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Environmental Assessment for the Proposed Construction of a Telecommunication Tower in the Otjozondjupa Region (Okonguarri site), Namibia

MEFT APP - 002508

Environmental Scoping Report

Version – Final

27 April 2021

Mobile Telecommunication Namibia

GCS Project Number: 19-0983

Client Reference: MTC Phase 2

Environmental Assessment for the Proposed Construction of a Telecommunication Tower in the Otjozondjupa Region (Okonguarri site), Namibia

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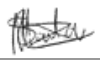
Author	Stephanie Strauss		April 2021
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PROPONENT AND EAP DETAILS

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Environmental Assessment Practitioner	GCS Water Environmental Engineering Namibia (Pty) Ltd PO Box 81808 Windhoek Contact person: Stephanie Strauss Email: stephanies@gcs-na.biz

EXECUTIVE SUMMARY

Introduction

Due to the increasing demand for mobile voice and data services in Namibia, the pressure to continuously expand the national mobile communications footprint is increasing. It is for this reason that Mobile Telecommunications Ltd (MTC) intends to expand their network coverage countrywide with the objective of providing 100% population coverage to all Namibians. This initiative will result in the construction of 554 new Base Transceiver Stations (BTS) across all 14 regions of Namibia until completion at the end of 2023.

Under the Environmental Management Act (Act 7 of 2007) the proposed construction of telecommunication networks is a listed activity that may not be undertaken without an Environmental Clearance Certificate (ECC).

As such MTC undertook an Environmental Assessment process in 2017 for the construction of the proposed BTS. Environmental Clearance for the sites were obtained in 2018.

As part of Phase 2 of the development, MTC has identified 9 additional sites which were not identified at the time of the Environmental Impact Assessment (EIA) which was conducted in 2017. MTC proposed to erect 9 telecommunication towers within the Erongo (1 site), Kunene (5 sites), Otjozondjupa (1 site), Omusati (1 site) and Kavango West (1 site) Regions respectively as depicted in **Figure 1-2**. As such MTC has appointed GCS Water Environmental Engineering Namibia (Pty) Ltd ("GCS" hereafter) to undertake an Environmental Assessment (EA) Process for the additional sites. The Scoping Reports for the sites within each region will be prepared and submitted to the Ministry of Environment Forestry and Tourism (MEFT) per region.

This report documents the assessment of potential impacts from the proposed construction and operation of the proposed site in the Otjozondjupa Region (**Figure 1-3**). The preliminary findings within this Scoping Report indicate that potential impacts will be of a low-medium significance. These potential impacts can be further mitigated by implementation of an effective Environmental Management Plan.

Project Description

MTC proposes to erect a telecommunication tower within the Otjozondjupa Region, which aims to strengthen the coverage for mobile services, inclusive of voice and data services within the subject area.

The proposed site location is detailed in **Table 1-1** below.

Table 1-1: Site location

Site Name	Latitude	Longitude	Region
Okonguarri	-20.587325	15.868463	Otjozondjupa

Public Participation

Communication with Interested and Affected Parties (I&APs) about the proposed development was facilitated through the following means and in this order:

- A Background Information Document (BID) containing descriptive information about the proposed activities was compiled (**Appendix D**) and sent out to all identified and registered I&APs on 2 November 2020;
- Notices were placed in *The Observer* and *The Sun* newspapers dated 20 November 2020 and 27 November 2020 and in *The New Era* newspaper dated 24 November and 1 December, briefly explaining the activity and its locality, inviting members of the public to register as I&APs (**Appendix E**);
- Due to lack of accessibility no site notice was placed on site.

The site is located within the Otjiwarongo Constituency. GCS has been in consultation with the Otjiwarongo Constituency Councillor to ascertain the ownership of the land in order to consult the affected parties. The Otjiwarongo Constituency Councillor confirmed that the land is not owned by a private owner and is thus within the Otjiwarongo Constituency jurisdiction.

Public consultation was carried out according to the Environmental Management Act's EIA Regulations. After the initial notification, the I&APs were given two weeks to submit their comments on the project until 11 December 2020.

The Draft Scoping Report was circulated from the **1st of March until the 15th of March 2021** for public review and comment. The overall commentary received from the public (if any) on the draft report is documented in the comments and responses trail document (**Appendix G**). This report highlights issues raised from the public on the documents and contain statements of how these are addressed and incorporated into the final document. The comment period will remain open until the final scoping report is submitted to MEFT.

Conclusions and Recommendations

The key potential biophysical impacts related to the construction, operation/maintenance and decommissioning phases of the proposed project were identified and assessed. Suitable mitigation measures (where required and possible) were recommended, and the impacts can be summarised as follows:

- **Impact on Biodiversity Loss** (during construction): The proposed construction of the tower, access road and associated infrastructure may impact the existing biodiversity in the area. This is due to the fact that the track would have to be cleared of vegetation to make way for the access road and proposed infrastructure. Care should be taken during the removal of vegetation for site preparation to ensure minimal disturbance in the area. The envisaged impact at the project site, is thus not of such magnitude and/ or significance that it will have irreversible impacts on the biodiversity and endemism of the area and Namibia at large. Therefore, the significance of this impact is medium. However, the impact can be adequately addressed by the recommendations given under subchapter 6.2.2 and management actions given in the EMP (Chapter 3).
- **Impact on Landscape** (during construction): Erosion is expected to occur at the proposed sites particularly during construction activities. Therefore, the significance of this impact is medium. However, the impact can be adequately addressed by the recommendations given under subchapter 6.2.2 and management actions given in the EMP (Chapter 3).
- **Impact on Avifauna** (during construction and operation): The proposed tower erection may pose a risk to avifauna found within the subject areas. The highest risk is considered to be collisions with tower structures, especially on stay wires, and collisions with power line structures (GCS Namibia, 2018).The tower is proposed to be 120 meters high which has potential to impact avifauna within the subject area. Therefore, the significance of this impact is medium-high. However, the impact can be adequately addressed by the recommendations given under subchapter 6.2.3 and management actions given in the EMP (Chapter 3).
- **Impacts on Surrounding Communities** (during construction and decommissioning): There is the possibility of disturbance of the surrounding communities due to the presence of the construction team. The construction work will last for a scheduled period and is not expected to continue for an extended period. Therefore, the significance of this impact is low. However, the impact can be adequately addressed by the recommendations given under subchapter 6.2.4 and 6.4.2 and management actions given in the EMP (Chapter 3).

- **Impacts on Health and Safety** (during construction and decommissioning) Workers may be subject to issues of health and safety during construction on site. Improper handling of construction materials and equipment may cause injuries. With no mitigation measures in place, this impact will receive a medium to high significance rating. However, the implementation of applicable safety measures, the impact can significantly be reduced to a low rating. The impact can be adequately addressed by the recommendations given under subchapter 6.2.5 and 6.4.3 and management actions given in the EMP (Chapter 3).

- **Impacts on Waste Generation** (during construction and decommissioning): Construction activities usually generates wastes which leads to environmental pollution, if not properly handled. This may pose a negative visual impact on the surrounding environment. Without any mitigation measures implemented, the impact can be rated as of a medium significance. After the implementation of the mitigations, the impact will be significantly reduced to low rating. The impact can be adequately addressed by the recommendations given under subchapters 6.2.6 and 6.4.4 and also management actions given in the EMP (Chapter 3).

- **Impacts on dust and noise (during construction):** Dust and noise generation may occur during construction. Without any mitigation measures implemented, the impact can be rated as of a medium significance. After the implementation of the mitigations, the impact will be significantly reduced to low rating. The impact can be adequately addressed by the recommendations given under subchapter 6.2.7 and 6.2.8 and also management actions given in the EMP (Chapter 3).

- **Impacts on archaeology (during construction):** The proposed construction activities should avoid the damage of archaeological resources. Should these be encountered during the construction activities mitigation measures need to be in place to ensure that these resources are not harmed. After the implementation of the mitigations, the impact will be significantly reduced to a low rating. The impact can be adequately addressed by the recommendations given under subchapter 6.2.9 and also management actions given in the EMP (Chapter 3).

- **Impacts on Health and Safety** (Potential Radiation) (during operational phase): Health concerns as they relate to potential radiation from telecommunication sites is a national and international topic that requires investigation. The significance of this impact can be reduced to a low significance rating by ensuring that the sufficient mitigation measures governed by the national and international legal standards such as ICNIRP on infrastructure EMR emissions are adequately implemented. The impact can be adequately addressed by the recommendations given under subchapters 6.3.1 and also management actions given in the EMP (Chapter 3).

- **Impacts on Civil Aviation** (during operational phase): Potential impacts on civil aviation due to the height and location of the sites may be experienced. The proposed structure is not located within proximity of an existing aerodrome. Therefore, this impact will receive a significantly low rating. The impact can be adequately addressed by the recommendations given under subchapter 6.3.3 and also management actions given in the EMP (Chapter 3).

- **Impact on visual** (during operational phase): The visual impact associated with the placement of a telecommunication site is a major issue that telecommunication companies face worldwide (GCS Namibia, 2018). The visual impact is therefore closely related to the social perception of the telecommunication tower and the effect it will have on the receptor's sense of place (GCS Namibia, 2018). This impact will receive a medium rating before mitigation and a low rating after the mitigation measures are implemented. The impact can be adequately addressed by the recommendations given under subchapter 6.3.4 and also management actions given in the EMP (Chapter 3).

- **Impact on mobile users** (during decommissioning phase): The affected residents and businesses will lose good network coverage in the area, if the towers are decommissioned and no other alternative cellular service infrastructure is put in place. This is an unlikely case due to the fact that, the modern world is advancing on a daily basis, and there will always be a need for improved mobile services. Even if the towers are to be removed in the future, it will most likely be replaced by better infrastructure for the same purpose. The impact can be adequately addressed by the recommendations given under subchapter 6.4.1 and also management actions given in the EMP (Chapter 3).

Based on the information provided in this report, GCS is confident the identified risks associated with the proposed development can be reduced to acceptable levels, should the measures recommended in the EMP be implemented and monitored effectively. It is therefore recommended that the project receive Environmental Clearance, provided that the EMP be implemented. Additionally, if authorized it recommended that the following be included as conditions of approval:

a) the implementation of EMP;
b) the submission of a Detailed Assessment form to MEFT; and
c) appointment of an ECO during construction.

DISCLAIMER

DECLARATION

In upholding the Code of Conduct of EAPAN (Environmental Assessment Professionals of Namibia), I hereby declare that, to my knowledge, I:

- Conducted my professional activities associated with this project with integrity, honesty and free from misrepresentation or deliberate bias;
- Do have knowledge of and experience in conducting assessments and have considered applicable laws, regulations, policies and guidelines;
- Performed the work relating to the application in an objective manner and that I did not bias the analysis or omit or distort facts in order to arrive at a predetermined finding or result;
- Do not have any personal or financial interest that could reasonably raise concerns as a possible conflict of interest; and
- Do not have any influence at the Department of Environmental Affairs that may affect the decision of whether or not an Environmental Clearance Certificate should be granted.

Stephanie Strauss

Environmental Assessment Practitioner (EAP)

LIST OF ABBREVIATIONS AND ACRONYMS

2G, 3G & 4G	**Second, Third and Fourth -generation wireless telephone technology.**
BID	Background Information Document
BTS	Base Transceiver Station
CRAN	Communication Regulatory Authority of Namibia
DCA	Department of Civil Aviation
DEA	Department of Environmental Affairs
EA	Environmental Assessment
EAP	Environmental Assessment Practitioner
ECC	Environmental Clearance Certificate
EIA	Environmental Impact Assessment
EIS	Environmental Information System
EMA	Environmental Management Act
EMP	Environmental Management Plan
EMR	Electromagnetic Radiation
EU	European Union
GG	Government Gazette
GN	Government Notice
HIV/AIDS	Human Immunodeficiency Virus / Acquired Immunodeficiency Syndrome
I&APs	Interested and Affected Parties
ICNIRP	International Commission of Non-Ionising Radiation Protection
MTC	Mobile Telecommunication Company
MTC Namibia	Mobile Telecommunications Company
NAC	Namibia Airport Company Ltd
NBC	Namibian Broadcasting Corporation
NCC	Namibia Communications Commission
NEA	National Environmental Assessment
NORED	Northern Regional Electricity Distributor

NRPAN	National Radiation Protection Authority of Namibia
RA	Roads Authority
Reg	Regulation
S	Section
SEP	Stakeholder Engagement Plan
UNDP	United Nations Development Programme

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1 BACKGROUND

The purpose of this chapter is to provide the context of the EA and the scope of work undertaken. It also outlines the approach to the EA process and how this process is in line with the requirements set by international best practice.

1.1 Background to the 100% Coverage project

Due to the increasing demand for mobile voice and data services in Namibia, the pressure to continuously expand the national mobile communications footprint is increasing. It is for this reason that Mobile Telecommunications Ltd (MTC) intends to expand their network coverage countrywide with the objective of providing 100% population coverage to all Namibians. This initiative will result in the construction of 554 new Base Transceiver Stations (BTS) across all 14 regions of Namibia until completion at the end of 2023.

By embarking on this project, MTC will increase their national footprint which will benefit particularly the remote and rural areas. MTC will deploy new 2G, 3G and 4G sites as well as upgrading existing sites with technologies like 3G and/or 4G. With the proposed project MTC aims to improve the quality of the service provided to the mobile users in all regions of Namibia. **Figure 1-1** below shows the location of the proposed sites for the project as a whole. MTC's main objective with this project is to provide network coverage to areas that currently have limited to no coverage.

Under the Environmental Management Act (Act 7 of 2007) the proposed construction of telecommunication networks is a listed activity that may not be undertaken without an Environmental Clearance Certificate (ECC).

As such MTC undertook an Environmental Assessment process in 2017 for the construction of the proposed BTS. Environmental Clearance for the sites were obtained in 2018.

COMPETENT AUTHORITY

"*Competent authority*" refers to the "*organ of state which is responsible, under any law, for granting or refusing an authorization*" and in this instance refers to the Environmental Commissioner from the Department of Environmental Affairs (DEA) at the Ministry of Environment, Forestry and Tourism (MEFT).

Construction has commenced and has been completed on some of the sites, whilst other sites are yet to be constructed. Below is a summary of the status of the sites:

- 133 sites have been completed under Phase 1;
- 110 sites have commenced construction under Phase 2;
- 42 sites have been commissioned and is on air under Phase 2.

As part of Phase 2 of the development, MTC has identified 9 additional sites which were not identified at the time of the EIA which was conducted in 2017. MTC proposed to erect 9 telecommunication towers within the Erongo (1 site), Kunene (5 sites), Otjozondjupa (1 site), Omusati (1 site) and Kavango West (1 site) Regions respectively as depicted in **Figure 1-2**. As such MTC has appointed GCS Water Environmental Engineering Namibia (Pty) Ltd ("GCS" hereafter) to undertake an EA Process for the additional sites. The Scoping Reports for the sites within each region will be prepared and submitted to the Ministry of Environment Forestry and Tourism (MEFT) per region. This report details the assessment for the tower proposed to be erected in the Otjozondjupa Region (**Figure 1-3**).

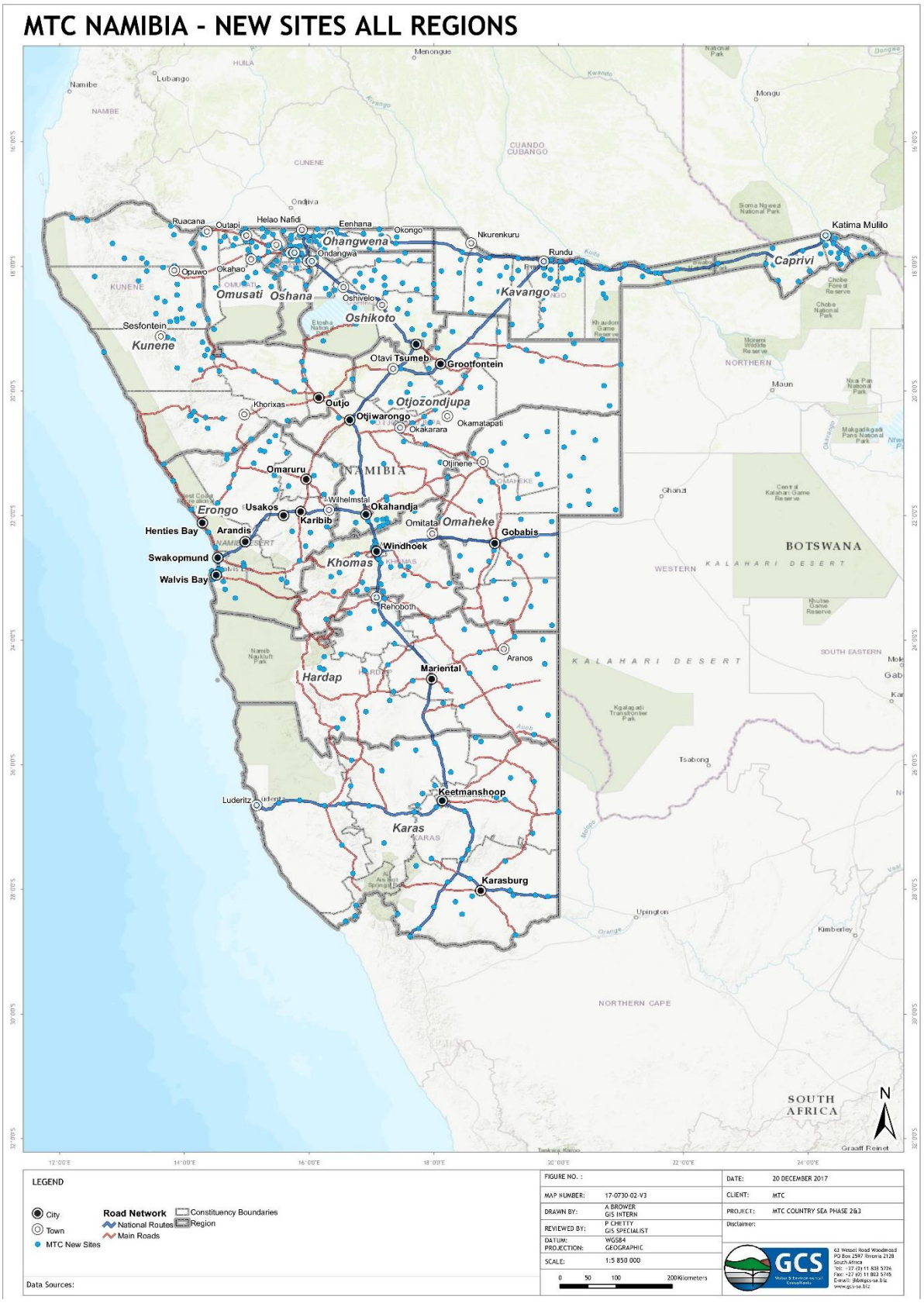


Figure 1-1: Location of the proposed sites across all 14 regions of Namibia.

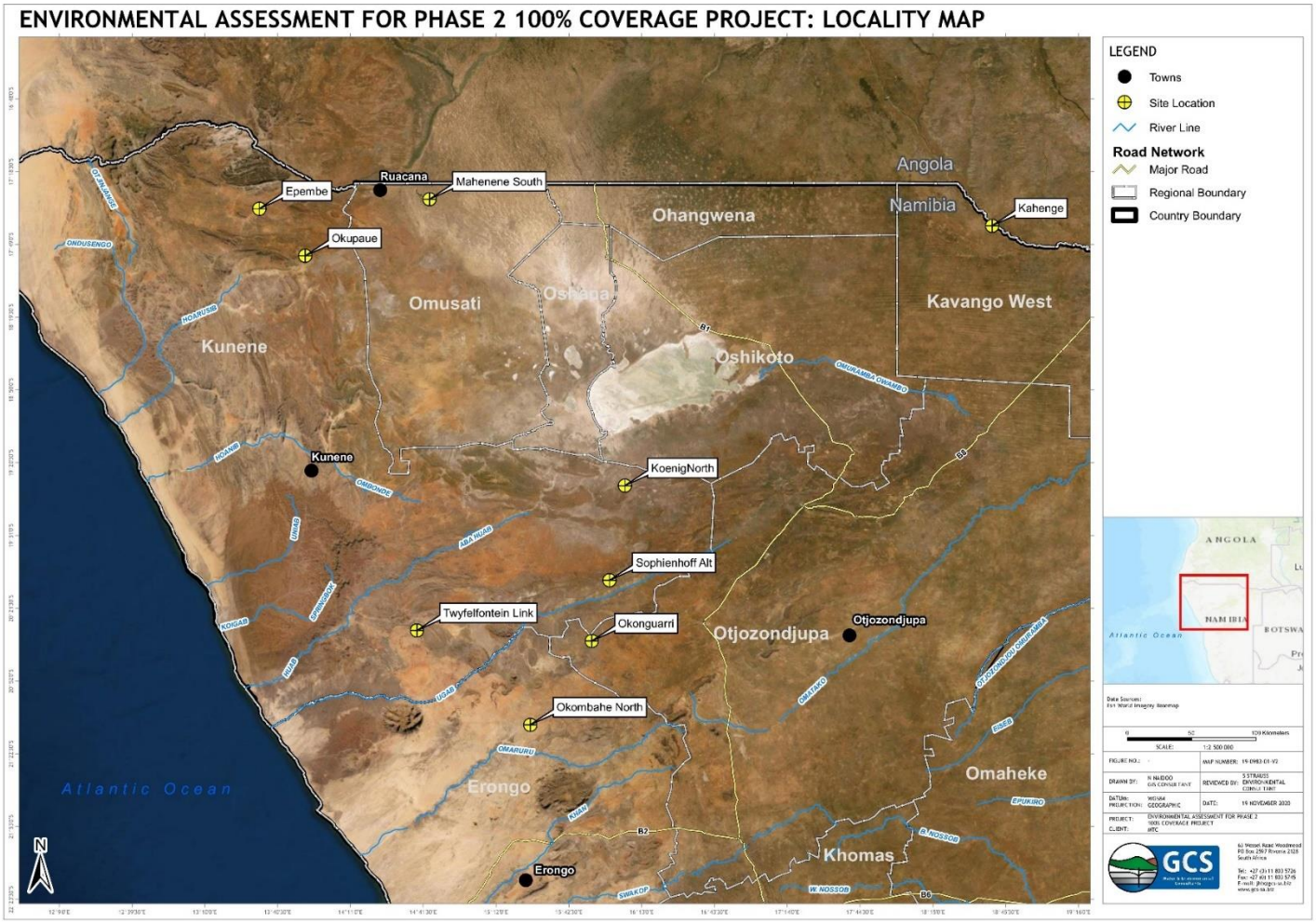


Figure 1-2: Locality of proposed sites

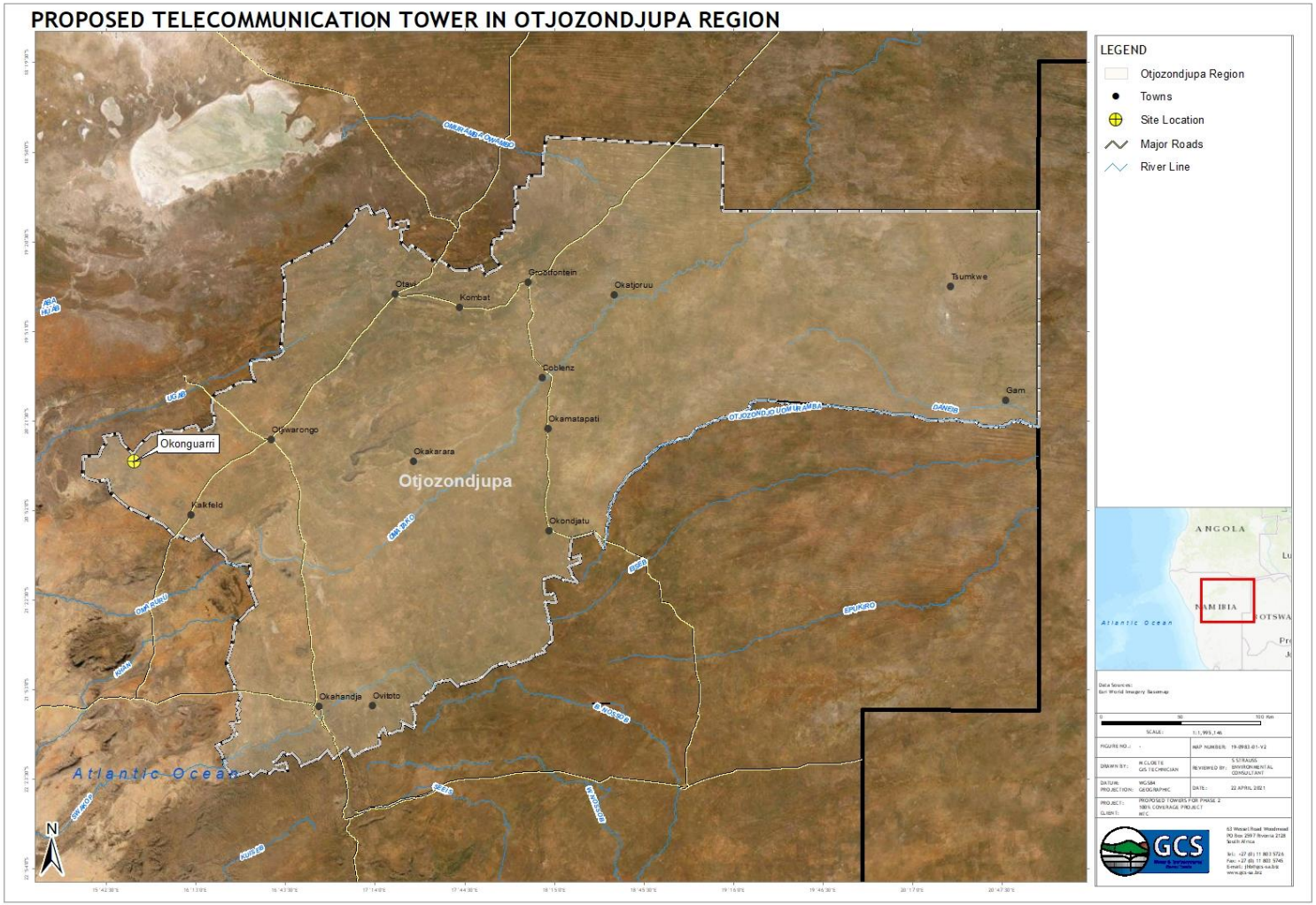


Figure 1-3: Locality of proposed site in the Otjozondjupa Region

1.2 The Environmental Assessment (EA) Process

Under the Environmental Management Act of 2007 an Environmental Assessment (EA) is required for the construction of "*communication networks including towers, telecommunication and marine telecommunication lines and cables*".

The definition of "*communication networks*" includes fibre optic lines, indoor antennae, antennae on existing infrastructure, temporary sites, as well as base transceiver stations (BTS) structures of various heights.

In addition to this, the project also involves activities related to the construction of associated infrastructure for the Project:

> *"Construction of facilities for the transmission and supply of electricity"*
>
> *"Construction of public roads"*

These listed activities form part of the Scope of Works of the EA and are considered in all the phases of the project.

1.2.1 The Environmental Consultant

GCS Water Environmental Engineering Namibia (Pty) Ltd ("*GCS*" hereafter) have been appointed by MTC as independent environmental consultants to conduct the required Environmental Assessment (EA). Stephanie Strauss is the Environmental Assessment Practitioner (EAP) who conducted this EA. Mrs. Strauss is suitably qualified and experienced to conduct this EA (see Appendix A for CV). Gerda Bothma is the Senior Environmental Scientist who provided technical support and review for the EA (see Appendix A for CV).

Neither GCS nor any of the authors of this Report have any conditional interest in the outcome of this Report, nor do they have any financial or other interest that could be reasonably regarded as being capable of affecting their independence or that of GCS.

GCS's fee for conducting this EA process is based on our normal professional hourly rates plus reimbursement of incidental expenses. The payment of that professional fee is not contingent upon the outcome of the Reports or the EA process.

1.3 Report Structure

Section 15 of the gazetted EIA Regulations requires specific content to be addressed in an Assessment Report. **Table 1-1** below is an extract from the EMA and highlights the required contents of the Assessment Report whilst assisting the reader to find the relevant section in the report.

Table 1-1: Content of the Assessment Report

Section	Description	Section of the Assessment Report/ Appendix
2 (a)	The curriculum vitae of the EAPs who prepared the report;	**Refer to Appendix A**
2 (b)	A detailed description of the proposed listed activity;	**Refer to Chapter 2**
2 (c)	a description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity;	**Refer to Chapter 4**
2 (d)	a description of the need and desirability of the proposed listed activity and identified potential alternatives to the proposed listed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity;	**Refer to Chapter 2**
2 (e)	an indication of the methodology used in determining the significance of potential effects;	**Refer to Chapter 6**
2 (f)	a description and comparative assessment of all alternatives identified during the assessment process;	**Refer to Chapter 2**
2 (g)	a description of all environmental issues that were identified during the assessment process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures;	**Refer to Chapter 6**
2 (h)	an assessment of each identified potentially significant effect, including -	**Refer to Chapter 6**
(aa)	cumulative effects;	**Refer to Chapter 6**
(bb)	the nature of the effects;	**Refer to Chapter 6**
(cc)	the extent and duration of the effects;	**Refer to Chapter 6**
(dd)	the probability of the effects occurring;	**Refer to Chapter 6**
(ee)	the degree to which the effects can be reversed;	**Refer to Chapter 6**
(ff)	the degree to which the effects may cause irreplaceable loss of resources; and	**Refer to Chapter 6**
(gg)	the degree to which the effects can be mitigated	**Refer to Chapter 6**
2 (i)	a description of any assumptions, uncertainties and gaps in knowledge;	**Refer to Chapter 7**
2 (j)	an opinion as to whether the proposed listed activity must or may not be authorised, and if the opinion is that it must be authorised, any conditions that must be made in respect of that authorisation; and	**Refer to Chapter 7**
2 (k)	a non-technical summary of the information.	**Executive summary**

2 DESCRIPTION OF THE PROPOSED PROJECT

This section provides a description of the proposed development. It also provides a description of the alternatives that are available for the implementation of the project.

2.1 Motivation for the proposed project

As the largest mobile operator in Namibia with about 2.5 million active subscribers and an existing nationwide area network coverage of 95%, MTC has an obligation to continuously find innovative ways to serve their users (MTC, 2016). The 100% coverage project is one such an undertaking where MTC aims to relieve some of the common concerns raised by their users in particularly the rural areas. Therefore, by embarking on this project MTC will be responding to the concerns raised by their users regarding coverage.

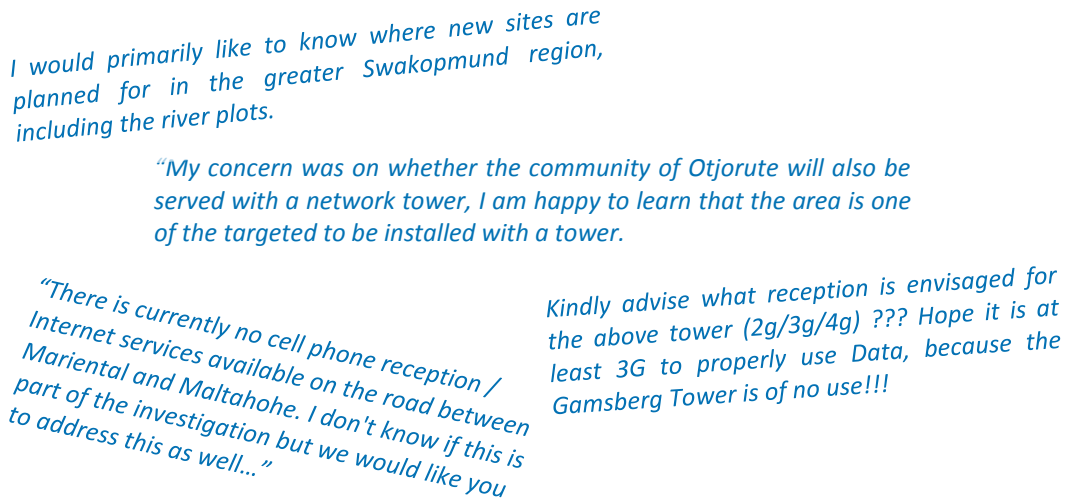
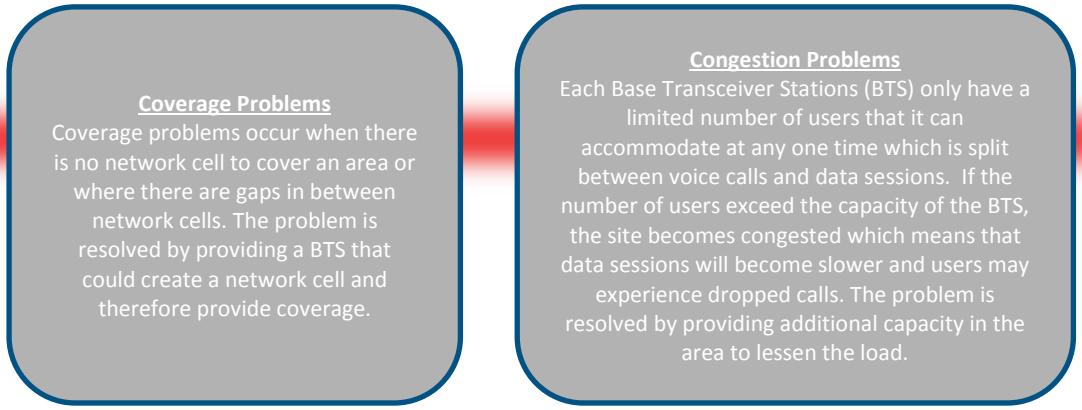


Figure 2-1: Some of the comments received during the public consultation process of the National EIA undertaken in 2017-18 illustrating the concerns regarding coverage.

Concerns raised by the public about the reception in their immediate area normally relates to two problems, namely:



2.2 *Existing coverage*

Currently MTC provides 97% coverage to the Namibian population which include most of the populated areas in the country as illustrated in **Figure 2-2** below. However, there are many rural areas that do not have coverage. It is also only the main cities and towns that have access to 4G / LTE (mobile broadband data coverage), most of the smaller towns only have 2G / GSM and 3G / UMTS services.

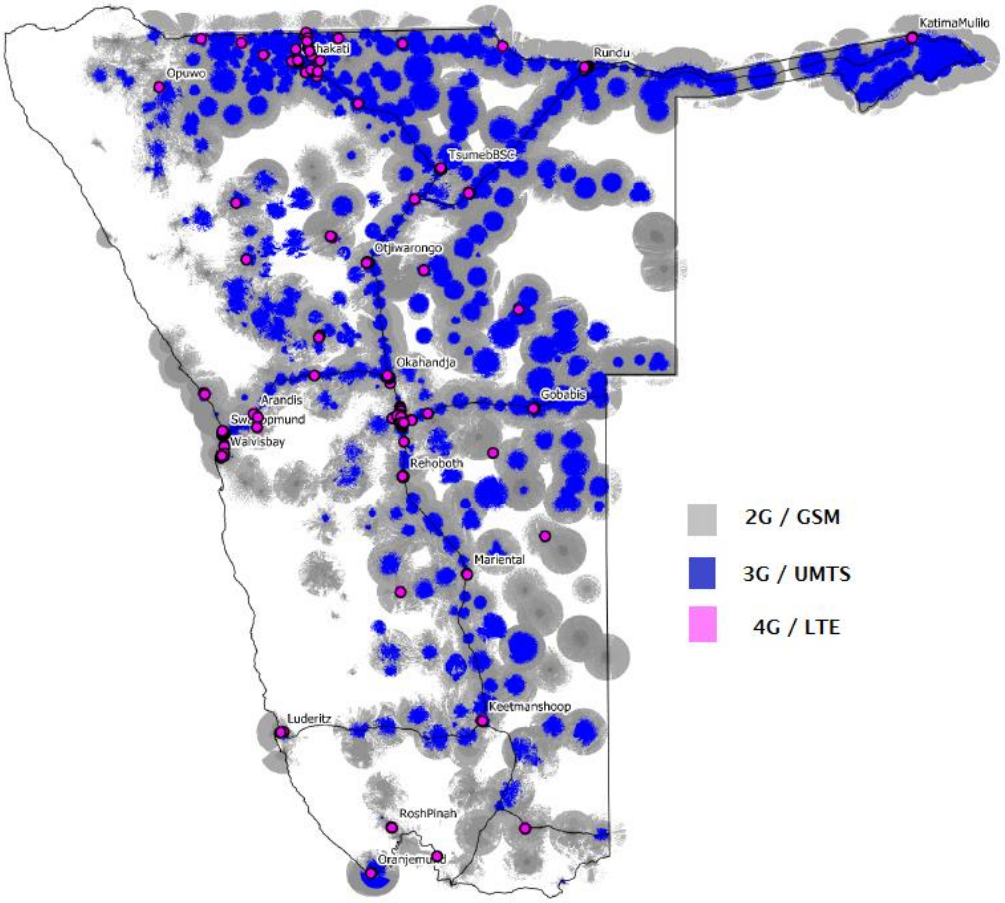


Figure 2-2: Current Coverage of MTC in Namibia

2G vs 3G vs 4G

The main difference between 2G (2nd Generation), 3G (3rd Generation) and 4G (4th Generation) Networks is that the downloading and browsing speed of mobile phones are much faster on 3G and 4G networks compared to 2G. The average speed of data transmission on a 2G network is 170 kbps compared to 3G that can reach speeds of 43,000 kbps (more than 250 times faster). With 4G these speeds can be up to 1,000 times faster than 2G allowing for the streaming of live movies and downloading large volumes of data.

2.3 *Cell phone Coverage: What does it mean?*[1]

Cell phones connect to a communications network by means of Base Transceiver Stations (BTS). Each tower creates a cell that ensures that a user stays connected as long as it remains within the bounds of the cell. Should the user move to another cell during a connected call or data session, a handover process takes place to the closest cell without disconnecting the session.

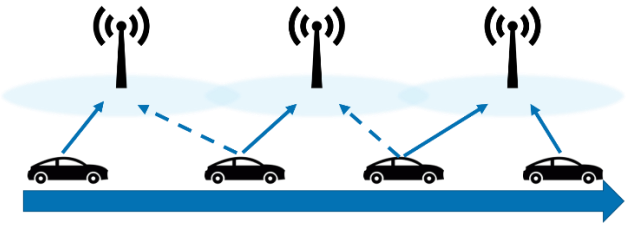


Figure 2-3: Overlapping between transmission cells.

Cell phone signal travels in a straight line and has limited penetration capabilities. Therefore, the strength of the signal is easily influenced by physical obstructions such as buildings and trees which may cause interferences.

In hilly areas 'dead zones' may be created because a direct signal between the handset and the BTS is blocked by the surrounding topography. It may also be that there are gaps in between the cells where they do not completely overlap. This is typically where users will experience dropped calls.

If a user passes through an area with poor reception, the cell phone will automatically boost its power to reach the BTS. This momentarily increases the power output of the cell phone and causes a sharp reduction in battery power.

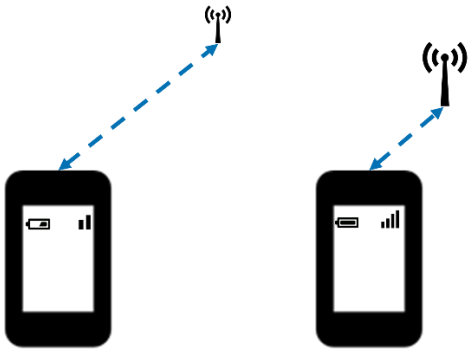


Figure 2-4: Correlation between poor reception and the phone's power output.

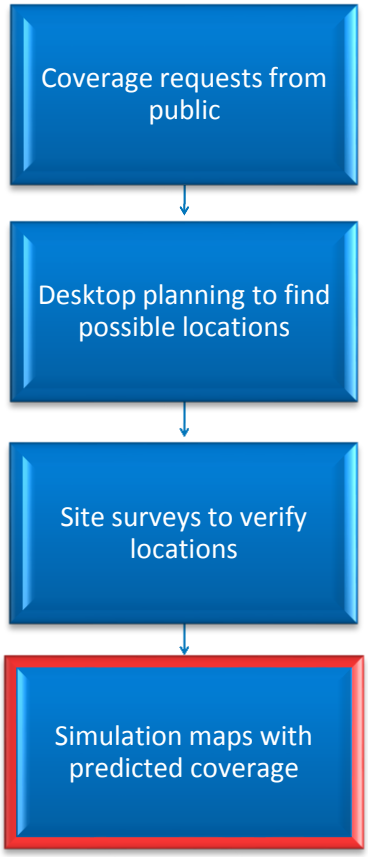
Wikipedia. Mobile Phone Signal. https://en.wikipedia.org/wiki/Mobile_phone_signal Online: 4 August 2017.

BTS can only accommodate a limited number of users at any one time which is split between voice calls and data sessions. During peak traffic periods this number can incrementally increase which may cause the BTS to become congested. Service providers try to avoid congestion by lessening the load on one site and transferring it to the next nearest site. However, this too may lead to dropped services.

Dropped calls and poor reception lead to customer complaints which MTC logs and use to identify potential problem areas.

2.4 *Selecting sites for the project*

In order to achieve their objective MTC has identified the need for an additional site within the Otjozondjupa Region. The location of the site was determined by:



This is where MTC currently is in the site selection process. While optimally positioned based on conceptual modeling, the process for final site selection is ongoing which means that the location can still be moved to a certain extent.

Once the EA is completed MTC still needs to undertake a site acquisition process which will include discussions and agreements with the landowner and local authority.

While topography or the lay of the land plays a significant role in the selection of a site, it is not the only determining factor and the highest point is not necessarily the most optimal position (although this may be the case in some instances). Sites are also assessed in terms of their technical viability and environmental suitability. The following criteria is used to determine the position of new structure:

- Access to available infrastructure such as powerlines and roads.
- Coverage of existing network infrastructure.
- Surrounding topography and built-up environment.
- Established and future urban area.
- The required footprint.
- The most appropriate design of the facility.

Engineering design tools and site surveys are required to optimize the final location of the site.

2.5 Sharing of sites

The Communications Act of 2009, requires that service providers consider sharing existing infrastructure in the area first, before constructing new structures. By sharing infrastructure uncontrolled construction of infrastructure is reduced and the cost for construction and operation can be shared between service providers.

The proposed site is located in a remote area where there are no existing sites and thus the sharing of infrastructure from existing site is not possible in this instance.

2.6 Description of Activity

2.6.1 Site Location

MTC proposes to erect a telecommunication tower within the Otjozondjupa Region, which aims to strengthen the coverage for mobile services, inclusive of voice and data services within the subject area.

2.6.2 Site Location

The proposed site location is detailed in **Table 2-1** below.

Table 2-1: Site location

Site Name	Latitude	Longitude	Region
Okonguarri	-20.587325	15.868463	Otjozondjupa

2.6.3 Type of Structures

The following type of tower is proposed to be used in the design of the project (**Photo 2-1**):

- **Guyed towers** or lattice structures that has guyed ropes to stabilize it because of its height. These towers normally exceed heights of 80m.

The guyed structures pose significant risk to birds and due to their height are visually more obtrusive. As a requirement from the Department of Civil Aviation regarding the erection of a permanent structure in an obstacle limitation zone near an aerodrome, some structures will be required to be painted red or white. Where this is not a requirement, galvanized structures will be preferred as the visual impact is less. The use of strobe lights on top of towers has not been found to affect bird species although it can attract insects and consequently bats. Red lights are normally regarded as more visually disturbing to humans whereas that is preferred from an animal point of view.

Photo 2-1: Example of a guyed structure.

2.6.4 Heights of structures

The height of the proposed structure is proposed to be 120m depending on the terrain (**Figure 2-5**).

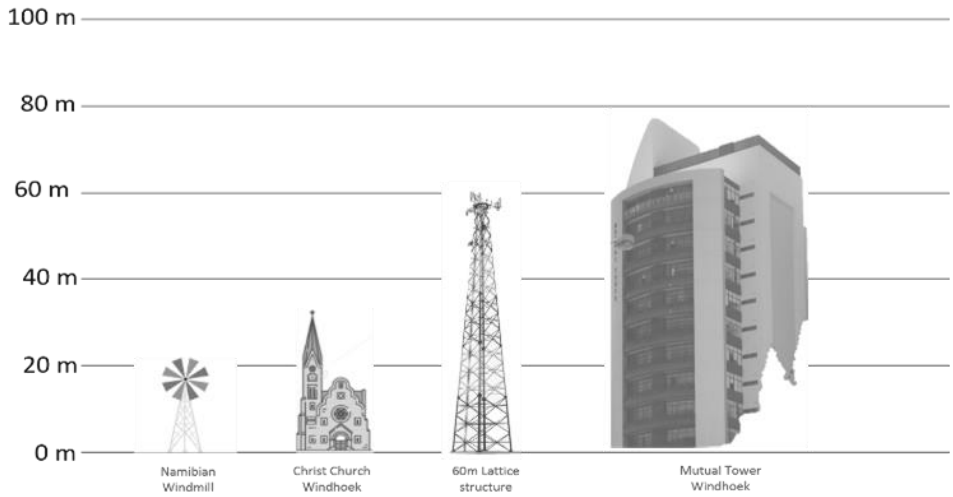


Figure 2-5: Heights of typical structures in Namibia

The proposed tower type and height for the intended project are detailed in the table below.

Table 2-2: Proposed tower types and heights

Site Name	Region	Tower Type	Tower Height (m)
Okonguarri	Otjozondjupa	Guyed Mast	120

2.7 Technical Descriptions

The technical descriptions of the sites may vary depending on the site-specific conditions. Neither the position nor the design has been fixed and some variations may occur upon final agreements with the landowners and/or immediate neighbours.

BTS vs BTS TOWER

BTS (Base Transceiver Station) refers to the equipment that is used to transmit information wirelessly between the network and the user's equipment (e.g., cell phone). It is normally housed in an equipment container next to the BTS tower.

A BTS tower is the physical structure that is used to hold the antennae that transmit the signal to and from the BTS. They come in different forms but in this project the main types that will be used are the lattice tower, monopole tower or guyed tower which will either be a lattice or monopole tower with guyed ropes to stabilize it.

2.7.1 The typical site

The various alternatives that are available for a site are described under Section 2.8. However, a typical site will be 81m^2 (9m x 9m) with a 2-meter-high palisade fence (with electric fencing on top) surrounding the premises. It will contain a 2.4m x 2.4m equipment container or outdoor Base Transceiver Station (BTS) and a structure (e.g., Lattice tower) on which telecommunication antennae will be installed.

2.7.2 Infrastructure and Services

Power will be supplied by means of solar panels or through a direct connection with the NamPower grid depending on its availability. Road access will also be required to each site, and where it is not currently available it will have to be created.

ALTERNATIVES

"Different means of meeting the general purpose and requirements of the activity" (Environmental Management Act (2007)).

2.7.3 Resources and construction process

Typically, about five people are required during the construction phase and the same number or less during operational and maintenance phases.

During the construction phase the structure is bolt together and the antennae attached to the structure before is it erected in a dug hole of about 3 meters deep. It is then grounded with cement for stability.

Construction normally lasts about 8 weeks. Approximately three weeks are required for the digging of the foundation and while waiting for the foundation to dry, the tower is laid down.

2.7.4 Operational and Maintenance Phase

The antennae of a cell phone tower normally lasts up to 1 million hours. As a result, a site usually requires very little maintenance. Software can be upgraded from MTC's head office and it is really only when hardware needs to be upgraded that maintenance is done on site.

2.8 Assessment of Alternatives

There are several different ways in which the sites can be developed. The purpose of this section is to describe and assess the proposed alternatives to establish the preferred alternative. It is however important to note that the selection of a specific design for a site depends on the site conditions and in some instances, it may not be technically or economically feasible to implement the preferred alternative.

2.8.1 The "No -go" Alternative

This alternative predicts the future scenario which would exist in the absence of any project. It is represented by the status quo, as described in the baseline description (Chapter 4). Should the proposed project not receive Environmental Clearance from the DEA, the 'no-go' alternative will prevail.

If this project did not proceed the existing situation of poor coverage in the subject areas (particularly the rural areas) will prevail and MTC will continue to receive complaints regarding coverage. It will however also mean that the proposed new sites will not be constructed along with the associated infrastructure such as roads and powerlines. The negative impacts on the receiving environments (biophysical and social) and associated with construction and operation of these sites will therefore not take place.

The proposed project could lead to some employment opportunities in the subject region of Namibia and contribute to both Harambee and Vision 2030 objectives for infrastructure development and community upliftment in the country. In that regard, the "no-go" alternative is not the preferred alternative as it is believed that this project could positively contribute to development in Namibia especially if the potentially negative effects of the project on the receiving environments are avoided or at least minimized.

2.8.2 Sharing of infrastructure

The provision in the Communications Act of 2009 regarding the sharing of infrastructure is clear. All infrastructure that can be used for their purposes (e.g., in terms of height and type of required coverage) should be considered before deciding on the construction of a site.

The proposed site is located in a remote area where there are no existing sites in proximity to the proposed site location and thus the sharing of infrastructure from existing sites is not possible. However, the sharing of existing infrastructure, such as access roads and powerlines should be considered for the proposed sites as far as reasonably possible.

In this instance sharing of infrastructure is the preferred alternative from an Environmental and Social point of view as it reduces the potential impacts associated with the construction of a new site and infrastructure such as roads and powerlines.

2.8.3 Type of Antennae

Antennae come in different shapes and sizes depending on the specific need. Two main groups can however be distinguished namely (**Figure 2-6**):

- Omni-directional antennae are designed to provide 360-degree coverage from one antenna. It is used in instances where coverage is needed. Because of the dispersed nature of this type of antenna, the signal is generally weaker and is therefore ideal to provide coverage over short distances.
- Directional Antennae are designed to focus the signal in a particular direction over greater distances. It allows for increased performance when transmitting and receiving information and ensure reduced interference from unwanted sources. It is often used when a signal is to be submitted over a longer distance through a number of obstacles such as buildings.

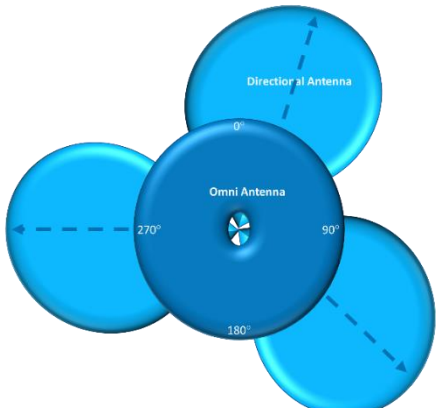


Figure 2-6: Different types of antennae.

2.8.4 Bandwidth

The bandwidth of the antennae refers to the range of frequencies that can effectively be supported. It covers the 800-900 MHz bands as well as the 1800-2100 MHz bands.

The UMTS frequency bands are used for the third generation (3G) communication networks. The various bands are deployed to different regions. The 900 and 2100 bands are specifically assigned to Namibia.

2.9 Infrastructure and services

As mentioned, the availability of existing infrastructure such as powerlines and roads is one of the criteria for the selection of a site. Therefore, should infrastructure be available it will be utilized and where not, new infrastructure will need to be constructed (**Figure 2-7**).

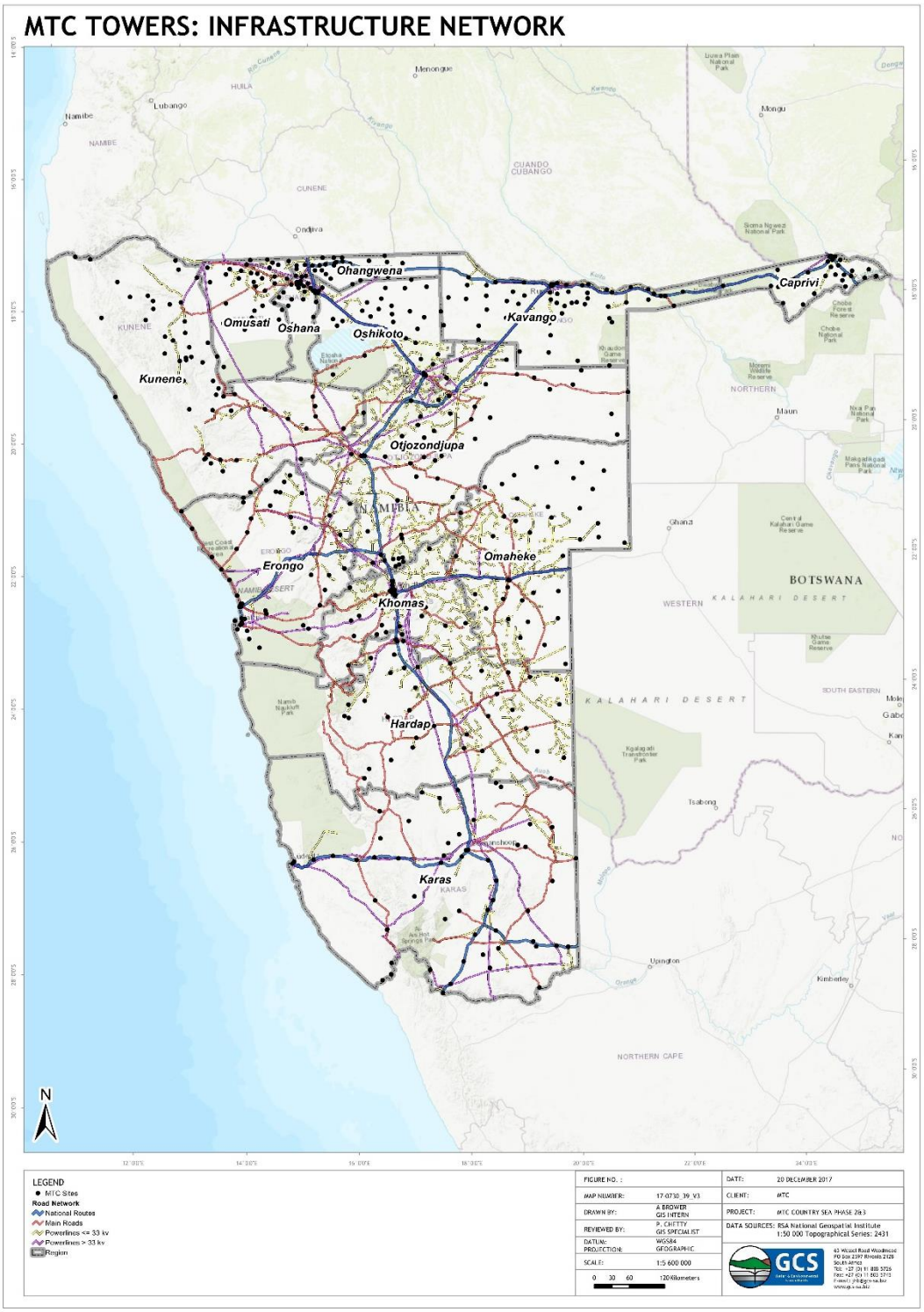


Figure 2-7: Availability of infrastructure in Namibia.

2.9.1 Road infrastructure

The construction of access roads in the rural areas entails the physical destruction of habitats for the required footprint of the road. This is regarded as a risk in sensitive areas such as protected areas and mountains, outcrops or inselbergs. In general, such areas need to be avoided.

Should access be required to a proposed site from the national proclaimed public road network for which the Roads Authority (RA) (Ministry of Works and Transport) is responsible permission will need to be obtained from the RA.

2.9.2 Powerlines vs solar

The construction and operation of a powerline to site independent of its length pose a risk to the surrounding fauna in particular birds. Should the powerline be buried the risk is significantly reduced, but this option is not always feasible because of the terrain and the cost associated with construction. Solar infrastructure is the preferred option from an environmental point of view. Generally, the following is considered in terms of the selection of power infrastructure at a site (**Table 2-3**):

Table 2-3: Assessment of alternatives in terms of power infrastructure.

	Cost/km or installation	Restriction
Solar infrastructure	Approximately N$980,000.00 per installation	Batteries need to be maintained every 4-6 months. Overcast conditions causes power cuts. Failures of system causes technical problems.
Tap off from a powerline	N$100,000.00/km	Can only tap-off from powerlines less than 33kV. Maximum 10km otherwise too expensive.
Buried powerline	Up to 3 times more expensive per km than a powerline	

For the purpose of the EA, sites that are located less than 10km from a 33kV (or less) powerline was assumed to receive power through a powerline (**Figure 2-8**). Any sites further than 10km would be too expensive to construct and was therefore assumed to receive solar power.

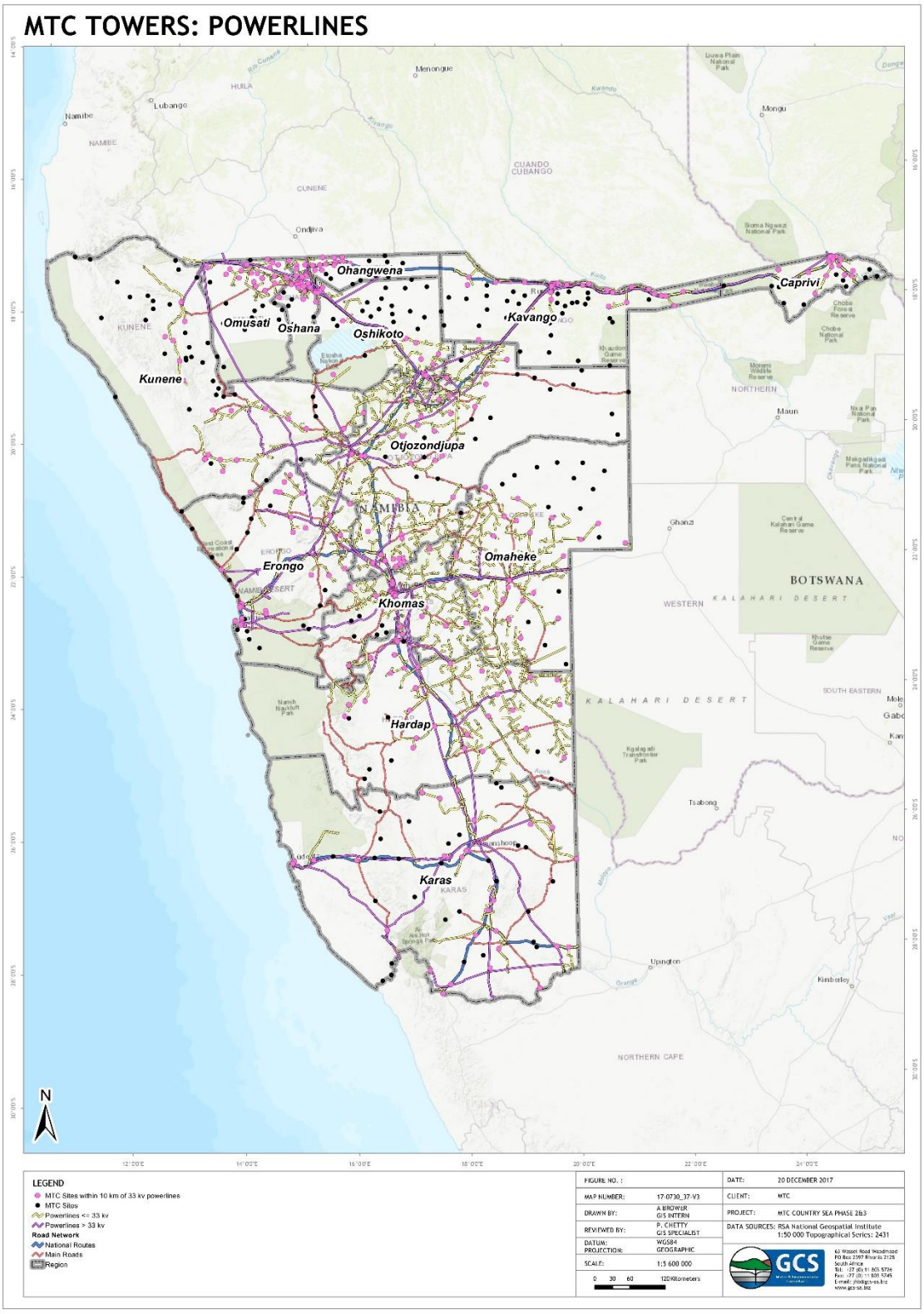


Figure 2-8: Sites (in pink) assumed to receive power by means of powerlines and not solar.

The next chapter will focus on the description of the relevant legislation and the potential legal implications of the implementation of the Development Plan.

3 LEGAL FRAMEWORK

This chapter provides an overview of the legislation and policy framework for the EA.

3.1 Relevant Legislation and implications for project

Legislation/Policy/ Guideline	Relevant Provisions	Implications for this project
The Constitution of the Republic of Namibia (1990)	The articles 91(c) and 95(i)	MTC should ensure that their proposed structural developments coexist with the natural environment and most importantly, the well-being of the Namibian citizens in terms of facilities and services.
Environmental Management Act EMA (No 7 of 2007)	Section 27	The EMA and its regulations should inform and guide this EA process.
Environmental Impact Assessment (EIA) Regulations GN 28-30 (GG 4878)	GN 30 S21 Scoping Report (GN 30 S8) Assessment Report (GN 30 S15).	
Communications Act, 2009	Section 50 (1)	MTC should consider sharing existing sites with other service providers to avoid cumulative impact.
Namibian Communications Commission Act, Act 4 of 1992	Entire Act	Standards for setting up cellular, wireless and satellite services outlined by this Act should be followed.
The Atomic Energy and Radiation Protection Act, Act 5 of 2005:	Section 2: a-c	Used to determine the "safe distance" around the site.
Guidelines for Limiting Exposure to Time Varying Electric, Magnetic, and Electromagnetic Fields (100kHz to 300GHz)" (2020) developed by the International Commission on Non Ionizing Radiation Protection (ICNIRP)	Entire document	MTC should adhere to the limitations put by the International Commission on Non-Ionizing Radiation Protection (ICNIRP).
Public Health Act 36 of 1919	Section 119	MTC should ensure that all workers involved in the construction and maintenance of the towers comply with this Act.

Legislation/Policy/ Guideline	Relevant Provisions	Implications for this project
Health and Safety Regulations GN 156/1997 (GG 1617)	All regulations	MTC should ensure that all workers involved in the construction and maintenance of the towers comply with this Act.
World Health Organisation: Base stations and wireless networks exposure and health consequences (2005)	Entire document	MTC should adhere and understand the exposure standards of wireless networks and potential health effects on the residents of the receiving environment.
The Aviation Act, Act 74 of 1962	Section 139.02.8	MTC Namibia to adhere to regulations for setting up a cellular structure in Namibia.
Convention on International Civil Aviation	Annex 14: to the Convention on International Civil Aviation. Chapter 4 & 6	MTC should adhere to the guidelines outlined in this Convention so as to avoid obstruction to aerodromes.
National Heritage Act (Act 27 of 2004):	Section 48	MTC should immediately inform the National Heritage Council of Namibia should any archaeological material, e.g. graves be found during the construction phase.
Forestry Act 12 of 2001	Section 22 Section 23	MTC should notify the relevant authorities in order to be allowed to construct in their jurisdictions. If there are any protected species, a permit to remove them is required.
Nature Conservation Ordinance (No. 4 of 1975)	Section 18 Section 19	The Proponent should acquire the right permits before entering national parks.
International Convention for the Protection of Birds (1950)	Article 1 Article 2	This convention should guide the site selection process, so as to reduce the potential interruption of avifauna, paying particular attention to their breeding sites and migration routes.
Water Resources Management Act (No. 11 of 2013)	Section 38 Section 68 Section 92	MTC Namibia should ensure that they comply with tis Act's regulations as deemed necessary for the project.

Legislation/Policy/ Guideline	Relevant Provisions	Implications for this project
The Pollution Control and Waste Management Bill (in preparation)	The entire Bill	The proponent should apply emissions and management measures and acquire the necessary permits.
Regional, Town or City Structure plan (1996)	Entire Plan	The proposed sites must be constructed to fit into the town's vision or plans with the proposed land.
If available, Town Planning Schemes	Entire Plan	MTC may need to apply to the different town councils for consent to use the sites for the construction of BTS stations.
Labour Act (No. 6 of 1992)	Section 39	MTC Namibia and its project contractors should ensure that the safety and welfare of workers are not compromised during the construction, operation and maintenance of the new network structures.
The Electricity Act (No. 4 of 2009)	Exercises control over the provision, use and consumption of electricity in Namibia.	Terms should be agreed between MTC Namibia and the electricity supplier (NamPower, NORED, CENORED, etc.) in the respective regions.
The Road Traffic and Transport Act (No. 22 of 1999)	Advertising on Roads and Ribbon Development Ordinance 30 of 1960.	MTC Namibia should obtain the relevant permits for road transportation or access to sites that are off the national proclaimed public road networks, if required.

The next chapter presents the baseline features of the study area and the surrounding areas.

4 THE RECEIVING ENVIRONMENT

This chapter provides a description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic, and cultural aspects of the environment may be affected.

4.1 Physical landscapes

Namibia lies on the west coast of Southern Africa and extends over 825 418 square kilometers. Geological processes over the last 2,600 million years have shaped the landscape into two distinct geological zones: one in western Namibia where there is a great variety of rock formations most of them in a rugged landscape of valleys, escarpments, mountains and large open plains. The other is in the east, where sands and other sediments were deposited relatively recently to cover most of the surface creating more uniform landscapes.

According to Shagama (2017) extensive physical weathering, as well as erosion under arid and semi-arid conditions are the dominant soil forming processes throughout Namibia. Over 70% of Namibia's surface area can be classified as highly susceptible to erosion activities, making soil development very difficult in general. Aeolian sedimentation processes are active in the Kalahari and Namib Deserts, where dunes and Hamada type landscapes prevail.

Namibia's varied geology encompasses rocks of Archaean to Cenozoic age, thus covering more than 2 600 million years (Ma) of Earth history. Nearly half of the country's surface area is bedrock exposure, while the remainder is covered by young surficial deposits of the Kalahari and Namib Deserts (Shagama, 2017).

The rivers within Namibia are ephemeral rivers, flowing only for a short period after good rains in their catchment areas. Most of them flow towards the Atlantic Ocean and form linear oases in the Namib Desert. Some limited drainage occurs towards the Kalahari Basin. Some large surface water storage dams have been built on these rivers to supply the major centers with water (Shagama, 2017).

According to Shagama (2017) different physical landscapes can be identified based on similarity in topography, geology and hydrogeology. These clusters are described in **Table 4-1** below:

Table 4-1: Description of the key physical landscapes affected by the proposed project based on Clusters of similarity.

Affected Regions	Description				
	Climate	Topography	Geology	Hydrogeology	Sensitivity
NORTH CENTRAL PROTECTED AREAS					
Oshikoto, Otjozondjupa and part of Kavango West, Omaheke, and Kunene Regions	Mean annual precipitation (MAP) is 503 mm and there are two months of average rainfall greater than 100 mm (January and February), with the highest monthly rainfall being 370.6 mm recorded in February 1944	No significant mountain ranges and inselberg in northern part of the cluster, area is mostly flat. Southern part of the cluster area, has a variety of landscapes such as Karstveld, Khomas Hochland Plateau, including the Otavi Mountains and Waterberg Plateau.	Common soil type gravel, sand and calcrete. Northern part - Kalahari Sediments, Southern part - carbonates rock units, including limestone and dolomites. Eastern part - huge sand-filled basin underlain by various rock types. Outcrops of carbonate and quartzite in Gam and Tsumkwe.	Surface water systems in the upper part of cluster are Omuramba Owambo, Oshigambo and Ekuma. Otjozondjupa Region, the main system is the Omuramba Omatako drainage line. Kalahari aquifers, north and east and fractured bedrock aquifers to the southern part of the cluster.	Sensitive areas include protected areas such as Etosha and Khaudom National Parks

Photo 4-1: Hills around Site Google 144 in the North Central Protected areas.

4.2 Ecology

The distribution of fauna and flora are affected by the regional climatic and topographic conditions such as rainfall altitude and rate of evaporation as described in the previous section. This natural occurrence of broad ecological communities of plants and animals within a specific region is called biomes (Shaw, 2017).

Namibia is classified into four terrestrial biomes namely Desert, Nama Karoo, Succulent Karoo and Tree and Shrub Savanna (Irish, 1994). Biomes are described as areas of discrete climate and animals are subjected to the same environmental pressures. Irish (2017) describes the Namib Desert and Succulent Karoo biomes as highly sensitive habitats for any form of disturbance.

Each biome is affected to different extents by land uses such as rangeland farming, agriculture, wildlife production, tourism and recreation, mining and urban development. Namibia's variable environmental conditions have also shaped a large diversity of vegetation zones, which have been divided into 29 such zones (Ministry of Environment and Tourism, 2010). The description of the biomes for the subject region is presented in **Table 4-2**.

Photo 4-2 Common vegetation cover in the Central Coast (left) and around the Brandberg area **(right).**

Table 4-2: Description of the Biomes for subject region.

Affected Regions	Description			
	Climate	Flora	Fauna	Sensitivity
TREE AND SHRUB SAVANNA				
All regions of Namibia	Annual rainfall of 450-700mm	*Colophospermum mopane*, *Euphorbia guerichiana*, *Cyphostemma spp.*, *Adenolobus* spp., quiver tree (*Aloe dichotoma)*, and *Moringa ovalifolia*. Brandberg acacia (*Acacia montis-ustii*) and *A. robynsiana*. *Acacia senegal* and *A. tortilis* *Euphorbia guerichiana*, *Cyphostemma spp.*, *Adenolobus spp.*, *Rhigozum trichotomum* *Parkinsonia africana*, *Acacia nebrownii*, *Boscia foetida*, *B. albitrunca*, and *Catophractes alexandri* *Pentzia spp. and Eriocephalus spp* (Spriggs, 2018)	High numbers of large mammals are present including 70% of Namibia's elephant population and the majority of the buffalo and hippopotamus populations. Important to transboundary cooperation as ecosystems are shared and species move across national boundaries	Poor land management through overstocking has led to soil erosion, loss of grass species diversity, and bush encroachment.

Photo 4-3: The Savana biome covers most of Namibia and includes different vegetation types.

4.3 Avifauna

The impact of communication masts on avifauna in Namibia is not well known, however, sensitivities of birds to power line impacts, including collisions and electrocutions, are well documented (Scott & Scott, 2017). In many cases, communication masts are energized by associated low voltage distribution power line structures, and it is assumed that collision sensitivities of birds to power line structures may be extrapolated to a certain extent to communication masts and their stay wires (Scott & Scott, 2017). Therefore, although avifauna forms part of the surrounding ecology, it was considered separately.

As with ecology, avifaunal distribution is best described based on biomes, which provides a useful way of distinguishing areas that share broadly similar plant life and climatic features, and often similar animal life, soils and geological features. The description of these features per biome has been provided in Section 4.2.

According to Scott and Scott (2017), a total of 687 bird species has currently been recorded for Namibia. Of these, some 71 (10%) are regarded as threatened. A number of these species are also Globally Threatened. Classified according to habitat type and lifestyle, 19 of the above species are coastal and wetland species, 22 occupy inland wetlands, 20 are birds of prey, 10 are found in savannas and woodlands, only one in grasslands, and two in Karoo and Namib habitats.

Sixteen species are endemic/near-endemic to Namibia, with 90%+ of their population in this country. Endemism or having limited distribution renders populations more vulnerable to threats. Every year from October to April, more than 150 migrant bird species visit Namibia from northern and central Africa, Europe and Asia (Scott & Scott, 2017).

The habitat category is further categorized into the following (**Table 4-3**):

- Biome;
- Protected area status;
- Landscapes, including mountains and inselbergs; and
- Wetland habitats, including rivers (perennial and ephemeral), dams and irrigation areas.

The bird species category is categorized into the following features (**Photo 4-4**):

- Bird diversity;
- Bird endemism, focusing on Namibian endemic/near endemic bird species;
- Collision-prone Red Data bird species; and

- Wildlife and power line incidents recorded in Namibia, 2009-2016. Note that for these 631 mortalities, mainly birds were involved, the chief groups being flamingos (39%) and bustards/korhaans (32%).

Photo 4-4: Typical bird habitats across Namibia.

Table 4-3: Regional distribution of birds in sensitive habitats.

Affected Biome(s)	Habitat Description			Sensitivity		
	Protected area status incl. IBAs	Landscapes (mountains, inselbergs)	Rivers, wetlands, dams	Bird diversity	Bird endemism	Collision-prone Red Data spp
OTJOZONDJUPA						
Tree and shrub savanna	Waterberg Plateau NP Von Bach Recreation Resort Gross Barmen Hot Springs N007 Bushmanland Pan System N008 Waterberg Plateau Park 8 communal conservancies Freehold conservancies	Karstveld Kalahari Sandveld Central-Western Plains Pans Khomas hochland Plateau	Ephemeral Omuramba Omatako Von Bach Dam Omatako Dam Swakkoppoort Dam	81->230 species	0-10 species	16-45 species

4.4 Social

Konstantinidi (2018) states that due to the low population density and the uneven distribution of population (with majority of the population living in the extreme north of the country) and the fact that 50% of the population lives in rural areas, there is a clear distinction between rural and urban environments:

Rural areas present a set of characteristics that is common to all sites that have been proposed for rural areas, despite the diversity in culture, economic activities and climate. These common factors are related to:

- the long distances between settlements;
- the small population which lives in each settlement;
- the lack of infrastructure and public services;
- the harsh climate conditions;
- the scarcity of water; and
- poor or no cell phone coverage.

Urban areas present another set of common factors:

- proximity between households;
- limited space for development;
- easy access to services and infrastructure;
- higher rate of school going children;
- better access to job opportunities;
- available cell phone coverage.

From the nationwide assessment of the above categories, key sensitive areas can be summarised as described below in **Table 4-4** (Konstatinidi, 2018).

Table 4-4: Description of specific sensitive communities in Otjozondjupa region.

Affected Community	Description				
	Urban or Rural Setting	Livelihood strategies	Connectivity	Triggered parameter(s)	Sensitivity/Need
OTJOZONDJUPA					
N'a-Jaqna Communal conservancy	**Rural:** Near Kwando River, 8km away from border post between Angola, Zambia and Namibia.	Land is limited to protection of wildlife, re-establishing game population and sustainable forest management.	Little to no network coverage.	• Isolation • Vulnerable groups	Provide road coverage and localize coverage to the communities. Lack of connectivity affects health mortality rate, development opportunities, business development, social networks and livelihood strategies. communities have no means of communicating urgencies and crimes. Problems with water pumps and generators cannot be solved remotely.
Nyae Nyae Communal Conservancy	**Rural:** Communal land starts soon after Perspeka and ends in the Botswana border post of Dobe. Settlements are also scattered in the communal land.	Hunter-gatherers. Possess only what they can carry. ablution, water and electricity supply mostly unavailable. minimal health infrastructure. villages close to town attend school	Connectivity is poor and unreliable. Currently only cell phone tower at Tsumkwe which provides localized coverage. No connection, no phone lines and no electricity.	• Isolation • Vulnerable groups	Business development, connectivity between remote families, the rest of namibia and the world. long isolated roads often have accidents and cars breaking down and no one can call for help. Nama-Pan Veterinary post, the police and veterinary officials need for coverage in order to manage the post better.

4.5 Archaeology

Namibia is one of the renowned countries in Southern Africa with rich archaeological records where the earliest evidence of human occupation can be traced back to about 400, 000 - 100,000 years ago (Early Middle Stone Age periods).

According to Nankela (2017) the archaeological sequences of Namibia can be summarized as follow (**Table 4-5**):

Table 4-5: Archaeological sequences in Namibia

Period	Year	Area	Evidence	Description/ Factors
Pleistocene	400 000- 100 000	Namib Plains, Namib Desert & Lower Kuiseb	Bone fragments of extinct elephant and stone tools	
Holocene	10 000- 1 000	Around Namibia	Scattered artefacts, rock art sites, potsherds, beads, grave cairns, hut circles, human remains, axes, pointed flakes, cleavers and blades.	Sites are fragile, inaccessible and due to inadequate archaeological investigations in some sites.
Historic Period	500	Around Namibia	Cemeteries, old mine workings, waste rock walling, architectural heritage and WWI military engagements.	Namibia has an indication of intensive settlements between indigenous people and Europeans.

Although water resources are restricted in Namibia, archaeological sites are relatively homogeneous in their distribution across Namibia. This can be attributed to this to pre-historic occupation of people in areas where water was readily available (Nankela, 2017). However, this is not the only basis to accurately predict where archaeological sites are likely to occur in the landscape as water changed over time (**Figure 4-1**). Nankela (2017) noted that there are other important resource indicators for human settlement such as availability of shelters, edible plants, movements of game species and raw materials for stone tool production.

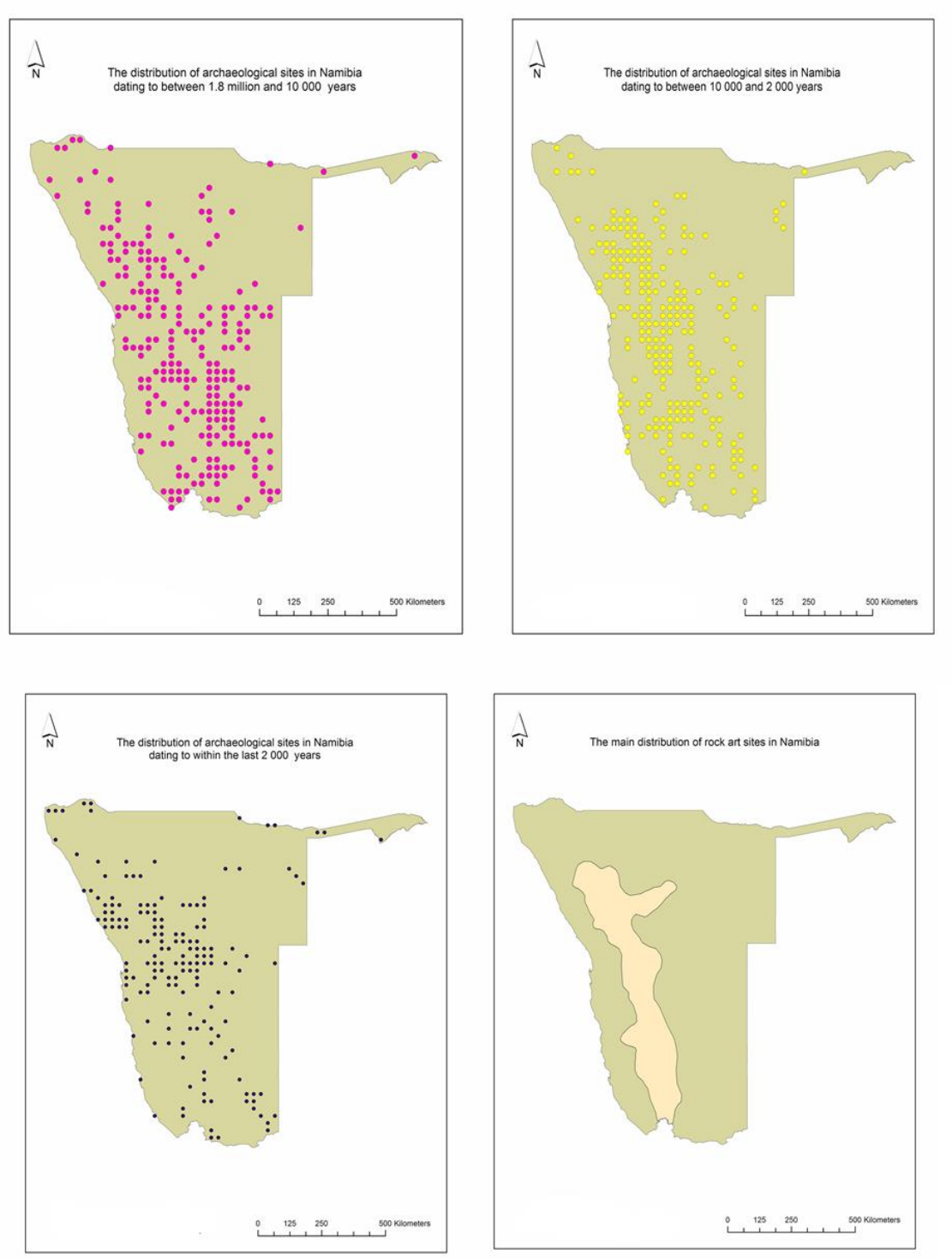


Figure 4-1: Maps of Namibia showing generalized distribution of archaeological sites.

In **Table 4-6** below are a few principle areas of highest and low concentrations within the subject region where archeological sites have been recorded and are likely to occur.

Table 4-6: Archaeologically sensitive landscapes and the areas they occur in Namibia.

Archaeological landscape	Description			
	Zone	Affected Regions	Archaeological feature	Sensitivity
Inselbergens and Outcrops	Brandberg, Erongo and Spitzkoppe mountains, Khomas Highland, Gamsberg Mountain, Auas Mountain range, Omatako mountain ranges, Naukluft mountains, Karasberg mountains, Kunene Hills and sedimentary formations (sandstones) such as the Twyfelfontein	Erongo, Khomas, Otjozondjupa, Hardap, //Kar as, Kunene	High concentrations of prehistoric rock art and other well-stratified archaeological deposits associated with prominent geological landforms that vary in sizes and shapes, from dome shaped massifs to small isolates outcrops. Widely distributed in Namibia.	Negatively impacted by infrastructure developments associated with mining explorations, pipelines and electricity lines.

Photo 4-5 Typical examples of inselbergens and outcrops

With the descriptions of the receiving environment described in this chapter, the next chapter describes the public's involvement and the sensitivities illustrated by them.

5 PUBLIC PARTICIPATION

This chapter provides an overview of the main stakeholders that were identified during the Environmental Assessment, the methodology followed to consult with them and their key areas of concern.

5.1 Objectives of Participation

Public consultation forms an important component of an Environmental Assessment (EA) process. Public consultation provides potential Interested and Affected Parties (I&APs) with an opportunity to comment on and raise any issues relevant to the project for consideration as part of the assessment process. Public consultation has been done in accordance with both the EMA and its EIA Regulations.

The public consultation process assists the Environmental Assessment Practitioner (EAP) in identifying all potential impacts and to what extent further investigations are needed. Public consultation can also aid in the process of identifying possible mitigations measures.

PUBLIC CONSULTATION

'Process in which potential interested and affected parties (I&APs) are given an opportunity to comment on, or raise issues relevant to, specific matters' (MET, 2007).

5.2 Approach:

5.2.1 Interested and Affected Parties (I&APs)

An I&AP is identified under the Environmental Management Act (2007) 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".

GCS identified specific I&APs, who were considered interested in and/or affected by the proposed activities through the following means:

- Information for the applicable local and/or regional authorities was obtained from the existing GCS stakeholder database;
- The constituency councilor for the affected communities contact information was obtained to assist in contacting the affected communities and assisting in arranging community meetings; and
- Notices were placed in the local newspapers requesting any potentially affected or interest members of the public to register as I&APs.

The complete list of I&APs is provided in **Appendix C.**

5.2.2 Communication with I&APs

Regulation 21 of the EIA Regulations details steps to be taken during a given public consultation process and these have been used in guiding this process.

Communication with I&APs about the proposed development was facilitated through the following means and in this order:

- A Background Information Document (BID) containing descriptive information about the proposed activities was compiled (**Appendix D**) and sent out to all identified and registered I&APs on 2 November 2020;
- Notices were placed in *The Observer* and *The Sun* newspapers dated 20 November 2020 and 27 November 2020 and in *The New Era* newspaper dated 24 November and 1 December, briefly explaining the activity and its locality, inviting members of the public to register as I&APs (**Appendix E**);
- Due to lack of accessibility no site notice was placed on site.

The site is located within the Otjiwarongo Constituency. GCS has been in consultation with the Otjiwarongo Constituency Councillor to ascertain the ownership of the land in order to consult the affected parties. The Otjiwarongo Constituency Councillor confirmed that the land is not owned by a private owner and is thus within the Otjiwarongo Constituency jurisdiction.

Public consultation was carried out according to the Environmental Management Act's EIA Regulations. After the initial notification, the I&APs were given two weeks to submit their comments on the project until 11 December 2020.

The Draft Scoping Report was circulated from the **1st of March until the 15th of March 2021** for public review and comment. The overall commentary received from the public (if any) on the draft report is documented in the comments and responses trail document (**Appendix G**). This report highlights issues raised from the public on the documents and contain statements of how these are addressed and incorporated into the final document. The comment period will remain open until the final scoping report is submitted to MEFT.

6 IMPACT IDENTIFICATION

The chapter describes the key environmental and environmentally linked social impacts utilizing the information that was obtained through an analysis of the regional baseline data, specialist input and consultation with the stakeholders.

6.1 Impact Assessment Methodology

The proposed activities have impacts on certain biophysical and social features. The identified impacts were assessed in terms of probability (likelihood of occurring), scale/extent (spatial scale), magnitude (severity) and duration (temporal scale) as presented in **Table 6-1**, **Table 6-2**, **Table 6-3** and **Table 6-4**. To enable a scientific approach to the determination of the environmental significance, a numerical value is linked to each rating scale. This methodology ensures uniformity and that potential impacts can be addressed in a standard manner so that a wide range of impacts are comparable.

It is assumed that an assessment of the significance of a potential impact is a good indicator of the risk associated with such an impact. The following process will be applied to each potential impact:

- Provision of a brief explanation of the impact;
- Assessment of the pre-mitigation significance of the impact; and
- Description of recommended mitigation measures.

The recommended mitigation measures prescribed for each of the potential impacts contribute towards the attainment of environmentally sustainable operational conditions of the project for various features of the biophysical and social environment.

The following criteria were applied in this impact assessment:

6.1.1 Extent (spatial scale)

Extent is an indication of the physical and spatial scale of the impact**. Table 6-1** shows rating of impact in terms of extent of spatial scale.

Table 6-1: Extent or spatial impact rating

Low (1)	Low/Medium (2)	Medium (3)	Medium/High (4)	High (5)
Impact is localised within the site boundary: Site only	Impact is beyond the site boundary: Local	Impacts felt within adjacent biophysical and social environments: Regional	Impact widespread far beyond site boundary: Regional	Impact extend National or over international boundaries

6.1.2 Duration

Duration refers to the timeframe over which the impact is expected to occur, measured in relation to the lifetime of the project. **Table 6-2** shows the rating of impact in terms of duration.

Table 6-2: Duration impact rating

Low (1)	Low/Medium (2)	Medium (3)	Medium/High (4)	High (5)
Immediate mitigating measures, immediate progress	Impact is quickly reversible, short term impacts (0-5 years)	Reversible over time; medium term (5-15 years)	Impact is long-term	Long term; beyond closure; permanent; irreplaceable or irretrievable commitment of resources

6.1.3 Intensity, Magnitude / severity

Intensity refers to the degree or magnitude to which the impact alters the functioning of an element of the environment. The magnitude of alteration can either be positive or negative. These were also taken into consideration during the assessment of severity. **Table 6-3** shows the rating of impact in terms of intensity, magnitude or severity.

Table 6-3: Intensity, magnitude or severity impact rating

Type of criteria	Negative				
	H- (10)	M/H- (8)	M- (6)	M/L- (4)	L- (2)
Qualitative	Very high deterioration, high quantity of deaths, injury of illness / total loss of habitat, total alteration of ecological processes, extinction of rare species	Substantial deterioration, death, illness or injury, loss of habitat / diversity or resource, severe alteration, or disturbance of important processes	Moderate deterioration, discomfort, partial loss of habitat / biodiversity or resource, moderate alteration	Low deterioration, slight noticeable alteration in habitat and biodiversity. Little loss in species numbers	Minor deterioration, nuisance or irritation, minor change in species / habitat / diversity or resource, no or very little quality deterioration.

6.1.4 Probability of occurrence

Probability describes the likelihood of the impacts actually occurring. This determination is based on previous experience with similar projects and/or based on professional judgment. See **Table 6-4** for impact rating in terms of probability of occurrence.

Table 6-4: Probability of occurrence impact rating

Low (1)	Medium/Low (2)	Medium (3)	Medium/High (4)	High (5)
Improbable; low likelihood; seldom. No known risk or vulnerability to natural or induced hazards.	Likely to occur from time to time. Low risk or vulnerability to natural or induced hazards	Possible, distinct possibility, frequent. Low to medium risk or vulnerability to natural or induced hazards.	Probable if mitigating measures are not implemented. Medium risk of vulnerability to natural or induced hazards.	Definite (regardless of preventative measures), highly likely, continuous. High risk or vulnerability to natural or induced hazards.

6.1.5 Significance

Impact significance is determined through a synthesis of the above impact characteristics. The significance of the impact "without mitigation" is the main determinant of the nature and degree of mitigation required. As stated in the introduction to this chapter, for this assessment, the significance of the impact without prescribed mitigation actions was measured.

Once the above factors (**Table 6-1, Table 6-2, Table 6-3** and **Table 6-4**) have been ranked for each potential impact, the impact significance of each is assessed using the following formula:

SP = (magnitude + duration + scale) x probability

The maximum value per potential impact is 100 significance points (SP). Potential impacts were rated as high, moderate or low significance, based on the following significance rating scale (**Table 6-5**).

Table 6-5: Significance rating scale

SIGNIFICANCE	*ENVIRONMENTAL SIGNIFICANCE POINTS*	*COLOUR CODE*
High (positive)	>60	H
Medium (positive)	30 to 60	M
Low (positive)	<30	L
Neutral	0	N
Low (negative)	>-30	L
Medium (negative)	-30 to -60	M
High (negative)	>-60	H

For an impact with a significance rating of high, mitigation measures are recommended to reduce the impact to a low or medium significance rating, provided that the impact with a medium significance rating can be sufficiently controlled with the recommended mitigation measures. To maintain a low or medium significance rating, monitoring is recommended for a period of time to enable the confirmation of the significance of the impact as low or medium and under control.

The impact assessment for the proposed activities is given in subchapter **6.2, 6.3** and **6.4**.

6.2 Construction Phase Impact Assessment

The potential impacts associated with the construction of the tower structures have been identified and assessed in this subchapter.

6.2.1 Impact Assessment on Biodiversity Loss

The proposed construction of the tower, access road and associated infrastructure may impact the existing biodiversity in the area. This is due to the fact that the track would have to be cleared of vegetation to make way for the access road and proposed infrastructure. Care should be taken during the removal of vegetation for site preparation to ensure minimal disturbance in the area. The envisaged impact at the project site, is thus not of such magnitude and/ or significance that it will have irreversible impacts on the biodiversity and endemism of the area and Namibia at large. The assessment of this impact is presented in **Table 6-6.**

Table 6-6: Assessment of the impacts on biodiversity loss

	Extent	Duration	Intensity	Probability	Significance
Pre-mitigation	L/M - 2	M - 3	M/H - 48	H - 5	**M - 65**
Post-mitigation	L/M - 2	L/M- 2	M- 6	M - 3	M - 30

6.2.1.1 Mitigations and recommendation to disturbance of surrounding property owners

- Large indigenous trees on site need to be identified, marked, surveyed and are not to be removed.
- Trees with a trunk size of 150 mm and bigger should be surveyed, marked with paint (readily visible) and protected.
- Protected Tree Species as per the Forest Act No 12 of 2001 may not be removed without a valid permit from the Department of Forestry.

6.2.2 Impact Assessment on Landscape

Potential impacts that can be experienced in terms of the soils, geology, hydrology and geohydrology of the sites include:

- Disturbance of flow dynamics of floodplains – The introduction of a structure within the flood plain will disturbs the natural dynamic of the water.
- Disturbance of the soils and geology – Impacts that cause disturbance during construction leading to erosion due to the removal of soil.
- Destruction of sensitive landscapes - Impacts on outcrops, hills or mountains due to construction i.e. clearing area for road or tower.

Erosion is expected to occur at the proposed sites particularly during construction activities. With no mitigation measures in place, this impact will receive a "medium to high" significance rating. However, the implementation of applicable mitigation measures, the impact can significantly be reduced to a low rating.

The assessment of this impact is presented in **Table 6-7.**

Table 6-7: Assessment of the impacts on landscape

	Extent	Duration	Intensity	Probability	Significance
Pre-mitigation	L/M - 2	M - 3	M - 6	H - 5	**M - 55**
Post-mitigation	L - 1	L/M- 2	L/M- 4	M - 3	M - 21

6.2.2.1 Mitigations and recommendation to disturbance on landscape

- Where possible, avoid the unnecessary destruction of habitat (e.g. large trees or bushes) and/or degradation of the environment, including the sensitive drainage lines and other vegetated areas.
- Sides of the road should be rehabilitated to reduce the risk for landslides and erosion.

6.2.3 Impact Assessment on Avifauna

The proposed tower erection may pose a risk to avifauna found within the subject areas. The highest risk is considered to be collisions with tower structures, especially on stay wires, and collisions with power line structures (GCS Namibia, 2018). The main sources of impact identified for this development are as follows:

- Guyed towers – These towers are usually 80-120m high, with a lattice structure and stay wires to stabilise them.
- Electrical power lines – electrical power is one of the options of powering the towers and certain areas would require construction of powerlines.

The subject tower is proposed to be a Guyed structure with a height of 120 meters. As such with no mitigation measures in place, this impact will receive a “medium to high” significance rating. However, the implementation of applicable mitigation measures, the impact can significantly be reduced to a low rating.

The assessment of this impact is presented in **Table 6-8.**

Table 6-8: Assessment of the impacts on avifauna

	Extent	Duration	Intensity	Probability	Significance
Pre-mitigation	M - 3	M - 3	M - 6	H - 5	**H - 60**
Post-mitigation	L/M - 2	L/M- 2	L/M- 4	M - 4	**M - 32**

6.2.3.1 Mitigations and recommendation to disturbance on avifauna

- Where possible, avoid the unnecessary destruction of habitat (e.g. large trees or bushes) and/or degradation of the environment, including the sensitive drainage lines and other vegetated areas.
- Ongoing awareness should be promoted about the value of biodiversity and the negative impacts of disturbance, reckless driving and poaching, especially to breeding birds.
- Stay wires of the communication structure should be marked with standard "vibration dampers" in alternating black and white, to increase visibility.
- The stay wires on powerline poles should be "gapped" similarly, by means of an insulator.
- Transformer/switchgear structures should be designed in such a way that they are not attractive as bird perches/nesting sites. Selected live components should be insulated (e.g. using PVC piping or low density polyethylene pipe (LDPE)). On strain structures where jumper wires are used in a horizontal configuration, the two outer jumpers should be suspended below the cross arm and the third/center jumper should be insulated, or all jumpers insulated.
- The primary mitigation for a power line is the choice of route options and alternatives. Where possible, the power line route should avoid any areas that are sensitive to birds, such as hill crests, or water courses/ephemeral drainage lines.

- Wherever possible, solar power should be investigated as the optimum source of power, in order to reduce the impacts of power lines on avifauna. Where necessary, security precautions should be improved or developed that discourage the theft of solar equipment, e.g. mounting the solar panels at a higher level, installing electric fencing, camera traps etc.
- If sensitive areas cannot be avoided, it may be necessary to mark identified "hotspots" on the power line with an appropriate design of bird flight diverter (BFD), in order to increase the visibility of the line and thereby avoid collisions.
- Regular monitoring of bird collisions is considered essential and, should the results indicate that collisions are still taking place, further mitigation should be investigated and applied.

6.2.4 Impact Assessment on Surrounding Communities

During the construction of the proposed towers, the presence of the construction team is likely to disturb the surrounding communities. The construction work is not expected to continue for an extended period. Therefore, the likelihood of this impact is low. The assessment of this impact is presented in **Table 6-9.**

Table 6-9: Assessment of the impacts on surrounding property owners

	Extent	Duration	Intensity	Probability	Significance
Pre-mitigation	L/M - 2	M - 3	M/L - 4	M/H - 4	**M - 36**
Post-mitigation	L - 1	L/M- 2	L- 2	L/M - 2	L - 10

6.2.4.1 Mitigations and recommendation to disturbance of surrounding property owners

- Construction work to take place during working hours only (08h00 – 17h00).
- Should construction need to be done outside of working hours, neighbouring communities need to be informed in writing prior to construction commencing.

6.2.5 Impact Assessment on Health and Safety

Construction workers will be working at heights when constructing the proposed structures. The lack of safety measures will potentially lead to injuries (falling down). Improper handling of construction materials and equipment may cause injuries. With no mitigation measures in place, this impact will receive a “medium to high” significance rating. However, the implementation of applicable safety measures, the impact can significantly be reduced to a low rating. The assessment of this impact is presented in **Table 6-10.**

Table 6-10: Assessment of the impacts on health and safety

	Extent	Duration	Intensity	Probability	Significance
Pre-mitigation	M - 3	M/H - 3	M /H- 8	M/H - 4	**M - 56**
Post-mitigation	L/M- 2	L/M- 2	L- 2	L/M - 2	L - 12

6.2.5.1 Mitigations and recommendation to health and safety

- The contractor(s) should ensure that all personnel are provided with personal protective equipment (PPE), such as gloves, safety boots, safety glasses and hard hats etc at all times during construction hours on site.
- No workers should be allowed to drink alcohol during working hours.
- No workers should be allowed on site if under the influence of alcohol.
- Construction workers should be trained on how to handle materials and equipment on site (if they do not already know how to) in order to avoid injuries.

6.2.6 Impact Assessment of Waste Generation

Construction activities usually generates wastes which leads to environmental pollution, if not properly handled. This may pose a negative visual impact on the surrounding environment. Without any mitigation measures implemented, the impact can be rated as of a "medium" significance. After the implementation of the mitigations, the impact will be significantly reduced to low rating. The assessment of this impact is presented in **Table 6-11**.

Table 6-11: Assessment of the impacts of waste generation

	Extent	Duration	Intensity	Probability	Significance
Pre-mitigation	L/M - 2	L/M - 2	M - 6	M - 3	**M - 30**
Post-mitigation	L - 1	L- 1	L- 2	L - 1	L - 4

6.2.6.1 Mitigations and recommendation to waste generation

- The construction site should be kept tidy at all times.
- All domestic and general construction waste produced on a daily basis should be cleaned and contained daily.
- No waste may be buried or burned on site or anywhere else.
- Waste containers (bins) should be emptied after the construction and removed from site to the municipal waste disposal site.
- Separate waste containers (bins) for hazardous and domestic / general waste must be provided on site.

- Construction labourers should be sensitised to dispose of waste in a responsible manner and not to litter.
- No waste may remain on site after the completion of the project.

6.2.7 Impact Assessment of Dust

Dust generation may occur during construction. Dust suppression interventions need to be incorporated if dust levels are found to be significant. Without any mitigation measures implemented, the impact can be rated as of a "medium" significance. After the implementation of the mitigations, the impact will be significantly reduced to low rating. The assessment of this impact is presented in **Table 6-12**.

Table 6-12: Assessment of the impacts of dust generation

	Extent	Duration	Intensity	Probability	Significance
Pre-mitigation	L/M - 2	L/M - 2	M/H - 8	M - 3	**M - 36**
Post-mitigation	L - 1	L- 1	M- 6	M/L - 2	L - 16

6.2.7.1 Mitigations and recommendation to dust generation

- Dust abatement techniques should be implemented e.g. Spraying of water.
- Waterless dust suppression means to be implemented in areas that experience water scarcity.

6.2.8 Impact Assessment of Noise

Construction equipment and machinery may produce high levels of noise during operations. Without any mitigation measures implemented, the impact can be rated as of a "medium" significance. After the implementation of the mitigations, the impact will be significantly reduced to a low rating. The assessment of this impact is presented in **Table 6-13**.

Table 6-13: Assessment of the impacts of noise generation

	Extent	Duration	Intensity	Probability	Significance
Pre-mitigation	L/M - 2	L/M - 2	M/H - 8	M - 3	**M - 36**
Post-mitigation	L - 1	L- 1	M- 6	L/M - 2	L - 16

6.2.8.1 Mitigations and recommendation to noise

- Construction work to take place during working hours only (08h00 – 17h00) unless otherwise arranged with the communities in proximity.

- Noise levels should adhere to the South African National Standards (SANS) regulations 10103.

6.2.9 Impact Assessment of Archaeology

The proposed construction activities should avoid the damage of archaeological resources. Should these be encountered during the construction activities mitigation measures need to be in place to ensure that these resources are not harmed. After the implementation of the mitigations, the impact will be significantly reduced to a low rating. The assessment of this impact is presented in **Table 6-14**.

Table 6-14: Assessment of the impacts on archaeology

	Extent	Duration	Intensity	Probability	Significance
Pre-mitigation	L/M - 2	L/M - 2	M/H - 8	M - 3	**M - 36**
Post-mitigation	L - 1	L- 1	M- 6	L/M - 2	L - 16

6.2.9.1 Mitigations and recommendation on archaeology

- All works are to be immediately ceased should an archaeological or heritage resource be discovered during activities on site.
- The chance find procedure as outlined in the EMP should be implemented should an archaeological or heritage resource be discovered during activities on site.
- The National Heritage Council of Namibia (NHCN) should advise with regards to the removal, packaging and transfer of the potential resource.

6.3 Operational and Maintenance Phase Impact Assessment

The main potential impacts associated with operational and maintenance phases identified are; health and safety and civil aviation concerns.

6.3.1 Impact on Health and Safety (Potential Radiation)

Health concerns as they relate to potential radiation from telecommunication sites is a national and international topic that requires investigation.

Electromagnetic radiation is emitted from electrical appliances commonly used in most homes today, such as TV's, radios, cell phones, microwave ovens, electrical blankets, and computers. Studies have shown that transceiver base stations emit weaker electromagnetic radiation than most household daily appliances i.e. microwave or cell phone used close to your body (Carstens and Kuliwoye, 2012).

The International Commission on Non-Ionizing Radiation Protection (ICNRP) provides guidance on protecting against the adverse health effects associated with electromagnetic fields (EMF) in their document ICNIRP Guidelines for Limiting Exposure to Electromagnetic Fields (100kHz to 300 GHz). These guidelines are based on short-term, immediate health effects such as stimulation of peripheral nerve muscles, shocks and burn caused by touching conducting objects, and elevated tissue temperatures resulting from absorption of energy during exposure to EMF.

The National Radiation Protection Authority of Namibia (NRPA) is charged with the administration of the Atomic Energy and Radiation Protection Act (Act 5 of 2005) that specifically require that account be taken of any guidelines published by ICNIRP regarding the radiation risks associated with BTS structures (National Radiation Protection Authority, Unknown date).

The following subchapters will assess the impact of short-term and long-term radiation.

6.3.1.1 Short-term Radiation (Health) Effects

The basic restrictions on the effects of exposure are based on established health effects. Different scientific bases were used in the development of basic exposure restrictions for various frequency ranges. Depending on the frequency, the physical quantities used to specify the basic restrictions on exposure to EMF are current density, SAR (Specific Energy Absorption Rate), and power density. For further information on the short-term effect, the reader is referred to the ICNIRP Guidelines for Limiting Exposure to EMF in **Appendix H**.

The significance of this impact can be reduced to a low significance rating by ensuring that the sufficient mitigation measures governed by the national and international legal standards such as ICNIRP on infrastructure EMR emissions are adequately implemented. The impact is assessed in **Table 6-15**.

Table 6-15: Assessment of the impacts of the antennae on health and safety: Short term radiation

	Extent	Duration	Intensity	Probability	Significance
Pre-mitigation	M - 3	M/H - 4	M/H - 8	M - 3	**M - 45**
Post-mitigation	L/M - 2	L/M- 2	L/M- 4	L/M - 2	L - 16

6.3.2 Mitigations and recommendation on health and safety: Short-term Radiation

- The proponent should ensure that the proposed tower and its EMR are within the international standards of The Atomic Energy and Radiation Protection Act, Act 5 of 2005 and Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300GHz) March 2020 developed by the ICNIRP).

- The design standards to be applied for the antennae should comply with the internationally accepted public exposure guidelines.
- The National Radiation Protection Authority should be involved during this phase (operational) to assess the possible emissions from antennae.

6.3.2.1 Long-term Radiation (Health) Effects

In the case of potential long-term health effects of exposure, such as an increased risk of cancer, ICNIRP concluded that the available data are insufficient to provide a basis for this setting exposure restriction. Thus, the ICNRIP guidelines alone should not be used as a basis for protection against non-thermal effects or long-term biological effects.

The significance of this impact is considered high, because the long-term effect is unknown. In the context of the above, a cautionary approach is adopted, and in particular the Precautionary Principle, which states that if an action or policy has a suspected risk of causing harm to the public or to the environment, in the absence of scientific consensus that the action or policy is harmful, the burden of proof that it is not harmful falls on those taking the action.

Therefore, ICNIRP uses a reduction factor of 10 to derive at occupational limits for workers and a factor of about 50 to arrive at exposure limits for the public. This factor serves as a precautionary buffer to compensate for uncertainties in the research. By adhering to the threshold levels of ICNIRP, the precautionary measures should be sufficient to adequately address this impact. However, the risk will not be abolished, and it is recommended that the Proponent keep up to date with regards to any new literature published by ICNIRP. The impact is assessed in **Table 6-16**.

Table 6-16: Assessment of the impacts of the antennae on health and safety: Long term radiation

	Extent	Duration	Intensity	Probability	Significance
Pre-mitigation	M - 3	H - 5	M/H - 8	M/H - 4	**H - 64**
Post-mitigation	L/M - 2	L/M- 2	L/M- 4	L/M - 2	L - 16

6.3.2.2 Mitigations and recommendation on health and safety: Long-term Radiation

- The proponent should ensure that tower construction and its EMR are within the international standards of The Atomic Energy and Radiation Protection Act, Act 5 of 2005 and Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300GHz) March 2020 developed by the ICNIRP).
- The design standards to be applied for the antennae should comply with the internationally accepted public exposure guidelines.

- The National Radiation Protection Authority should be involved during this phase (operational) to assess the possible emissions from antennae.

6.3.3 Impact on Civil Aviation

Potential impacts on civil aviation due to the height and location of the sites may be experienced. Generally, the effective utilisation of an aerodrome can significantly be influenced by natural features and man-made constructions inside and outside its boundary. These features may result in limitations on the distance available for take-off and landing and on the range of meteorological conditions in which take-off and landing can be undertaken. For these reasons certain areas of the local airspace are regarded as integral parts of the aerodrome environment (Carstens and Kuliwoye, 2012).

The proposed structure is not located within proximity of an existing aerodrome. Therefore, this impact will receive a significantly low rating.Therefore, this impact will receive a significantly low rating. This impact is assessed in **Table 6-17** below.

Table 6-17: Assessment of the impacts of the antennae on civil aviation

	Extent	Duration	Intensity	Probability	Significance
Pre-mitigation	M - 3	M/h - 4	M - 6	M/h - 4	**M - 52**
Post-mitigation	L - 1	L- 1	L- 2	L/M - 2	L - 8

6.3.3.1 Mitigations and recommendation on civil aviation

- The proponent should ensure that the structures adhere to the Namibia Civil Aviation Regulations (NAMCARs) Part 139 Aerodromes and Heliports: licencing and Operation where applicable.

6.3.4 Impact on Visuals

The visual impact associated with the placement of a telecommunication site is a major issue that telecommunication companies face worldwide (GCS Namibia, 2018). The visual impact is therefore closely related to the social perception of the telecommunication tower and the effect it will have on the receptor's sense of place (GCS Namibia, 2018).

This impact will receive a medium rating before mitigation and a low rating after mitigation measures are implemented. This impact is assessed in **Table 6-18** below.

Table 6-18: Assessment of the impacts of the antennae on visuals

	Extent	Duration	Intensity	Probability	Significance
Pre-mitigation	M - 3	M/h - 4	M - 6	M/h - 4	**M - 52**

Post-mitigation	L - 1	L- 1	L- 2	L/M - 2	L - 8

6.3.4.1 Mitigations and recommendation on visual impacts

- At sites with a high visual prominence (e.g. located close to a road or on slightly elevated ground) the following should be investigated (subject to approval from the Director of Civil Aviation):
    - The equipment container and palisade fence should be painted brown or green (depending on the vegetation cover of the surrounding area) or covered with wooden poles to blend in with the surrounding area.
    - With the approval of the Directorate of Civil Aviation, masts should be left galvanized to minimize the visual impact.

6.4 Decommissioning Phase

6.4.1 Impact of the Decommissioning on Mobile Users

The affected communities will lose good network coverage in the area, if the towers are decommissioned and no other alternative cellular service infrastructure is put in place. This is an unlikely case due to the fact that the modern world is advancing on a daily basis, and there will always be a need for improved mobile services. Even if the towers are to be removed in the future, it will most likely be replaced by a better infrastructure for the same purpose. Pre-implementation of the necessary mitigation measures, this impact can be rated as "low to medium" and with the implementation of the necessary mitigation measures, the impact significance will be low. This impact is assessed in **Table 6-19** below.

Table 6-19: Assessment of the impacts of the antennae decommissioning

	Extent	Duration	Intensity	Probability	Significance
Pre-mitigation	L/M - 2	L/M - 2	M - 6	M - 3	**M - 30**
Post-mitigation	L/M - 2	L- 1	L- 2	L - 1	L - 5

6.4.1.1 Mitigations and recommendation to antennae decommissioning impact

- The mobile services network provider should ensure that the mobile coverage is not compromised, by putting up an alternative cellular infrastructure.

6.4.2 Impact Assessment on Surrounding Property Owners

During the removal and destruction of infrastructure of the tower, the presence of the construction team will disturb the surrounding communities. The construction work is not expected to continue for an extended period. Therefore, the likelihood of this impact is low. The assessment of this impact is presented in **Table 6-20.**

Table 6-20: Assessment of the impacts on surrounding property owners

	Extent	Duration	Intensity	Probability	Significance
Pre-mitigation	L/M - 2	L - 1	M/L - 4	M - 3	**M - 21**
Post-mitigation	L - 1	L- 1	L- 2	L - 1	L - 4

6.4.2.1 Mitigations and recommendation to disturbance of surrounding property owners

- Construction work to take place during working hours only (08h00 – 17h00).
- Should construction need to be done outside of working hours, neighbouring property owners need to be informed in writing prior to construction commencing.

6.4.3 Impact Assessment on Health and Safety

Improper handling of construction materials and equipment may cause injuries. With no mitigation measures in place, this impact will receive a "medium to high" significance rating. However, the implementation of applicable safety measures, the impact can significantly be reduced to a low rating. The assessment of this impact is presented in **Table 6-21.**

Table 6-21: Assessment of the impacts on health and safety

	Extent	Duration	Intensity	Probability	Significance
Pre-mitigation	M - 3	M/H - 3	M /H- 8	M/H - 4	**M - 56**
Post-mitigation	L/M- 2	L/M- 2	L- 2	L/M - 2	L - 12

6.4.3.1 Mitigations and recommendation to health and safety

- The contractor(s) should ensure that all personnel are provided with personal protective equipment (PPE), such as gloves, safety boots, safety glasses and hard hats etc at all times during construction hours on site.
- No workers should be allowed to drink alcohol during working hours.
- No workers should be allowed on site if under the influence of alcohol.
- Construction workers should be trained on how to handle materials and equipment on site (if they do not already know how to) in order to avoid injuries.

6.4.4 Impact Assessment of Waste Generation

The demolition of infrastructure will result in the generates of waste which leads to environmental pollution, if not properly handled. This may pose a negative visual impact on the surrounding environment. Without any mitigation measures implemented, the impact can be rated as of a "medium" significance. After the implementation of the mitigations, the impact will be significantly reduced to low rating. The assessment of this impact is presented in **Table 6-22**.

Table 6-22: Assessment of the impacts of waste generation

	Extent	Duration	Intensity	Probability	Significance
Pre-mitigation	L/M - 2	L/M - 2	M - 6	M - 3	**M - 30**
Post-mitigation	L - 1	L- 1	L- 2	L - 1	L - 4

6.4.4.1 Mitigations and recommendation to waste generation

- The site should be kept tidy at all times.
- All domestic and general waste produced on a daily basis should be cleaned and contained daily.
- No waste may be buried or burned on site or anywhere else.
- Waste containers (bins) should be emptied after the construction and removed from site to the municipal waste disposal site.
- Separate waste containers (bins) for hazardous and domestic / general waste must be provided on site.
- Construction labourers should be sensitised to dispose of waste in a responsible manner and not to litter.
- No waste may remain on site after the completion of the project.

7 RECOMMENDATIONS AND CONCLUSION

7.1 Conclusion

The key potential biophysical impact related to the construction, operational and maintenance and decommissioning phases of the proposed project were identified and assessed. Suitable mitigation measures (where required and possible) were recommended, and the impacts can be summarised as follows:

- **Impact on Biodiversity Loss** (during construction): The proposed construction of the tower, access road and associated infrastructure may impact the existing biodiversity in the area. This is due to the fact that the track would have to be cleared of vegetation to make way for the access road and proposed infrastructure. Care should be taken during the removal of vegetation for site preparation to ensure minimal disturbance in the area. The envisaged impact at the project site, is thus not of such magnitude and/ or significance that it will have irreversible impacts on the biodiversity and endemism of the area and Namibia at large. Therefore, the significance of this impact is medium. However, the impact can be adequately addressed by the recommendations given under subchapter 6.2.2and management actions given in the EMP (Chapter 3).
- **Impact on Landscape** (during construction): Erosion is expected to occur at the proposed sites particularly during construction activities. Therefore, the significance of this impact is medium. However, the impact can be adequately addressed by the recommendations given under subchapter 6.2.2 and management actions given in the EMP (Chapter 3).
- **Impact on Avifauna** (during construction and operation): The proposed tower erection may pose a risk to avifauna found within the subject areas. The highest risk is considered to be collisions with tower structures, especially on stay wires, and collisions with power line structures (GCS Namibia, 2018). The subject tower is proposed to be a Guyed structure with a height of 120 meters. As such with no mitigation measures in place, this impact will receive a “medium to high” significance rating. However, the impact can be adequately addressed by the recommendations given under subchapter 6.2.3 and management actions given in the EMP (Chapter 3).

- **Impacts on Surrounding Communities** (during construction and decommissioning): There is the possibility of disturbance of the surrounding communities due to the presence of the construction team. The construction work will last for a scheduled period and is not expected to continue for an extended period. Therefore, the significance of this impact is low. However, the impact can be adequately addressed by the recommendations given under subchapter 6.2.4 and 6.4.2 and management actions given in the EMP (Chapter 3).

- **Impacts on Health and Safety** (during construction and decommissioning) Workers may be subject to issues of health and safety during construction on site. Improper handling of construction materials and equipment may cause injuries. With no mitigation measures in place, this impact will receive a medium to high significance rating. However, the implementation of applicable safety measures, the impact can significantly be reduced to a low rating. The impact can be adequately addressed by the recommendations given under subchapter 6.2.5 and 6.4.3 and management actions given in the EMP (Chapter 3).

- **Impacts on Waste Generation** (during construction and decommissioning): Construction activities usually generates wastes which leads to environmental pollution, if not properly handled. This may pose a negative visual impact on the surrounding environment. Without any mitigation measures implemented, the impact can be rated as of a medium significance. After the implementation of the mitigations, the impact will be significantly reduced to low rating. The impact can be adequately addressed by the recommendations given under subchapters 6.2.6 and 6.4.4 and also management actions given in the EMP (Chapter 3).

- **Impacts on dust and noise (during construction):** Dust and noise generation may occur during construction. Without any mitigation measures implemented, the impact can be rated as of a medium significance. After the implementation of the mitigations, the impact will be significantly reduced to low rating. The impact can be adequately addressed by the recommendations given under subchapter 6.2.7 and 6.2.8 and also management actions given in the EMP (Chapter 3).

- **Impacts on archaeology (during construction):** The proposed construction activities should avoid the damage of archaeological resources. Should these be encountered during the construction activities mitigation measures need to be in place to ensure that these resources are not harmed. After the implementation of the mitigations, the impact will be significantly reduced to a low rating. The impact can be adequately addressed by the recommendations given under subchapter 6.2.9 and also management actions given in the EMP (Chapter 3).

- **Impacts on Health and Safety** (Potential Radiation) (during operational phase): Health concerns as they relate to potential radiation from telecommunication sites is a national and international topic that requires investigation. The significance of this impact can be reduced to a low significance rating by ensuring that the sufficient mitigation measures governed by the national and international legal standards such as ICNIRP on infrastructure EMR emissions are adequately implemented. The impact can be adequately addressed by the recommendations given under subchapters 6.3.1 and also management actions given in the EMP (Chapter 3).

- **Impacts on Civil Aviation** (during operational phase): Potential impacts on civil aviation due to the height and location of the sites may be experienced. The proposed structure is not located within proximity of an existing aerodrome. Therefore, this impact will receive a significantly low rating after mitigation. The impact can be adequately addressed by the recommendations given under subchapter 6.3.3 and also management actions given in the EMP (Chapter 3).

- **Impact on visual** (during operational phase): The visual impact associated with the placement of a telecommunication site is a major issue that telecommunication companies face worldwide (GCS Namibia, 2018). The visual impact is therefore closely related to the social perception of the telecommunication tower and the effect it will have on the receptor's sense of place (GCS Namibia, 2018). This impact will receive a medium rating before mitigation and a low rating after the mitigation measures are implemented. The impact can be adequately addressed by the recommendations given under subchapter 6.3.4 and also management actions given in the EMP (Chapter 3).

- **Impact on mobile users** (during decommissioning phase): The affected residents and businesses will lose good network coverage in the area, if the towers are decommissioned and no other alternative cellular service infrastructure is put in place. This is an unlikely case due to the fact that, the modern world is advancing on a daily basis, and there will always be a need for improved mobile services. Even if the towers are to be removed in the future, it will most likely be replaced by better infrastructure for the same purpose. The impact can be adequately addressed by the recommendations given under subchapter 6.4.1 and also management actions given in the EMP (Chapter 3).

7.2 Recommendation

Based on the information provided in this report, GCS is confident the identified risks associated with the proposed development can be reduced to acceptable levels, should the measures recommended in the EMP be implemented and monitored effectively. It is therefore recommended that the project receive Environmental Clearance, provided that the EMP be implemented. Additionally, if authorized it recommended that the following be included as conditions of approval:

a) the implementation of EMP,
b) the submission of a Detailed Assessment form to MEFT and
c) appointment of an ECO during construction.

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