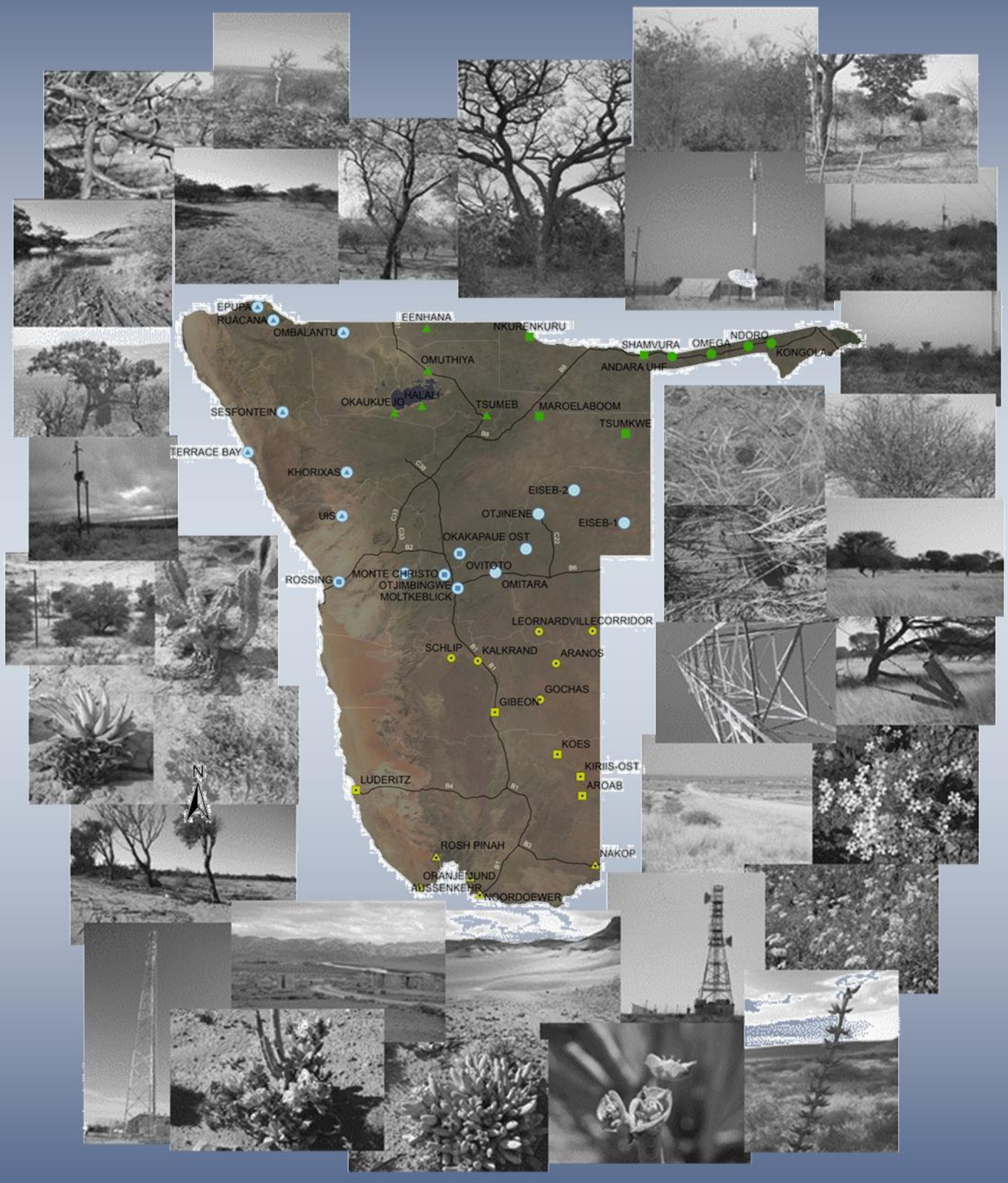
STRATEGIC ENVIRONMENTAL ASSESSMENT (SEA) FOR THE DIGITAL TERRESTRIAL TELEVISION MIGRATION PROCESS



VOLUME I of ii: SEA Report

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ABBREVIATIONS AND ACRONYMS

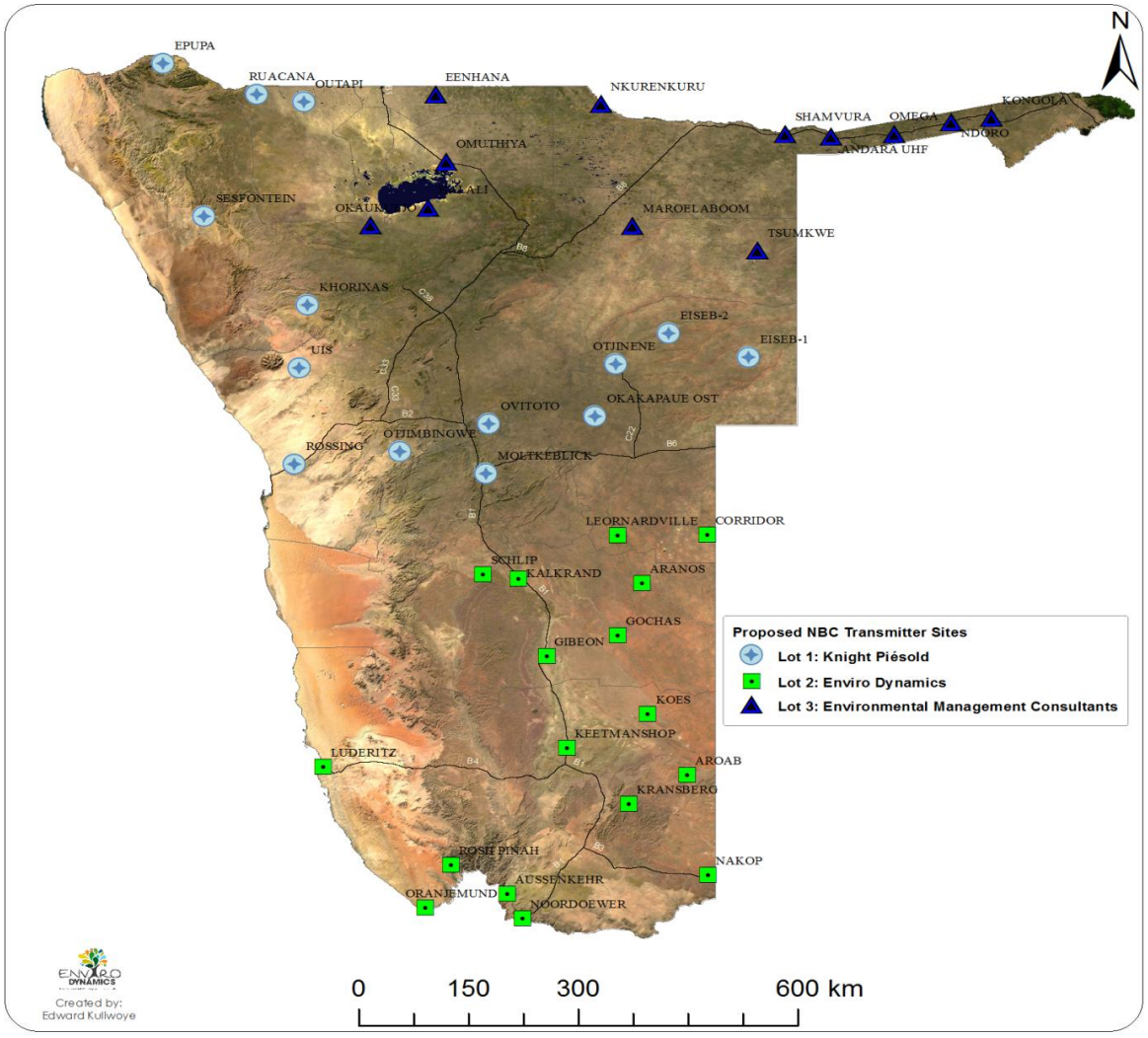
BID	Background Information Document
CBNRM	Community Based Natural Resource Management
CE	Common Era
CRAN	Communications Regulatory Authority of Namibia
DEA	Department of Environmental Affairs
DTT	Digital Terrestrial Television
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMF	Electro Magnetic Fields
EMP	Environmental Management Plan
ESA	Early Stone Age
GDP	Gross Domestic Product
GIS	Geographical Information System
I&APs	Interested and Affected Parties
IBA's	Imported Bird Areas
ICAO	International Civil Aviation Organization
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IFC	International Finance Corporation
ITU	International Telecommunications Union
LSA	Later Stone Age
MSA	Middle Stone Age
NBC	Namibian Broadcasting Corporation
NBC	Namibian Broadcasting Corporation
NGOs	Non-Governmental Organizations
RED	Regional Electricity Distributor
RF emissions	Radio Frequency emissions
RRC	Regional Radio Communication conference
SEA	Strategic Environmental Assessment

EXECUTIVE SUMMARY

INTRODUCTION

Subsequent to the 2006 Regional Radio Conference in Geneva, the Namibian Broadcasting Corporation (NBC) intends to migrate from analogue to digital television broadcasting by 17th June 2015. In order to achieve this, NBC *inter alia* aims to install 44 new antennae with associated infrastructure countrywide.

In line with the Environmental Management Act (Act 7 of 2007) a Strategic Environmental Assessment (SEA) process was followed to determine the scope and content of work to be undertaken at each site. Three environmental management consulting companies have been appointed to ensure that all biophysical and social implications of the project are identified and mitigated. The three consultancies are Enviro Dynamics, Knight Piésold and Enviro Management Consultants. Each of these consultancies was allotted a group of sites (see Figure below). Enviro Dynamics is responsible for the SEA and the integration of the work.



PROJECT DESCRIPTION

The existing NBC analogue network for TV and FM needs to be upgraded to accommodate digital transmitters. The advantages of this upgrade include:

- using smaller spectrum space whilst increasing the capacity to carry multiple television programmes. This will facilitate the sharing of infrastructure between broadcasters including telecommunications operators such as MTC, Telecom Namibia and Leo;
- better quality picture and service;
- lower operating cost for broadcasting; and
- aerial broadcasting to TV/FM antenna instead of a satellite dish or cable connection.

The sites proposed for the migration were selected and investigated in further detail by the consulting teams in terms of technical viability, and environmental suitability.

From a technical point of view, the sites had to:

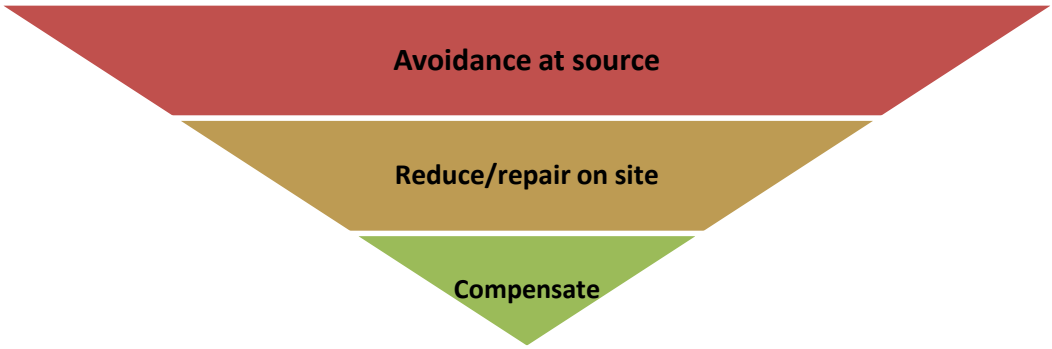
- provide the largest coverage area possible;
- be close to commercial power lines;
- be accessible by vehicle; and
- be suitable for constructing a foundation for the guyed mast.

Sites selected therefore had to fulfil these technical criteria. The environmental criteria are the basis of the SEA process and are described in more detail in the following sections. The technical and environmental teams worked concurrently and the process was iterative to achieve excellence. The process commenced in 2011 and is now concluded in 2013.

METHODOLOGY

Although the project entailed 44 sites with almost identical project activities, the environment of each is unique. Desktop studies were undertaken to determine the expected sensitivity for each site. These sensitivities were verified during reconnaissance visits and through consultation with key stakeholders (see below). The issues identified were categorized as generic (i.e. those issues that are similar for all sites) or site specific depending on their nature and extent. By considering the significance of these issues/sensitivities the suitability of each site for the construction of a mast was determined. Subsequently, a mitigation hierarchy was applied to

ensure that cumulative impacts could be identified and avoided.



The first step in the hierarchy was to consider how negative impacts can be avoided. This was done by considering:

- ✓ the need for the site in general, and
- ✓ any alternative sites that would provide similar or adequate cover but with a lower risk to the environment.

Examples of applying avoidance of unwanted impacts include combining or removing sites where they would not cover a wide enough area, and moving sites to reduce visual impact.

Where avoidance was not possible, and for less significant impacts, local measures were considered (e.g. moving the facilities on site) to lessen the impact.

As a last resort, mitigation measures (such as bird collision prevention mechanisms) were introduced.

PUBLIC CONSULTATION AND DISCLOSURE

Consultation with stakeholders was conducted at two levels, namely:

- **SEA Level -** included consultation at a national level with various ministries and NGOs by making use of:
    - notices in the press
    - circulating a Background Information Document (BID), and
    - two meetings

  Issues raised at this level were summarized and further considered during the SEA process.

- **Site specific EIA Level –** included consultation during site visits with local stakeholders such as land owners, municipalities, and town and regional

councils.

- Where the exact position of the mast had not yet been determined, consultation could however not be conducted due to the risk of creating unrealistic expectations.
- In addition it is not known when each site will be constructed, the program is likely to stretch over several years. Therefore I&APs are likely to change, which could result in consultation being repeated several times before construction actually takes place. The aim is therefore to repeat the consultation process with the site specific stakeholders before construction, **and this needs to be imposed as a condition in the clearance certificate.**

BIOPHYSICAL AND SOCIO-ECONOMIC OVERVIEW OF THE RECEIVING ENVIRONMENT

Features that were considered for this SEA include:

- climate
- landscape
- surface water
- vegetation
- reptiles
- birds
- coverage and population density
- land use activities
- conservation, parks and tourism
- archaeology, and
- radiation

BIOPHYSICAL AND SOCIAL SENSITIVITIES

These features were used to identify and rate sensitivities in terms of reptile, bird and vegetation diversity, visual resources, archaeology and radiation risk based on specialist input and secondary sources. An overall expected sensitivity rating of low, medium and high was assigned to each site.

These preliminary sensitivity ratings were verified (ground-truthed) during site visits undertaken by the consultants. The actual sensitivity of each was then described as low, medium or high, as follows.

	LOW	MEDIUM	HIGH
Description	The site is not sensitive at all. No additional specialist studies are required.	The site is moderately sensitive and although specialist inputs are not required, it requires specific management measures.	The site has sensitive elements that need to be further investigated by a specialist. Sites that have a "high" sensitivity rating should only be used as the preferred alternative once all other options have been eliminated.
Implication	Generic EMP is sufficient.	An additional appendix is required to the document that contains site specific mitigation measures.	Specialist investigations are required in an EIA separate from the SEA.

The ratings (i.e. low, medium and high) in the table below portray the final sensitivity ratings.

Sensitivity ratings of sites and how these will be managed.

SENSITIVITY RATING	LOW	MEDIUM		HIGH	
DESCRIPTION	**Proposed position has a low sensitivity rating**	**Proposed position is sufficient but potential impacts rate "medium"**	**Exact position not determined yet or the proposed position is located in a sensitive area**	**Proposed position is located in a highly sensitive area, but less sensitive alternative is available**	**Proposed position is located in a highly sensitive area and an alternative site could not be found during the SEA investigation**
Site names	Keetmanshoop Nakop Nkurenkuru	Andara Aranos Aussenkehr Corridor Elandsfontein Eiseb 1 Eiseb 2 Gibeon Gochas Khorixas Koës Kransberg Leonardville Maroelaboom Noordoewer Omuthiya	Aroab Eenhana Epupa Kalkrand Kongola Lüderitz Ndoro Omega Otjimbingwe Otjinene Ovitoto Tsumkwe	Halali Okaukuejo	Molteblick* Oranjemund Rössing

SENSITIVITY RATING	LOW	MEDIUM		HIGH	
DESCRIPTION	**Proposed position has a low sensitivity rating**	**Proposed position is sufficient but potential impacts rate "medium"**	**Exact position not determined yet or the proposed position is located in a sensitive area**	**Proposed position is located in a highly sensitive area, but less sensitive alternative is available**	**Proposed position is located in a highly sensitive area and an alternative site could not be found during the SEA investigation**
		Okapaue Ost Outapi Rosh Pinah Ruacana Schlip Sesfontein Shamvura Uis			
Management	Generic EMP only	Generic EMP with Site specific appendix	Sensitivity map indicating areas suitable for the construction of the site in proximity to the originally proposed position. Generic EMP with Site specific appendix.	Placing the mast at the less sensitive Elandsfontein will avoid the impact at both of the sensitive sites.	EIAs separate from the SEA is required to find an appropriate site. * The Molteblick site has since been moved to the Gross Herzog site. The EIA for this site is being done separate from the SEA.

CUMULATIVE IMPACT ASSESSMENT

The cumulative impacts have been identified and the expected significance rating is as follows:

CUMULATIVE IMPACT	EXPECTED SIGNIFICANCE ON NATIONAL LEVEL:	
	Before Mitigation	After mitigation
Impact of radiation on nearby settlements, schools and towns	Medium negative	Low negative
Erosion	Medium negative	Low negative
Impact on civil aviation	High negative	Low negative
National coverage	Medium positive	High positive
Impact on birds: Electrocutions, collision, destruction of habitats	High negative	Low negative
Loss of plant diversity and endemism	Medium negative	Low negative
Loss of reptile diversity	Medium negative	Low negative
Loss of cultural heritage	Medium negative	Low negative
Visual impact	High negative	Medium negative

CONCLUSIONS AND RECOMMENDATIONS

By applying the mitigation hierarchy described in this report, namely avoidance, reduction, reparation, followed by compensation as the last resort, the following outcomes were achieved.

Avoidance

The SEA process identified five sites with an overall potentially high sensitivity, namely, Okaukuejo, Halali, Moltkeblick, Rössing and Oranjemund. By applying the basic level of the mitigation hierarchy, the impact on Okaukuejo and Halali can be **avoided** by placing the mast at Elandsfontein - a site located outside the Etosha National park which has minimally been impacted on by farming activities.

As for the Moltkeblick, Rössing and Oranjemund sites, alternative locations were investigated but none were found to be suitable. The Moltkeblick site has since been moved to Gross Herzog. Separate environmental assessments have been recommended for these sites and they are not included in the SEA process.

Reduce and repair

For the remaining impacts, following due consideration of avoidance possibilities, management actions are required that would reduce and repair damage. Considering these, and the sensitivities at each site, the following assessment was made:

a) **Impact of radiation on nearby settlements, schools and towns:** The specialist concluded that none of the sites pose a high radiation risk. A precautionary distance (of 3 km) from populated areas has nonetheless been applied. At some sites (i.e. Corridor, Gochas and Leonardville) this was not possible due to physical or technical constraints (e.g. topography, distance to nearest road or power line). Additional mitigation measures have therefore been recommended in the site specific EMPs of these sites including:

- reducing the power output; and
- tilting the beams.

The following mitigation measures have been recommended for all sites in the generic EMP:

- Based on the safe distances identified in this project, servitudes should be registered around each of the sites.
- Safe distances (including servitudes) should be communicated to the applicable authorities. Authorities will be responsible for enforcing the safe distances in terms of settlement and development.
- It is strongly recommended that CRAN determine the cumulative impact of RF emissions of all broadcasting and telecommunication providers at a national level.

b) **Erosion:** During site selection steep slopes and areas prone to erosion have been avoided, particularly with regard to the placement of masts. No-go areas for the construction of roads have been indicated in site specific EMPs where applicable. Where avoidance was not possible, the following has been recommended in the site specific EMPs of certain sites:

- Structural mitigation measures such as gabions and berms.
- Avoidance of unnecessary damage to or removal of vegetation.

c) **Negative impact on civil aviation:** In consultation with the Directorate of Civil Aviation obstacle restriction zones around airports have been identified that have been avoided during site selection. However, NBC still has to apply to the ICAO (International Civil Aviation Organization) for Annex 14 approval for

the sites where avoidance was impossible, and depending on the ICAO requirements it may be necessary to:

- place a strobe light on top of the mast (day markings), and
- place a red light on top of the mast (night markings).

At sites where such markings are not required under Annex 14, NBC should apply to the ICAO to waive this requirement.

d) **Loss of bird diversity:** The masts and associated power lines are likely to impact negatively on birds if no mitigation is implemented. The risks include potential collision of birds with power lines or mast structures, electrocution on power line poles and the disturbance of birds due to habitat destruction. For this reason a bird specialist was appointed to identify potentially sensitive areas at a national level. Based on the specialist assessment, some sites with good habitat for sensitive birds were avoided (e.g. Moltkeblick, Okaukuejo, Halali). Where the impact could not be avoided mitigation measures, primarily design changes, were recommended. These are elaborated on in the generic and site specific EMPs.

e) **Loss of plant diversity and endemism:** The towers with associated infrastructure will not have a large footprint and the removal of large expanses of vegetation will therefore not be required. However, due to the construction of roads and power lines, habitat destruction could still be significant in highly sensitive areas such as Rosh Pinah (located in a biodiversity hotspot). The following is recommended:

- When doing the final positioning at these sites, a vegetation specialist should accompany the team to assess the sensitivity of the plants on the site and make recommendations for on-site avoidance or the relocation of sensitive plant species where avoidance is impossible.
- Further mitigation measures are contained in the generic and site specific EMPs.

f) **Loss of cultural heritage:** Namibia has a rich cultural heritage and for this reason an archaeological specialist identified the significance ratings of each of the tower positions based on their potential to damage highly sensitive archaeological sites. The following recommendations were made:

- When doing the final positioning at sites where archaeological sensitivity is potentially high, an archaeologist should accompany the team to determine whether any significant cultural or historical artifacts occur on the site. He will then verify the sensitivity and, if

necessary, make recommendations for on-site avoidance or will relocate sensitive archaeological artifacts where avoidance is impossible.

- Further mitigation measures are contained in the generic and site specific EMPs.

g) Visual Impact: The transmission towers are normally highly visible structures and the best possible mitigation is to hide them as far as possible. Visual impact depends on the number of sensitive receptors, the presence of nearby roads or tourist attractions and the height of the tower. During site selection, the potential visual impact of each site was considered and where possible lower ground was preferred or surrounding topography used to conceal auxiliary infrastructure. By implementing the following mitigation measures the potential visual effect can further be reduced:

- The co-sharing of broadcasting infrastructure is highly recommended. It is however also recommended that redundant infrastructure be immediately removed to avoid the accumulation of towers on any one site.
- NBC should apply to the Civil Aviation Authority to waive the need for the red and white markings at sites where this is not a requirement under Annex 14.

Concluding remarks

The overall cumulative impact of the project is expected to be *low*. Several of the potential impacts have been avoided by applying the criteria set by the specialists or making structural changes to the proposed infrastructure during the site selection phase. In addition to this, mitigation measures have been prescribed either in a generic EMP or site specific EMPs to further reduce the negative impacts of the project.

The Enviro Dynamics' team is confident that the proposed project poses no long term or irreversible threat to the affected environment. However, based on the findings contained in this report, environmental clearance should be conditional to the following:

- A local person, independent from the contractor (an **ECO** or Environmental Control Officer), **should be appointed** for the duration of the construction period. Provision has also been made for continuous monitoring by the consultants during the implementation phase of the project.
- The requirements set out in both the generic and site specific **EMPs should**

be adhered to. The implementation of this will be the responsibility of the ECO.

- The **public consultation process should be repeated** before commencing with construction. The following applies:
    - Applicable land owners, local authorities (e.g. municipality and town council) and regional councils should be contacted once an optimal site has been determined to gather their inputs and make minor adjustments to the location of the site.
    - A meeting needs to be scheduled with owners, neighbors and headmen etc. to ensure that they are aware of the development and to gather their inputs regarding the location of the site.
    - Consultation with land owners should continue throughout the course of the project to ensure transparency and that concerns are timeously addressed.
- Based on the **safe distances** identified in this project, servitudes should be registered around each of the sites. These should be communicated to the applicable authorities. Authorities will be responsible for enforcing the safe distances in terms of settlement and development.
- **Redundant infrastructure** should immediately be removed to avoid the accumulation of towers on any one site.

Below, the requirements that apply to specific sites are highlighted. These requirements should be included by the DEA in the conditions for environmental clearance.

POTENTIAL IMPACT	DESCRIPTION OF RESIDUAL IMPACTS AFTER AVOIDANCE WAS APPLIED	CONDITION FOR ENVIRONMENTAL CLEARANCE	SITES TO WHICH CONDITION APPLY
Impact of radiation on nearby settlements, schools and towns	Sites are located less than the applied precautionary distance (3km) from the nearest settlement albeit still within the safe distance (<40m) prescribed by ICNIRP.	Reduce the power output; Tilt the beams.	Andara, Aranos, Aussenkehr, Corridor, Eiseb 1 & 2, Gochas, Khorixas, Leonardville, Lüderitz, Okapaue Ost, Outapi, Ovitoto, Rosh Pinah, Ruacana, Schlip, Sesfontein, Shamvura and Tsumkwe.
Impact on civil aviation	Sites are located within the obstacle limitation zones of aerodromes (i.e. less than 8 km from the nearest aerodrome).	NBC should apply to the ICAO (International Civil Aviation Organization) for Annex 14 approval and depending on the ICAO requirements: • A strobe light should be placed on top of the mast (day markings), and • A red light should be placed on top of the mast (night markings). • The mast should have red and white markings.	Aranos, Gochas, Halali, Khorixas, Koës, Leonardville, Uis.
Impact on birds: Electrocutions, collision, destruction of habitats	Sites are located in areas likely to be sensitive for birds.	Mitigation measures (primarily design changes), as recommended in the generic and site specific EMPs, should be implemented.	Andara, Aranos, Aroab, Aussenkehr, Corridor, Eiseb 1 & 2, Elandsfontein, Epupa, Gibeon, Gochas, Kalkrand, Khorixas, Koës, Kongola, Kransberg, Leonardville, Lüderitz, Maroelaboom, Ndoro, Noordoewer, Okapaue Ost, Omega, Omuthiya, Otjinene, Outapi, Ovitoto, Rosh Pinah,

POTENTIAL IMPACT	DESCRIPTION OF RESIDUAL IMPACTS AFTER AVOIDANCE WAS APPLIED	CONDITION FOR ENVIRONMENTAL CLEARANCE	SITES TO WHICH CONDITION APPLY
			Ruacana, Shamvura, Tsumkwe.
Loss of plant diversity and endemism	Sites are located in areas likely to contain sensitive plant species.	When doing the final positioning at these sites, a vegetation specialist should accompany the team to assess the sensitivity of the plants on the site and make recommendations for on-site avoidance or the relocation of sensitive plant species where avoidance is impossible.	Lüderitz, Rosh Pinah
Loss of cultural heritage	Sites are located in areas likely to contain archaeological artefacts of cultural importance.	When doing the final positioning at sites where archaeological sensitivity is expected to be high, an archaeologist should accompany the team to determine whether any significant cultural or historical artefacts occur on the site. He will then make recommendations for on-site avoidance or will relocate sensitive archaeological artefacts where avoidance is impossible.	Aroab, Aussenkehr, Khorixas, Ndoro, Noordoewer, Otjimbingwe, Rosh Pinah, Tsumkwe.
Visual impact	Sites are located more than 8 km from an aerodrome. Therefore red and white markings (which increase the mast's visibility) may not be required.	NBC should apply to the ICAO to waive the requirement of red and white markings.	Aussenkehr, Khorixas

POTENTIAL IMPACT	DESCRIPTION OF RESIDUAL IMPACTS AFTER AVOIDANCE WAS APPLIED	CONDITION FOR ENVIRONMENTAL CLEARANCE	SITES TO WHICH CONDITION APPLY
	Masts of other broadcasters are located in the area, but due to structural limitations, it is not possible for NBC to use their infrastructure.	Other broadcasters should be approached to co-share NBC's infrastructure. This should be enforced by CRAN.	

1 INTRODUCTION

1.1 Background

The Namibian Broadcasting Corporation (NBC) intends to expand their broadcasting infrastructure to cater for the migration from analogue to Digital Terrestrial Television (DTT). In addition, they propose to extend their services to those parts of the country that are currently poorly covered by installing 44 masts with associated infrastructure countrywide.

This is in accordance with the agreement to a new digital broadcasting plan for Europe, Africa, the Middle East and Iran reached at a Regional Radio Communication (RRC) conference by the International Telecommunications Union (ITU) in Geneva in 2006. One of the key responsibilities of the ITU is the global management of the radio frequency spectrum. Nations represented at the Conference, including Namibia, resolved that all signatories to the agreement should migrate from analogue to digital television broadcasting. All cross border interference issues should be resolved by 17th June 2015.

In line with the Environmental Management Act of 2007, an Environmental Impact Assessment (EIA) is required for the construction of "*communication networks including towers, telecommunication and marine telecommunication lines and cables*". For this reason, three Environmental Management Consultancies were commissioned to ensure that all biophysical and social implications of the project are identified and mitigated. The three consultancies are Enviro Dynamics, Knight Piésold and Enviro Management Consultants. Each of these consultancies was allotted a group of sites.

Since this project involves 44 sites with potential cumulative and generic issues, it was decided that a Strategic Environmental Assessment (SEA) process would be followed. This process would allow for the identification of sensitivities, to screen significant impacts from insignificant ones and to determine the scope and content of work to be undertaken at each site.

Enviro Dynamics was responsible for carrying out the SEA that guided the site-specific work. This document provides a description of the SEA process followed and its findings.

1.2 Why an SEA?

Partidário (2003) defines the advantages of high-level SEAs as follows:

- It achieves environmental protection and sustainable development by:
    - Considering the effects of the proposed actions strategically,
    - Identifying the best achievable options, and
    - Considering early warning signs of cumulative effects.
- It strengthens and streamlines EIAs by:
    - Identifying the scope of potential impacts early on in the process,
    - Clearing up strategic issues, and
    - Reducing the time and effort needed to conduct individual reviews.
- It integrates the environment into the decision making process by:
    - Changing the way that alternatives are considered and decisions made.

The aim of the SEA is to provide decision makers at national, regional and local level, affected stakeholders and the proponent with timely and relevant information on the potential environmental impacts. This allows NBC to make modifications in design and adjustments in the locations of sites to avoid negative environmental impacts and disasters.

The objectives of the SEA are therefore to consider the following:

- The overall need for the programme with possible strategic alternatives.
- The environmental, legal and regulatory requirements and implications for the implementation and operation of the programme.
- Public consultation and disclosure for the entire process.
- Consideration of environmental and social sensitivities as well as the potential impacts related to these.
- Mitigation hierarchy to be followed during the selection and design of sites and consideration of technology in order to avoid ecological and social impacts.
- Classification of sites according to ecological and social sensitivities.

- Identification of generic impacts applicable to all sites for the construction and operational phases.
- A generic Environmental Management Plan to be implemented at each site.

Figure 1 is a flow diagram that displays the relationships between the information inputs (from specialists and environmental consultants) and outputs (in the form of decision support tools). The following chapter provides a description of the project (i.e. its need and desirability) and aspects of it that are expected to interact with the receiving environment).

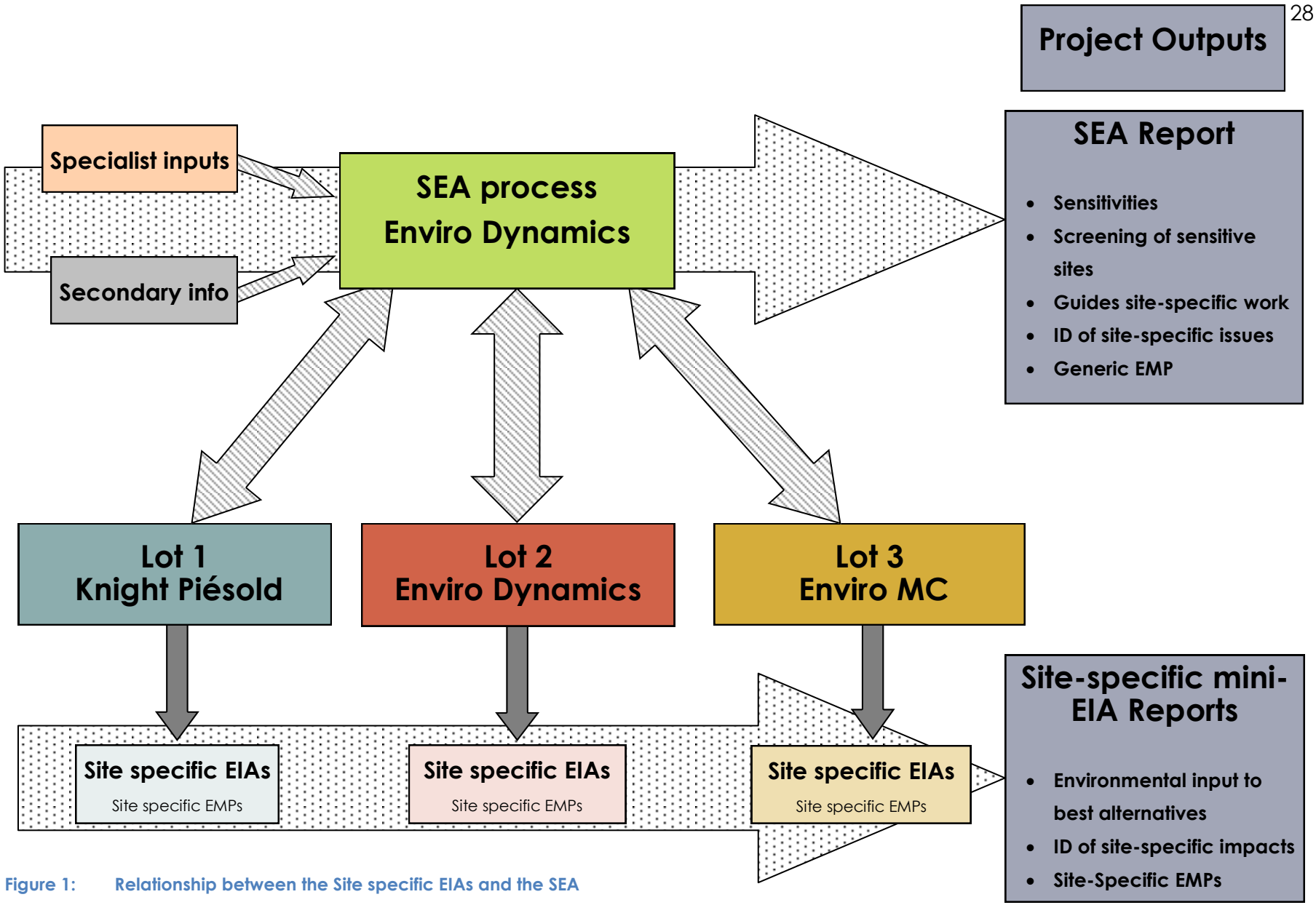


Figure 1: Relationship between the Site specific EIAs and the SEA

2 PROJECT DESCRIPTION

2.1 Rationale and feasibility

In terms of the Namibian Broadcasting Act, NBC's mandate is to provide a broadcasting service throughout Namibia in order to:

- inform and entertain the Namibian public;
- contribute to the education and unity of the nation, and to peace in Namibia;
- provide and disseminate information relevant to the socio-economic development of Namibia; and
- promote the use and understanding of the English Language.

NBC currently operates 52 analogue television transmitters that provide coverage to about 66% of the Namibian population. Since NBC is already running the analogue network for TV and FM, they have the basic infrastructure for the DTT and only need to change the analogue transmitter to a new digital DVB-T2 transmitter at all the stations.

The uplink system and compression system have also become obsolete with no further support from the manufacturer. This provides the opportunity to upgrade the system with the latest technology. The upgrade will be done in such a way that it will have minimum effect to the running system during the migration process.

***Digital Terrestrial Television (DTTV** or **DTT**) is the technological evolution of broadcast television and advance from analogue television, which broadcasts land based (terrestrial) signals. The purpose of digital terrestrial television, similar to digital versus analogue in other platforms such as cable, satellite, telecoms, is characterised by reduced use of spectrum and more capacity than analogue, better-quality picture, and lower operating costs for broadcast and transmission after the initial upgrade costs. A terrestrial implementation of Digital Television (DTV) technology uses aerial broadcasts to a conventional television antenna(or aerial) instead of a satellite dish or cable television connection.[Source: Wikipedia]*

The International Telecommunications Union (ITU) is a specialised agency of the United Nations, with responsibility for global management of information and communications technology. One of the key

responsibilities of the ITU is the global management of the radio frequency spectrum. The ITU held a Regional Radio communication Conference in Geneva in 2006 to, amongst other matters; agree on a new digital broadcasting plan for Europe, Africa, the Middle East and Iran.

This involves a new broadcasting frequency plan in VHF band III (174-230MHz), and UHF bands IV and V (470-862MHz). Participants to the conference, including Namibia, resolved that all signatories of the agreement should migrate from analogue to digital television broadcasting where transmission interference is anticipated. All cross border interference issues should be resolved by 17th June 2015.

2.2 Shared use of the Digital Terrestrial Television Infrastructure

In addition to NBC, all other broadcasters in Namibia such as One Africa Television and Trinity Broadcasting Network also have to migrate their broadcasting services from analogue to digital technology. Since a DTT transmitter can carry many programmes, some of the private broadcasters have expressed interest in sharing NBC's transmitters. This will:

- reduce duplication of infrastructure;
- expand coverage of services for all service providers to all parts of the country;
- reduce capital and operation costs for all service providers; and
- provide consumers with a diversity of services.

Mast infrastructure can also be shared with operators such as MTC, Telecom Namibia and Leo. All such usage will be good from both an economic and environmental point of view.

2.3 Benefits of digital broadcasting

Digital broadcasting uses advanced signal processing techniques such as signal compression. This leads to much more efficient use of network capacity than is the case with analogue broadcasting. Some of the major benefits of digital broadcasting include:

- *Enhanced broadcasting services* – enables new or improved broadcasting services such as data and interactive services and high quality (e.g. High Definition Television) programs.

- *Efficient utilization of radio spectrum* – multiple television programmes can be carried within the limited spectrum. With analogue broadcasting, an 8 MHz channel can only carry one programme. In contrast, the same channel can carry up to 17 programmes in digital broadcasting.

  Therefore, the released television spectrum ("digital dividend") can be reallocated to other communication services such as fixed telephone services, mobile telephone services, mobile television, etc

- *Competition* – digital broadcasting will increase competition, innovation and diversification of services in the broadcasting market. It will also attract new entrants at different levels of the broadcasting value chain.

- *Diversified consumer services* - digital broadcasting transmission technologies delivers discrete signals resulting in better visual and sound quality and offers broadcasters an opportunity to provide a wide variety of programmes to meet their different needs.

2.4 Site selection

NBC provided preliminary sites that were investigated in further detail by the consulting teams. During the site-specific surveys, these sites were assessed in terms of their technical viability and environmental suitability.

In choosing an optimal location for a site, the following were considered:

- It must provide service to as many communities as possible. It must provide the largest coverage area possible.

- Its proximity to commercial power lines. Availability of commercial power is critical because high power transmitters provide large coverage areas but can only be powered from commercial power.

*The **coverage area** is the area around the transmitter in which the signal is high enough to ensure good reception, assuming there is no interference. Large coverage areas ensure that fewer transmitters are required and thus lower capital and operational cost. In most cases, the best coverage is achieved by choosing a site that is on an elevated location such as a hill or mountain top.*

- Its accessibility, preferably by a vehicle, during construction and maintenance. Many hills could provide wide coverage but are not accessible.

- The terrain around the site should be suitable for constructing a foundation

for the guyed mast and the soil should be suitable for the foundations of the mast and guy ropes.

All the above criteria were considered using design tools and site surveys by an independent and professional consultant.

Figure 2 provides an indication of the locality of the sites.

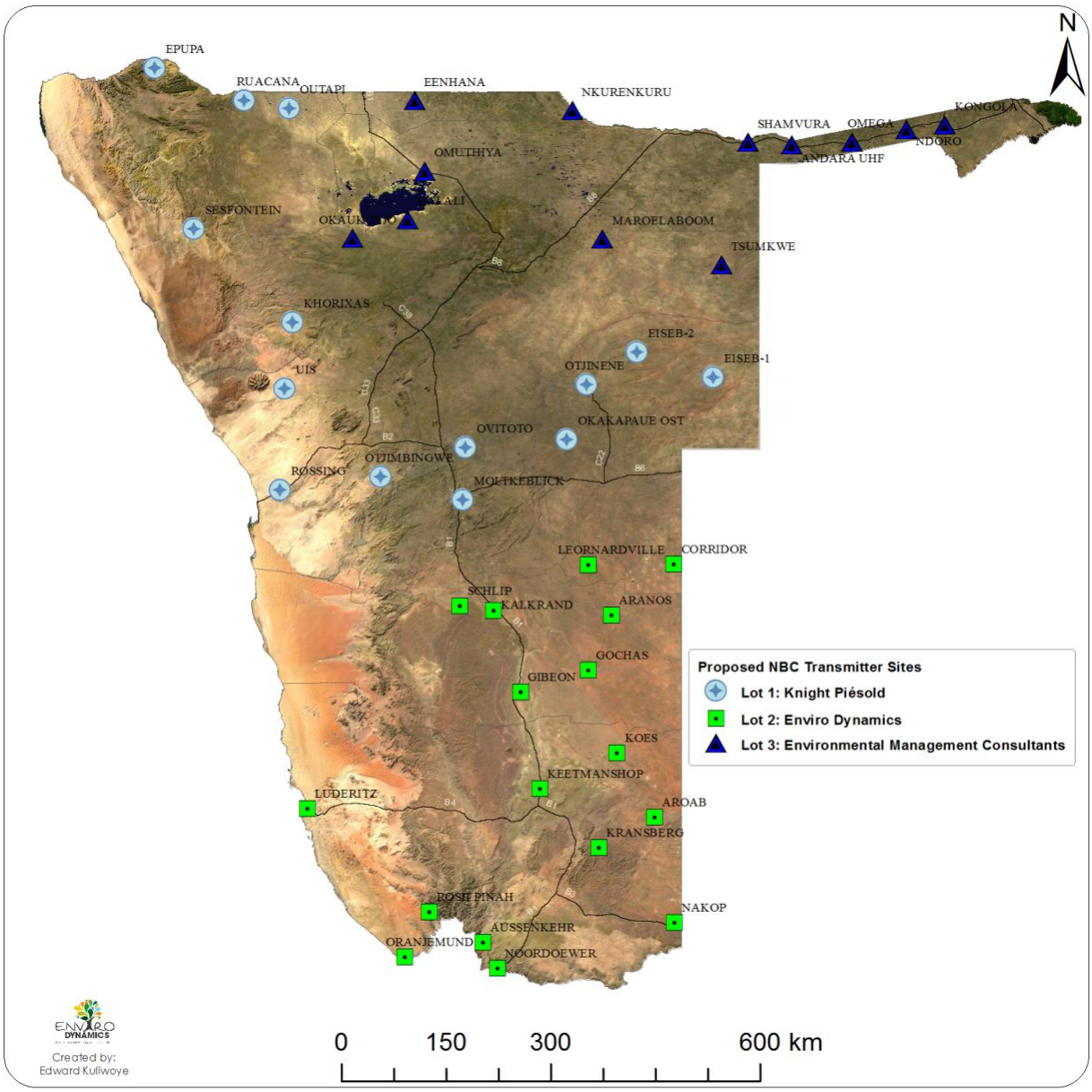


Figure 2: Locality of the proposed new transmitters throughout Namibia

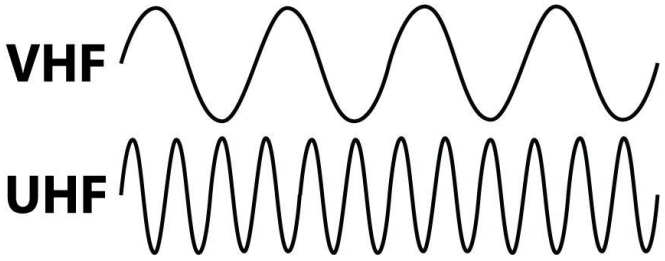
In terms of technical considerations, the following concepts were used:

- **Antenna height:** Refers to the distance from the ground to where the antenna is located on the mast. **It does not refer to the total height of the mast.**
- **Frequency:** The bandwidth in which the antenna operates (**Table 1**).

Table 1: Difference in frequency and wavelength of VHF and UHF.

FREQUENCY	WAVELENGTH	DESCRIPTION
30 – 300 MHz	10 – 1 m	Very high frequency (VHF)
300 MHz – 3 GHz	1 m – 10 cm	Ultra high frequency (UHF)

The higher frequency signals (i.e. UHF) become weaker faster than the lower frequency signals (VHF) and can become too weak to be detected at the receiver if located at greater distances. An amplifier is then needed to increase the power level of such a signal, so that it can travel greater distances. As a rule of thumb, longer wavelengths allow a signal to travel greater distances whereas narrower wavelengths have greater penetrating power through obstacles such as walls.



- **Transmitter power:** Power required for the transmitter to transmit the signal over a distance. The higher the power requirements, the further the antennae can transmit.
- **Antenna gain:** The gain of an antenna is the maximum amount of energy that is radiated in a particular direction. This amount of radiated energy cannot be increased in sum but it is possible to bend the field in a particular direction. A demonstration of this is a balloon. If squeezed from above and below, the amount of air will remain the same but the balloon will stretch further in radius. The effect of this on the power level in a specific direction is used to direct radiation where it will be used, rather than waste the energy beaming it into space, or the ground. The energy

radiated (in dB) from a dipole antenna would be written as dBd.

- **Polarisation:** The orientation of electromagnetic waves from the antenna. It can either be horizontal (H) (i.e. with its electric field parallel to the earth's surface) or vertical (V) (i.e. with its electric field is perpendicular to the Earth's surface) (**Figure 3**).

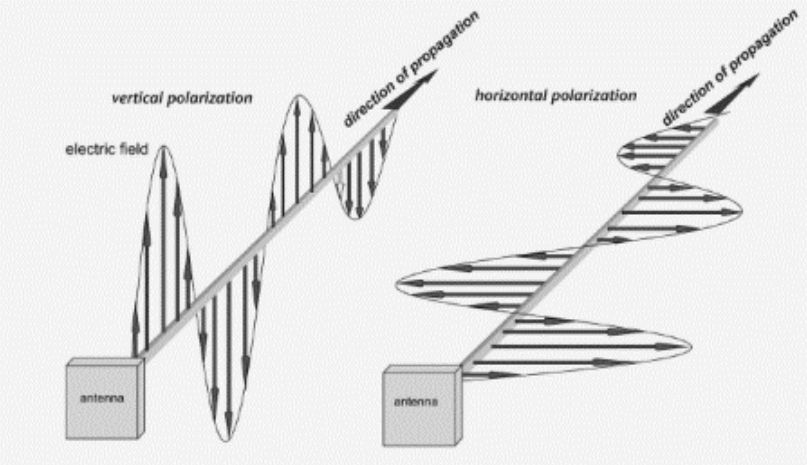


Figure 3: Difference in vertical and horizontal polarisation patterns.

Table 2 below provides the technical information for each of the investigated sites.

Table 2: Information on each of the proposed sites identified for this project.

TRANSMITTER SITE NAME	LATITUDE	LONGITUDE	ANTENNA HEIGHT (M)	FREQUENCY (MHZ)	TRANSMITTER POWER (WATTS)	ANTENNA GAIN (DBD)	POLARISATION	DISTANCE TO CLOSEST SETTLEMENT IN LINE OF SIGHT (KM)	CLOSEST TOWN
ANDARA UHF	-18.07405556	21.42158333	120	658	2000	18.2	V	0.74	Ekuli
ARANOS	-24.14794444	19.09325000	90	626	500	12.1	H	0.86	Aranos
AROAB	-26.75208333	19.64441667	90	666	500	12.1	V	3.76	Aroab
AUSSENKEHR	-28.36611111	17.43583333	60	530	50	12.1	V	0.98	Aussenkehr
CORRIDOR	-23.49425000	19.89105556	150	474	1000	14.4	H	0.17	Motsomi
EENHANA	-17.50297222	16.56111111	150	578	1000	15.4	H	0.98	Eenhana
EISEB-1	-21.07200000	20.40413889	120	482	100	12.1	H	12	Gobabis
EISEB-2	-20.74830556	19.42677778	120	514	100	12.1	H	0.63	Otjinene
ELANDSFONTEIN	-19.40019444	16.27744444	204	482	2000	12.1	V	4.6	Outjo
EPUPA	-17.08697222	13.20455556	90	618	100	7.5	H	3.1	Otjivakuanda
GIBEON	-25.14002778	17.91791667	140	210	2000	14.7	V	9.6	Gibeon
GOCHAS	-24.85663889	18.79513889	90	498	500	12.1	H	0.38	Gochas
HALALI	-19.03980556	16.47222222	90	530	250	12.35	H	0.22	Halali
KALKRAND	-24.08497222	17.57466667	183	522	2000	12.1	H	1.07	Kalkrand

TRANSMITTER SITE NAME	LATITUDE	LONGITUDE	ANTENNA HEIGHT (M)	FREQUENCY (MHZ)	TRANSMITTER POWER (WATTS)	ANTENNA GAIN (DBD)	POLARISATION	DISTANCE TO CLOSEST SETTLEMENT IN LINE OF SIGHT (KM)	CLOSEST TOWN
KEETMANSHOOP	26°22'58.80"S	18°10'0.72E	60	*				100	Keetmanshoop
KHORIXAS	-20.36063889	14.81602778	*140*	202	2000	13	V	11.84	Khorixas
KOËS	-25.92169444	19.16133333	90	746	500	9.1	H	1.23	Koës
KONGOLA	-17.82000000	23.39761111	120	642	500	9.1	H	0.09	Kongola
KRANSBERG	27° 8'35.75"S	18°55'38.43"E	90	666	500	12.1	V	3.76	Keetmanshoop
LEORNARDVILLE	-23.49569444	18.79147222	120	506	500	12.1	V	0.33	Leonardville
LÜDERITZ	-26.63888889	15.16388889	*90*	498	500	15.2	V	0.07	Lüderitz
MAROELABOOM	-19.28769444	18.98344444	210	178	2000	12.1	H	1.87	Grootfontein
MOLTKEBLICK	-22.65055556	17.17925000	140	194	4500	13	H	2.1	Windhoek
MONTE CHRISTO	-22.39016667	16.98369444	*110*	178	800	11	H	3	Windhoek
NAKOP	-28.10855556	19.90463889	140	626	500	13.45	H	5.76	Ariamsvlei
NDORO	-17.87825000	22.89761111	120	610	250	14	H	0.52	Omega III
NKURENKURU	-17.63252778	18.59505556	180	762	2000	16.6	V	0.4	Nkurenkuru
NOORDOEWER	-28.70155556	17.62222222	90	210	250	9	V	0.62	Noordoewer
OKAKAPAUE OST	-21.87825000	18.51847222	140	210	1000	14.7	H	4.02	Witvlei

TRANSMITTER SITE NAME	LATITUDE	LONGITUDE	ANTENNA HEIGHT (M)	FREQUENCY (MHZ)	TRANSMITTER POWER (WATTS)	ANTENNA GAIN (DBD)	POLARISATION	DISTANCE TO CLOSEST SETTLEMENT IN LINE OF SIGHT (KM)	CLOSEST TOWN
OKAUKUEJO	-19.28061111	15.75852778	90	562	250	14.7	H	2.99	Okaukuejo
OMEGA	-18.03977778	22.20144444	120	194	100	11.8	H	0.82	Omega I
OMUTHIYA	-18.41527778	16.68930556	210	514	2000	17.45	V	0.24	Omuthiya
ORANJEMUND	-28.55900000	16.42719444	90	602	250	11	H	0.07	Oranjemund
OTJIMBINGWE	-22.35083333	16.12030556	72	498	500	10.5	H	0.2	Otjimbingwe
OTJINENE	-21.16836111	18.77300000	210	530	2000	15.3	V	1.05	Otjinene
OUTAPI	-17.60447222	14.93655556	90	487.25	500	12.1	V	0.63	Outapi
OVITOTO	-21.96513889	17.21441667	82	514	100	10.5	V	0.3	Okahandja
ROSH PINAH	-27.97161111	16.74113889	90	634	100	11.1	H	1.06	Rosh Pinah
RUACANA	-17.50547222	14.35711111	230	554	2000	15.4	V	0.239	Ruacana
SCHLIP	-24.02747222	17.13738889	210	522	2000	15.3	H	1.2	Schlip
SESFONTEIN	-19.16194444	13.71025000	110	186	2000	13	V	1.8	Sesfontein
SHAMVURA	-18.04238889	20.86277778	210	626	2000	17	V	0.44	Kayaru
TSUMKWE	-19.62544444	20.51680556	74	602	100	12.1	H	2.69	Tsumkwe
UIS	-21.22108333	14.88425000	60	490	100	10.5	H	0.2	Uis

*Information not available at the time of compilation of the report

2.5 Facilities proposed for each site

Typically, a broadcasting site will consist of:

- The mast, on which broadcasting antennas are mounted. The height of the mast will vary between 80 m and 240 m, depending on the design requirements.
- FM-TV room: An equipment shelter/room next to the mast in which the broadcasting transmitter will be installed. In most cases, the equipment room/shelter will be fenced off to provide security for the equipment in the shelter/room.
- Generator building: A room where a generator is located for power and/or standby power.
- Exterior users building: a room for exterior users' (e.g. MTC, LEO) equipment.
- Bunded area for the storage of fuel used for the standby generator(s).
- Dish (3.5m or 5.5m diameter): Uplink or downlink system for receiving satellite signals (uplink) and transmitting satellite signals (downlink) to end users.
- A NamPower transformer nearby to provide power to the equipment.
- A power line and access road (differs between the sites).

Figure 4 provides examples of what a typical transmission mast and equipment room would look like.

Figure 4: Left: Transmitter tower with antennae

Right: Transmitter mast with equipment shelter/room for a low power site.

2.6 Roll-out programme

Migration will be done according to feasibility. Almost all the existing sites will be covered during the first phase and amongst them priority will be given based on viewership and population density of the particular region. If all goes as planned, this phase should be finished by October 2016. In the mean time, the civil work on the new sites will be planned and carried out and the DTT system will be installed at a later stage.

2.7 Socio-economic implications

Final cost estimates for the project are currently being calculated but is estimated to be approximately N$500 million excluding equipment (this figure is subject to change as per a number of possible variables). At this stage it has not been decided from where these funds will be sourced from own coffers.

Tenders will be called for the execution of the construction work. Local contractors will receive preference during this process where their skills can be applied such as the clearing of new sites and construction of roads. However due to the fact that the erection of the masts is a specialised function, skilled labour (as per contractors) will be relied upon.. The contractor is likely to use his/her own workforce for this, moving from one site to the next, (although the contractor may be encouraged to use local labour where possible as mentioned above). During maintenance, the NBC is likely to use its existing maintenance personnel for the upkeep of the sites. . Therefore with regards to employment for this projects the following is anticipated:

- Generation of some new employment opportunities and increased sustainability for existing portfolios during the construction phase. This is of national magnitude within the scope of the SEA and in considering 44 sites to be upgraded or established);.
- Increased sustainability of employment for NBC workers during the operational phase as the maintenance of new sites will be added to the maintenance of existing sites. At this stage of the planning phase, there is no information available to determine whether NBC will have to employ additional staff for the additional work which will be required to be conducted.

Nationally, there are various additional positive impacts (apart from employment related impacts) which are indirectly linked to the operational phase of the proposed project. Consideration should be given (but not limited to) the following:

- National cohesion of the Namibian state;

- Increased Information accessibility within new and existing geographical areas of Namibia;
- Hopes and aspiration of previously "un-served communities"; and
- Aspirations for the future for all citizens.

As per the preliminary assessment conducted during this SEA, it is anticipated that all of the above aspects will be impacted on in a positive manner. However, should additional information regarding the National Socio-Economic impacts be required, it is recommended that a Strategic Social Assessment be performed, which will consider both quantitative and qualitative data.

3 METHODOLOGY

3.1 Objectives

The project activities associated with construction and operation will almost be identical for the 44 sites. However, the environment of each site is unique. It is therefore important to distinguish site-specific from generic issues, i.e. those that that are similar for all sites from those that are unique. The methodology therefore aimed to:

- ✓ using as much desk-study work as possible to identify sensitivities, yet using high level of expertise so that unnecessary expenditure and delays can be avoided;
- ✓ avoiding duplication in conducting assessments and the production of subsequent documents;
- ✓ screening out those sites where further work and management is needed from the ones which may be dealt with in a generic way;
- ✓ providing an opportunity for public participation at a strategic level; and
- ✓ guiding the work of the three environmental consultants so that their input is integrated and compatible.

3.2 Limitations

In undertaking the SEA for the proposed project, the consultants were faced with the following limitations:

- ✓ Due to the insufficient provision of information from other service providers, the cumulative impact of the RF emissions of all broadcasting and telecommunication towers across Namibia could not be determined.
- ✓ Although the division of the workload amongst three consultants removed some of the pressure on any one consultant, consistency in assessing the sensitivity of sites was compromised in the process.
- ✓ Since the implementation process of the project is expected to extend over a number of years, site-specific consultation was not practical. Several of the proposed sites' exact positions have not yet been established, making consultation very difficult. It is also very likely that the local, regional and national government officials will change a number of

times throughout the various stages of the project.

3.3 Mitigation hierarchy

The objective of this study was to apply the following mitigation hierarchy to the various sites.

The first aim was to avoid an impact, particularly if the significance of the impact was considered to be high (**Figure 5** below). The second option would to reduce/ repair (i.e. mitigate) the impact on site while the last resort would be to compensate a particular community, group of individuals or person, if the impact cannot be either avoided or mitigated to acceptable levels.

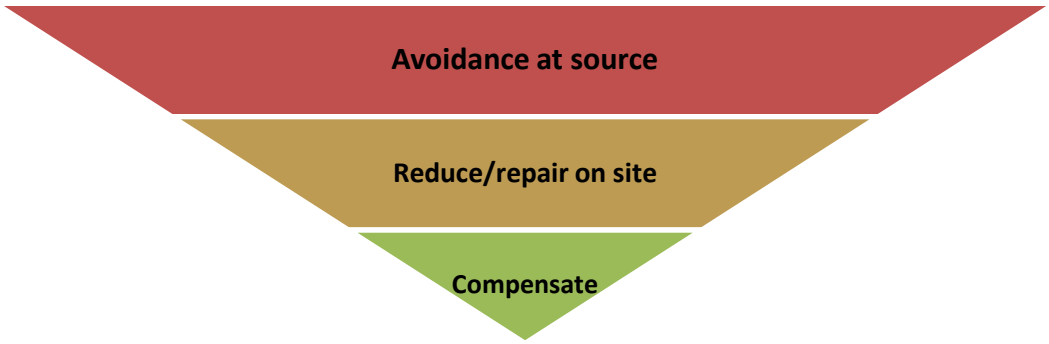


Figure 5: Mitigation hierarchy applied at each site.

We use visual impact here as an example. If one considers a theoretical site where the tourism potential and topographic qualities are high (i.e. making the site sensitive to visual impact) we would give the site a high visual sensitivity rating. We would proceed to consider 1) the need for the site in general, and 2) any alternative sites which would provide similar or adequate cover, but with a low potential for visual resources. If this is not possible, we would consider moving the facilities on site to avoid visual impact, and lastly we would choose colours, paint types, and building materials that would reduce reflection and thus visual impact. Avoidance therefore is the first priority, followed by the alternative mitigation measures.

3.4 Work done at strategic and at site-specific level

Figure 6 below illustrates what level of work was carried out at strategic and site specific level. The desk study work performed at strategic level informed and prompted the sensitivities to be expected on site. In return the site specific information verified the sensitivities of each site, by supplementing ground truthed data which is not available without visiting the site.

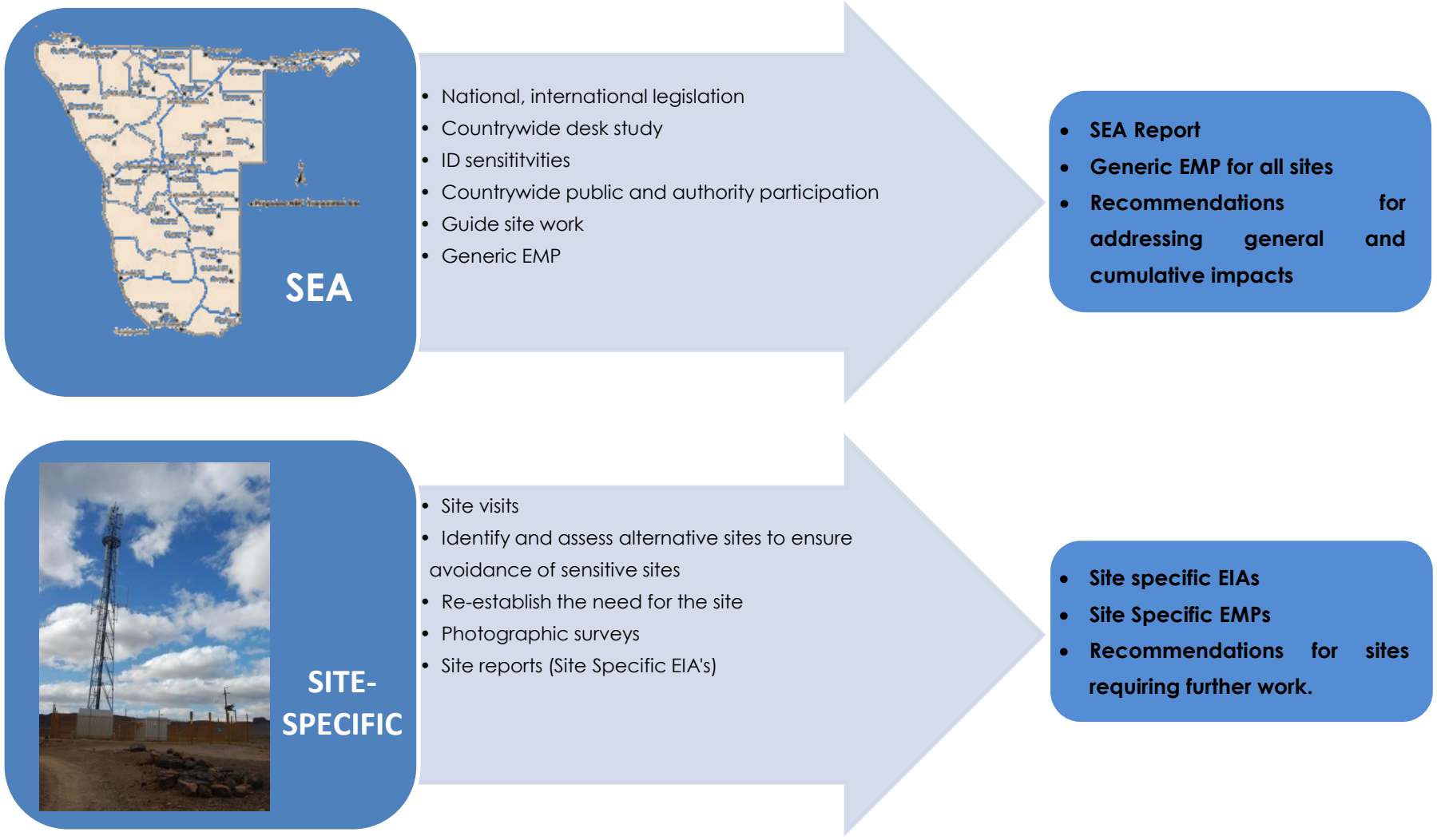


Figure 6: Tasks performed at strategic and site specific levels.

The assessment of issues and ultimately the selection of an environmentally sound site were guided by various legal guidelines. These are described in the following section.

4 LEGAL FRAMEWORK

Table 3 below provides a summary of all pertinent international and national standards, guidelines, policies and laws that are of relevance to the DTT project. The right-hand column in the table provides an indication of the relevance of each legal instrument to this project.

Table 3: Summary of Relevant Environmental and Social Legislation.

ISSUE	APPLICABLE LEGISLATIVE INSTRUMENT	APPLICATION TO THE PROJECT
International Legislation and Treaties:		
International Finance Corporation (IFC)	• *IFCs overall policy on Environmental and Social Sustainability with the following specific Performance Standards:* • *Performance Standard 1: Social and Environmental Assessment and Management System* • *Performance Standard 2: Labour and Working Conditions* • *Performance Standard 3: Pollution Prevention and Abatement* • *Performance Standard 4: Community Health, Safety and Security* • *Performance Standard 6: Biodiversity Conservation and Sustainable Natural Resource Management* • *Performance Standard 8: Cultural Heritage*	• *If NBC is to apply for funding internationally, then these standards need to be adhered to.*
Equator principles	• *The equator principles require that an environmental and social impact assessment address key social and sustainable environmental requirements.*	• *If international funding is sought, then NBC will have to demonstrate its adherence to these requirements.*
United Nations Convention on Biological Diversity 1992	• *Regulates conservation of biodiversity, sustainable use of its components, and equitable share benefits arising from the use of genetic resources.*	• *Sites which are likely to affect biodiversity should be identified and assessed.*

ISSUE	APPLICABLE LEGISLATIVE INSTRUMENT	APPLICATION TO THE PROJECT
Convention of Biological Diversity Rio de Janeiro (1992)	• *Details the preservation of rare and endemic species, Namibia is a signatory to this convention. Ratified by Namibia in 1997. Article 14 requires that EIA's are carried out for projects that are likely to adversely affect biological diversity, avoid or minimize such effects, and where appropriate, allow for public participation.*	• *Sites which are likely to affect biological diversity to be identified and assessed and the impacts avoided or minimized.*
Namibian National Legislation		
General principles – human rights, biodiversity, education, etc.	• *Namibian Constitution:* – *General human rights – eliminates discrimination of any kind.* – *The right to a safe and healthy environment.* – *Affords protection to biodiversity.*	• *Ensure these principles are enshrined in the planning documentation of all the sites".*
Waste Management	• *Hazardous Substances Ordinance 14 of 1974:* – *Control of substances which may cause injury or ill-health or death of human beings because of their toxic, corrosive, irritant, strongly sensitizing or flammable nature.* • *Pollution Control and Waste Management Bill:* – *Aims to prevent and regulate the discharge of pollutants to air, water, land, and will regulate noise, dust and odour pollution. Further aims are to establish a system of waste planning and management, and to enable Namibia to comply with its obligations under international law in this regard.*	• *Consider waste management options at each site and include in each EMP.* • *Identify hazardous substances disposed of during construction and operation and identify practical handling and disposal options.*
Biodiversity	• *Article 95 of the Constitution:* – *"maintenance of ecosystems, essential ecological processes and biological diversity of Namibia and utilization of living natural resources on a sustainable basis for the benefit of all Namibians, both present and future".* • *Forest Act 12 of 2001:* – *Provision for the protection of various plant species.* – *Section 22(1): It is unlawful for any person to "cut, destroy or remove any living tree, bush or shrub growing within 100 metres from a river, stream or watercourse on land that is not part of a surveyed erf or a local authority area*	• *Identify the existence of any protected plants and habitats of conservation concern at each site.* • *Identify those sites which require further investigation and address the applicable issues in a more detailed EIA.* • *List applicable biodiversity compliance issues in the EMP.*

ISSUE	APPLICABLE LEGISLATIVE INSTRUMENT	APPLICATION TO THE PROJECT
	without a licence. • *Nature Conservation Ordinance 4 of 1975:* – *Protects inter alia nature reserves, conservancies, the hunting and protection of wild animals, and the protection of indigenous plants.* – *Prohibits disturbance or destruction of the eggs of huntable game birds or protected birds without a permit.* – *Requires a permit for picking (the definition of "picking" includes damage or destroy) protected plants without a permit.* • *Preservation of Trees and Forests Ordinance:* – *Protection to tree species.*	
General Environmental and Social Protection and Social and Environmental Assessment and Management Systems	• *Environmental Management Act (2007):* – *Requires that projects with significant environmental impact are subject to an Environmental Assessment Process.* – *Requires for adequate public participation during the environmental assessment process for interested and affected parties to voice their opinions about a project.* – *Projects with cumulative impact (i.e. a programme) require SEA.*	• *Communication sites trigger an EIA.* • *Conduct public participation as part of the EIA process as described in the act.*
Heritage	• *National Heritage Act (2004):* – *All heritage resources to be identified and either protected or removed/mitigated with a permit from the National Monuments Council, before any development may take place. Heritage assessments undertaken as part of the environmental assessment process.*	• *Identify sites for their archaeological potential. Conduct further archaeological assessment if required.*
Labour, Working Conditions and Employment	• *Labour Act (1992):* – *Health and Safety Regulations.* – *Minimum wages and working conditions including health and safety measures.* – *Affirmative Action (Employment) Act 29 0f 1998.*	• *Include health and safety regulations in the EMP.* • *Ensure that minimum wage and working conditions are stipulated in the contract.*

ISSUE	APPLICABLE LEGISLATIVE INSTRUMENT	APPLICATION TO THE PROJECT
	– *Article 9 of the Namibian Constitution.*	
Public Health	• *Public Health Act 36 of 1919:* – *Provides for the prevention of pollution of public water supplies.*	• *Identify sites where potential pollution may occur, introduce mitigation measures where needed.*
Land Issues	• *Communal Land Reform Act 5 of 2002:* – *Provides for the allocation of rights in respect of communal land.* – *Powers of Chiefs and Traditional Authorities in relation to communal land.* • *Traditional Authorities Act 25 of 2000:* – *Provides for the establishment of traditional authorities and leaders.*	• *Consider the land acquisition process at sites where communal land is required.* • *Consult with the applicable traditional authorities.*
Communications – sharing of infrastructure	• *Communications Act, 2009.* • *Promotes the sharing of infrastructure of the dominant carrier with other carriers.*	• *Encourage the sharing of towers to avoid cumulative impact.*
Radiation	• *The precautionary distance for RF Radiation level as considered safe by the ICNIRP standard of 0.2 milliwatt/cm² for the NBC transmitter sites is between 2.59 and 40.22 meters*	• *Used to determine the safe distance around each of the site sites.*
Civil Aviation	• *Annex 14 to the Convention on International Civil Aviation.* • *Chapter 4: Obstacle restrictions and removal* • *Chapter 6: Visual aids and donating of obstacles*	• *The proposed new structures may be obstacles to some aerodromes in Namibia. Those that are close to existing aerodromes need to be assessed in accordance with the document.* • *Visual aids to the new structures to make them visible to aircraft need to be applied in accordance with this Convention.*

These obligations have been considered during the SEA process and specific requirements listed here have been spelt out in the EMP (both generic and site specific). The next section outlines how the public has been consulted and informed throughout the SEA.

5 PUBLIC CONSULTATION AND DISCLOSURE

5.1 Introduction

Public Participation forms an integral part of a SEA because it ensures a thorough and comprehensive process during which the public becomes a valuable source of information to the project. According to the Environmental Management Act of 2007 public participation is the "*process in which potentially interested and affected parties are given an opportunity to comment on, or raise issues relevant to, specific matters*".

The Environmental Management Act (2007) defines an I&AP as "*(a) any person, group of persons or organization interested in or affected by an activity; and (b) any organ of state that may have jurisdiction over any aspect of the activity*."

The public consultation process has been divided into two levels of communication. These are described below.

5.1.1 Consultation at SEA level

Public consultation at the SEA level was aimed at a broader group of "*high level*" stakeholders including various ministries and NGOs (see **Table 4** below). These parties were identified by using the existing Enviro Dynamics stakeholder database and advertising the project in various newspapers inviting the public to register as interested and affected parties.

5.1.2 Consultation at site specific EIA level

Consultation at this level was aimed at the local community including farm and land owners, municipalities, town and regional councils. These parties were informed of the project by means of faxes and emails (and where this was impossible, phone calls) and/or informal meetings. Although this was done for most sites, this approach was not possible at some of the sites.

In addition, because of the prolonged period over which the project is expected to run, many officials and local I&APs are likely to change throughout the course of the project. This contributes to the variability of I&AP information and could result in consultation becoming out dated.

The aim is therefore to repeat the consultation process just before commencing with the construction phase.

Following the identification process, each of the registered I&APs was ranked according to national, regional and local level (**Table 4**). The complete list of registered I&APs can be viewed in **APPENDIX A2.**

Table 4: Identification of key I&APs

ITEM	LEVEL	DESCRIPTION	APPLICATION
STAKEHOLDER DATABASE	NATIONAL	Ministry of Environment and Tourism Ministry of Information and Communication Technology Ministry of Health and Social Services Ministry of Regional and Local Government Housing Ministry of Lands and Resettlement	SEA
		CRAN	
		Civil Aviation	
		Tourism industry	
		NGOs	
		Other I&APs	
	REGIONAL	Regional Councils	SITE SPECIFIC
		Erongo RED	
	LOCAL	Farmers/ Smallholding owners Tourism Operators	
		Town Councils I&APs Schools	

The following section relates to the SEA level consultation. It indicates how the various Interested and Affected Parties (I&APs) were identified, the communication process applied to obtain comments as well as the common themes resulting from the process. A summary of all issues and concerns that have been raised is provided as **APPENDIX A1**.

5.2 Methodology

The public was informed about the SEA in various ways as described below.

Notices were placed in the press for three consecutive weeks inviting people to register as I&APs (**APPENDIX A3**).

A Background Information Document (BID) (**APPENDIX A4**) was drafted and distributed to all contacts on the Stakeholders List (I &APs) via e-mails and per fax.

Two meetings were scheduled to which key authorities, stakeholders and registered I&APs were invited. One meeting was held in Windhoek on the 7th of September 2011 at the Polytechnic Hotel School (28 attendees) and the other at the Hotel Deutsches Haus in Swakopmund on the 8th of September 2011 (10 attendees). The attendees consisted of various private companies, NGO's and government officials. The aim of the meeting was to share information and obtain concerns (**Figure 7**). The minutes of the meetings and the attendance lists are attached as **APPENDIX A5**.

Before submitting the SEA report to the DEA, the document will be circulated again to all registered I&APs to inform them of any changes that may have occurred since 2011.

All issues raised by the stakeholders and the public are further considered in next section of this report. These issues and concerns are also contained in the issues and responses trail **(APPENDIX A1).**

Figure 7: Information on the proposed project was presented to the public during the public meetings.

5.3 Public concern

Key issues raised at the meetings are listed in **Table 5** below. These issues are further considered in the following section of this report.

Table 5: Summary of key issues that needs further investigation in impact assessment

SUMMARY OF ISSUES	
Health and Safety	• *Radiation risk associated with the close proximity of power line and masts to schools* • *Impact of "safe distance" on future spatial planning*
Construction of Roads	• *Visual impact of roads* • *Damage caused by roads (erosion during rainy season)*
Rehabilitation	• *Previous damage caused by sites and roads need to be remedied*
Coverage	• *Concerns about equal access to the network*
Economic	• *Financial implications for residents*
Civil Aviation	• *Towers potential obstacle*
Co-sharing of Infrastructure	• *Visual impact of towers*
Impact on Birds	• *Impact of towers on bird movement*
National Parks	• *Visual impact of towers and resultant impact on tourism*
Aesthetics	• *Visual impacts to be considered in mast/tower design*

In the following section the receiving biophysical and social environment is elaborated on to establish which of the proposed sites are expected to be sensitive.

6 BIOPHYSICAL AND SOCIO-ECONOMIC OVERVIEW OF THE RECEIVING ENVIRONMENT

6.1 Introduction

In this section the following are discussed: Biophysical and socio-economic overview of the receiving environment

- Features of the receiving environment likely to be affected by the project.
- Features likely to influence the positioning and erection of the transmitters.
- The findings of the specialist investigations.

It specifies sensitive areas where human disturbance is to be avoided and where specific management directives are required.

This section provides general information to guide the site work. Further detailed information is included in the site specific assessments which may be found in **VOLUME 2** of this report.

6.2 Biophysical Profile

6.2.1 Climate

Climatic conditions in Namibia are generally described as dry, variable and relatively harsh. These characteristic conditions influence many other aspects of Namibia's biophysical environment. Although the construction and operation of the proposed transmitters does not influence the climate, features such as wind and fog could affect the siting and erection of the transmitters and therefore needs to be considered. Furthermore the climate of a region greatly influences the vegetation cover and habitat, and in effect the biophysical profile and sensitivity of an area.

Wind is a dominating feature of the coastal climate because of the presence of the South Atlantic Anticyclone off the coast. The Anticyclone produces strong winds that drive the Benguela current northwards and carry sand from the shore into the vast sea of Namib dunes. Along the coast the summer is characterised by windy afternoons with directions being predominantly west-southwest to south-southwest. These winds are cold and moist with the cold conditions preventing convection, which means that the moisture causes fog only and no rain. Lüderitz has average

winds of over 40km/h during summer afternoons (**Figure 8**).

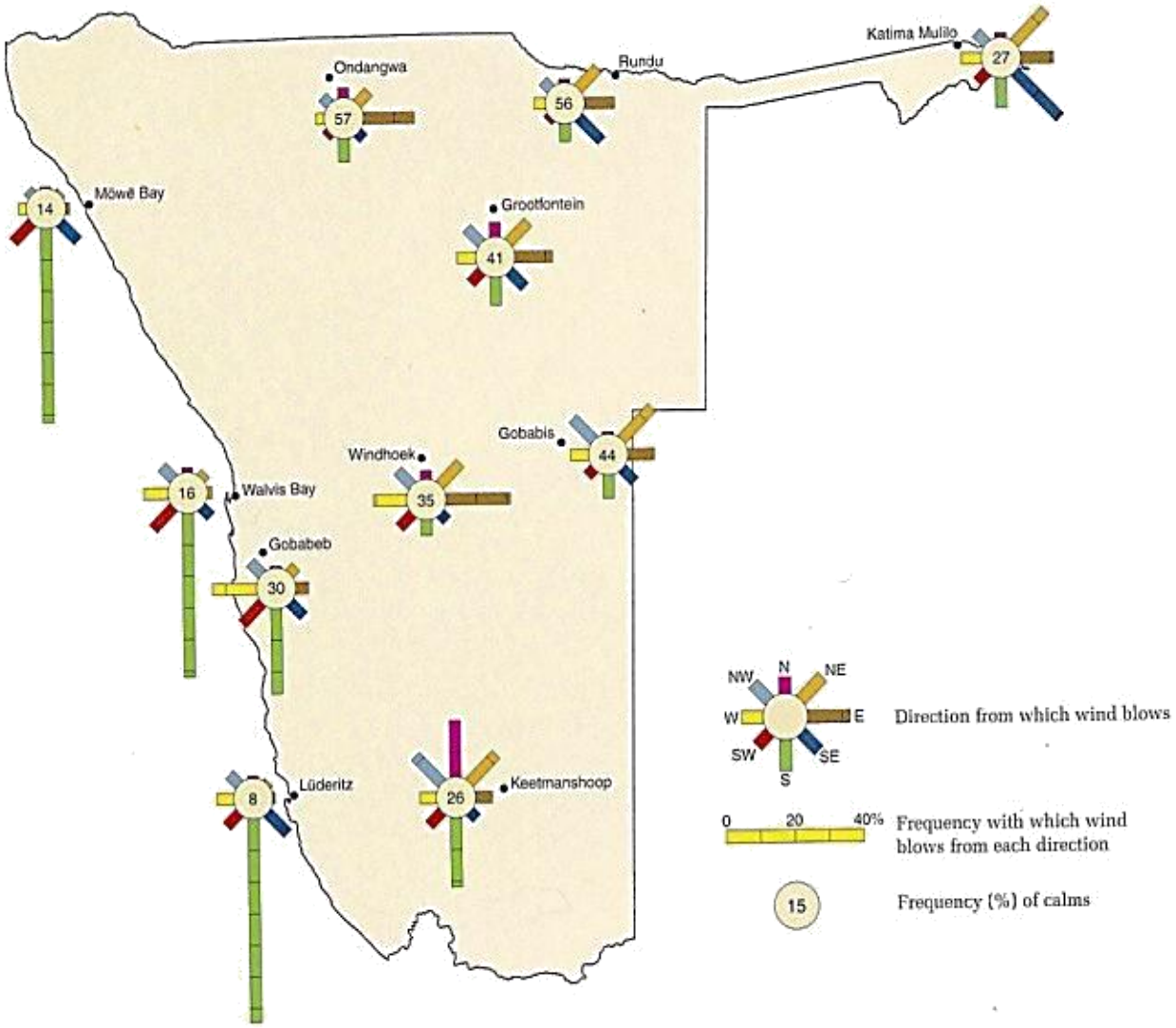


Figure 8 : Prevailing wind directions (Mendelsohn et al, 2002)

From a broader perspective, it has been recorded that when the wind blows from the interior, In Namibia, it is mainly from an easterly/north-easterly direction. These winds are caused by a combination of temperature and topographic differences, which mean that they are mostly dry and hot. Strong airflows known as berg winds from the escarpment to the coastal areas occur approximately 50 times per year, mainly during winter. These high-velocity winds are accompanied by marked increases in temperature and carry large quantities of dust.

Wind is less prominent inland, but large areas of sand dunes are found in the Kalahari Sandveld. Other than along the coast, wind speeds are generally lower over much of the interior and especially so in northern Namibia, with stronger winds in the afternoon and early evening between April and June. The most significant

winds in the interior are from the north, north-east and east (Mendelsohn *et al.* 2009).

Fog occurs more frequently along the central Namib Desert than elsewhere, probably because of the upwelling off that part of the coast. 146 fog-days/years are recorded for Walvis Bay, 127 for Lüderitz and 81 days at Oranjemund. Fog is recorded when visibility on the ground is reduced to 1000m/less. Fog may be formed along the coast but also extends further inland due to rising air for a distance of up to 60 km during many nights and is densest at an elevation of between 300 and 600 m (**Figure 9**).

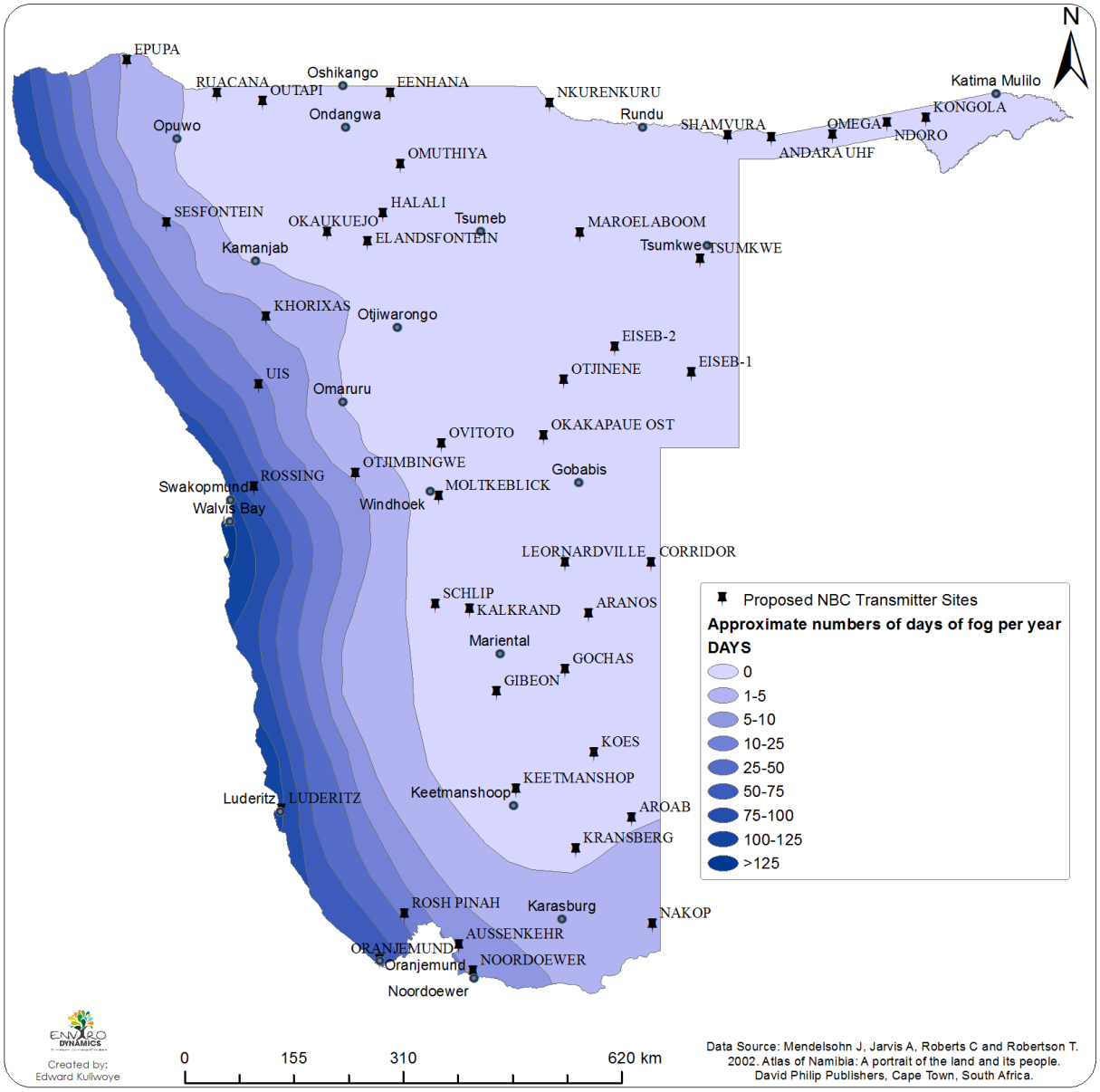


Figure 9: **Number of fog days per year.**

The fog causes levels of high humidity along the coast. Even when fog is absent, the humidity along the coast remains the highest in Namibia with night values of more than 80% not unusual. This pattern constitutes a foggy and cool zone lying along the coast, followed by a zone between 30 and 60 km inland from the coast where fog and high humidity is common during the morning, but disappears before noon when the temperatures rise. The latter is a zone of extremes, experiencing great diurnal fluctuations in temperature and humidity (Mendelsohn *et al.* 2009). Salty Spray, pushed inland from by costal winds, could cause corrosion of the structures over time and needs to be considered.

Sensitivities and potential impacts related to climate are highlighted in **Table 6** below.

Table 6: Sensitivities and potential impacts related to climatic conditions

ENVIRONMENTAL FEATURE	SENSITIVITY	POTENTIAL IMPACT/ENHANCEMENT	SITES MOST LIKELY TO BE SENSITIVE
Wind	High velocity east or east-northeast winds during winter at coast. Prevailing wind direction Frequency of wind at coast during summer	Influence on height and siting of transmitters Increased dust Dune formation at base of structures	Oranjemund Lüderitz Rössing
Salty Spray	Moisture and salinity content	Corrosion of structures	Oranjemund Lüderitz Rössing Rosh Pinah Uis Khorixas

6.2.2 Landscape

The visual impact of the proposed transmitters and their infrastructure will be largely influenced by the landscape.

Much of Namibia consists of a wide, rather flat plateau that continues north, south and east into neighbouring countries (**Figure 10**). The height of the plateau ranges between about 900 and 1300m above sea level, there is however great variation in altitude to the west and south where the escarpment rises. The coastal plain rises to an elevation of 800 -900m and varies in width between 50 and 100km. The landscape then rises quite sharply to form an escarpment between the coastal plain

and central, inland plateau being the steepest in the north. The highest point in Namibia is the Brandberg (2579m); followed by Moltkeblick (2479m) in the Auas mountains close to Windhoek (**Figure 10**). Other mountain ranges worth mentioning are the Baynes and Zebra Mountains in the North-west of the country, Otavi Mountains (North-central), Naukluft and Karas mountains in the south as well as Brukkaros near Keetmanshoop. Sharp cliffs mark the western edge of the Weissrand Plateau in southern Namibia (**Figure 10**).

From an aesthetic point of view the construction of transmitters on elevated sites as well as on pans would be most undesirable. Furthermore the slopes of outcrops are less favourable from a potential erosion point of view. Should infrastructure be routed across steep slopes, this would likely lead to erosion in future, and would increase the visual impact of the site.

Koppies, inselbergs, mountains and the escarpment are also sensitive in terms of high biodiversity and endemism of plants, reptiles and birds (**Figure 10**). Pans, oshanas (Cuvelai system), rivers and floodplains are also important bird areas and need to be avoided in the selection of sites. Sensitivities and potential impacts related to different landscape features are discussed in **Table 7** and the impacts further addressed in **Section 8.**

Table 7: Sensitivities and potential impact related to landscape

ENVIRONMENTAL FEATURE	SENSITIVITY	POTENTIAL IMPACT/ENHANCEMENT	SITES MOST LIKELY TO BE SENSITIVE
Escarpment	Visibility Aesthetic value	High visual impact Erosion	Rosh Pinah, Sesfontein
Koppies, Inselbergs and mountains	Visibility Aesthetic value	High visual impact Erosion	Nakop, Koës, Gibeon, Epupa, Ovitoto, Moltkeblick
Pans, rivers, floodplains and oshanas.	Visibility Aesthetic value	High visual impact	Okaukuejo, Halali, Omuthiya, Outapi

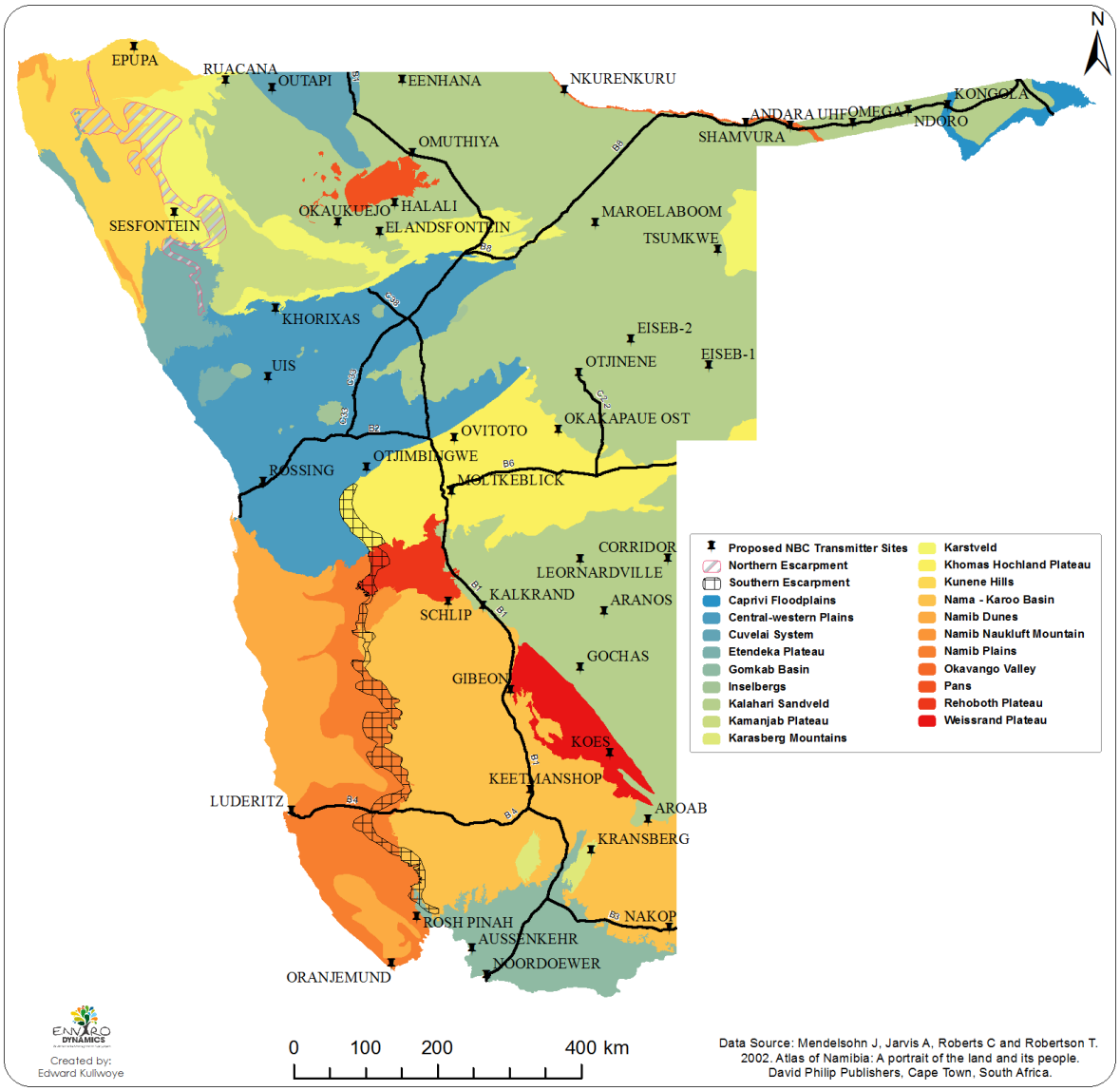


Figure 10: Landscape features

6.2.3 Surface water

Surface water will not be affected significantly by the presence of transmitters, except for localised occurrences of hydrocarbon spills, erosion and the like. These can be avoided through proper management on site. The siting and erection of the transmitters will however have an effect on the fauna and flora associated with surface water systems, specifically birds since these areas are seen as Important Bird Areas (IBA's) (Simmons *et al,*1999). In addition, the occasional flooding of rivers and the cuvelai could affect the infrastructure.

There is not a lot of surface water to be seen in Namibia. Rainwater evaporates, seeps into the ground or is rapidly drained by ephemeral rivers. The majority of surface water areas are dry for most of the year; this is particularly true for the network of ephemeral rivers. The ephemeral rivers flow westwards, south or north

and some of the bigger rivers regularly carry enough water to reach the sea. The Tsondab and Tsauchab rivers however never reach the sea but their water filters into the ground or collect and evaporate from large pans such as Tsondab- and Sossusvlei. Easterly flowing ephemeral rivers are essentially dry rivers and cut through flat areas dominated by Kalahari sands. Westerly flowing rivers have clearly defined catchment areas, with the largest being the Fish, Ugab, Swakop and Omaruru catchment areas (**Figure 11**). The rivers support a rich fauna and flora diversity.

Of the freshwater Pan systems (basins) in Namibia, Etosha Pan is the largest. There are several smaller pans scattered throughout the north, south-east and coastal areas with Pans in the north-east near Tsumkwe, having been rated as extremely important breeding sites for birds. Some pans to the north and west of Etosha are salty and some of the these, located along the coastal regions, are commercially mined for salt. The two natural lake systems, i.e. Omadhiya Lake Complex and Lake Liambezi in the Caprivi are also important bird breeding sites (Mendelsohn, *et al.* 2009).

Table 8 indicates the sensitivities and potential impacts related to surface water and these impacts are further discussed in **Section 7.**

Table 8: Sensitivities and potential impacts associated with surface water

ENVIRONMENTAL FEATURE	SENSITIVITY	POTENTIAL IMPACT/ENHANCEMENT	SITES MOST LIKELY TO BE AFFECTED
Rivers	Associated bird species Breeding sites for birds Associated protected trees Associated faunal diversity	Loss of bird diversity Loss of tree diversity Loss of faunal diversity Floods* Erosion*	Shamvura, Omega, Kongola, Ndoro, Oranjemund, Aussenkehr, Noordoewer
Pans, floodplains, wetlands and oshanas.	Associated bird species Associated fauna and flora	Loss of bird diversity Loss of floral and faunal diversity Floods* Erosion*	Okaukuejo, Halali, Omuthiya, Outapi
* The likelihood of flooding or erosion depends on the surrounding landscape and is thus impossible to determine at this level. Refer to the descriptions per site to see the likelihood.			

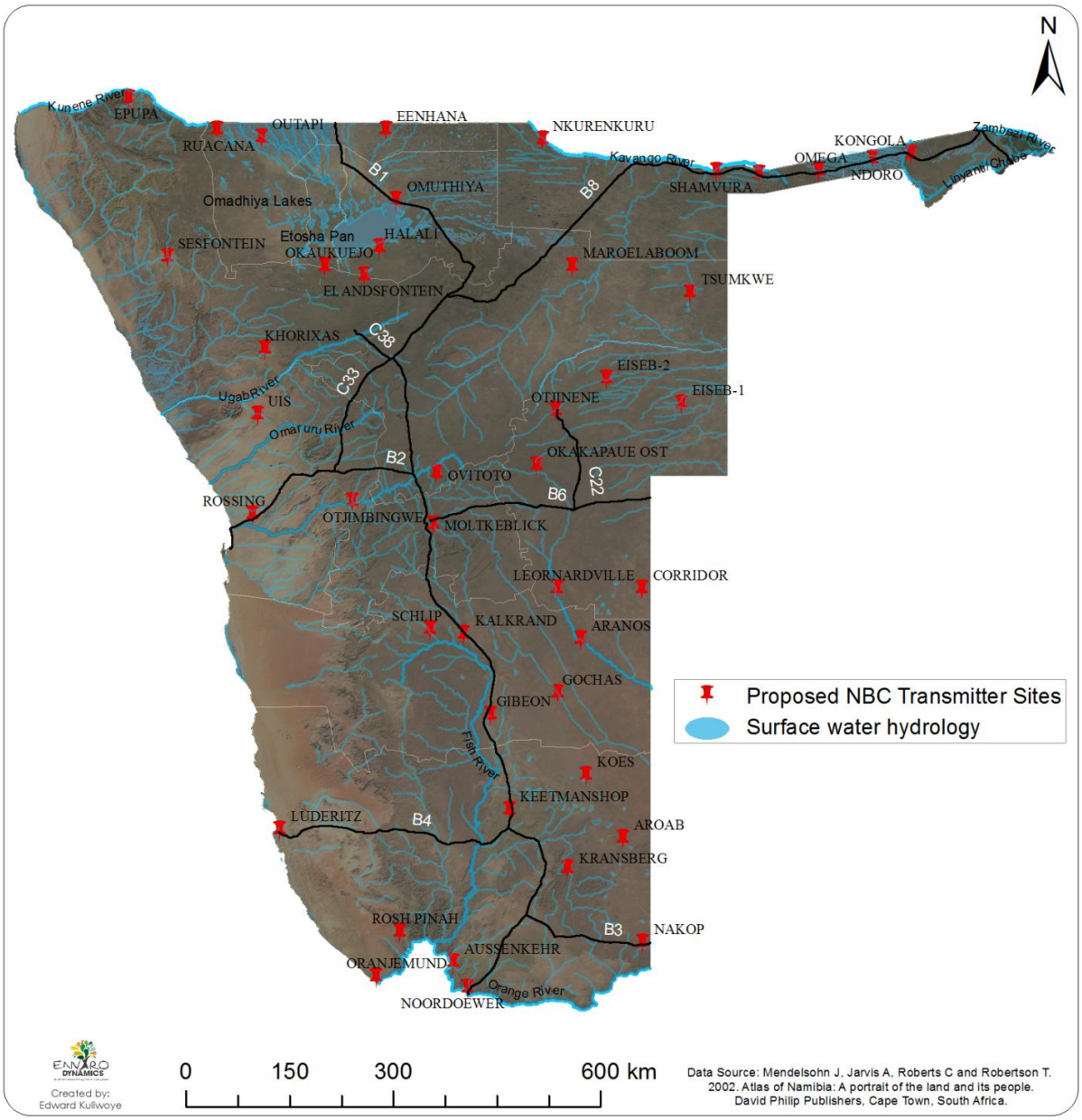


Figure 11: Surface water hydrology

6.2.4 Vegetation

Plant species play an important role in the functioning of ecological processes that maintain the health, productivity and beauty of the environment. Since plant diversity and endemic plant species may be affected by the position and erection of transmitters it is important to determine those areas that are particularly important in terms of plant diversity. The general principal should always by to minimise the disruption of plant cover no matter the status of the vegetation. Plant cover inter alia protects the soil from erosion and contributes to ensure water infiltration.

Biomes provide a useful way of distinguishing areas that share broadly similar plant life and climatic features. The following 5 biomes are distinguished in Namibia:

1. Lakes and Salt pans,
2. Nama Karoo,
3. Namib Desert,
4. Succulent Karoo, and
5. Tree-and-shrub Savanna.

Namibia's vegetation is strongly influenced by rainfall; therefore plant life is tallest and most lush in the north-east and progressively more sparse and short in the west and south. The largest biome Tree-and-Shrub Savanna is divided into Broadleaved Tree-and-shrub Savanna (that largely covers the deep Kalahari Sandveld) and Acacia Tree-and-shrub Savanna (which is characterised by large, open expanses of grasslands dotted with *Acacia* trees) (Mendelsohn, *et al*. 2009).

The Succulent Karoo Biome is an enormously important biome; it coincides with the parts that receive a small, but significant, amount of winter rain. This biome is recognised as one of the world's 25 biological hotspots, and is regarded as the most diverse desert on Earth with an exceptional high occurrence of endemic species. The biome is recognised as one of the world's richest succulent areas – it is estimated that 50 genera's out of a total of 160 belonging to the family *Mesembryanthemaceae* occur here with many of them endemic (SAN Parks, 2006). In the Sperrgebiet alone some 1,050 plants are known to occur – nearly 25% of the entire flora of Namibia, on less than 3% of land area of the country (Mendelsohn et al, 2009). Other important plant families include *Euphorbiaceae*, *Asclepiadiaceae* and *Liliaceae*.

On a surface area of one square kilometre, more than 360 flowering plant species are found at a site where the annual rainfall average 68 mm. A magnificent variety of dwarf shrubs and succulents with water-storing leaves occur in this biome (SAN Parks, 2006).

The pockets of with highest plant diversity are dispersed throughout Namibia in small areas where several different habitats are found close together, or in areas of transition between major habitats. Many of these high-diversity areas are associated with highlands or isolated hills and mountains due to the varied slopes and relief and numerous microclimates. Large numbers of endemic species are also associated with these habitats. Five of the proposed sites fall within areas of high plant biodiversity and endemism.

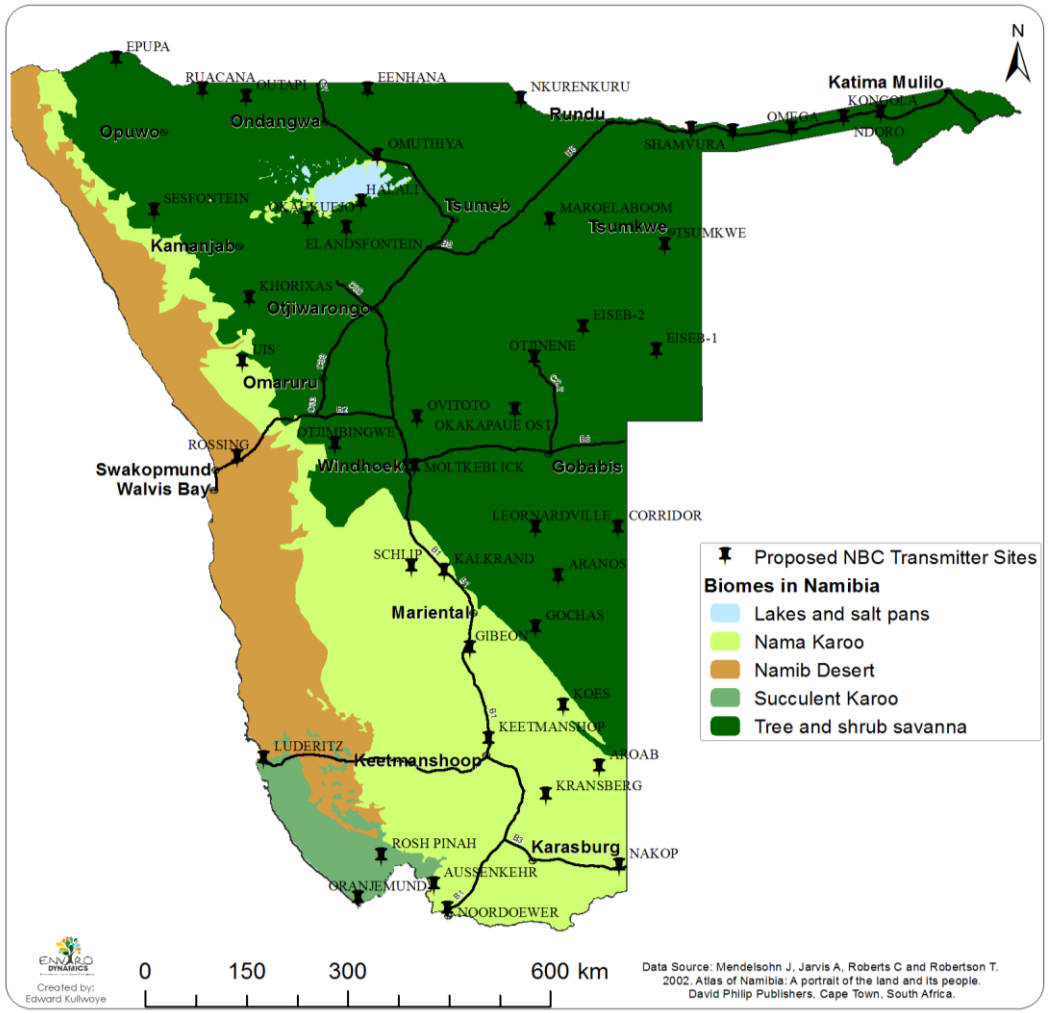


Figure 12: Biomes in Namibia

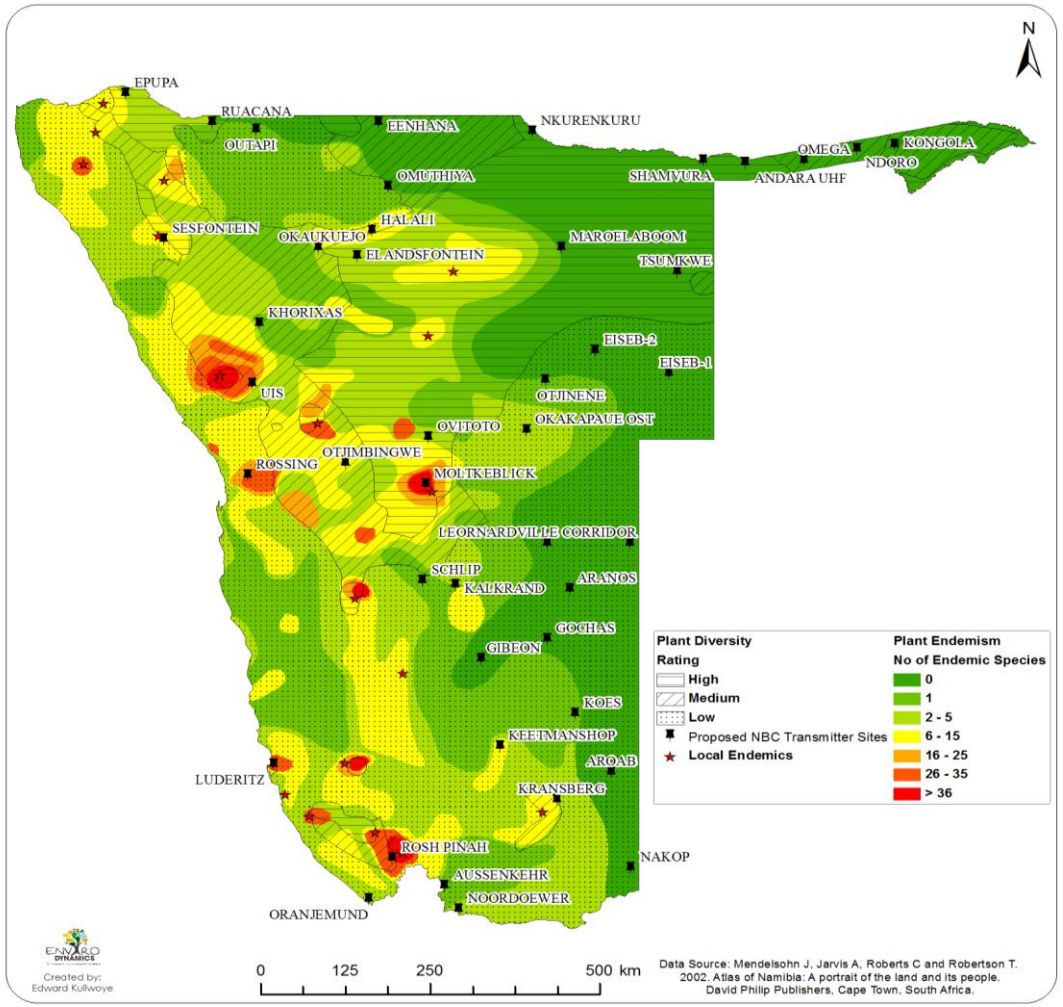


Figure 13: Overall Plant diversity and Endemism

Table 9 summarises the sensitivities and potential impacts associated with vegetation.

Table 9: Sensitivities and potential impacts related to vegetation

ENVIRONMENTAL FEATURE	SENSITIVITY	POTENTIAL IMPACT/ENHANCEMENT	SITES MOST LIKELY TO BE AFFECTED
Succulent Karoo Biome	Associated plant diversity Biodiversity Hotspot	Loss of plant diversity Loss of endemic plant species	Rosh Pinah, Lüderitz, Oranjemund, Aussenkehr
Drainage lines and River systems	Associated tree species	Loss of tree diversity	Epupa, Ruacana, Shamvura, Andara, Omega, Otjinene, Ndoro, Kongola
Koppies, ridges, inselbergs, escarpment, mountains	Associated high plant diversity	Loss of plant diversity Loss of endemic plant species	Otjimbingwe, Rössing, Sesfontein, Mölteblick, Uis

6.2.5 Reptiles

Reptile diversity is generally highest in a band that extends from the north-west eastwards into Otjozondjupa (**Figure 14**). There are over 60 species in this zone, in which much of the diversity is due to a mosaic of gravel plains, shrubland, inselbergs, mountains and other distinct habitats. There is also a concentration of diversity in Eastern Caprivi, up to 85 species, due to the occurrence of wetland species (Mendelsohn, *et al*. 2009). Marble outcrops and ridges are specifically vulnerable in terms of unique reptiles (Table 10).

Table 10: Sensitivity and potential impact related to reptiles

ENVIRONMENTAL FEATURE	SENSITIVITY	POTENTIAL IMPACT/ENHANCEMENT	SITES MOST LIKELY TO BE AFFECTED
Koppies, inselbergs, mountains, escarpment	Associated high reptile diversity	Loss of reptile diversity and endemism	Andara, Aranos, Aussenkehr, Elandsfontein, Epupa, Gibeon, Gochas, Okaukuejo, Halali, Khorixas, Koës, Kransberg, Leonardville, Lüderitz, Noordoewer, Omuthiya,

ENVIRONMENTAL FEATURE	SENSITIVITY	POTENTIAL IMPACT/ENHANCEMENT	SITES MOST LIKELY TO BE AFFECTED
			Otjimbingwe, Moltkeblick, Rosh Pinah, Ruacana, Schlip, Shamvura, Sesfontein, Uis
Eastern Caprivi	Associated wetland species	Loss of reptile diversity	

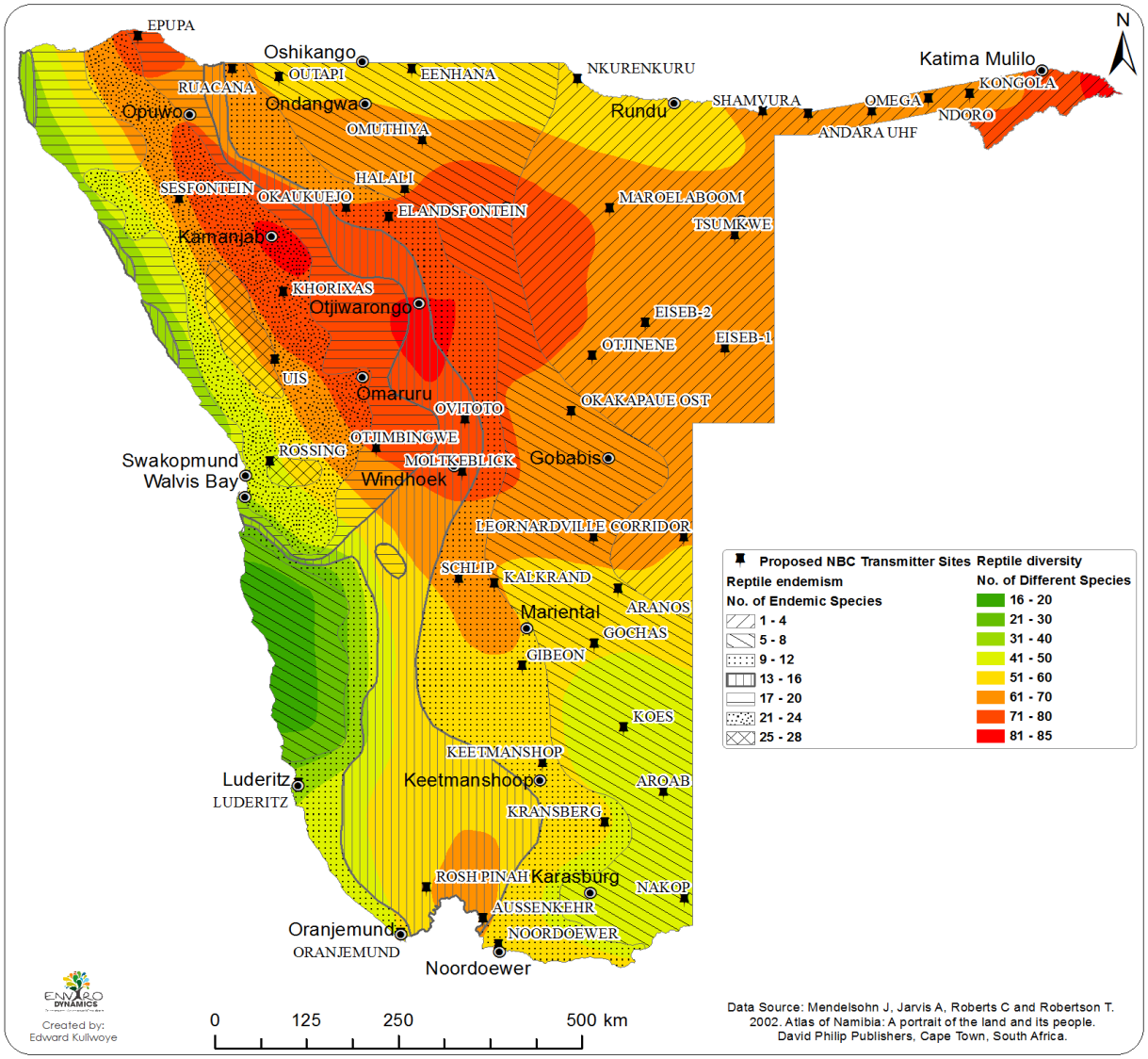


Figure 14: Reptile endemism and diversity distribution in Namibia.

6.2.6 Birds

Koppies, inselbergs, mountains and the escarpment are sensitive in terms of high biodiversity and endemism of birds. Pans, oshanas (Cuvelai system), rivers and floodplains (**Figure 15**) are also important bird areas and need to be avoided in the selection of sites (**APPENDIX C1**: Scott & Scott, 2011). According to Simmons *et al*. (1999) there are 21 Important Bird Areas (IBAs) in Namibia. 19 of these sites qualify as globally important sites; the remaining two are of sub-regional importance (**Error! Reference source not found.**). Important Bird Areas are those areas that are mportant for the long-term viability of bird populations across the entire range of each species. The sites are predominantly coastal, emphasising the importance of the Benguela current and coastal wetlands (**Table** 12).

Table 11: Important Bird Areas in Namibia

SITE NAME	IBA STATUS	CRITERIA USED TO SELECT SITE*	NBC SITE LOCATED IN OR CLOSE TO THE IBA
Cunene River mouth	SR	4	---
Epupa Ruacana	G	1,2,3	Epupa, Ruacana
Eastern Caprivi wetlands	G	1,3	Kongola, Ndoro
Mahango Game Reserve & Okavango River	G	1,3	Shamvura, Andara
Etosha National Park	G	1,3,4	Okaukuejo, Halali, Omuthiya, Elandsfontein
Hobatere	G	2,3	---
Bushmanland Pan system	G	1,3,4	Tsumkwe
Waterberg Plateau Park	G	1,3	---
Brandberg	G	2,3	Uis
Cape Cross Lagoon	G	1,4	---
Namib Naukluft	G	1,2,3,4	---
Mile 4 Saltworks	G	1,4	---
Walvis-Swakopmund	G	1,4	---
Walvis Bay	G	1,4	---
Sandwich Harbour	G	1,4	---
Hardap Nature Reserve	SR	4	---
Mercury island	G	1,4	---
Ichaboe Island	G	1,4	---
Lüderitz bay Islands	G	1,4	Lüderitz

Possession Island	**G**	**1,4**	**---**
Sperrgebiet	**G**	**1,2,3,4**	**Oranjemund**

*SR = Sub regional, G=global; 1 includes threatened species, 2includes restricted-range species, 3biome-representative site, 4wetland site

Since birds are effective indicators of biodiversity in other plant and animal taxa it is important to conserve the IBA network in order to ensure the survival of a correspondingly large number of other taxa (Simmons *et al.* 1999).

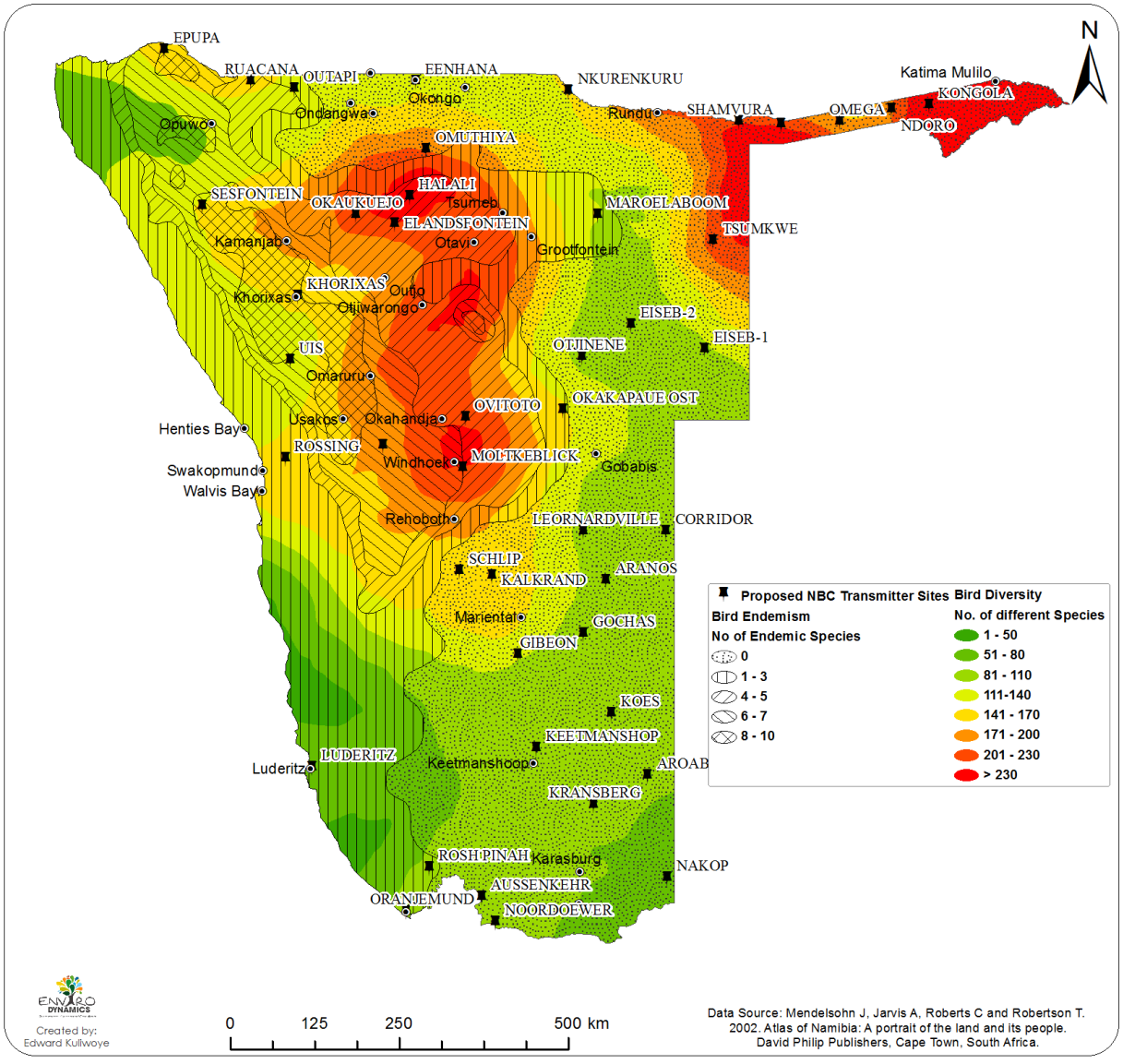


Figure 15: Overall Bird diversity and endemism

Table 12: Sensitivities and potential impacts related to birds

ENVIRONMENTAL FEATURE	SENSITIVITY	POTENTIAL IMPACT/ENHANCEMENT	SITES MOST LIKELY TO BE AFFECTED
Rivers	Associated bird species Breeding and nursery sites for birds	Loss of bird diversity and endemism	Aranos, Kongola, Ndoro, Andara, Shamvura, Epupa, Ruacana
Pans, floodplains, wetlands and oshanas.	Associated bird species Breeding and nursery sites for birds	Loss of bird diversity Collisions of birds with stay wires	Okaukuejo, Halali, Elandsfontein, Okapaue Ost, Omuthiya, Otjinene, Tsumkwe
Important Bird Areas	Long term viability of bird species	Loss of specific bird species Collision of bird species with stay wires	Epupa, Ruacana, Kongola, Ndoro, Shamvura, Andara, Uis, Okaukuejo, Halali, Omuthiya, Tsumkwe, Lüderitz, Oranjemund

6.3 Socio economic Profile

6.3.1 Population Density

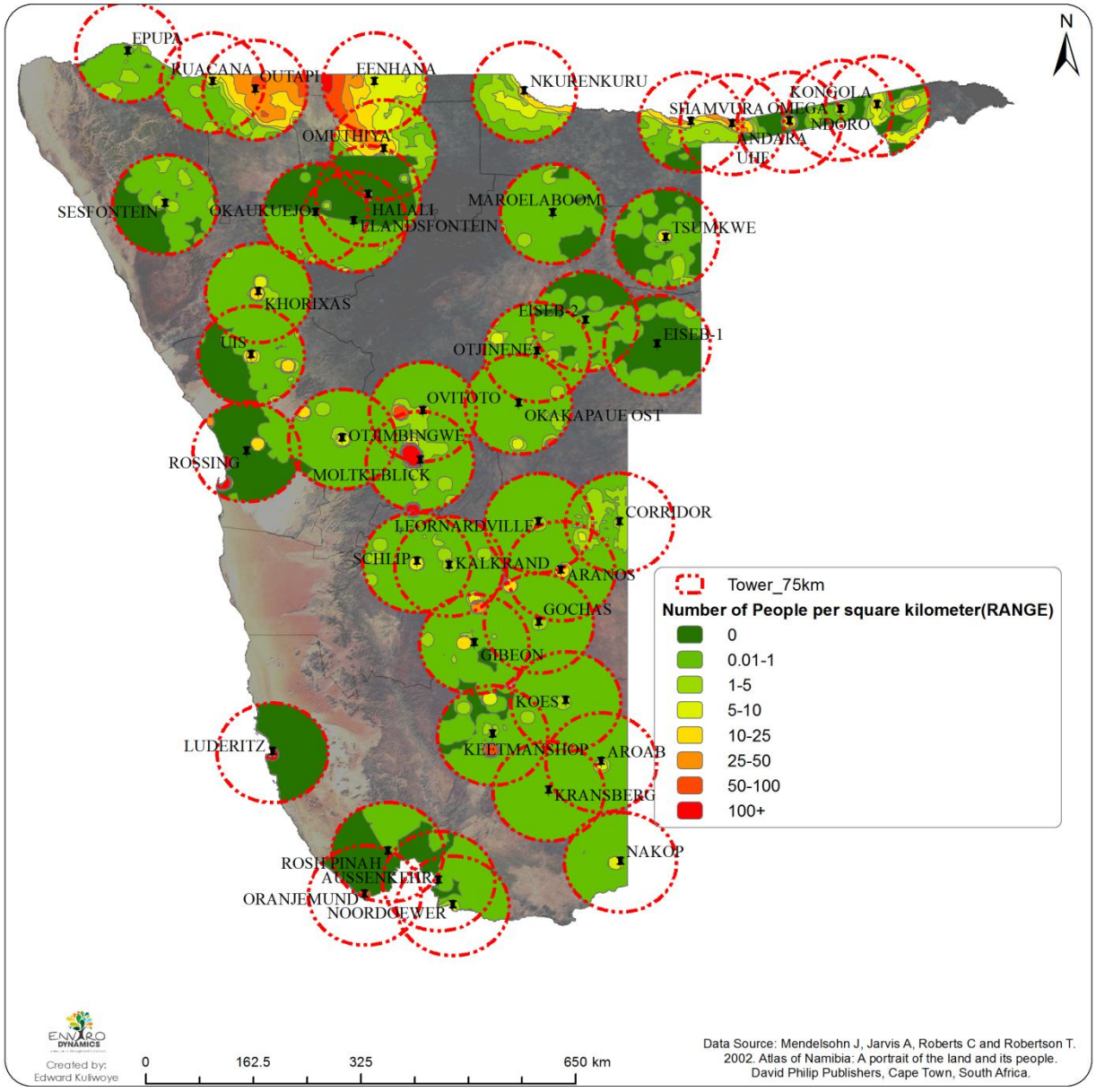
According to the 2011 National Housing and Population Census, Namibia has a population of 2 113 077 people. The population is spread unevenly across the country, with some areas very densely populated whereas others are uninhabited or sparsely populated.

As explained in the Atlas of Namibia (2002), settlement patterns in Namibia are determined by factors that include:

- *Availability of natural resources* such as drinking water, areas suitable for crop cultivation and grazing pastures for livestock. Hence, the high population density in the North-Central areas of Namibia along the Cuvelai Drainage System.
- *Availability of employment and business opportunities*, which explains immigration to urban centres. In 2011, 43% of Namibia's population resided in urban areas.
- Availability *of transport, water and other services* that are evident in the Kavango and Caprivi regions where people cluster along the main roads.

Figure 16 displays the population density for a 75km radius from each proposed tower. The red areas have the highest population density with more than 100 people/ km^2 within the coverage area. The high population densities can be explained by being located near urban centres, or within the Cuvelai Drainage System.

The dark green areas are where one may expect the lowest population densities. These areas can be ascribed to the towers either being located on freehold agricultural land or in areas with harsh environmental and climatic conditions which limits habitation.



[1] **Figure 16 : Population density within a 75km radius of each proposed transmitter.**

6.3.2 Land Uses

Landownership in Namibia can be divided into three categories: 56% of the land is owned by central government, 0.9% by local authorities and 43.3% by companies or private individuals (Mendelsohn et al, 2002). **Figure 17** displays the various types of land uses by these owners, the clear majority of the land being used for agriculture, whether on commercial freehold or communal land. Land uses relevant to the locality of the proposed NBC towers are highlighted in the sections below.

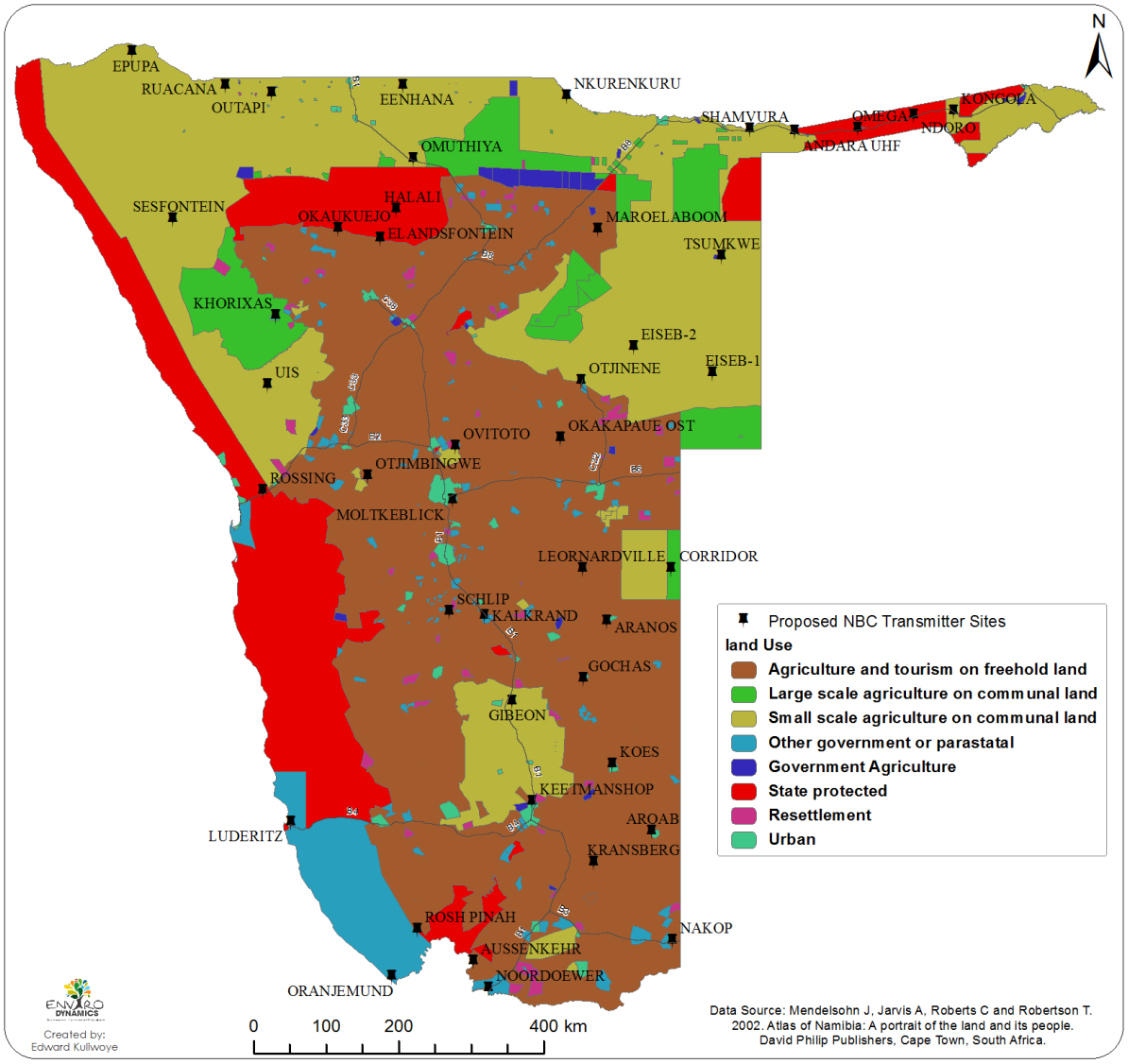


Figure 17 : Various land uses

[1] At the time of printing, the latest 2011 census data were not yet available in GIS format. Therefore, the information used in Figure 16 is based on the 2001 census data.

a) Agriculture and Tourism on Freehold Land

Agriculture on freehold land is dominated by livestock farming, mainly sheep and cattle for the Namibian meat market as well as for export. In addition, commercial rain-fed crop cultivation can be found in the Tsumeb-Otavi-Grootfontein triangle where maize is grown as the predominant crop (Mendelsohn et al. 2002).

These commercial farms also include hunting and game viewing farms, guest farms and lodges frequented by tourists from all over the world. Both commercial farming and tourism are significant contributors to the Namibian economy.

b) Large and Small Scale Agriculture on Communal Land

According to Mendelsohn et al (2002), an estimated 71% of Namibians live in rural areas and are likely to practice subsistence farming. Crops such as mahangu, sorghum and maize are cultivated while cattle and goats are also herded on these farms. The produce from communal farms are either used for personal consumption or sold at local markets, while livestock is seen as a form of capital investment, used for draught power, meat and milk production or to sell commercially. Agriculture on communal land is a key livelihood strategy for many rural people, making them vulnerable to any threats or disturbances to this practice.

c) State Protected Land

Large areas of land in Namibia have been set aside for conservation in the form of national parks of game reserves with regulations for all activities which have to be adhered to. In addition, some communal land has been declared as conservancies where the natural resources are protected and managed to benefit those members living in the conservancy. In 2004 conservancies in Namibia had an income of more than N$14 million (Wildlife Conservancies, 2011). The national parks such as the Bwabwata National Park in the Caprivi Strip and the Etosha National Park, along with game reserves and conservancies, play a key role in tourism in Namibia, which in turn is a valuable contributor to the Namibian economy. Tourism brings income and foreign currency to the country, while also creating thousands of jobs. Thus, unspoiled landscapes and open wilderness along with a diversity of wildlife, holds economic value and should therefore be protected (Mendelsohn et al, 2002).

d) Other Government and Parastatal Uses

Some areas in Namibia are used by the government or parastal companies mainly for mining and fishing, important pillars in the Namibian economy. The south western corner of Namibia is known as the Sperrgebiet, and is where diamonds are mined. The closed mining town of Oranjemund is located in this area. Walvis Bay in turn is home to Namibia's largest harbour, fishing factories and related industries. This port is managed by the Parastatal known as NamPort.

6.3.3 Conservation, Parks and Tourism

As noted in the Atlas of Namibia (2002), it is Namibia's wildlife, scenery and solitude that attract many tourists to this country. Tourism in Namibia has increased over the years. This is reflected in that 254,978 people visited Namibia in 1993, increasing to 833,350 visitors in 2006 (Shangula, 2007).

According to the Permanent Secretary of the Ministry of Environment and Tourism, this industry benefits the country in the following ways with figures for the year 2006:

- Foreign exchange earnings (amounting to 4.2 billion)
- Job creation (an estimated 71,800 jobs, directly and indirectly)
- Contribution to National Income (3.7% of total GDP)
- Contribution to Government Revenues (a total of N$120 851 930.91 generated through park fees, film fees, wildlife registration and licenses, tourism concessions, etc.)

Namibia is renowned for its Community Based Natural Resource Management (CBNRM) programmes amongst conservancies. In 2006, CBNRM generated more than N$24 million, benefiting many of the conservancy community members (Shangula, 2007).

The tourism potential of different areas in Namibia is displayed in **Figure 18**. According to this map and information from Mendelsohn et al (2002), the areas with the highest tourism potential are in eastern Otjozondjupa, the Etosha National Park and some areas in the Kunene region.

A large part of the tourism potential areas are also registered communal conservancy areas.

It is clear that tourism plays an important role in sustaining many livelihoods and the Namibian economy. Hence, the wildlife and undulating landscapes of the country should be conserved and protected.

The table below (**Table 13**) highlights the key sensitivities related to the Socio-economic Environment in which the proposed project will take place. The potential impacts are also identified.

Table 13: Sensitivities and potential impacts related to the socio-economic environment.

ENVIRONMENTAL FEATURE	SENSITIVITY	POTENTIAL IMPACT/ENHANCEMENT
Population density	High density areas	The most number of people are likely to receive coverage in the areas with the highest density.
		The higher the number of sensitive receptors, the higher the visual impact resulting from the proposed towers.
		The higher the density, the higher the number of people to be affected by radiation which might call for relocation.
Agriculture and Tourism on Freehold Land	Distance to tower and density	Disturbance to the visual amenity for land owners and tourists. The impact increases as the number of sensitive receptors increases.
Agriculture on Communal Land	Distance to tower	Disturbance to crop fields during construction.
Agriculture on Communal Land	Distance to tower and density	Disturbance to visual amenity and sense of place, impacting on tourism within CBNRM areas.
Aviation	Distance from airstrips Planned aviation routes	Collisions with towers Interference with aviation regulations
State Protected Areas	Natural Resources	Disturbance to natural resources and wildlife, as well as visual amenity and sense of place impacting negatively on tourism.
Tourism and Conservation	Undulating, unspoiled landscapes	Disturbance to the visual amenity and sense of place of areas with high tourism potential, affecting the tourism in that area.

Additional positive socio-economic impacts have also been identified and listed below. As these are positive impacts, no mitigation or management measures have been identified neither has a sensitivity aspect been applied. The positive impacts have been identified as:

- Possible additional employment opportunities;
- Increased sustainability of existing employment profiles associated with the proposed project;

- Increased national cohesion of the Namibian state;
- Increased information accessibility within new and existing geographical areas of Namibia;
- Hopes and aspiration of previously "un-served communities"; and
- Aspirations for the future for all citizens of Namibia.

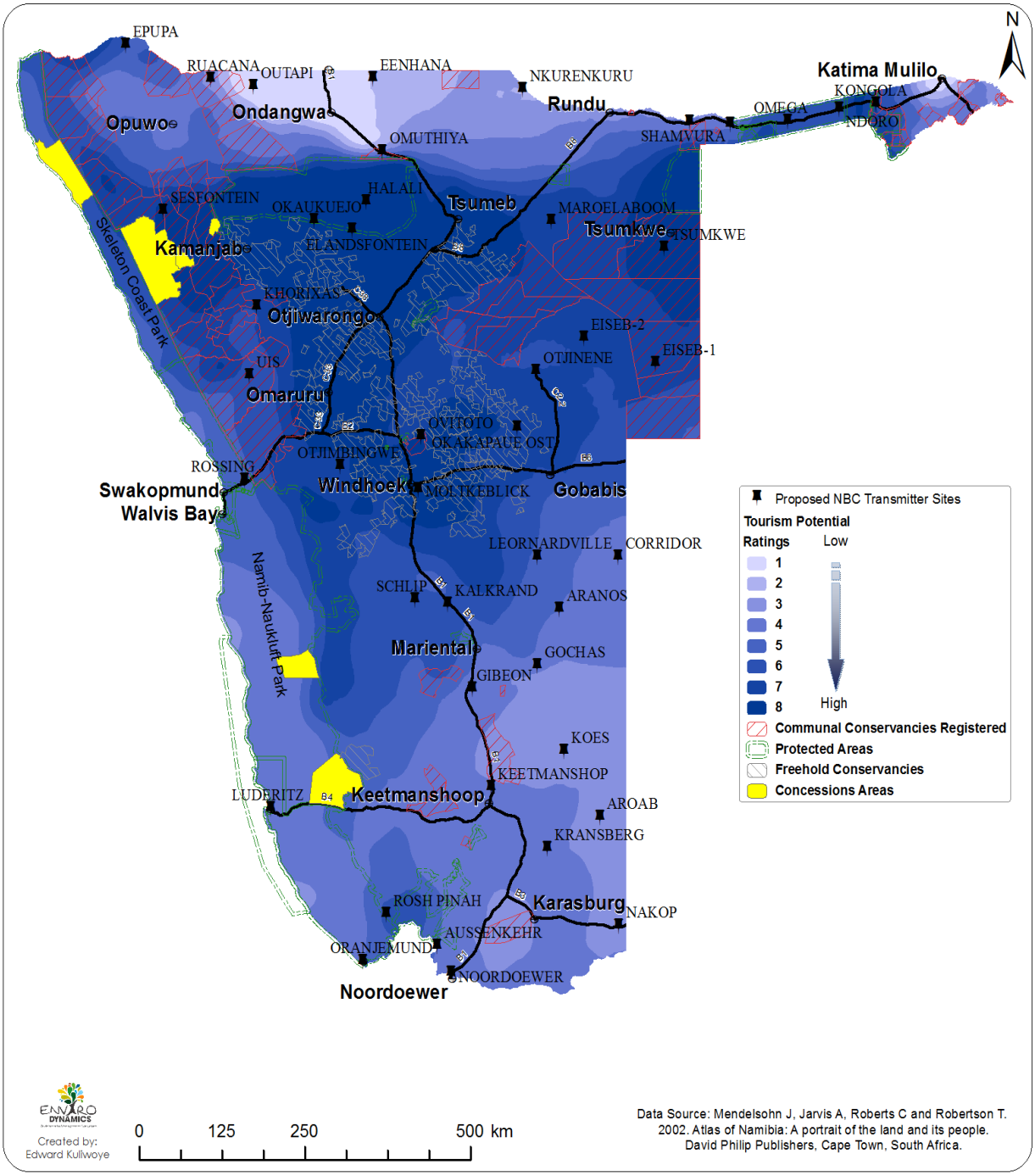


Figure 18: Conservation, Parks and Tourism Potential Areas

6.3.4 Archaeology

Namibia has an archaeological sequence spanning most of the last one million years. This evidence is of both regional and global significance as it is crucial to our understanding of several key developments in human history, including the early spread of ancestral humans and their adaptation to extremely arid climatic conditions. Intensive field survey and excavation has yielded several thousand archaeological sites, in Namibia. These range from early Pleistocene ESA (Early Stone Age) sites and mid-Pleistocene MSA (Middle Stone Age) sites, generally surface scatters of stone artefact debris; Holocene LSA (Later Stone Age) sites, often including natural shelters with rock art; recent pastoral, farming and meal working sites CE (Common Era). The country however remains incompletely explored. Field surveys are routinely carried out for large projects and these contribute to the documented archaeological record. As this knowledge increases it becomes possible to predict impacts and target field surveys (**APPENDIX C2**: Kinahan, 2011).

Unfortunately, little archaeological research has been done on the eastern and northern parts of Namibia, hence little information is available on archaeology in these areas. Many sites with rock paintings and engravings have been uncovered and are today also popular tourist attractions. Other artefacts include metal workings and pottery. Archaeological sites provide one with information or snapshots of the past and should be protected and preserved (Mendelsohn, *et al.* 2009).

For this very reason, deciding whether one site is more "conservation worthy" than another is a very difficult undertaking and requires a comprehensive understanding of archaeology. By relying on GIS data and other available information, Kinahan (2011) was able to assess each NBC mast site. The criteria used included:

- ***Expected local density of archaeological sites:*** Ranging from "*unknown*" (mast sites where no comparative data were available), to "*high*", where available data showed that the general area might yield high local densities. For these purposes, "high" density is more than 5 sites/km^2; "medium" is 2 sites/km^2, and "low" is <1 site/km^2.
- ***Estimated archaeological significance and vulnerability***: Using separate interval scales developed for this type of assessment in Namibia, the significance and vulnerability values were combined in a matrix (**Figure 19**). The inferred archaeological sensitivity is expressed on a scale of 1 (lowest) to 25 (highest). These combined values weigh the significance of the site against the potential loss (vulnerability) of

archaeological information (Kinahan, 2011). Least sensitive are sites of low significance that are under no direct threat; whereas most sensitive are highly significant sites that are under direct and certain threat (**Table 14**).

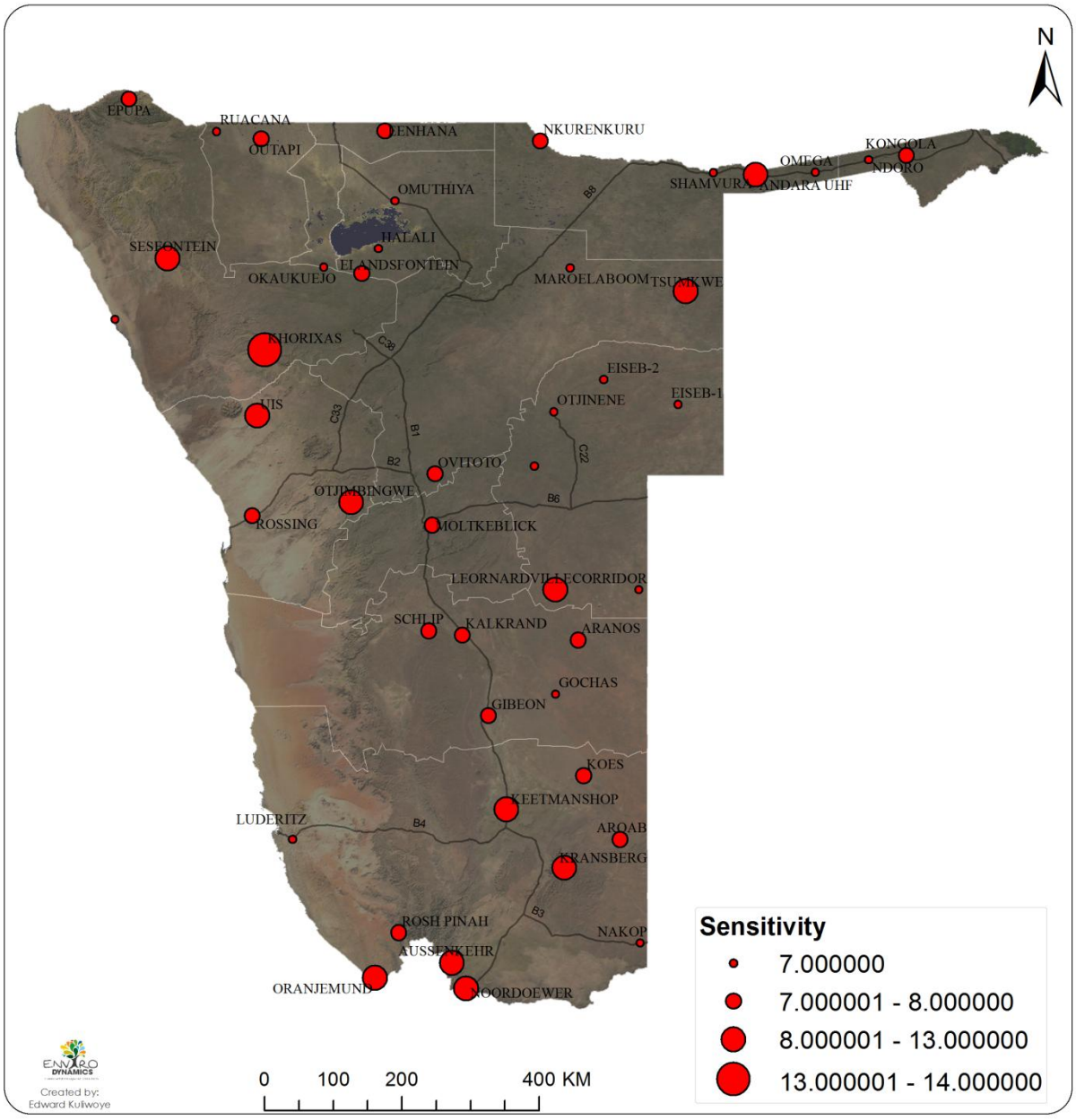


Figure 19: Archaeological sensitivity of sites based on a combination of significance and vulnerability rating, expressed on a scale of 1 (lowest) to 25 (highest).

Table 14: Sensitivity and potential impact related to archaeology

ENVIRONMENTAL FEATURE	SENSITIVITY	POTENTIAL IMPACT/ENHANCEMENT	SITES MOST LIKELY TO BE AFFECTED
Heritage	Archaeological sites	Disturbance to archaeological sites, especially during construction.	Aroab, Andara, Tsumkwe, Noordoewer, Aussenkehr, Oranjemund, Otjimbingwe, Uis, Khorixas, Sesfontein.

6.3.5 Radiation

A specialist was contracted to carry out an investigation of the possible RF Radiation risks related to the erection of new masts, and the transmission of DTT signals, as detailed in the National DTT Transmission Network plan (**APPENDIX C3:** Cosburn, 2011).

The proposed transmission strengths and frequencies required by the National DTT Transmission Network plan have been used to calculate a radius from each mast where RF radiation from proposed DTT transmissions would be within acceptable limits. While immediate reductions in RF radiation are typical at analogue switch off, it is expected that the new mast infrastructure may also be attractive to other operators. The exact nature of these services cannot be predicted, but increases in RF radiation are to be expected. As the positions of the towers are fixed (but still flexible to accommodate/avoid local fixtures), and the proximity of existing settlements known, calculations were made to predict RF radiation limits that would keep RF radiation levels within acceptable limits in these areas.

Since no standards on RF radiation levels have been formally adopted in Namibia, the International Commission on Non-Ionizing Radiation Protection (ICNIRP) standards have been used as a benchmark, and the precautionary principle as suggested in the Bio Initiative Report has also been considered. RF emission safety standards would best be handled by the regulator, Communications Regulatory Authority of Namibia (CRAN), and it is recommended that a standard be adopted as soon as possible, to provide guidelines in an as yet unregulated area of RF use.

Generally, most RF radiation exposure of the public is far below levels necessary to produce significant heating effects. However, limits or other restrictive measures should be put in place to prevent exposure to potentially harmful EMF levels.

Due to the low RF exposure levels in areas not directly adjacent to transmission towers, it is not expected that the RF radiation from these towers will have any significant impact on the biodiversity in the transmission footprint, so the focus is on

human settlements, and the safety of RF levels in these areas (**Table 16**). The precautionary distance for RF Radiation level as considered safe by the ICNIRP standard of 0.2 miliwatt/cm^2 for the NBC transmitter sites is between 2.59 and 40.22 meters (Cosburn, 2011).

Table 15: Maximum Permissible Exposure (MPE) for each Transmission Site

SITE #	TRANSMITTER SITE NAME	MAXIMUM PERMISSIBLE EXPOSURE (MPE)* LIMIT RADIUS (M)
L1-1	EPUPA	3.78
L1-1	KHORIXAS	28.11
L1-1	RUACANA	29.61
L1-1	SESFONTEIN	20.69
L1-1	TERRACE BAY	2.28
L1-1	UIS	4.98
L1-2	MOLTKEBLICK	42.16
L1-2	MONTE CHRISTO	15.22
L1-2	OTJIMBINGWE	10.49
L1-2	OVITOTO	4.47
L1-2	ROSSING	19.76
L1-3	EISEB-1	4.46
L1-3	EISEB-2	4.46
L1-3	OKAKAPAUE OST	17.23
L1-3	OMITARA	8.16
L1-3	OTJINENE	18.52
L2-1	AUSSENKEHR	4.23
L2-1	NAKOP	10.55
L2-1	NOORDOEWER	5.71
L2-1	ORANJEMUND	7.19
L2-1	ROSH PINAH	4.60
L2-2	AROAB	11.55

SITE #	TRANSMITTER SITE NAME	MAXIMUM PERMISSIBLE EXPOSURE (MPE)* LIMIT RADIUS (M)
L2-2	GIBEON	24.37
L2-2	KIRIIS-OST	17.28
L2-2	KOëS	8.17
L2-2	LÜDERITZ	16.50
L2-3	ARANOS	11.55
L2-3	CORRIDOR	15.85
L2-3	GOCHAS	11.55
L2-3	KALKRAND	14.63
L2-3	LEORNARDVILLE	9.96
L2-3	SCHLIP	18.52
L3-1	EENHANA	17.78
L3-1	ELANDSFONTEIN	13.19
L3-1	HALALI	8.40
L3-1	OKAUKUEJO	11.01
L3-1	OMUTHIYA	23.72
L3-1	TSUMEB	1.90
L3-2	MAROELABOOM	12.81
L3-2	NKURENKURU	24.92
L3-2	SHAMVURA	22.52
L3-2	TSUMKWE	5.59
L3-3	ANDARA UHF	40.22
L3-3	KONGOLA	7.05
L3-3	NDORO	8.77
L3-3	OMEGA	4.31

The maximum permissible exposure (MPE) is the highest power or energy density (in W/cm2 or J/cm2) of a light source that is considered safe i.e. that has a negligible probability for creating damage.

For this project, sites were placed at a precautionary distance of 3 km from any populated area. Where this was impossible, additional mitigation measures such as tilting the beam have been recommended. The key sensitivity associated with radiation exposure is listed in the table below

Table 16: Key sensitivities related to radiation exposure

FEATURE	SENSITIVITY	POTENTIAL IMPACT	SITES MOST LIKELY TO BE AFFECTED
Population density	Distance to tower and density	Exposure to harmful radiation if in a radius of 40.22 m from settlements.	None of the sites are located less than 1 km from any settlement. The sites less than the precautionary distance of 3km are: Andara, Aranos, Aussenkehr, Corridor, Eiseb 1&2, Gochas, Khorixas, Leonardville, Lüderitz, Okapaue Ost, Outapi, Ovitoto, Rosh Pinah, Ruacana, Schlip, Shamvura, Tsumkwe, Uis.

The following Section describes how the various sensitivities identified in this section are used to determine the overall sensitivity rating of each of the sites. It also elaborates on how the mitigation hierarchy (**Figure 5**) can be applied to avoid highly sensitive sites and mitigate residual impacts.

7 BIOPHYSICAL AND SOCIAL SENSITIVITIES

7.1 Expected sensitivity ratings

Table 17 represents the expected sensitivity ratings of the various sites in terms of the reptiles, birds, vegetation, visual resources, archaeology and potential radiation. These ratings are based on specialist input and secondary sources (like scientific publications). Once these were assigned per environmental variable, an expected overall sensitivity rating (low, medium and high) was assigned to each site.

If the potential impact can be mitigated on site and the sensitivity consequently reduced, the site was rated medium or low (depending on its ability to be mitigated). However, if the potential impact cannot be mitigated and the sensitivity is expected to remain high post mitigation, the site was rated high.

Table 17: Overall expected sensitivity rating for each of the sites based on ratings for identified environmental features

Lots	Locality	Expected sensitivity rating (low, medium, high)							Expected overall Sensitivity
		Reptiles	Birds	Vegetation	Visual	Archaeology	Radiation	Aviation	
L3-3	ANDARA UHF	Medium	High	Medium	Low	Medium	Medium	Low	Medium
L2-3	ARANOS	Low	Medium	Low	Low	Low	Low	Low	Medium
L2-2	AROAB	Low	Medium	Low	High	Low	Low	Low	Medium
L2-1	AUSSENKEHR	High	Low	Low	High	High	Low	Low	Medium
L2-3	CORRIDOR	Low	Low	Low	Low	Low	Medium	Low	Medium

Lots	Locality	Expected sensitivity rating (low, medium, high)							Expected overall Sensitivity
		Reptiles	Birds	Vegetation	Visual	Archaeology	Radiation	Aviation	
L3-1	EENHANA	Low	Medium	Low	Low	Low	Low	Low	Medium
L1-3	EISEB-1	Low	Medium	Low	Low	Low	Medium	Low	Medium
L1-3	EISEB-2	Low	Medium	Low	Low	Low	Medium	Low	Medium
L1-1	EPUPA	High	Medium	Medium	Medium	Low	Low	Low	Medium
L2-2	GIBEON	Low	Low	Low	High	Low	Low	Low	Low
L2-3	GOCHAS	Low	High	Low	Low	Low	Medium	Low	Medium
L3-1	**HALALI**	**High**	**High**	**Medium**	**High**	**Low**	**Medium**	**High**	**High**
L2-3	KALKRAND	Low	Medium	Low	Medium	Low	Low	Low	Medium
	KEETMANSHOOP	Low	Low	Low	Medium	Low	Low	Low	Low
L1-1	KHORIXAS	Medium	Medium	Low	Medium	High	Low	Low	Medium
L2-2	KOËS	Low	Medium	Low	Medium	Low	Low	Low	Medium
L3-3	KONGOLA	Medium	High	Medium	Medium	Low	Medium	Low	Medium
	KRANSBERG	Medium	Medium	Low	Low	Low	Low	Low	Medium
L2-3	LEORNARDVILLE	Low	Low	Medium	Medium	High	Medium	Low	Medium
L2-2	LüDERITZ	High	Medium	Medium	Medium	Low	Medium	Low	Medium
L3-2	MAROELABOOM	Low	Medium	Medium	Low	Low	Low	Low	Medium

Lots	Locality	Expected sensitivity rating (low, medium, high)							Expected overall Sensitivity
		Reptiles	Birds	Vegetation	Visual	Archaeology	Radiation	Aviation	
L1-2	**MOLTKEBLICK**	**High**	**High**	**High**	**High**	**Low**	**Low**	Low	**High**
L2-1	NAKOP	Medium	Low	Low	High	Low	Low	Low	Medium
L3-3	NDORO	Low	Medium	Medium	Low	Low	Low	Low	Medium
L3-2	NKURENKURU	Medium	Low	Medium	Low	Low	Medium	Low	Medium
L2-1	NOORDOEWER	High	Medium	Low	Medium	High	Low	Low	Medium
L1-3	OKAKAPAUE OST	Low	Medium	Low	Low	Low	Low	Low	Medium
L3-1	**OKAUKUEJO**	**High**	**High**	**Medium**	**High**	**Low**	**Low**	**Medium**	**High**
L3-3	OMEGA	Low	Medium	Low	Medium	Low	Low	High	Medium
L3-1	OMUTHIYA	Low	Medium	Low	Medium	Low	Medium	Low	Medium
L2-1	**ORANJEMUND**	**High**	**Medium**	**Low**	**High**	**High**	**Medium**	**High**	**High**
L1-2	OTJIMBINGWE	Medium	Low	High	Low	High	Medium	Low	Medium
L1-3	OTJINENE	Low	Medium	Low	Low	Low	Low	Low	Medium
L1-1	OUTAPI	Low	Medium	Low	Low	Low	Low	Low	Medium
L1-2	OVITOTO	Low	Medium	Medium	Low	Low	Low	Low	Medium
L2-1	ROSH PINAH	High	Medium	High	Low	Low	Low	Low	Medium
L1-2	**RÖSSING-2**	**High**	**High**	**High**	**Medium**	**Low**	**Low**	Low	**High**

Lots	Locality	Expected sensitivity rating (low, medium, high)							Expected overall Sensitivity
		Reptiles	Birds	Vegetation	Visual	Archaeology	Radiation	Aviation	
L1-1	RUACANA	High	Medium	Medium	Low	Low	Medium	Low	Medium
L2-3	SCHLIP	Medium	Low	Low	High	Low	Low	Low	Medium
L1-1	SESFONTEIN	Medium	Medium	Medium	Low	High	Low	Low	Medium
L3-2	SHAMVURA	High	Medium	Medium	Low	Low	Medium	Low	Medium
L3-2	TSUMKWE	Medium	High	Medium	Low	High	Low	Low	Medium
L1-1	UIS	Low	Medium	Medium	Low	High	Low	Low	Medium

Figure 20 indicates the overall expected sensitivity rating for each of the sites.

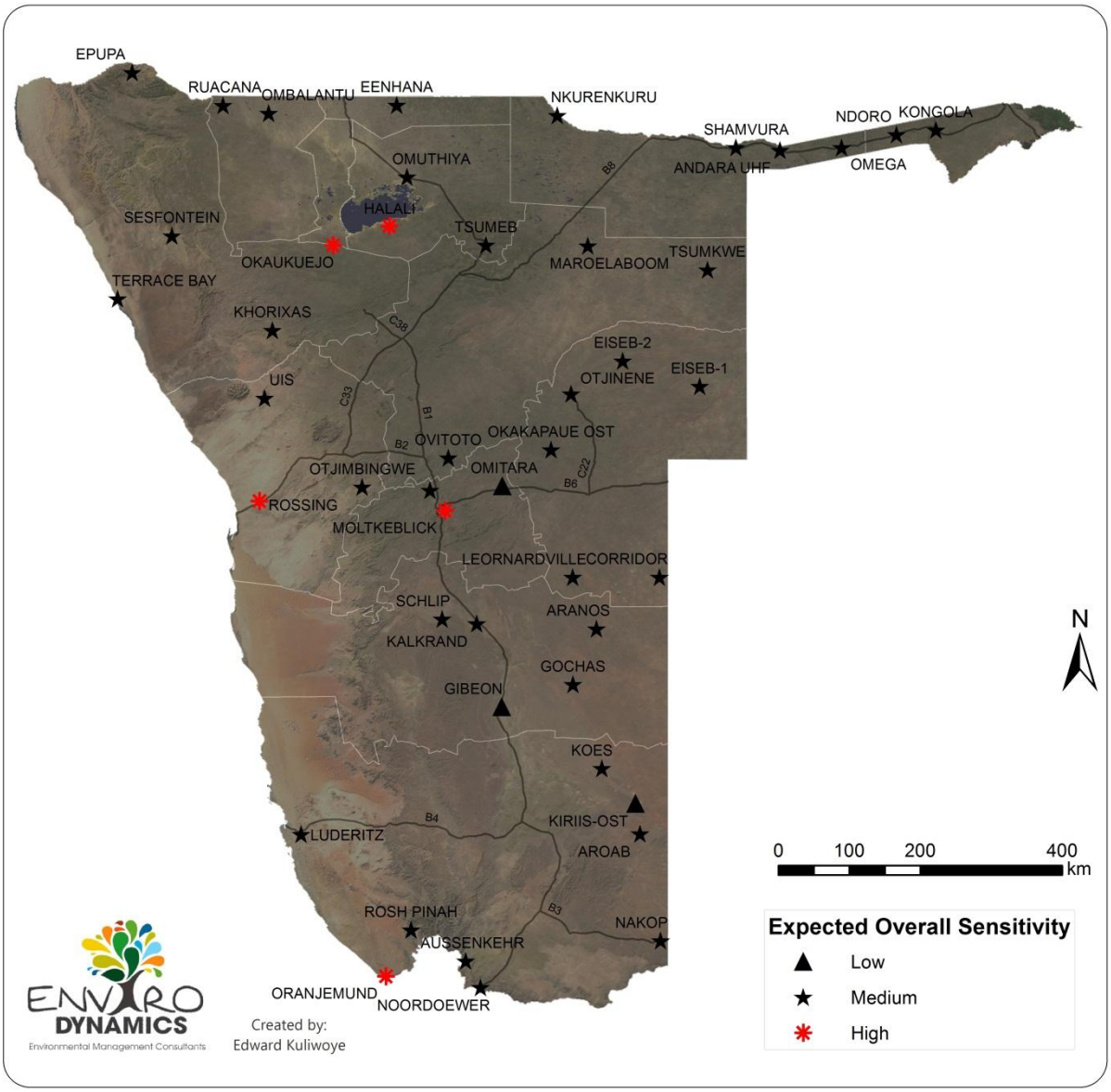


Figure 20: Overall expected sensitivity of each of the transmitter sites within Namibia

7.2 Verified sensitivity ratings

Site visits were undertaken to validate (i.e. ground-truth) the predictions made during the specialist studies and to apply changes to the site locations or design where necessary. The mitigation hierarchy concept has been explained in **Section 3.2** and illustrated in **Figure 5.** Based on this concept, priority was given to avoiding the most significant impacts through alternative site selection. The position of the mast was subsequently determined by selecting a location that would ensure optimised coverage whilst exerting the lowest possible environmental impact.

The sensitivity of each site was assessed according to the table below (**Table 18**).

Table 18: Sensitivity rating of site

	LOW	MEDIUM	HIGH
Description	The site is not sensitive at all. No additional specialist studies are required.	The site is moderately sensitive and although specialist inputs are not required, it requires specific management measures.	The site has sensitive elements that need to be further investigated by a specialist. Sites that have a "high" sensitivity rating should only be used as the preferred alternative once all other options have been eliminated.
Implication	Generic EMP is sufficient.	An additional appendix is required to the document that contains site specific mitigation measures.	Specialist investigations are required in an EIA separate from the SEA.

7.2.1 Description of high sensitivity sites

The five sites with a **HIGH** overall expected sensitivity are:

- Halali,
- Okaukuejo,
- Moltkeblick,
- Rössing and
- Oranjemund

By applying the mitigation hierarchy to the highly sensitive sites, avoidance is the first priority to reduce the expected sensitivity (Table 19).

Table 19: Applying mitigation hierarchy to highly sensitive sites

Highly sensitive sites	Avoidance	Rationale	Reduce and repair on site
Rössing 2	X	Site too sensitive in terms of biodiversity. Alternative site needs to be found.	Full EIA with EMP required Rehabilitation plan

Highly sensitive sites	Avoidance	Rationale	Reduce and repair on site
Moltkeblick	✓	Site too sensitive in terms of biodiversity. Alternative site investigated at Gross Herzog.	Full EIA with EMP required
Oranjemund	✓	Site too sensitive in terms of biodiversity, visual and civil aviation. Alternative site needs to be found.	Full EIA with EMP required
Halali	✓	Local alternative available	Replace both sites with Elandsfontein.
Okakuejo	✓	Local alternative available	

At Halali and Okakuejo the sensitivities can be avoided by moving the proposed sites to an alternative location. Elandsfontein is situated outside the southern border of the Park on a recently re-settled farm. The topography is very flat, but should the mast be constructed high enough it could service both Halali and Okaukuejo. Elandsfontein was assessed and it was concluded that, due to farming activities previously conducted on the farm, the site is not as sensitive as Halali and Okaukuejo.

All possible alternative sites, which might provide the required coverage for the Moltkeblick, Oranjemund and Rössing, were considered but were not suitable from a technical or environmental point of view (refer to **VOLUME 2** of this report).

As a result the Moltkeblick site has been eliminated and the possibility of adding transmitters to the existing infrastructure at Gross Herzog is being considered. A full EIA (separate from this SEA) is required for the Gross Hertzog, Oranjemund and Rössing sites.

7.2.2 Description of low and medium sensitivity sites

All **LOW AND MEDIUM** sensitivity sites have been subjected to environmental assessments (**VOLUME 2** of this report) to reduce and repair potential impacts.

For **LOW** sensitivity sites, impacts can sufficiently be addressed through the implementation of a generic EMP (see below).

MEDIUM sensitivity sites were divided into two groups:

- Sites where the proposed position is sufficient but potential impact rates "medium";
- Sites where an exact position for the mast has not been determined yet or the proposed position is located in a sensitive area (e.g. its distance to an airport/strip, populated area (in terms of radiation risk); or its location in ecologically sensitive terrain). In these instances, relocating the proposed site with a few kilometres from the original position could avoid the impacts. Based on criteria provided by the specialists (see **Table 20** below), sensitivity maps were compiled indicating suitable zones and potential *no-go* zones. Should the site be located in the suitable zones the impact on the receiving biophysical and social environment is expected to be minimal, provided that the mitigation is applied. In contrast to this, no-go zones are areas that should be avoided. An example of a sensitivity map is provided in **Figure 21**.

Table 20: Criteria to which an optimal site should adhere based on specialist findings.

CRITERIA	RECOMMENDATION BY SPECIALIST	DESCRIPTION
Distance to nearest populated area	No mast should be erected within a 3km radius of an inhabited area to minimize the effect of radiation.	The precautionary radius as described by the specialist is based on ICNIRP standards. Provision was also made for the potential expansion of towns/villages/ settlements in the direction of the mast.
Biodiversity	The construction of a mast on top of an outcrop should be avoided. There is a strong correlation between outcrops and areas of biodiversity significance.	Although elevated ground increases the reach of the transmitter, biodiversity is often concentrated on outcrops. In some instances extending the mast height by a few meters the same reach can be achieved whilst avoiding the negative effect on biodiversity (e.g. Rosh Pinah).
Civil Aviation	Any mast to be erected within an 8km radius from any aerodrome, airfield, airstrip or airport needs clearance from the Directorate of Civil Aviation in compiance with the International Civil Aviation Organization (ICAO).	During the site selection process, an 8km buffer zone was created around all aerodromes, airfields, airstrips or airports close to potential mast sites. Where possible, mast positions were moved to areas further than 8 km. Where this was impossible, NBC has to apply to the ICAO for Annex 14 approval.
Visual Impacts	The visibility of the mast should be kept as low as possible. The perspective of all sensitive receptors, including the road user and the nearest residents to the site, should be taken into account.	Masts are less visible when constructed: • In a deeply incised valley compared to a ridgeline; • On lower slopes compared to upper slopes; • In a rugged/diverse landscape compared to a homogenous landscape, such as a plain (e.g. Rosh Pinah). Visibility is also influenced by the location height relative to the heights of surrounding topographic features.
Infrastructure	Avoid or minimize the construction of infrastructure e.g. roads or power lines. If new infrastructure is to be built, the distance should be	The construction of infrastructure such as roads results in areas being cleared of vegetation and consequently causes damage to the receiving environment.

CRITERIA	RECOMMENDATION BY SPECIALIST	DESCRIPTION
	kept to a minimum.	
Archaeology	Avoid areas of archaeological significance recommended by the specialist.	The specialist has indicated 6 sites that are likely to be archaeologically sensitive: • Aussenkehr: Rock art on upper slopes of undisturbed high ground – less than 5km from the Orange River. • Khorixas: Rock art associated with small outcrops and occasional grave sites along drainage lines • Noordoewer: Rock art on the upper slopes of the plateau surrounding the town. • Oranjemund: Pleistocene material near coastline and in the Orange River valley. • Otjimbingwe: Any undisturbed ground is expected to be archaeologically sensitive. • Sesfontein: Any undisturbed ground is expected to be archaeologically sensitive. • Tsumkwe: Pan margins and ancient baobab groves are expected to be sensitive. • Uis: Local density of archaeology on high ground. Any undisturbed ground is expected to be archaeologically sensitive.
Birds	Avoid areas sensitive for birds as recommended by specialist.	Koppies, inselbergs, mountains and the escarpment are sensitive in terms of high biodiversity and endemism of birds. Pans, oshanas (Cuvelai system), rivers and floodplains are also important bird areas and need to be avoided in the selection of sites.

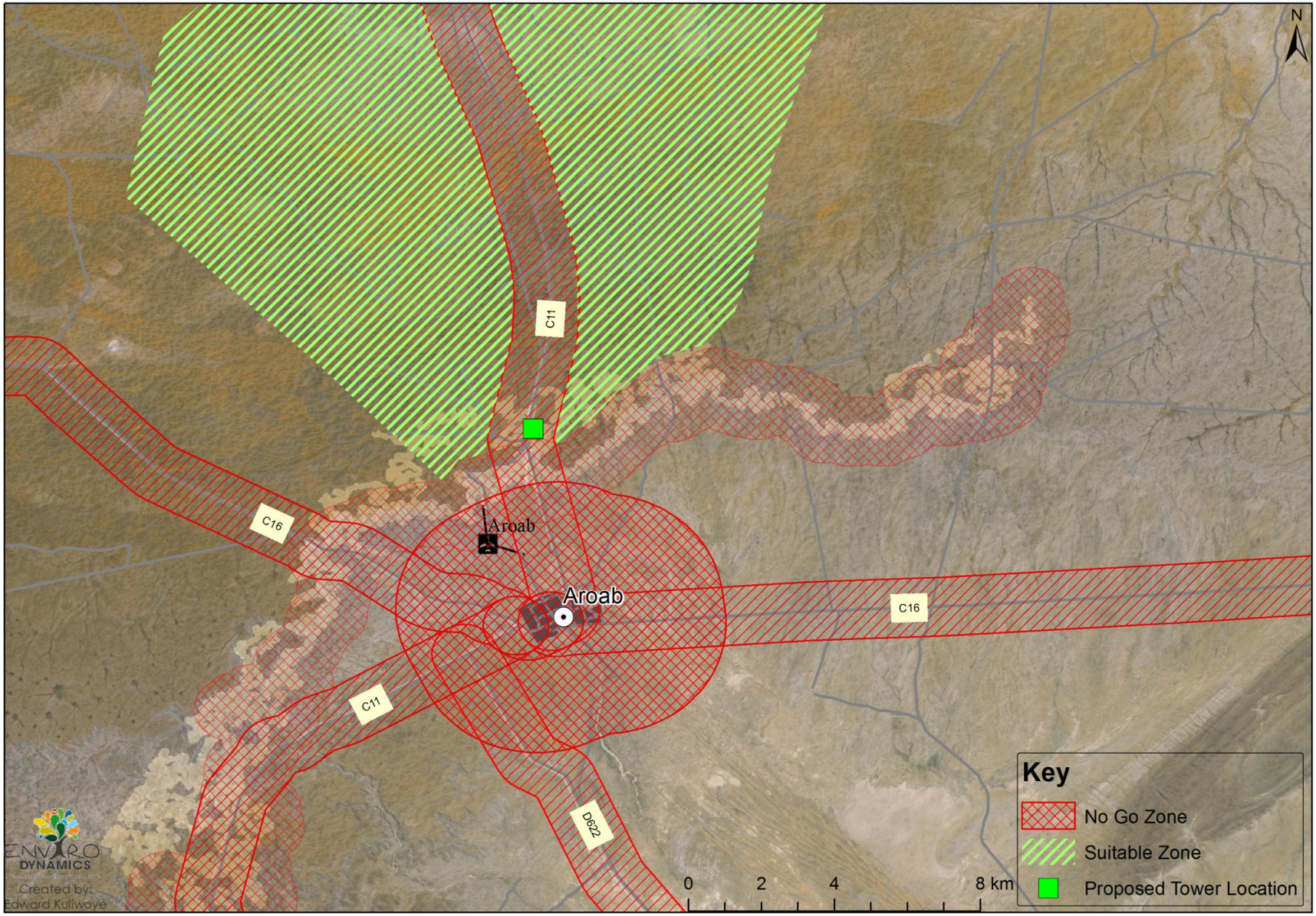


Figure 21: Sensitivity map of the proposed Aroab site indicating no-go and suitable zones in the proximity of the site

7.2.3 Managing the site specific issues

Although avoidance is the first step in the mitigation process, residual impacts may still remain. The next step in the mitigation process is therefore to reduce and repair impacts on site. Residual impacts can be screened according to the set of questions below (**Figure 22**).

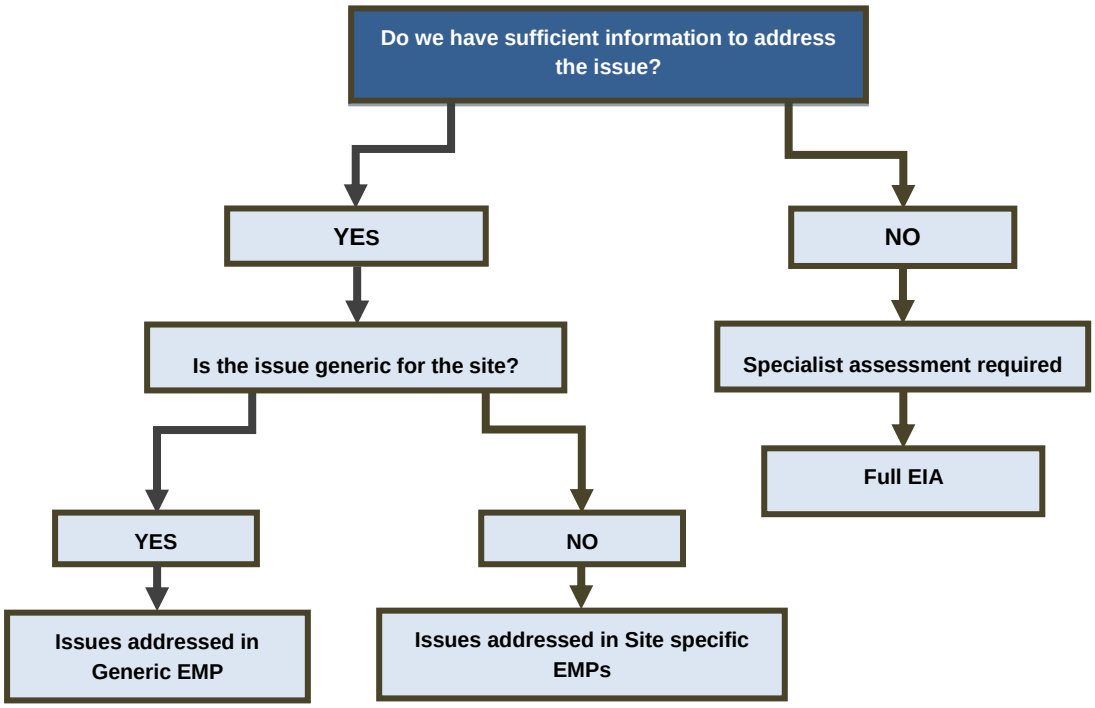


Figure 22: Screening process to identify key issues

The sites that had insufficient information to address issues (i.e. sites under the "NO" category) namely Moltkeblick, Oranjemund and Rössing, require specialist input in a full EIA that will be undertaken separately from this project. The rest of the sites had sufficient information (i.e. sites under the "YES" category) to address issues through the implementation of a generic and/or site specific EMP.

A generic EMP (**VOLUME 1: APPENDIX B**) has been developed for all sites. For specific issues an additional appendix has been drafted to manage the impacts on the site.

In these documents mitigation measures are prescribed that could decrease or avoid impacts on site.

*A **Generic EMP** is an Environmental Management Plan that addresses the management of general issues that apply to all sites.*

*A **Site Specific EMP** is an Environmental Management Plan that addresses the management of issues that are specific to a given site.*

7.2.4 Summary of sensitivity assessments

The table below (**Table 21**) provides a summary of the sensitivities of the proposed sites and the management thereof. The ratings (i.e. low, medium and high) are based on the verified assessments undertaken by the consultants.

Table 21: Sensitivity ratings of sites and how these will be managed.

SENSITIVITY RATING	LOW	MEDIUM		HIGH	
DESCRIPTION	**Proposed position has a low sensitivity rating**	**Proposed position is sufficient but potential impacts rate "medium"**	**Exact position not determined yet or the proposed position is located in a sensitive area**	**Proposed position is located in a highly sensitive area, but less sensitive alternative is available**	**Proposed position is located in a highly sensitive area and an alternative site could not be found during the SEA investigation**
Site names	Keetmanshoop Nakop Nkurenkuru	Andara Aranos Aussenkehr Corridor Elandsfontein Eiseb 1 Eiseb 2 Gibeon Gochas Khorixas Koës	Aroab Eenhana Epupa Kalkrand Kongola Lüderitz Ndoro Omega Otjimbingwe Otjinene Ovitoto	Halali Okaukuejo	Molteblick* Oranjemund Rössing

SENSITIVITY RATING	LOW	MEDIUM		HIGH	
DESCRIPTION	**Proposed position has a low sensitivity rating**	**Proposed position is sufficient but potential impacts rate "medium"**	**Exact position not determined yet or the proposed position is located in a sensitive area**	**Proposed position is located in a highly sensitive area, but less sensitive alternative is available**	**Proposed position is located in a highly sensitive area and an alternative site could not be found during the SEA investigation**
		Kransberg Leonardville Maroelaboom Noordoewer Omuthiya Okapaue Ost Outapi Rosh Pinah Ruacana Schlip Sesfontein Shamvura Uis	Tsumkwe		
Management	Generic EMP only	Generic EMP with Site specific appendix	Sensitivity map indicating areas suitable for the construction of the site in proximity to the originally proposed	Placing the mast at the less sensitive Elandsfontein will avoid the impact at both of the sensitive sites.	EIAs separate from the SEA is required to find an appropriate site.

SENSITIVITY RATING	LOW	MEDIUM		HIGH	
DESCRIPTION	Proposed position has a low sensitivity rating	Proposed position is sufficient but potential impacts rate "medium"	Exact position not determined yet or the proposed position is located in a sensitive area	Proposed position is located in a highly sensitive area, but less sensitive alternative is available	Proposed position is located in a highly sensitive area and an alternative site could not be found during the SEA investigation
			position. Generic EMP with Site specific appendix.		
* The Moltkeblick site has since been moved to the Gross Herzog site. The EIA for this site is being done separate from the SEA.					

The following section deals with the identification of cumulative impacts associated with the preferred transmitter locations on a national level.

8 CUMULATIVE IMPACT ASSESSMENT

8.1 Methodology for identifying cumulative impacts

Cumulative impacts refer to those environmental effects of a project that can combine and interact with one another (and similar effects from other past, existing and imminent projects) to cause aggregate effects. These impacts may be different in nature or extent from the effects of the individual activities and may occur over a certain period of time and distance (NAOO, 2012).

Cumulative Impacts are determined by overlaying issues associated with the proposed development (**Section 2**) with the key environmental sensitivities identified in **Sections 5 & 6** (including the comments received by the public) (See **Table** 22). The resulting possible impacts are then assessed and further recommendations made.

Table 22: **Process of determining the possible cumulative impacts resulting from certain aspects of the proposed development.**

Issue	Environmental Sensitivity	Possible cumulative impact
RF emissions	• Distance of human settlements or activity from transmitters.	• Impact of safe distance on future spatial planning • Proximity of masts to settlements, schools, towns - Could result in health issues due to radiation
Construction of roads and power lines	• High visibility • Biodiversity	• Visual impact • Habitat destruction • Negative impact on biodiversity • Erosion
Rehabilitation	• High visibility	• Existing damage on site • Erosion • Visual impact
Coverage	• Number of people	• Better national coverage
Job creation	• Poverty	• Financial implications for local residents
Civil Aviation	• Distance from airfields or airstrips • Planned aviation routes	• Collisions • Interference with aviation

Issue	Environmental Sensitivity	Possible cumulative impact
	• Height of transmitter masts	regulations
Proliferation of broadcasting and communication infrastructure	• Cumulative impact of broadcasting and communication infrastructure.	• Failure to remove redundant infrastructure.
Bird diversity	• Landscape and associated bird species. • Breeding and nesting sites of birds. • Migration and flight paths of birds.	• Electrocution of birds on poles and conductors. • Collision of birds with overhead cables and guy ropes. • Nesting of birds on poles and towers. • Destruction of bird habitat during construction and maintenance. • Disturbance of birds during construction and maintenance.
Plant diversity	• Landscape and associated vegetation. • Biodiversity and endemism. • Succulent Karoo biome. • Large indigenous trees.	• Disturbance to unique plant species. • Loss of plant diversity.
Reptile diversity	• Habitat and associated reptile species.	• Loss of reptile diversity. • Disturbance to reptiles.
Tourism destinations and routes and aesthetics	• High visibility and sensitive receptors.	• Visual impact.
Archaeology	• Heritage value.	• Loss of cultural heritage.

8.2 Assessment of impacts

By subjecting each of the potential impacts (**Table** 22) to the criteria stipulated in **Table 23**, it is possible to establish the significance of each impact prior to implementing mitigation measures and then after mitigation measures have been implemented. This method complies with the Namibian EIA regulations (February 2012) whereby the significance refers to the overall rating of the impact on the environment.

Table 23: Definitions of the various significance ratings

SIGNIFICANCE RATING	CRITERIA
Low	Where the cumulative impact can have a negligible influence on national level and modifications or mitigation is only necessary at site specific level.
Medium	Where the cumulative impact could have an influence on national level, which will require modification of the development design and/or alternative mitigation at site specific level.
High	Where the cumulative impact could have a significant influence on national level and, in the event of a negative impact the activity(ies) causing it, should not be permitted (i.e. there could be a 'no-go' implication for the development, regardless of any possible mitigation).

By implementing the mitigation hierarchy during site selection many of the cumulative impacts have already been avoided. Some of the mitigation measures are mentioned in the table below but detailed descriptions of management actions are contained in the accompanying generic EMP (**APPENDIX B**) and site specific EMPs (**VOLUME 2** of this report).

The impact assessment is provided in **Table 24.**

Table 24: Impact Assessment

IMPACT	STATUS/ NATURE	DEGREE OF CONFIDENCE	SIGNIFICANCE ON NATIONAL LEVEL (before mitigation)	MITIGATION/ ENHANCEMENT	SIGNIFICANCE ON NATIONAL LEVEL (after mitigation)

Impact of radiation on nearby settlements, schools and towns.*	Power output and distance to nearest populated area	High	Medium negative	• During site selection, care was taken to avoid placing any mast within the safe distance from the nearest populated areas.
				• Where this avoidance was not possible (e.g. Aussenkehr, Eiseb 1 & 2, , Corridor, Gochas, Okapaue Ost, Leonardville, Lüderitz, ,) the following additional mitigation measures are required:
				  • Reduce the power output
				  • Tilt the beams
					Low negative

*Based on the ICNRP standards the specialist has calculated the safe distance to populated areas at 40.22 meters. A precautionary distance of 3 km was however applied to all sites. Where this was not possible, additional measures were put in place. No site is however located less that 1 km from a populated area – still well within the prescribed safe distance.					
Erosion	Construction activities in areas prone to erosion.	Medium	Medium negative	• During site selection steep slopes and areas prone to erosion have been avoided for the placement of the masts. • No-go areas for the construction of roads have been indicated in	Low negative

IMPACT	STATUS/ NATURE	DEGREE OF CONFIDENCE	SIGNIFICANCE ON NATIONAL LEVEL (before mitigation)	MITIGATION/ ENHANCEMENT	SIGNIFICANCE ON NATIONAL LEVEL (after mitigation)
				site specific EMPs where applicable.	
Negative impact on civil aviation	Distance to airports or airstrips, height of towers/masts	Medium	High negative	• Based on DCA requirements zones of 8km around airports have been avoided during site selection. • Where this was impossible, NBC has to apply to the ICAO for Annex 14 approval. • Depending on the *ICAO* requirements it may be necessary to: o *P*lace a strobe light on top of the mast (day markings). o Place a red light on top of the mast (night markings).	Low negative
National coverage	Overall reach of coverage	High	Medium positive	• During site selection, position of mast was placed to achieve optimal coverage.	High positive
Birds: Electrocutions,	Negative impact on	High	High negative	• Areas where sensitive bird species	Low negative

IMPACT	STATUS/ NATURE	DEGREE OF CONFIDENCE	SIGNIFICANCE ON NATIONAL LEVEL (before mitigation)	MITIGATION/ ENHANCEMENT	SIGNIFICANCE ON NATIONAL LEVEL (after mitigation)
collisions, destruction of habitats	bird diversity			are likely to occur (e.g. small pans, rivers etc.) have been avoided during site selection. • In addition, mitigation measures have been prescribed in the site specific EMPs of potential sensitive sites, including: • Removal of earth-wire of power lines • Fitting wires with markers	
Loss of plant diversity and endemism	Negative impact on plant diversity	High	Medium negative	• Areas where sensitive plant species are likely to occur have been avoided during site selection by placing masts on existing disturbed areas. • Where this was not possible photographic records have been provided of sensitive vegetation to be avoided during site construction e.g. large trees or endemic or protected plant	Low negative

IMPACT	STATUS/ NATURE	DEGREE OF CONFIDENCE	SIGNIFICANCE ON NATIONAL LEVEL (before mitigation)	MITIGATION/ ENHANCEMENT	SIGNIFICANCE ON NATIONAL LEVEL (after mitigation)

				species.
				• For sites with particularly sensitive vegetation (e.g. Rosh Pinah) recommendations have been made for a specialist to visit the site prior to construction to either
				  • Make recommendations for on-site avoidance or
				  • To relocate sensitive plant species where avoidance is impossible.	

Loss of reptile diversity	Negative impact on reptile diversity	High	Medium negative	• Areas where sensitive reptile species are likely to occur (e.g. outcrops, rivers etc.) have been avoided during site selection. • No-go areas for the construction of roads have been indicated in site specific EMPs where applicable.	Low negative
Loss of cultural heritage	Negative impact on culturally significant	High	Medium negative	• Sensitive archaeological areas indicated by the specialist have	Low negative

IMPACT	STATUS/ NATURE	DEGREE OF CONFIDENCE	SIGNIFICANCE ON NATIONAL LEVEL (before mitigation)	MITIGATION/ ENHANCEMENT	SIGNIFICANCE ON NATIONAL LEVEL (after mitigation)

	sites			been avoided during site selection.
				• For sites with a known high archaeological significance (e.g. Sesfontein, Khorixas) recommendations have been made for a specialist to visit the site prior to construction to either:
				  • Make recommendations for on-site avoidance or
				  • To relocate sensitive archaeological artefacts where avoidance is impossible.	

Visual Impact	High visibility and Negative impact on sensitive receptors	High	High negative	• Areas with high tourism potential have been avoided during site selection by e.g. refraining from putting masts close to roads. • At the onset of the project discussions have been initiated with other broadcasters to share infrastructure where possible.	Medium negative

IMPACT	STATUS/ NATURE	DEGREE OF CONFIDENCE	SIGNIFICANCE ON NATIONAL LEVEL (before mitigation)	MITIGATION/ ENHANCEMENT	SIGNIFICANCE ON NATIONAL LEVEL (after mitigation)
				• For sites located more than 8km from an aerodrome, NBC should apply for the relaxation of the red and white markings at sites.	

By considering the cumulative impacts indicated in the table above, during the site selection phase of the project, many of the impacts could be eliminated. Where this was only partially possible or impossible, measures have been prescribed in the site specific EMPs to further mitigate the effects. Should these measures be successfully implemented the overall cumulative effect of the project is expected to be low.

9 CONCLUSIONS AND RECOMMENDATIONS

9.1 Approach to study

The approach taken with the SEA was to assess the proposed sites at a strategic level and apply a screening process to determine which require in-depth studies at a later stage. The overall sensitivity rating of each site was determined by considering available data, specialist inputs and ground-truthing during reconnaissance visits. Common issues such as waste management and conduct on site were addressed in a generic EMP. Issues pertaining to individual sites were combined in site-specific EMPs.

The strategic approach to which the project was subjected ensured that cumulative impacts could be identified and avoided whereas common issues could be addressed in a generic document. This approach contributed to a significantly more streamlined process.

9.2 Public consultation

A high level (SEA) consultation process was undertaken with various Ministries, associations, Regional Councils and NGO's. These stakeholders were provided with a BID and invited to attend one of two meetings (in Swakop or Windhoek). The project was also advertised in two national newspapers for three consecutive weeks, inviting any member of the public to attend the scheduled meetings. People in remote areas were invited to communicate with us.

Some concerns were raised about the potential radiation impact of the towers, the impact on birds or overall biodiversity. Some technical aspects were also raised. The general consensus was, however, that the project will contribute positively to the economy of Namibia.

EIA or site specific level consultation was done for most sites, but at some sites, this was not possible because:

- The exact position of these sites had not been established yet and premature consultation could therefore cause unrealistic expectations.
- In addition, because of the prolonged period over which the project is expected to run, many officials and local I&APs are likely to change throughout the course of the project. This contributes to the variability of I&AP information and could result in consultation becoming out dated.

The aim is therefore to repeat the consultation process just before commencing with the construction phase. The following applies to the sites involved:

- Applicable land owners, local authorities (e.g. municipality and town council) and regional councils should be contacted once an optimal site has been determined to gather their inputs and make minor adjustments to the location of the site.
- A meeting needs to be scheduled with owners, neighbours and headmen etc. to ensure that they are aware of the development and to gather their inputs regarding the location of the site.
- Consultation with land owners should continue throughout the course of the project to ensure transparency and that concerns are timeously addressed.

9.3 Outcomes of the SEA

By applying the mitigation hierarchy described in this report, namely avoidance, reduction, reparation, followed by compensation as the last resort, the following outcomes were achieved.

9.3.1. Avoidance

The SEA process identified five sites with an overall potentially high sensitivity, namely, Okaukuejo, Halali, Moltkeblick, Rössing and Oranjemund. By applying the basic level of the mitigation hierarchy, the impact on Okaukuejo and Halali can be **avoided** by placing the mast at the already disturbed Elandsfontein - a site located outside the Etosha National park.

Due to the findings of the individual EIAs and this SEA, the original Moltkeblick, Rössing and Oranjemund sites have been deemed so sensitive for the proposed activities (establishment of telecommunication mast and related infrastructure). Therefore alternative locations were suggested and investigated . Such additional investigations (and related EIA's) fall outside the Scope of this SEA and the sensitivity ratings awarded in this report relate to the original sites investigated. Application for Environmental Clearance for these sites will be conducted outside the process being followed for this application. Moltkeblick has since been replaced by Gross Herzog.

9.3.2. Reduce and repair

The remaining impacts, following due consideration of avoidance possibilities, management actions are required that would reduce and repair damage. Considering these, and the sensitivities at each site, the following assessment was made:

Table 25: Cumulative Impact Significance

CUMULATIVE IMPACT	EXPECTED SIGNIFICANCE ON NATIONAL LEVEL:	
	Before Mitigation	After mitigation
Impact of radiation on nearby settlements, schools and towns	Medium negative	Low negative
Erosion	Medium negative	Low negative
Impact on civil aviation	High negative	Low negative
National coverage	High positive	High positive
Impact on birds: Electrocutions, collision, destruction of habitats	High negative	Low negative
Loss of plant diversity and endemism	Medium negative	Low negative
Loss of reptile diversity	Medium negative	Low negative
Loss of cultural heritage	Medium negative	Low negative
Visual impact	High negative	Medium negative

a) **Impact of radiation on nearby settlements, schools and towns:** The specialist concluded that none of the sites pose a high radiation risk. A precautionary distance (of 3 km) from populated areas has nonetheless been applied. At some sites (i.e. Sesfontein, Corridor, Gochas and Leonardville) this was not possible due to physical or technical constraints (e.g. topography, distance to nearest road or power line). Additional mitigation measures have therefore been recommended in the site specific EMPs of these sites including:

- reducing the power output; and
- tilting the beams.

The following mitigation measures have been recommended for all sites in the generic EMP:

- Based on the safe distances identified in this project, servitudes should be registered around each of the sites.
- Safe distances (including servitudes) should be communicated to the applicable authorities. Authorities will be responsible for enforcing the safe distances in terms of settlement and development.
- It is strongly recommended that CRAN determine the cumulative impact of RF emissions of all broadcasting and telecommunication providers at a national level.

b) **Erosion:** During site selection steep slopes and areas prone to erosion have been avoided, particularly with regard to the placement of masts. No-go areas for the construction of roads have been indicated in site specific EMPs where applicable.

c) **Impact on civil aviation:** In consultation with the Directorate of Civil Aviation obstacle restriction zones around airports have been identified that have been avoided during site selection. As far as possible, masts were not placed closer that 8km from an aerodrome. Where this was not possible (e.g. the existing infrastructure is located less than 8km from an aerodrome), NBC still has to apply to the ICAO (International Civil Aviation Organization) for Annex 14 approval and depending on the ICAO requirements it may be necessary to:

- place a strobe light on top of the mast (day markings), and
- place a red light on top of the mast (night markings).

At sites where such markings are not required under Annex 14, NBC should apply to the ICAO to waive this requirement.

d) **Impact on birds:** The masts and associated power lines are likely to impact negatively on birds if no mitigation is introduced. The risks include potential collision of birds with power lines or mast structures, electrocution on power line poles and the disturbance of birds due to habitat destruction. For this reason a bird specialist was appointed to identify potentially sensitive areas at a national level. Based on the specialist assessment, some sites with good habitat for sensitive birds were avoided (e.g. Moltkeblick, Okaukuejo, Halali). Where the impact could not be avoided mitigation measures, primarily design changes, were recommended. These are elaborated on in the generic and site specific EMPs.

e) **Loss of plant diversity and endemism:** The towers with associated infrastructure will not have a large footprint and the removal of large expanses of vegetation will therefore not be required. However, due to the construction of roads and power lines, habitat destruction could still be significant in highly sensitive areas

such as Rosh Pinah (located in a biodiversity hotspot). The following is recommended:

- When doing the final positioning at these sites, a vegetation specialist should accompany the team to assess the sensitivity of the plants on the site and make recommendations for on-site avoidance or the relocation of sensitive plant species where avoidance is impossible.
- Further mitigation measures are contained in the generic and site specific EMPs.

f) **Loss of cultural heritage:** Namibia has a rich cultural heritage and for this reason an archaeological specialist identified the significance ratings of each of the tower positions based on their potential to damage highly sensitive archaeological sites. The following recommendations were made:

- When doing the final positioning at sites where archaeological sensitivity is expected to be high, an archaeologist should accompany the team to determine whether any significant cultural or historical artefacts occur on the site. He will then make recommendations for on-site avoidance or will relocate sensitive archaeological artefacts where avoidance is impossible.
- Further mitigation measures are contained in the generic and site specific EMPs.

g) **Visual Impact:** The transmission towers are normally highly visible structures and the best possible mitigation is to hide them as far as possible. Visual impact depends on the number of sensitive receptors, the presence of nearby roads or tourist attractions and the height of the tower. During site selection, the potential visual impact of each site was considered and where possible lower ground was preferred or surrounding topography to concealing auxiliary infrastructure. By implementing the following mitigation measures the potential visual effect can further be reduced:

- The co-sharing of broadcasting infrastructure is highly recommended. It is however also recommended that redundant infrastructure be immediately removed to avoid the accumulation of towers on any one site.
- NBC should apply to the Civil Aviation Authority to waive the need for the red and white markings at sites where this is not a requirement under Annex 14.

9.4 Concluding remarks

The overall cumulative impact of the project is expected to be *low*. Several of the potential impacts have been avoided by applying the criteria set by the specialists or making structural changes to the proposed infrastructure during the site selection phase. In addition to this, mitigation measures have been prescribed either in a generic EMP or site specific EMPs to further reduce the negative impacts of the project. The project is further associated with a national positive impact with regards to social aspects associated with the proposed activities.

The Enviro Dynamics' team is confident that the proposed project poses no long term or irreversible threat to the affected environment. However, based on the findings contained in this report, environmental clearance should be conditional to the following:

- A local person, independent from the contractor (an **ECO** or Environmental Control Officer), **should be appointed** for the duration of the construction period. Such an independent ECO will be responsible for the monitoring and auditing of the implementation of the various EMP's for each site. Provision has also been made for continuous monitoring by the consultants during the implementation phase of the project.
- The requirements set out in both the generic and site specific **EMPs should be adhered to**. The implementation of this will be the responsibility of the ECO.
- The **public consultation process should be repeated** before commencing with construction. The following applies:
    - Applicable land owners, local authorities (e.g. municipality and town council) and regional councils should be contacted once an optimal site has been determined to gather their inputs and make minor adjustments to the location of the site.
    - A meeting needs to be scheduled with owners, neighbours and headmen etc. to ensure that they are aware of the development and to gather their inputs regarding the location of the site.
    - Consultation with land owners should continue throughout the course of the project to ensure transparency and that concerns are timeously addressed.
- Based on the **safe distances** identified in this project, servitudes should be

registered around each of the sites. These should be communicated to the applicable authorities. Authorities will be responsible for enforcing the safe distances in terms of settlement and development.

- **Redundant infrastructure** should immediately be removed to avoid the accumulation of towers on any one site.

Below, the requirements that apply to specific sites are highlighted. These requirements should be included by the DEA in the conditions for environmental clearance.

Table 26: Summary of potential impacts and related conditions for Environmental Clearance

POTENTIAL IMPACT	DESCRIPTION OF RESIDUAL IMPACTS AFTER AVOIDANCE WAS APPLIED	CONDITION FOR ENVIRONMENTAL CLEARANCE	SITES TO WHICH CONDITION APPLY
Impact of radiation on nearby settlements, schools and towns	Sites are located less than the applied precautionary distance (3km) from the nearest settlement albeit still within the safe distance (<40m) prescribed by ICNIRP.	Reduce the power output; Tilt the beams.	Andara, Aranos, Aussenkehr, Corridor, Eiseb 1 & 2, Gochas, Khorixas, Leonardville, Lüderitz, Okapaue Ost, Outapi, Ovitoto, Rosh Pinah, Ruacana, Schlip, Shamvura Tsumkwe and Uis.
Impact on civil aviation	Sites are located within the obstacle limitation zones of aerodromes (i.e. less than 8 km from the nearest aerodrome).	NBC should apply to the ICAO (International Civil Aviation Organization) for Annex 14 approval and depending on the ICAO requirements: • A strobe light should be placed on top of the mast (day markings), and • A red light should be placed on top of the mast (night markings). • The mast should have red and white markings.	Aranos, Gochas, Halali, Khorixas, Koës, Leonardville.
Impact on birds: Electrocutions, collision, destruction of habitats	Sites are located in areas likely to be sensitive for birds.	Mitigation measures (primarily design changes), as recommended in the generic and site specific EMPs, should be implemented.	Andara, Aranos, Aroab, Aussenkehr, Corridor, Eiseb 1 & 2, Elandsfontein, Epupa, Gibeon, Gochas, Halali, Kalkrand, Khorixas, Koës, Kongola, Kransberg, Leonardville, Lüderitz, Maroelaboom, Ndoro,

POTENTIAL IMPACT	DESCRIPTION OF RESIDUAL IMPACTS AFTER AVOIDANCE WAS APPLIED	CONDITION FOR ENVIRONMENTAL CLEARANCE	SITES TO WHICH CONDITION APPLY
			Noordoewer, Okapaue Ost, Okaukuejo, Omega, Omuthiya, Otjinene, Outapi, Ovitoto, Rosh Pinah, Ruacana, Shamvura, Sesfontein, Tsumkwe, Uis.
Loss of plant diversity and endemism	Sites are located in areas likely to contain sensitive plant species.	When doing the final positioning at these sites, a vegetation specialist should accompany the team to assess the sensitivity of the plants on the site and make recommendations for on-site avoidance or the relocation of sensitive plant species where avoidance is impossible.	Halali, Lüderitz, Okaukuejo, Otjimbingwe, Otjinene, Rosh Pinah, , Tsumkwe.
Loss of cultural heritage	Sites are located in areas likely to contain archaeological artefacts of cultural importance.	When doing the final positioning at sites where archaeological sensitivity is expected to be high, an archaeologist should accompany the team to determine whether any significant cultural or historical artefacts occur on the site. He will then make recommendations for on-site avoidance or will relocate sensitive archaeological artefacts where avoidance is impossible.	Aroab, Aussenkehr, Khorixas, Noordoewer, Otjimbingwe, Rosh Pinah, Sesfontein, Tsumkwe, Uis.
Visual impact	Sites are located more than 8 km from an aerodrome. Therefore red and white markings (which	NBC should apply to the ICAO to waive the requirement of red and white markings.	Aussenkehr, Khorixas

POTENTIAL IMPACT	DESCRIPTION OF RESIDUAL IMPACTS AFTER AVOIDANCE WAS APPLIED	CONDITION FOR ENVIRONMENTAL CLEARANCE	SITES TO WHICH CONDITION APPLY
	increase the mast's visibility) may not be required.		
	Masts of other broadcasters are located in the area, but due to structural limitations, it is not possible for NBC to use their infrastructure.	Other broadcasters should be approached to co-share NBC's infrastructure. This should be enforced by CRAN.	Aussenkehr, Epupa, Khorixas

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