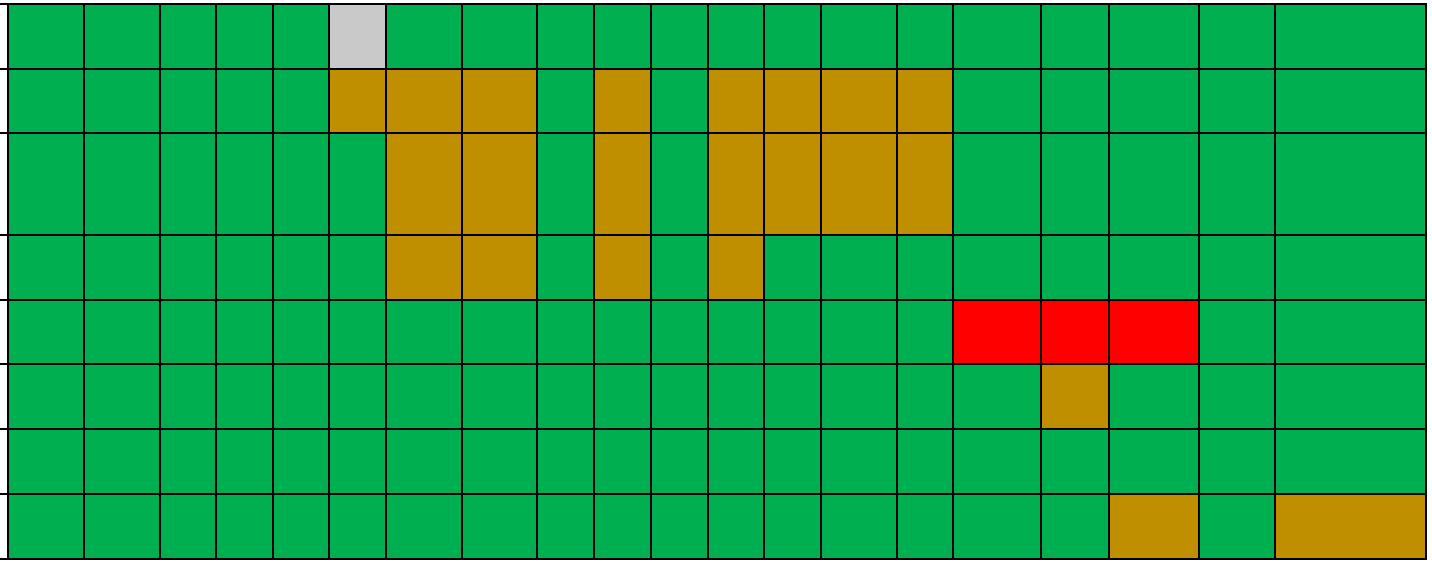
Table 9: Probability.

IMPACTS	CLIMATE, LAND AND WATER RESOURCES					BIODIVERSITY RESOURCES										HUMAN ENVIRONMENT				
LP Low probability (possibility of impact occuring is low, below 25%). P Probable (there is a distinct possibility that it will occur, approximately 50%) HP Highly probable (the impact is most likely to occur, 75%). D Definite (the impact will occur 100%)	i. Air quality	ii. Soil	iii. Grazing land	iv. Water quality	v. Land scenery	vi. Aves	vii. Amphibians	viii. Anthropoda	ix. Fish	x. Small mammals	xi. Large mammals	xii. Reptiles	xiii. Grasses	xiv. Shrubs and bushed	xv. Trees	xvi. Palaeo-rchaeological rock paintings	xvii. Heritage sites	xviii. Tourism sector	xix. Food production	xx. Human welfare
1. Dust from construction																				
2. Dust from aircraft landing and takeoff																				
3. Noise from construction																				
4. Noise from aircraft																				
5. Release of GHGs from fuel combustion																				
6. Exclusion from grazing land																				
7. Water contamination																				

8. Waste pollution																				
9. Removal of grasses																				
10. Bird striking																				
11. Habitat modification																				
12. Loss of endangered or protected species																				
13. Accident road kills by vehicles																				
14. Destruction of rock paintings																				
15. Disturbance of holy sites																				
16. Limited access to holy sites																				
17. Traffic and safety																				

Table 9: Significance.

IMPACTS	CLIMATE, LAND AND WATER RESOURCES					BIODIVERSITY RESOURCES										HUMAN ENVIRONMENT				
Major 5/5 Moderate 4/5 Minor 2/5 None 1/1	i. Air quality	ii. Soil	iii. Grazing land	iv. Water quality	v. Land scenery	vi. Aves	vii. Amphibians	viii. Anthropoda	ix. Fish	x. Small mammals	xi. Large mammals	xii. Reptiles	xiii. Grasses	xiv. Shrubs and bushed	xv. Trees	xvi. Palaeo-rchaeological rock paintings	xvii. Heritage sites	xviii. Tourism sector	xix. Food production	xx. Human welfare
1. Dust																				
2. Dust from aircraft landing and takeoff																				
3. Noise from construction																				
4. Noise from aircraft																				
5. Release of GHGs from fuel combustion																				
6. Exclusion from grazing land																				
7. Water contamination																				
8. Waste pollution																				
9. Removal of grasses																				

10. Bird striking	
11. Habitat modification	
12. Loss of endangered or protected species	
13. Accident road kills by vehicles	
14. Destruction of rock paintings	
15. Disturbance of holy sites	
16. Limited access to holy sites	
17. Traffic and safety	

7. DISCUSSIONS AND RECOMMENDATIONS

Extreme harsh climatic conditions in the area pose a critical threat to water, soils, land, and biodiversity. Local people depend directly on these critical resources for survival and without these their livelihood is impossible. The past difficult climatic conditions including below average rainfall had forced people to adapt other ways of living. Consequently, there is an observed change, locally, from a livelihood strategy dependent on farming and natural resources harvesting to a livelihood strategy which depend on other sectors such as tourism and mining. It is possible that this paradigm shift in livelihood strategies could have impacts (both negative and positive) on the environment. While the need to diversify and venture into other economic activities exist as farming is no longer working, it is important at the same time to document and monitor environmental impacts of these new activities.

The proposed plan to develop the airstrip will enable the Lodge Operator to generate revenues for the Tsiseb Communal Conservancy. However, this proposed development should be done in line with principles of sustainable development, international best practices and indeed relevant Namibian environmental laws and policies.

Therefore, based on the above, the ECC should be granted on the conditions that:

- The proponent develops an environmental monitoring plan as part of the EMP, which should be prepared and submitted prior to commencement of construction activities;
- A dedicated baseline monitoring survey (focusing on grasses, reptiles, insects and amphibians) should be conducted before construction to establish baseline conditions;
- A follow up monitoring survey (focusing more on grasses, reptiles, insects and amphibians) should be conducted during construction to monitor activities and mitigate negative impacts, and
- Monitoring of noise, waste, biodiversity and livelihood of local residents should be conducted during the operation phase.

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APPENDIX A – FLORA DIVERSITY

Table 1.1: Trees.

Species Name	Namibian conservation and legal status	Brief notes on species	Reference
Vachelia erioloba	Widespread, not a concern.	Also well known as *Acacia erioloba* or camel tree is common in southern Africa tree. In the project area, these plant are common along the River bank. Very common in the project area.	Mendelsohn, Jarvis, Roberts, & Robertson (2003).
Acacia montis-usti	Namibian endemic, near threatened.	Locally known as Brandberg acacia as it occur only in the Brandberg mountain and inselbergs area. Preferred habitats in the rocky hills and rocky outcrops. In the general project area a health population has been reported.	Mendelsohn, Jarvis, Roberts, & Robertson (2003).
Faidherbia albida	Widespread, not a concern.	See also *Acacia albeida*. Locally known as Anaboom or wither-thorn. Mostly found in river systems and sometimes gravel plains. Common in nort-western and central-western.	Mendelsohn, Jarvis, Roberts, & Robertson (2003).
Dombeya rotundufolia	Namibian, endemic and least concern.	Semi-deciduous shrub or multi-stemmed tree. Occurs in hill slopes, outcrops and plains.	Mendelsohn, Jarvis, Roberts, & Robertson (2003).
Rhus marlothii	Namibian, endemic. Conservation concern not recorded.	Shrub often grow under other trees. Distribution in the north west and north-east,	Mendelsohn, Jarvis, Roberts, & Robertson (2003).

		mainly in hill slopes, rivers and plains. Roots are of medicinal value.	
Ozoroa crassinervia	Namibian, endemic	Attractive, drought-tolerant deciduous tree which is near-endemic.	Mendelsohn, Jarvis, Roberts, & Robertson (2003).
Olea europaea subspecies africana	Namibian, endemic	Shrub or tree with termite resistant wood. Found in plain and rivers. Scattered all over Namibia.	Mendelsohn, Jarvis, Roberts, & Robertson (2003).
Tamarix usneoides	Widespread, not evaluated.	Generally found in many river systems in the Namib and north-west. Very common in the Deserts, water efficient and form dense thickets. It is common in the Namib central Desert. It is named after a suburb (Tamarikia) in Swakomund. Very poor combustion properties and could be used to prevent further spread of fire.	Mendelsohn, Jarvis, Roberts, & Robertson (2003).
Salvadora persica		Dominant in the sandy plains and in many river systems in the north-west but has been recorded in the Swakop river as well. Local name (in Damara) is 'Xoris' and associated with the name the Khorixas. In the project area this plant dominates with a plant cover of approximately 30% in the sandy terrain or riverbed and 25% in the rocky terrain.	Mendelsohn, Jarvis, Roberts, & Robertson (2003).
Moringa ovalifolia	Widespread, potentially threatened.	Locally known as Moringa or Srokiesboom. Generally widespread in western Namibia. Grow mainly in the hills slopes and outcrops.	Mendelsohn, Jarvis, Roberts, & Robertson (2003).

Cyphostemma currorrii	Namibian, endemic. Potentially threatened.	Deciduous tree with large succulent trunk. Found in hillslopes and outcrops.	Mendelsohn, Jarvis, Roberts, & Robertson (2003).

Table 1.2: bushes and shrubs.

Species Name	**Namibian conservation and legal status**	**Remarks**	**Reference**
Acanthosicyos horridus	Namibian, endemic. Least concern.	Commonly known as! Nara. Scattered localities within the Namib Desert. Occur on dunes and in dry river beds.	Mendelsohn, Jarvis, Roberts, & Robertson (2003).
Petalidium englerianum	Namibian. Near-endemic	Savanna, bushveld. Perennial.	www.biodiversity.org.na
Petalidium luteo-album	Namibian, endemic	Savanna, bushveld. Perennial.	www.biodiversity.org.na
Barleria damarensis	Namibian, endemic. Not evaluated.	Tree or large woody shrub.	www.biodiversity.org.na
Montinia caryophyllacea	Widespread.	Also known as wild clove bush. Widespread over north-western and central Namibia mainly occupying hill slopes, outcrops and rivers.	Mendelsohn, Jarvis, Roberts, & Robertson (2003).
Sesomothamnus spp.	Endemic.	Semi-deciduous shrub. Widespread over north-western and central Namibia. Occurring in hill slopes, plains and rivers.	Mendelsohn, Jarvis, Roberts, & Robertson (2003).
Salvadora persica	Widespread.	Dominant in the sandy plains and in many river systems in the north-west but has been recorded in the Swakop River. Local name (in Damara) is ‘Xoris’ and associated	Mendelsohn, Jarvis, Roberts, & Robertson (2003).

		with a local town name Khorixas. Used to strengthen gums and prevent tooth decay.	
Euphobia avasmontana	Namibian, near endemic	Cactus-like succulent plant. Fairly widespread throughout Namibia. Hillslopes and outcrops.	Mendelsohn, Jarvis, Roberts, & Robertson (2003).
Euphobia damarana	Namibian, endemic. Listed in the CITES appendix II.	Widespread in the central to north-western Namib Desert. Hill slopes and plains.	Mendelsohn, Jarvis, Roberts, & Robertson (2003).
Euphobia guerichiana	Southern Africa, endemic. Listed in the CITES appendix II.	Deciduous shrub or tree. North-west and central Namibia. Occur in the hillslopes.	Mendelsohn, Jarvis, Roberts, & Robertson (2003).
Euphobia monteiroi subspecies brandbergensis	Namibian, endemic. Listed in the CITES appendix II.	Savannah bushveld.	www.biodiversity.org.na
Euphobia monteiroi sub. monteiroi	Southern Africa, listed in the CITES appendix II.	Savannah bushveld, succulent and perennial plant. Found mainly on sandy soils in the wild	www.biodiversity.org.na
Euphobia namibiensis	Namibian, near endemic, listed in the CITES appendix II.	Small woody shrub. Found in sparse cover desert, calcrete, gentle slope in full sun, and in sand	www.biodiversity.org.na
Euphobia peplus	Wide spread	Wide spread in Europe, northern Africa, and western Asia, an erect, annual plant growing in vegetable gardens, heap of earth, wasteland, and loading areas	Mendelsohn, Jarvis, Roberts, & Robertson (2003).
Euphobia phylloclade	Namibian, near endemic, listed in the CITES appendix II.	Terrestrial desert plant and perennial woody shrub, in the central-Namibia	www.biodiversity.org.na
Euphobia stapelioides	Namibian, near endemic. Listed in the CITES appendix II.	Terrestrial, succulent and perennial small woody shrub.	www.biodiversity.org.na

Ricinus communis	Namibian, near endemic. Listed in the CITES appendix II.	Soft woody shrub or small tree. Perennial plant. Widespread in Northern Namibia	Mendelsohn, Jarvis, Roberts, & Robertson T. (2003).

Table 1.3: Grasses species that occur or are reasonably expected to occur locally.

Species Name	**Namibian conservation and legal status**	**Notes**	**Reference**
Sporobolus virginicus.	Endemic	Mat-forming perennial, grow well on dunes, beaches and tidal streams, as well as on sand.	van Wyk and van Oudtshroon (2012)
Enneapogon scaber	Endemic	A short, densely tufted perennial grass with hairy leaves and culms. Grows on rock outcrops, usually between rocks.	van Wyk and van Oudtshroon (2012)
Cymbopogon pospischilii	Endemic	Grows in open patches and I heavier soils in bushveld regions. The leaves are narrow and often blue-green colour.is distributed in southern Africa.	van Wyk and van Oudtshroon (2012)
Fingerhuthia Africana	Endemic	A perennial tufted grass with unbranched culms. Spikelet are prominently flattened with two curved awns on the side. It grows well in gravelly soil, and found in warm sunny places.	van Wyk and van Oudtshroon (2012)
Enneapogon desvauxii	Endemic	A short, densely tufted annual or short-lived perennial grass with a ring of hairs around the nodes. Leaves are usually short and rolled and culms are knee-like bent. Usually grows in shallow water in overgrazed veld.	van Wyk and van Oudtshroon (2012)

Aristida congesta subsp, congesta	Endemic	A short-lived perennial tufted grass with long white hairs present where the leaf blade and leaf sheath join. Associated with disturbed soil, but mostly in loam soil.	van Wyk and van Oudtshroon (2012)
Polypogon monspeliensis	Endemic	A sparse tufted annual grass, sometimes with creeping culms. Inflorescence is attractive, dense and silver-green panicle. Spikelets are exceptionally small and abundant with two long, thin awns. Grows in disturbed soil and saline soil.	van Wyk and van Oudtshroon (2012)
Centropodia glauca	Endemic	A perennial tufted grass with shrub-like growth form. The culms are brittle and break easily and spikelet have papery glume. Grows mainly in deep sandy and gravelly soil.	van Wyk and van Oudtshroon (2012)
Setaria verticillata	Endemic	A soft, annual, tufted grass with loose culms. The inflorescence has numerous barbs on the bristles that stick to clothes and the leaf blade is open, soft and covered with velvety hairs. It grows under trees in damp fertile soil.	van Wyk and van Oudtshroon (2012)
Stipagrostis namaquensis	Endemic	A hard, shrub-like tufted grass with stolons and rhizomes. It has hard needle-like leaves and forms cluster of leaves at the nodes. The spikelets are yellowish. Usually grows in dry riverbeds and along roadsides.	van Wyk and van Oudtshroon (2012)
Enneapogon cenchroids	Endemic	A perennial tufted grass with dense shrub-like growth form and have narrow and rolled leaves.	van Wyk and van Oudtshroon (2012)
Tricholaena monachne	Endemic	A sparsley tufted perennial grass, usually with slanted culms. Culms are mostly branched, with knee-like bent nodes. Spikelets are hairless and usually have purple-blue tint and have long thin stalks. Usually grows in disturbed	van Wyk and van Oudtshroon (2012)

		soil and mainly occurs in bushveld and in grassland regions.	
Melinis repens	Endemic	A short lived, perennial tufted grass with attractive hairy inflorescences and velvety hairy nodes. Spikelets fade from red to white as they mature. It grows mainly in disturbed soil.	van Wyk and van Oudtshroon (2012)
Eragrostis cilianensis	Endemic	A sparse, annual, tufted grass with slanting culms and usually knee-like bent nodes. The culms are branched from the lower nodes and spikelets are grey-green. It grows in disturbed soils and occurs in gardens and cultivated lands.	van Wyk and van Oudtshroon (2012)
Eragrostis lehmanniana	Endemic	A tufted grass with the culms often branched and strongly knee-like bent nodes. The lower leaves are peppery and straw-coloured. It grows in disturbed soil and in undisturbed sandveld is arid region. occurs in bushveld and karoo regions.	van Wyk and van Oudtshroon (2012)
Sporobolus festivus	Endemic	An attractive, delicate and reasonably dense tufted grass. Inflorescence is multi-branched fine open panicle and reddish in colour. Basal leaf sheaths breaks up into fibres. Grows in poorly drained and rocky places. Occurs in bushveld, grassland and karoo regions.	van Wyk and van Oudtshroon (2012)
Stipagrostis hirtigluma	Endemic	A dense, perennial or annual tufted grass with rolled and stiff leaves, mostly at the base. Culms are mostly branched. Have long, feathered awns spikelets with shades of purple. Grows in dry, warm parts and on rocky outcrops. Occurs in bushveld, karoo and desert regions.	van Wyk and van Oudtshroon (2012)

Stipagrostis uniplumis	Endemic	A tufted perennial ass with numerous hard culms. The plant often has a shrub-like growth form and leaves are usualyly rolled and tough. It has long white hairs at the upper parts of the leaf sheath.it grows in sandy and gravelly soil and occurs in arid regions.	van Wyk and van Oudtshroon (2012)
Eragrostis nindensis	Endemic	It grows in shallow and gravelly soil and in other places particularly in sandy soil. Is a short, dense tuffed perennial grass with leaves concentrated at the base Their culms are sturdy and erect. It occurs in southern Africa and northwards.	van Wyk and van Oudtshroon (2012)
Schmidtia kalihariensis	Endemic	An annual tufted grass hat can form dense stands. The entire plant is finely hairy and it has sour smell, is sticky and can irritate the skin during the extended contact. It grows mainly in sand soil and occurs in arid and desert regions.	van Wyk and van Oudtshroon (2012)
Schmidtia pappophoroides	Endemic	A perennial tufted grass with a shrub-like growth form. It often have stolons or root formation on the lower nodes. The leaves are blue-green to grey-green and are often densely hairy. Grows in sandy to loam and gravel soil and occurs in dry grassland and bushveld regions.	van Wyk and van Oudtshroon (2012)
Stipagrostis obtusa	Endemic	A short, dense tufted grass usually with erect culms. Nodes are dark-coloured and leaves are short, rolled and curled mostly concentrated at the base. It grows in sandy soil and occurs in arid regions.	van Wyk and van Oudtshroon (2012)
Stipagrostis ciliata	Endemic	An erect perennial tufted grass with a ring of long white hairs around the nodes. Leaves are mostly concentrated	van Wyk and van Oudtshroon (2012)

		around the base and culms are typically yellow. It usually grows in coarse sandy soil on gravel plains and river beds. Occurs in arid regions.	
Eragrostis echinochloidea	Endemic	A sparse tufted grass, the nodes of which are often knee-like bent, spikelets are densely packed against each other. Nodes are purple in colour. Grows in lime soil and gravelly soil and found at the edge of the pans. Occurs in bushveld and karoo regions	van Wyk and van Oudtshroon (2012)
Eragrostis rotifer	Endemic	A tufted perennial grass with relatively erect culms. Inflorescence a big open panicle with lax branches and its spikelets are purple in colour. Grows in dry riverbeds on the edge of the pans and drainage canals. Occurs in bushveld and karoo regions	van Wyk and van Oudtshroon (2012)
Brachiaria deflexa	Endemic	An annual tufted grass often with branched culms. The entire plant is bright green when young. The base of the leaf blade is rounded and covered in velvety hairs and spikelets are arranged in pairs. Grows mostly in shade in disturbed places. Occurs throughout tropical and subtropical Africa	van Wyk and van Oudtshroon (2012)
Cladoraphis spinosa	Endemic	A hard, perennial tufted grass with a shrub-like growth form and man branches. The leaves are exceptionally short or are absent. Leaf sheaths usually separate from the culm. Grows in sand soil, occurs in karoo, desert and fynbos regions.	van Wyk and van Oudtshroon (2012)
Cynodon dactylon	Endemic	A short, mat-forming grass that spread by means of stolons and rhizomes. Spikelets are flats and without awns, leaves	van Wyk and van Oudtshroon (2012)

		point upward. Grow in disturbed soil. It widely distributed and occurs in all regions.	
Chloris virgata	Endemic	Inflorescence contracted and digitated, with hairy spikelets. The leaf blade is folded open, with a prominent midrib and rough margin and flattened leaf sheath. It grows in damp and disturbed soil. Is distributed over virtually all warm and moderate climatic regions of the world.	van Wyk and van Oudtshroon (2012)

APPENDIX B – FAUNA DIVERSITY

Table 1.4: list of reptiles that occur or reasonably expected to occur in proposed area.

Species Name	**Common name**	**Namibian conservation and legal status**	**Remarks**	**Reference**
Geckos				
Ptenopus carpi	Carpis' Barking Gecko	Endemic	Slender gecko with long legs and weakly fringed toes. Live in shallow burrows with a few side tunnels dug in very hard soil. Inhabit flat barren plains.	Branch (1998)
Ptenopus garrulus	Common Barking Gecko	Endemic	Small barking gecko with swollen nostrils and strongly fringed toes. Briefly become active after sunset as indicated by their call signals.	Branch (1998)

			Desert to semi-desert on various soil substrates.	
Ptenopus kochi	Common Barking Gecko	Endemic	Have large bulging eyes and swollen nostril. They have flattened fringed toes with elongated scales and body longer than the tail of reddish-brown colour. Desert in the burrows	Branch (1998)
Rhoptropus afer	Common Namib day gecko		Small species with relatively short stout toes. Occupy dry gravel plains with sheet rocks and exfoliating flakes. Restricted to the coastal of the Namib Desert from the Kuiseb river and extending up to the north-western.	Branch (1998)
Rhoptropus boultoni	Bourton's Namib Day Gecko		Larger and stocky with slender toes. They feed on vertical granite, basalt boulders and Baobab trees. Feed mainly on ants, spiders and beetles.	
Rhoptropus bradfieldi	Damara Namib day gecko	Endemic, not evaluated	Have 11 undivided scansors beneath the fourth toe and tail longer than the head and body. Hang on the shaded vertical surfaces of large, dark rocks on sunny day. Prefer semi-desert regions and found from the Kuiseb River to Tweyfelfontein in W. Damaraland.	Branch (1998)
Pachydactylus fasciatus	Damaraland banded gecko	Endemic,	A medium-sized, slender, flattened gecko with irregular rows of enlarged, rounded and keeled tubercles separated by scales on the back. Have thin tail longer than the body. Terrestrial that lives in small tunnels of sandy soils. Prefers arid mopane *Acacia* savannah	Branch (1998)
Pachydactylus gaiasensis	Brandberg gecko	Endemic,	A medium-sized, flattened gecko with large head. The tail is shorter than the body and segmented. Emerge at night underneath sandstone boulders. Arid sandy veld and vicinity of Brandberg in Namibia	Branch (1998)

Lizards				
Pepsina alberti	Albert's burrowing skunk	Endemic, not evaluated		
Pedioplanis husabensis	Husab sand lizard	Endemic, not evaluated	Small species with small tympanic shield, and eight opaque scales in each lower eyelid, bear dark dots and bars. Prefers expanses of flat rock on exposed bedrock in rocky desert.	Branch (1998)
Cordylus namaquensis	Namaqua spinytail lizard	Endemic, not evaluated	A small girdled lizard with flattened body and a triangular, flat head with rough shields. The nasals are slightly tabular and in contact separating rostral and frontonasal. Lives in semi-desert in rock cracks and crevices of mountains	Branch (1998)
Cordylus pustulatus	Campbell's spinytail lizard	Endemic, not evaluated	Smallish finely scaled lizard with flattened body and a triangular head with rough head shields. Tail has whorls of range of spine, lives in arid savannah.	Branch (1998)
Homopus sp.nov	Nama padloper	Endemic, vulnerable	Small tortoise that lack hinge and nuchal and paired gulars. Lives in rocky semi-desert in rock cracks and beneath boulders.	Branch (1998)
Meroles reticulatus	Reticulated desert lizard	Endemic, not evaluated	Small-sized desert with rounded snout and lack sharp edge on the upper lip. Live in arid savannah to desert on flat gravel and sandy plains	Branch (1998)
Cordylosaurus subtessellatus	Dwarf plated lizard	Endemic, not evaluated	Short head with large head shields and no prefrontal and each nostril is pierced between	Branch (1998)

			two nasals and first labial. Lower eyelids have transparent disc. Lives in succulent and small veld on small rocks	
Snakes				
Leptotyphlops labialis	Damara worm snake	Endemic, not evaluated	Large, fairly slender with scales around the tail. Have supraoculars fused with oculars. Arid savannah species.	Branch (1998)
Telescopus crf. semiannulatus polystictus	Damaraland tiger snake	Endemic, not evaluated	A thin-bodied snake with distinct head and large eyes with vertical pupils. Terrestrial savannah and sandveld.	Branch (1998)

Table 1.5: Mammal species that occur or reasonably expected to occur.

Species Name	**Common name**	**Namibian conservation and legal status**
Myotis seabrai	Angola hairy bat	Endemic, vulnerable
Galerella swalius	slender mongoose	-
Petromyscus shortridgei	rock mose	-
Laephotis namibensis,	Bat	Endemic, endangered
Aepceros melampus petersi	Black face impala	Endemic, vulnerable
Equus zebra hartmannae	Hartmann's mountain zebra	Endemic, endangered
Xerus princeps	Mountain ground squirrel	Endemic, secure
Petromus typicus	Dassie rat	Endemic, secure
Gerbillurus setzeri	Namib bushy-tailed gerbil	Endemic, threatened
Otocyon megalotis	Bat –eared fox	Endemic, secure

Tragelaphus strepsiceros	Kudu	Endemic, secure
Panther pardus	Leopard	Vulnerable
Acinonyx jubatus	Cheetah	Vulnerable
Loxodonta Africana	Elephant	Endangered
Struthio camelus	Ostrich	Endemic Secure
Oryx gazelle	Gemsbok	Endemic Secure
Antidorcas marsupialis	Springbok	Endemic Secure
Raphicerus campestris	Steenbok	Endemic Secure
Diceros bicornis	Black rhino	Endemic Critically endangered
Canis mesomelas	Black backed Jackal	Endemic Secure
Panthera leo melanochaita	Desert lion	Endemic, vulnerable
Madoqua kirkii	Damara dik-dik	Endemic, vulnerable

Table 1.6: avian species that occur or reasonably expected to occur.

Scientific name	**Common names**	**Namibian conservation and legal status**

Nelierax canonis	Pale chanting goshawk	Least concern
Falco tinnunculus	Common Kestrel	Least concern
Ardeotis kori	Kori bustard	Near threatened
Nestis ludwigii	Ludwigs bustard	Endangered
Eupodotis rueppelli	Ruppell's korhaan	Least concern
Rhinoptilus africanus	Double- banded courser	Least concern
Ammomanopsis gray	Grays lark	Least concern
Eremalauda starki	Starks lark	Least concern
Cercomela tractrac	Tractrac chat	Least concern
Francolinus hartlaubi	Hartlaub's spurfowl	Least concern
Agapornis roseicollis	Roxy faced lovebird	Least concern
Tockus monteiri	Monteiros hornbill	Least concern
Poicephalus rueppellii	Ruppell's parrot	Least concern
Turdoides gymnogenyo	Bare-cheeked babbler	Least concern
Phoeniculus damarensis	Violet wood hoopoe	Least concern
Namibornis herero	Herero chat	Least concern
Achaetops pycnopygius	Rockerrunner	Least concern

Moniticola brevipes	Short toed rock thrush	Least concern

Table 1.7: annual total number of mammals in the north-west of Namibia.

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Baboon	108	116	203	135	555	165	567	239	310	390	172	510	548	192	334	667	302	356	**5869**
Cheetah	5	1	7	7	14	2	4	7	6	3		5	3	11	5		6	1	**87**
Duiker	12	6	3	5	18	3	8	0	7	6	11	3	14	9	6	11	2	5	**129**
Eland	63	19	0	12	10	12	45	5	30	0	13	2	0	5	45	21	5	9	**296**
Elephant	40	24	45	17	107	5	36	44	72	31	73	39	34	74	64	41	94	31	**871**
Gemsbok	1616	2698	3483	2749	3506	2612	3898	2609	2652	2755	2238	3244	2413	1791	1247	1510	856	782	**42659**
Girafee	215	232	189	281	213	296	268	231	253	441	362	420	336	256	346	504	354	418	**5615**
Hyaena	2	0	0	1	7		4	3	1	10	2	1	9	1	5	4	8	3	**61**
Jackal	45	84	60	82	78	94	108	59	81	119	68	91	104	83	89	87	86	51	**1469**
Klipspringer	3	14	20	17	34	15	24	5	19	21	10	45	27	21	9	20	14	11	**329**
Kudu	189	297	241	316	413	324	576	207	337	327	190	329	269	221	200	296	88	53	**4873**
Ostrich	577	659	815	871	903	741	902	666	1247	832	772	1027	911	752	630	706	610	545	**14166**
Springbok	11606	14560	16734	10509	14227	11746	12135	18729	12411	15601	12818	1711	7586	7531	5876	10744	6823	6456	**197803**
Steenbok	49	85	122	203	154	101	245	85	117	149	88	261	325	167	218	197	110	70	**2746**
Warthog	6	14	8	7	13	11	13	2	2	3	6	8	12	3	8	4	5	4	**129**
H. Zebra	1210	1274	1414	1376	1738	1838	1684	2136	3004	3248	3361	2583	2790	2648	1812	2084	1671	2105	**37976**
Total	**15746**	**20083**	**23344**	**16588**	**21990**	**17965**	**20517**	**25027**	**20549**	**23936**	**20184**	**10279**	**15381**	**13765**	**10894**	**16896**	**11034**	**10900**	**315078**