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DRAFT BASIC ASSESSMENT REPORT

for

PROPOSED IMPROVEMENT OF NATIONAL ROAD R33, SECTION 13, FROM MODIMOLLE (KM 0.6) TO WITKLIP (KM 13.6), LIMPOPO PROVINCE

Report No : 22104-46-Rep-001-SANRAL R33 Road Upgrade BA-Rev0

Submitted to :

Department of Forestry, Fisheries and Environment Environment House 473 Steve Biko Arcadia Pretoria 0083 South Africa

Submitted on behalf of :

South African National Roads Agency SOC Limited 38 Ida Street Menlo Park Pretoria 0040

12 June 2023

22104



Director: S. Pillay Associate Directors: J. Heera (Ms.), T. Kaponda, Dr. M. Vosloo



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ACTION	DESIGNATION	NAME	DATE	SIGNATURE
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Reviewed	Environmental Lead	Dr. Mathys Vosloo		
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RECORD OF REVISIONS

Date	Revision	Author	Comments

EXECUTIVE SUMMARY

A INTRODUCTION

Zitholele Consulting (Pty) Ltd ("Zitholele") has been appointed by V3 Consulting on behalf of SANRAL SOC Limited, as the independent Environmental Assessment Practitioner (EAP) to undertake a Basic Assessment (BA) Process, including the Public Participation Process and Specialist Studies for the proposed upgrade of the R33 (Section 13) from Modimolle (km0.6) to Witklip (km13.6) in Limpopo Province.

The proposed road upgrade requires Environmental Authorisation (EA) from the Competent Authority i.e. Department of Forestry, Fisheries and the Environment (DFFE) and a Water Use Authorisation (WUA) from the Department of Water and Sanitation (DWS) prior to construction. This Basic Assessment Report (BAR) deals with the EA process for consideration by the DFFE.

An Application for Environmental Authorisation form by way of a Basic Assessment (BA) Process in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) as per the Environmental Impact Assessment (EIA) Regulations of 2014 (*as amended*) was submitted to the DFFE on 19 June 2023.

This BAR includes the following details:

- A description of the project, including project motivation;
- A description of the environment affected by the project, including Specialist Study findings;
- The Public Participation Process;
- Discussion of applicable alternatives;
- Assessment of impacts for the pre-construction, construction, operational and decommissioning phases; and
- The EAP's recommendations.

The purpose of this BAR is to provide the Interested and Affected Parties (I&APs), the approving authority, the DFFE, and the Commenting authorities with all the required and relevant information regarding the proposed project during the public review of the Draft BAR i.e. from 19 June 2023 to 19 July 2023.

Subsequent to the public review period, the comments received during the public review period will be responded to by the Environmental Assessment Practitioner (EAP). The Comments and Responses Report (CRR) which will include all comments received and responses thereto, will be included in the Final BAR that will be submitted to the DFFE for review and decision-making.

B LOCATION

The proposed upgrade of the R33 commences at km0.6 at Modimolle and will end at km13.6 at Witklip in Limpopo Province. The site falls within the jurisdiction of the Modimolle-Mookgophong Local Municipality, which is located within the Waterberg District Municipality.

C PROJECT DESCRIPTION

SANRAL proposes to upgrade of the R33 from Modimolle km0.6) to Witklip (km13.6) in Limpopo Province.

The total length of the road upgrade is 13km. The road upgrade will entail the following:

- Widening of the existing road to provide paved shoulders
- Provide new pavement structure on widenings
- Upgrading and strengthening of existing pavement layers
- Surfacing of road constructed to new levels
- Upgrading side drains
- Continuous or selective vertical and/or horizontal realignment inclusive of new pavement layers including drainage.
- Geometric/safety/capacity improvements at intersections.

The R33 is currently a single carriageway road with 3.7m lanes and 0.3m to 0.5m surfaced shoulders. There is an existing climbing lane on the west bound (LHS) of the road from km5.6 to km6.2. The proposed upgrade requires a four-lane facility up to the Kokanje Retirement Village. The following cross-sections for the R33 are proposed:

- km 0.6 km 2.4: 4-lane undivided single carriageway, including sidewalks in both directions up to the roundabout at Kokanje Retirement Village.
- km 2.4 km 6.8: 2-lane single carriageway with climbing lane from the roundabout through the "pass" section.
- km 6.8 13.6: 2-lane single carriageway with climbing/passing lanes

The posted speed limits across the route alignment are as follows:

- 60 km/h from km 0.6 to km 3.2 (Weesgerus junction)
- 80 km/h from km 3.2 to km 6.8
- 100 km/h from km 6.8 to km 13.6

Climbing lanes have been provided to match the level of service on an upgrade with that of the flatter grade on either side of it. Passing lanes have been provided to improve the operational efficiency of the road, by increasing its capacity and hence the LOS experienced at various flow levels and also reducing delays resulting from inadequate passing

opportunities. All the intersections located within the R33 Section 13 project limits have been provided with public transport stops at major intersections near settlement developments.

The following intersections will be upgraded:

- Koro Creek Golf Estate at km1.445
- Kokanje Retirement Village at km2.425
- Weesgerus Holiday Resort at km3.135
- Road to Donkerpoort at km4.745
- Road to Elandsfontein at km10.035
- Road to Alma at km12.075

There are approximately 21 culverts along the R33. Most culverts are in good condition, the main problems are erosion at the outlet ends and gabions need to be installed. The water course is blocked by farmers service roads within the farm because the outlet invert level is lower than the natural ground level towards the farm property, the invert level will to be raised at these locations or a channel with a flat slope will be constructed for daylighting from outlet structures due to silting. Gabions and stone pitching at certain side drains adjacent to the road will be installed.

From the capacity analysis, the outcome was that many of the culverts will be upgraded to larger diameter pipes or box culverts. Especially the existing 400Ø to 450Ø pipes or box culverts will be replaced to a bigger diameter pipe or box.

The following surface drainage and roadside drainage is proposed:

- Surface drainage along the 4-lane dual carriageway section involves the provision of a combination of kerb and channel, kerbside drainage inlets, pipe culverts and drainage outlets. The high fill sections will include the provision of stormwater downchute pipes;
- Rural road high fill sections will include guardrails, kerb and channel, drainage inlets and downchute pipes. In instances of fills without guardrails, the kerb and channel detail will be replaced with a narrow V-drain 800mm wide combined with downchute pipes;
- Roadside drainage immediately adjacent to the surfaced road edge (generally along the flatter and/or road cut sections) will entail the provision of concrete-lined side drains to SANRAL's "Type F" concrete side channel detail, to widths which will vary between 1.5m and 2.5m wide, depending on the catchment area of the section of side drain. All concrete-lined drains will terminate standard dissipator sections in accordance with the SANRAL standard detail;
- In some instances existing earth drains located away from the edge of the road will be retained but will need to be reshaped/reconstructed to align with the new alignment of the road; and

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• The existing earth drains exhibiting severe erosion damage (located beyond the edge of the road of the existing road) will be reinstated in terms drain-bed preparation following which the earth drains will be stone pitched or alternatively lined with gabion mattresses.

The existing Klein Nyl River Bridge (Bridge B1272) is the only major drainage structure along the R33 and is located at km1.12. The existing structure consists of two spans of 5.35m each (10.7m in total) and has a skew of approximately 30°. As part of the road upgrade, the existing bridge will be replaced with a new, larger structure with a 32.52m total span and a 22.250 width between the parapets

The proposed road geometry at the location of the bridge is based on an undivided 4-lane single carriageway. The proposed cross-section at the location of the bridge is as follows:

- 2.5m raised sidewalk on LHS and RHS
- 3.6m slow lane
- 3.4m fast lane
- 2.8m raised median

The bridge cross section is therefore similar with a clear distance of 22.25m between the edges of the handrail coping which becomes 21.8m between the faces of the parapets, should there ever be a requirement to widen the road with one additional lane in each direction. The design allows for a further 3.5m lane if the sidewalks are removed.

The barrier is to protect pedestrians where the traffic exceeds 60km/h. The guardrails on the edge are provided only where the fill is high.

The bridge horizontal alignment is on a straight, with the bridge crossing the river at a skew of 30°.

The bridge will consist of 3 spans, with the end spans being 11.060m long and the central span being 15.40m long measured along the centreline of the road. The deck soffit will be at a maximum height of 5.4m above the river. The bridge construction will use traditional building materials and techniques. The use of reinforced concrete as the main construction material, specifying high durability mixes, will ensure that the bridge will require minimal maintenance over the design life.

The river bridge is downstream from the Coro Kreek Golf estate and will be visible from the golf course. The road towards Modimolle is near the edge of town approaching residential areas.

The appearance of the bridge should look functional with clean lines across the river.

There will be closure/relocation of some access roads to comply with SANRAL and TRH, TMH and UTG design guidelines and standards, road safety improvement and access management policies. Alternate access will be provided for landowners on affected properties during the final design.

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Commercial material sources will be obtained for the proposed construction, therefore, there will be no application for any borrow pits.

D KEY IMPACTS

The following key impacts were identified and assessed within this BAR.

Pre-construction Phase

- Loss or fragmentation of indigenous natural vegetation
- Loss of individuals of threatened plants
- Impact on faunal species habitat
- Loss of protected tree species

Construction Phase

- Degradation of soil resources
- Impact on wetland degradation
- Impact on alteration of aquatic habitat
- Impact on water quality impairment of drainage lines and river systems
- Impacts of noise pollution
- Impact on ambient air quality
- Lowering of PES and EIS of the associated river systems and degradation of the aquatic habitat
- Potential increase in erosion due to clearance of vegetation
- Impacts on traffic congestion
- Fragmentation of vegetation continuity
- Loss of faunal habitat
- Impact on change of visual character
- Temporary job creation

Operational Phase

- Impact on wetland degradation
- Increase in erosion and sedimentation of aquatic resources
- Increase in spread of declared weeds and alien invader plants
- Improved level of service for traffic flow

E PROJECT ALTERNATIVES

To give effect to the principles of NEMA and Integrated Environmental Management (IEM), an EIA should assess a number of reasonable and feasible alternatives that may achieve the same end result as that of the preferred project alternative.

E-1 Location / Site Alternatives

The proposed project involves the upgrade of the existing 13.0km of the R33, Section 13 between Modimolle (km0.6) and Witklip (km13.6). Alternate sites have not been addressed in the Basic Assessment Report, as this site has been predetermined during the planning stage.

The original design for the proposed R33 upgrade between the Modimolle and Witklip was carried out to accommodate additional lanes for future traffic growth and demand, noting that this is a major tourist route. Therefore, there are no alternative sites, as the proposed road upgrade is required in its current location as per past planning initiatives.

The implication of providing additional lanes and intersection upgrades on the R33 will result in greater width of the road prism over certain sections. Majority of the proposed road upgrade will occur within the existing road reserve, however, there will be land acquisition of privatelyowned properties outside the existing SANRAL road reserve.

The process for the land acquisition will be aligned and integrated with the SANRAL Land Acquisition Guidelines Manual. The property report details the properties adjacent to and within the project battery limits which are affected by the project. A total of 2,121 ha of land will be acquired through the land acquisition process from the identified properties to accommodate widening of the existing carriageway. The Property Report has been submitted to SANRAL for approval. Once approved the compilation of the land acquisition diagrams can be commenced with.

Given the reasons outlined above, there are no other site alternatives for the proposed R33 road upgrade.

E-2 Design / Layout Alternatives

(a) Proposed Road Upgrade

No alternative layouts have been addressed in the Basic Assessment Report as the proposed road upgrade was recommended as the preferred layout, based on the geometry of the road.

The R33 is currently a single carriageway road with 3.7m lanes and 0.3m to 0.5m surfaced shoulders. There is an existing climbing lane on the west bound (LHS) of the road from km5.6 to km6.2. The proposed upgrade requires a four-lane facility up to the Kokanje Retirement Village.

The following cross-sections for the R33 are proposed:

- km 0.6 km 2.4: 4-lane undivided single carriageway, including sidewalks in both directions up to the roundabout at Kokanje Retirement Village.
- km 2.4 km 6.8: 2-lane single carriageway with climbing lane from the roundabout through the "pass" section.
- km 6.8 13.6: 2-lane single carriageway with climbing/passing lanes

(b) Proposed Bridge Upgrade

Following a Preliminary Design Investigation for the Klein Nyl River Bridge, Bridge B0576, it is recommended that the existing bridge (B1272) be demolished and replaced with a new, larger structure so as to comply with SANRAL's design standards.

The bridge structure B0576 – Klein Nyl River Bridge will be designed in accordance with the following standards:

- Loading: TMH7, Parts 1 and 2 as amended 1988
- Concrete Design: TMH7, Part 3
- Hydraulic design: SANRAL Road Drainage Manual 6th edition
- Integral Bridge Design: PD 6694-1:2011 Recommendation for the design of structures subject to traffic loading to BS EN 1997-1:2004

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The design loads applicable to the bridge are as follows:

- Dead Loads:
- Reinforced concrete: 25.0 kN/m³

- Asphalt surfacing: 22.0 kN/m³
- Road Fill: 20.0 kN/m³
- Horizontal earth pressure:
- Soil density: 20.0 kN/m³
- Existing bridge:
 - Ka (yielding elements): 0.33
 - Ko (unyielding elements): 0.50
 - Internal friction angle: 30°
 - Wall friction: 0°
- New integral bridge option:
 - Earth pressure coefficients according to PD 6694-1:2011
 - Internal friction angle: 30°
 - Wall friction: 0°
- Live loads:
- NA normal traffic loading
- NB36 abnormal traffic loading
- NC 30 x 5 x 40 super-load
- Flood loads.

It is recommended to design and construct the fully integral bridge because it is anticipated to be the most economical solution with further maintenance cost savings over the lifespan of the bridge, since there are no bearings and deck joints.

The bridge superstructure will be supported on wall type abutments and piers with rounded ends enabling smoother transition between the river flow before and through the bridge. The maximum pier height is estimated at 5.1 m, with abutments having similar heights.

The bridge superstructure will be a solid slab deck. The deck will be cast monolithically with the piers and abutments.

Owing to the skew, the detailed design must consider the tendency of the deck to rotate in plan and the abutment foundations will be sized accordingly.

Figure 0-1 and Figure 0-2 below includes diagrams of the proposed design, The bridge report is included in Appendix H3.



Figure 0-1: Longitudinal Section through the Fully Integral Bridge





The proposed bridge will be built along a new vertical profile which is approximately 1.7m higher than the existing bridge. The new bridge will be wider than the existing bridge which leaves sufficient space to accommodate the two-way traffic in stages. Referring to Figure 0-3 and Figure 0-4, phased construction is proposed whereby the new bridge is built in half-widths up to a particular point allowing traffic to be transferred from one road alignment to the next before demolition of the existing bridge allowing completion of the second half of the bridge.

The proposed phased construction allows for sufficient working space and considers the approach to the bridge which will require an embankment constructed at a slope of 1:1 near the bridge, flattening out further away from the bridge as the vertical alignment of the new converges to the original alignment. Referring to Figure 0-4, a return wingwall will be

constructed in phase 1 to provide working space and facilitate subsequent completion of the abutment walls in phase 2.

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The concept confirms that the option selected would not be influenced by accommodation of traffic. It does however influence the duration of construction.



Figure 0-3: Traffic Accommodation – Phased Construction, Deck and Approaches



Figure 0-4: Traffic Accommodation - Phased Construction, Abutments

It is recommended to design and construct the fully integral bridge because it is anticipated to be the most economical solution with further maintenance cost savings over the lifespan of the bridge.

E-3 **Technology Alternatives**

There are no alternative technologies relevant to the proposed road upgrade.

E-4 **No-go Alternatives**

The do-nothing' alternative (i.e. no-go alternative) is the option of not constructing the development and operation of the proposed R33 upgrade. Should this alternative be selected, the status quo of the environment will remain. Should the DFFE decline the application, the biophysical and socio-economic impacts (as indicated in Section 7) would not occur.

There would be a lack of road infrastructure to meet the traffic growth demand in the next 25 years, based on a growth rate of 2.5% per annum that is projected nationally on SANRAL routes. There could be a traffic congestion due to the future growth in housing establishments at the Modimolle area and expansion of the Koro Creek Golf Estate and the increase in motorists travelling along the tourist route.

There would be no job opportunities that would be created during the construction phase, to benefit the local community on a short-term basis for several construction activities. Therefore, there would be no short-term economic opportunities created, and skills transfer to the local communities during the construction phase.

Therefore, the no-go alternative is not considered to be feasible.

F CONCLUSIONS AND RECOMMENDATIONS

It is the opinion of the EAP that should the project proceed, as impacts on the receiving environment can be minimised through the careful adherence to suggested mitigation measures.

The findings of the Specialist Studies undertaken together with the broader environmental assessment conclude that there are no fatal flaws that should prevent the project from proceeding. However, the key impacts (Table 9-2) have been identified which will require the application of site and activity specific mitigation measures. These mitigation measures are included within the Environmental Management Programme (EMPr) to ensure that they receive the necessary attention.

Having assessed all the potential environmental impacts associated with the proposed development, it is the opinion of the EAP that the project is issued with a positive Environmental Authorisation from DFFE, based on the following reasons:

- The decision to upgrade the R33 is motivated by the projected traffic growth in the next 25 years, based on a growth rate of 2.5% per annum that is projected nationally on SANRAL routes. Furthermore, economic development and infill and densification, future growth in housing establishments at the Modimolle area and expansion of the Koro Creek Golf Estate will require an upgrade of the R33, which also serves as a primary pedestrian route. The R33 occurs within a tourist route, and added with the future growth in housing, upgrade of the R33 is deemed neccessary. There are several intersections occurring along the R33 that will be upgraded to accommodate the widening of the R33 and to meet safety of pedestrians and motorists alike.
- A project-specific draft EMPr (*legally binding*) has been compiled according to (*but not limited to*) the impacts and mitigation measures included in this assessment.
- The proposed development will have minimal impacts on the receiving biophysical and socio-cultural and socio-economic environment. There are no fatal flaws that hinder the proposed development from proceeding.

To ensure that the identified negative impacts are minimised, and the positive impacts are enhanced, the following clauses are recommended as conditions of the Environmental Authorisation:

- The EMPr is a legally binding document and the mitigation measures stipulated within the document and Basic Assessment Report must be implemented.
- An independent Environmental Control Officer (ECO) must be appointed to manage the implementation of the EMPr during the construction phase. Environmental Audit Reports must be compiled and made available for inspection.
- Rehabilitation of the construction areas must take place soon after construction is completed.
- The environment must be protected during the construction operations, and any disturbed areas must be revegetated with indigenous vegetation to prevent the establishment of invasive vegetation.
- Parts of the study area are infested with alien and invasive vegetation. This should be cleared, and the clearing should be routinely followed up with a programme to keep the area clear.
- As part of the construction team's rehabilitation strategy/plan, it is advised to ensure that a "clean up" strategy is implemented after construction. Other general rehabilitation measures must be implemented to ensure that the integrity of the drainage line and the Klein Nyl River is re-instated post-construction.
- The ECO must be present during the construction activities within the regulated areas of the river systems.
- During construction, the appointed ECO must undertake monthly In-Situ water quality samples at the effected drainage line/river crossings. Should there be significant changes in the water quality during construction, an Aquatic Ecologist must be appointed to provide recommendations to minimise the impacts on the watercourses. The first and last samples of the construction monitoring must be taken to a laboratory for analysis.
- Biomonitoring is required to be undertaken in the event of an incident, in order to identify the extent of the said incident on the effected watercourse.
- If during construction, any possible finds such as stone tool scatters, artefacts or bone and fossil remains are made, the operations must be stopped, and a qualified archaeologist must be contacted for an assessment of the find and therefore the Chance Find Procedures should be put in place as part of the EMPr.
- If fossils are found by the Contractor, Environmental Officer or other responsible person once clearing of vegetation, excavations or drilling have commenced, then they should be rescued, and a Palaeontologist must be called to assess and collect a representative sample.
- All Marula trees found on site must be surveyed and recorded. Should the Marula trees require removal, a permit for this must be obtained from the DFFE. Prior to construction, a suitably experienced ECO, must undertake a walk-down of the road upgrade section to tag Marula trees to be removed. Each Marula tree to be removed

must be included in a permit application. Small Marula trees must be considered in landscaping an any areas to be landscaped.

- Areas that have been disturbed during construction must be rehabilitated with species naturally occurring in the study area, and the disturbed areas should be monitored to detect any alien plant species and measures must be taken immediately to eradicate it from spreading.
- All parties involved in the construction and ongoing maintenance of the proposed road upgrade (including Contractors, Engineers, and the Developer) are, in terms of NEMA's "Duty of Care" and "Remediation of Damage" principals (Section 28), required to prevent any pollution or degradation of the environment, be responsible for preventing impacts occurring, continuing or recurring and for the costs of repair of the environment.

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LIST OF ACRONYMS

Acronym	Description
ADDT	Annual Average Daily Traffic
ADT	Average Daily Traffic
ADTT	Average Daily Truck Traffic
AIP	Alien Invasive Plants
BA	Basic Assessment
BAR	Basic Assessment Report
BESS	Battery Energy Storage System
BMC	Benthic Microbial Communities
СА	Competent Authority
СВА	Critical Biodiversity Area
CFP	Chance Finds Procedure
CRR	Comments and Responses Report
СТО	Comprehensive Traffic Observations
CVB	Channelled Valley Bottom
DBAR	Draft Basic Assessment Report
DFFE	Department of Forestry, Fisheries and the Environment
DEM	Digital Elevation Model
DWS	Department of Water and Sanitation
DS	Downstream
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EAPASA	Environmental Assessment Practitioner Association of South Africa
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMF	Environmental Management Framework
EMPr	Environmental Management Programme
ESA	Ecological Support Area

Acronym	Description
EST	East Settling Tank
GA	General Authorisation
GPS	Global Positioning System
GNR	Government Notice Regulation
HV	Heavy Vehicles
HHF	Highest Hourly Flow
HIA	Heritage Impact Assessment
HGM	Hydrogeomorphic Unit
HTM	Highway Traffic Model
IBA	Important Bird Area
I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
IWULA	Integrated Water Use License Application
IS	Importance and Sensitivity
IUCN	Union for Conservation of Nature
LDEDE&T	Limpopo Department of Economic Development, Environment and Tourism
LHS	Left Hand Side
LOS	Level of Service
mamsl	Meters Above Mean Sea Level
MESA	Million Equivalent Standard Axles
NEMA	National Environmental Management Act 107 of 1998 (as amended)
NFEPA	National Freshwater Ecosystem Priority Area
NPAES	National Protected Areas Expansion Strategy
NT	National Treasury
NWA	National Water Act 36 of 1998
NWM5	National Wetland Map Version 5
OHS	Occupational Health and Safety Act 85 of 1993
OLC	Overland Conveyor
PES	Present Ecological State

Acronym	Description
POSA	Plants of Southern Africa
POPIA	Protection of Personal Information Act, 2013 (Act No. 4 of 2013)
PPP	Public Participation Process
REC	Recommended Ecological Category
RHS	Right Hand Side
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information Systems
SACNASP	South African Council for Natural and Scientific Professions
SANRAL	South African National Roads Agency (SOC) Limited
SANBI	South African National Biodiversity Institute
SCC	Species of Conservation Concern
SDF	Standard Design Flood
S&EIR	Scoping and Environmental Impact Reporting
US	Upstream
VU	Vulnerable
WUA	Water Use Authorisation
WST	West Settling Tank
ZC	Zitholele Consulting

GLOSSARY OF TERMS

Term	Description
Alien species	A species that is not indigenous to the area or out of its natural distribution range.
Alternatives	Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives may include location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives or the 'do nothing' alternative.
Assessment	The process of collecting, organising, analysing, interpreting and communicating information which is relevant.
Basic Assessment Process	As defined by NEMA.
Biological diversity	The variables among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes they belong to.
Commence	The start of any physical activity, including site preparation and any other activity on site furtherance of a listed activity or specified activity, but does not include any activity required for the purposes of an investigation or feasibility study as long as such investigation or feasibility study does not constitute a listed activity or specified activity.
Construction	Construction means the building, erection or establishment of a facility, structure or infrastructure that is necessary for the undertaking of a listed or specified activity as per Regulations GNR 544, 545 and 546 of June 2010. Construction begins with any activity which requires Environmental Authorisation.
Cumulative impacts	The impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.
Decommissioning	To take out of active service permanently or dismantle partly or wholly, or closure of a facility to the extent that it cannot be readily re-commissioned. This usually occurs at the end of the life of a facility.
Direct impacts	Impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity (e.g. noise generated by blasting operations on the site of the activity). These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.
'Do nothing' alternative	The 'do nothing' alternative is the option of not undertaking the proposed activity or any of its alternatives. The 'do nothing' alternative also provides the baseline against which the impacts of other alternatives should be compared.
Drainage Line?	A drainage line is a lower category or order of watercourse that does not have a clearly defined bed or bank. It carries water only during or immediately after periods of heavy rainfall i.e. non-perennial, and riparian vegetation may or may not be present.

Term	Description
Ecosystem	A dynamic system of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.
Endangered species	Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included here are taxa whose numbers of individuals have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.
Endemic	An "endemic" is a species that grows in a particular area (is endemic to that region) and has a restricted distribution. It is only found in a particular place. Whether something is endemic or not depends on the geographical boundaries of the area in question and the area can be defined at different scales.
Environment	the surroundings within which humans exist and that are made up of: The land, water and atmosphere of the earth; Micro-organisms, plant and animal life; Any part or combination of (i) and (ii) and the interrelationships among and between them; and The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.
Environmental assessment practitioner:	An individual responsible for the planning, management and coordinating of environmental management plan or any other appropriate environmental instruments introduced by legislation.
Environmental impact	An action or series of actions that have an effect on the environment.
Environmental management	Ensuring that environmental concerns are included in all stages of development, so that development is sustainable and does not exceed the carrying capacity of the environment.
Environmental management programme	An operational plan that organises and co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its on-going maintenance after implementation.
Habitat Heritage	The place in which a species or ecological community occurs naturally. That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act of 2000).
Hazardous waste	Any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment.
Indigenous	All biological organisms that occurred naturally within the study area prior to 1800
Indirect impacts	Indirect or induced changes that may occur as a result of the activity (e.g. the reduction of water in a stream that supply water to a reservoir that supply water to the activity). These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken, or which occur at a different place as a result of the activity.

Term	Description
Interested and affected party	Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups and the general public.
Pollution	A change in the environment caused by substances (radio-active or other waves, noise, odours, dust or heat emitted from any activity, including the storage or treatment or waste or substances.
Rare species	Taxa with small world populations that are not at present Endangered or Vulnerable but are at risk as some unexpected threat could easily cause a critical decline. These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range. This category was termed Critically Rare by Hall and Veldhuis (1985) to distinguish it from the more generally used word "rare".
Red data species	Species listed in terms of the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species, and/or in terms of the South African Red Data list. In terms of the South African Red Data list, species are classified as being extinct, endangered, vulnerable, rare, indeterminate, insufficiently known or not threatened (see other definitions within this glossary).
Riparian	The area of land adjacent to a stream or river that is influenced by stream- induced or related processes. Riparian areas which are saturated or flooded for prolonged periods would be considered wetlands and could be described as riparian wetlands. However, some riparian areas are not wetlands (e.g. an area where alluvium is periodically deposited by a stream during floods, but which is well drained).
Significant impact	An impact that by its magnitude, duration, intensity, or probability of occurrence may have a notable effect on one or more aspects of the environment.
Waste	Any substance, material or object, that is unwanted, rejected, abandoned, discarded or disposed of, or that is intended or required to be discarded or disposed of, by the holder of that substance, material or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 to the Waste Amendment Act (as amended on June 2014); or any other substance, material or object that is not included in Schedule 3 that may be defined as a waste by the Minister.
Watercourse	As per the National Water Act means - (a) a river or spring; (b) a natural channel in which water flows regularly or intermittently; (c) a wetland, lake or dam into which, or from which, water flows; and (d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.
Wetlands	land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which under normal circumstances supports or would support vegetation typically adapted to life in saturated soil (Water Act 36 of 1998); land where an excess of water is the dominant factor determining the

Term	Description
	nature of the soil development and the types of plants and animals living at the soil surface (Cowardin et al., 1979).

DOCUMENT ROADMAP

This Basic Assessment Report (BAR) aims to conform to the requirements stipulated in Appendix 1 of the National Environmental Management Act 107 of 1998 (NEMA) Environmental Impact Assessment Regulations, 2014, as amended. The table below presents the document's structure, in terms of the aforementioned regulatory requirements. Based on the contents of this table, it is evident that the BAR conforms to the regulatory requirements and provides sufficient information to facilitate the Competent Authority (CA) to reach an informed decision with regards to granting or refusal of the Environmental Authorisation (EA).

Regulatory Requirement		Description	Document Section
3(a)		Details of - (i) the EAP who prepared the report; and (ii) the expertise of the EAP, including a curriculum vita;	Appendix A Section 1.4
3(b)		Details of the location of the activity, including: (i) the 21-digit Surveyor General code of each cadastral land parcel; (ii) where available, the physical address and farm name; and (iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	Section 2.2
3(c)		A plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is - (i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; (ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;	Appendix F
3(d)		 (d) a description of the scope of the proposed activity, including- (i) all listed and specified activities triggered and being applied for; (ii) a description of the associated structures and infrastructure related to the development; 	Section 2.4 Section 4.1
3(e)		a description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context.	Section 4
3(f)		a motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred location.	Section 2.7
3(g)		a motivation for the preferred development footprint within the approved site.	Section 2.7 and Section 3.2
3(h)		A full description of the process followed to reach the proposed develop within the approved site, including	oment footprint
	(i)	details of the development footprint alternatives considered;	Section 3
	(ii)	details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	Section 6
	(iii)	a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;	To be provided in the Final BAR

Document Roadmap in terms of Appendix 1 NEMA EIA Regulations, 2014

Regulatory Requirement		Description	Document Section
•	(iv)	the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 5
	(v)	the impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts – (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated;	Section 7
	(vi)	the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks	Section 7
	(vii)	positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 7
	(viii)	the possible mitigation measures that could be applied and level of residual risk;	Section 7
	(ix)	if no alternative development locations for the activity were investigated, the motivation for not considering such; and	Section 3
	(x)	a concluding statement indicating the preferred alternative development location within the approved site	Section 3.2
3(i)		a full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred location through the life of the activity, including - (i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and (ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures	Section 7
3(j)		 an assessment of each identified potentially significant impact and risk, including- (i) cumulative impacts; (ii) the nature, significance and consequences of the impact and risk; (iii) the extent and duration of the impact and risk; (iv) the probability of the impact and risk occurring; (v) the degree to which the impact and risk can be reversed; (vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and (vii) the degree to which the impact and risk can be mitigated; 	Section 7
3(k)		where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report;	Section 9.1 Section 10
3(I)		 an environmental impact statement which contains – (i) a summary of the key findings of the environmental impact assessment: (ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and (iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives; 	Section 9 Section 10.1 Section 10.2 Section 10.3

Regulatory	Description	Document
Requirement	hand on the approximent, and where applies his recommendations	Section 10.2
3(m)	from specialist reports, the recording of proposed impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation	Section 10.2 Section 10.3 Appendix J: EMPr
3(n)	any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation	Section 10.3
3(o)	a description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed	Section 1.9
3(p)	a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	Section 10
3(q)	where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded, and the post construction monitoring requirements finalised	N/A
3(r)	an undertaking under oath or affirmation by the EAP in relation to: (i) the correctness of the information provided in the reports; (ii) the inclusion of comments and inputs from stakeholders and I&APs (iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and (iv) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties	Section 1.6
3(s)	where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	N/A
3(t)	any specific information that may be required by the competent authority; and	N/A
3(u)	any other matters required in terms of section 24(4)(a) and (b) of the Act.	N/A
1 INTRODUCTION

1.1 **Project Background**

The South African National Roads Agency SOC Limited (SANRAL) proposes the upgrade of the R33 from Modimolle to Witklip, based on future traffic growth projected for the next 25-year horizon. A growth rate of 2.5% per annum is predicted and is in line with the growth rate projected nationally on SANRAL routes. Other factors that were taken into consideration when determining future traffic growth, included infill and densification within the current development footprint at Modimolle, expansion in housing development, as well as future expansion of the Koro Creek Golf Estate. The R33 also plays a role in promoting economic development in the Modimolle area. The R33 is also considered an internal road within the Municipality that is also a primary pedestrian route.

Based on the capacity requirements of the projected traffic volumes, the road upgrade requires expansion as follows:

- km 0.6 km 2.4: 4-lane undivided single carriageway, including sidewalks in both directions up to the roundabout at Kokanje Retirement Village.
- km 2.4 km 6.8: 2-lane single carriageway with climbing lane from the roundabout through the "pass" section.
- km 6.8 13.6: 2-lane single carriageway with climbing/passing lanes

Safety and capacity upgrades will be required at various intersections along the R33. The following layouts have been recommended for implementation:

- Koro Creek Golf Estate: This intersection has been converted into a butterfly intersection with a protected lane for vehicles turning right onto the R33; an exclusive right-turn lane from the R33 to the golf estate is incorporated into the intersection; an acceleration lane is added for the traffic turning left onto the R33.
- Kokanje Retirement Village: This intersection has been converted to a roundabout with the staggered gravel road aligned with the intersection, formalizing it as the fourth leg; an acceleration lane is added for vehicles turning left onto the R33 from the retirement resort; a public transport layby lane is incorporated after the intersection, in the direction towards Modimolle town; a deceleration lane is added at the access road into the retirement resort for the vehicles turning left from the R33.
- Weesgerus Holiday Resort: This intersection has been converted into a butterfly intersection with a protected lane for vehicles turning right onto the R33.
- Road to Donkerpoort: An exclusive right-turn lane from the R33 to the gravel road towards Donkerpoort has been incorporated into the intersection.
- Road to Elandsfontein: An exclusive right-turn lane from the R33 to the gravel road towards Elandsfontein has been incorporated into the intersection.
- Road to Alma: No improvements.

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The alignment and width of the existing road will undergo improvements to comply with the required geometric standards. Such improvements will require a new pavement structure. To ensure a uniform pavement over the length of the road, the same pavement surfacing, base and subbase is proposed as for the rehabilitation of the existing road. Special provision will be made for the pavement design for the bus stops in terms of slow vehicle movement and static loading and possible petroleum spillage.

The existing bridge (B1272) at km1.12, crossing the Klein Nyl River will be demolished and replaced with a new bridge at the same position along the R33. A roadway and walkway for pedestrian safety will be incorporated into the design of the new bridge.

As a result of the proposed road upgrade, the existing 21 culverts that occur along the R33 will be lengthened with new inlet and outlet headwalls and wingwalls to increase its capacity to meet the requirements for a Class 2 road.

The existing side drains will be replaced with new side drains, due to the new vertical alignment that will be above the existing road level. A combination of gabion mattresses may be laid on the earth drain to prevent erosion.

There will be climbing lanes constructed to match the level of service on an upgraded road with that of the flatter grades on either side of it. The passing lane on the other hand, is intended to improve the operational efficiency of the road as a whole by increasing its capacity and hence the Level of Service (LOS) experienced at various flow levels and also reducing delays resulting from inadequate passing opportunities.

All the intersections located within the R33 Section 13 project limits have been provided with public transport stops at major intersections near settlement developments.

Zitholele Consulting (Pty) Ltd ("Zitholele") has been appointed by V3 Consulting on behalf of SANRAL SOC Limited, as the independent Environmental Assessment Practitioner (EAP) to undertake a Basic Assessment (BA) Process, including the Public Participation Process and Specialist Studies for the proposed project.

1.2 Purpose of this Report

In accordance with the National Environmental Management Act, No. 107 of 1998 (Act No. 107 of 1998) (NEMA) and the EIA Regulations of 4 December 2014 (Government Notice Regulation (GN R.982) (as amended), the issuing of an EA requires the undertaking of a BA process, with the associated Public Participation Process (PPP) and required the Specialist Studies. This will enable the Competent Authority (CA) to decide whether or not, to issue an EA for the proposed development.

The EIA Regulations of 2014 (as amended) allows for a BA process to be undertaken for activities with environmental impacts as listed in Listing Notice 1 (GN R.983) and Listing Notice

3 (GN R.985), as well as for the undertaking of a more rigorous two-tiered Scoping and Environmental Impact Reporting (S&EIR) process for activities with potentially greater environmental impact. Activities that may trigger the need to undertake a S&EIR process are listed in Listing Notice 2, as stipulated in GN R.984.

In terms of the EIA regulations of 2014 (as amended), activities associated with the proposed development are listed under Listing Notice 1 (GN R.983) and Listing Notice 3 (GN R.985), which requires a BA process to be undertaken. As such, a BA Process will be followed.

1.3 Report Structure

This Basic Assessment Report (BAR) aims to conform to the requirements stipulated in Appendix 1 of the National Environmental Management Act 107 of 1998 (NEMA) Environmental Impact Assessment Regulations, 2014, as amended.

This report documents the process and findings of the BA process and associated Public Participation Process (PPP) for the proposed upgrade of the R33, Section 13, between Modimolle (km0.6) to Witklip (km13.6), in Limpopo Province. This report will be subject to a public comment period, after which it will be finalised, and submitted to the Competent Authority (CA) i.e. the Department of Forestry, Fisheries and the Environment (DFFE) for review and decision-making.

The BA Report is structured according to the following chapters:

- Chapter 1 provides background to proposed development and the BA process.
- Chapter 2 provides a description of proposed development.
- Chapter 3 provides details of the alternatives assessment.
- Chapter 4 outlines the policy and legislative context of the proposed development.
- Chapter 5 describes the affected biophysical and socio-economic environment.
- Chapter 6 outlines the approach to undertaking the BA and Public Participation Process.
- Chapter 7 describes the methodology for impact identification and assessment of impacts.
- Chapter 8 provides an assessment of the potential cumulative impacts
- Chapter 9 provides a summary of the key environmental findings.
- Chapter 10 presents the conclusions and recommendations based on the findings of the BA Report.
- Chapter 11 provides references used in the compilation of the BA Report.

1.4 Details of Environmental Assessment Practitioner

Zitholele is an empowerment company formed to provide specialist consulting services primarily to the public sector in the fields of Water Engineering, Integrated Water Resource

Management, Environmental and Waste Services, Communication (public participation and awareness creation) and Livelihoods and Economic Development.

Zitholele has no vested interest in the proposed project and hereby declares its independence as required in terms of the EIA Regulations. Table 1-1 provides the Environmental Assessment Practitioner (EAP) details. CVs of the EAPs that undertook the assessment and compiled the report is included in Appendix A.

Name and Surname	Ms. Natasha Lalie (EAP)	
Highest Qualification	MSc (Environment and Society), University of Pretoria	
Professional Registration	Registered EAP: Environmental Assessment Practitioners	
	Association of South Africa (EAPASA), Registration No. 2021/3611	
Company Represented	Zitholele Consulting (Pty) Ltd	
Physical Address	Building 1, Maxwell Office Park, Magwa Crescent West, Waterfall	
	City, Midrand	
Postal Address	P O Box 6002, Halfway House, 1685	
Contact Number	011 207 2060	
Facsimile	086 674 6121	
E-mail	natashal@zitholele.co.za	
Name and Surname	Dr. Mathys Vosloo (Project Associate, Project Consultant)	
Highest Qualification	PhD (Zoology)	
Professional Registration	Registered Pr.Sci.Nat. (Registration no. 400136/12) with South	
	African Council for Natural Scientific Professions (SACNASP)	
Company Represented	Zitholele Consulting (Pty) Ltd	
Physical Address	Building 1, Maxwell Office Park, Magwa Crescent West, Waterfall	
	City, Midrand	
Postal Address	P O Box 6002, Halfway House, 1685	
Contact Number	011 207 2079	
Facsimile	086 674 6121	
E-mail	mathysv@zitholele.co.za	

 Table 1-1: Applicant and Consultant Contact Details

1.5 Expertise of the Environmental Assessment Practitioner

Ms. Natasha Lalie has a MSc. Environment and Society from the University of Pretoria and has been an Environmental Assessment Practitioner (EAP) for almost nineteen years. She has undertaken numerous Scoping Reports, Environmental Management Programmes (EMPr's), Environmental Screening and Feasibility Studies and Environmental Permitting and Licencing project, as required by NEMA and the EIA Regulations (as amended). She has been involved in a wide range of projects, which include waste management, industrial, establishments. mixed-use development, township road upgrades, infrastructure developments, change of land use, lodge developments, proposed bulk water pipelines, proposed transmission power lines, proposed filling stations, shopping centre developments and so on. Natasha Lalie is a registered EAP with the Environmental Assessment Practitioners Association of South Africa (EAPASA) since September 2021.

Dr Mathys Vosloo graduated from the Nelson Mandela Metropolitan University with a PhD in Zoology in 2012, after successfully completing a MSc in Zoology and BSc (Hons) in Zoology. Dr Vosloo is a member of the International Association for Impact Assessments (IAIA) and is a registered Professional Natural Scientist (*Pr. Sci. Nat*) in the field of Ecological Science with the South African Council for Natural Scientific Professionals (SACNASP) since 2012. He has been involved in electricity generation, transmission and distribution projects and their potential impacts on the environment for a large part of his career. Mathys has gained extensive experience in managing integrated environmental authorisation processes and has successfully managed large projects through the phases of EIA in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) and National Environmental Management of integrated authorisation processes.

Dr. Vosloo has been involved in electricity generation, transmission and distribution projects and their potential impacts on the environment for a large part of his career. Mathys has gained extensive experience in managing integrated environmental authorisation processes and has successfully managed large projects through the phases of EIA in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) and National Environmental Management Waste Act, 2008 (Act No. 59 of 2008). Mathys has also been involved in Water Use Licensing as a component of integrated authorisation processes. Mathys has a comprehensive understanding of the relevant environmental legislation and works intimately with specialist consultants to ensure that potential impacts are accurately identified, assessed and mitigated.

1.6 Statement of Zitholele's Independence and EAP Affirmation

Neither Zitholele, nor any of the authors of this Report have any material interest in the outcome of this Report, nor do they have any pecuniary or other interest that could be reasonably regarded as being capable of affecting their independence or that of Zitholele. Zitholele has no beneficial interest in the outcome of the assessment which is capable of affecting its independence.

EAP AFFIRMATION:

Section 16 (1) (b) (iv), Appendix 1 Section 3 (1) (r), Appendix 2 Sections 2 (I) and (j) and Appendix 3 Section 3 (s) of the Environmental Impact Assessment (EIA) Regulations, 2014 (promulgated in terms of the NEMA), require an undertaking under oath or affirmation by the EAP in relation to:

- The correctness of the information provided in the report;
- The inclusion of comments and inputs from stakeholders and interested and affected parties;

- The inclusion of inputs and recommendations from the specialist reports where relevant; and
- Any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested and affected parties.

Zitholele and the EAPs managing this project hereby affirm that:

- To the best of our knowledge, the information provided in the report is correct, and no attempt has been made to manipulate information to achieve a particular outcome. Some information, especially pertaining to the project description, was provided by the applicant and/or their sub-contractors.
- To the best of our knowledge all comments and inputs from stakeholders and interested and affected parties have been captured in the report and no attempt has been made to manipulate such comment or input to achieve a particular outcome. Written submissions are appended to the report while other comments are recorded within the report. For the sake of brevity, not all comments are recorded verbatim and are mostly captured as issues, and in instances where many stakeholders have similar issues, they are grouped together, with a clear listing of who raised which issue(s).

Information and responses provided by the EAP to interested and affected parties are clearly presented in the report. Where responses are provided by the applicant (not the EAP), these are clearly indicated.

The EAP Declaration of Interest is included in Appendix B.

1.7 DFFE Screening Tool Assessments

In terms of GN R 960 (promulgated on 5 July 2019) and Regulation 16(1)(b)(v) of the 2014 EIA Regulations (as amended), the submission of a Screening Report generated from the DFFE's national web based environmental screening tool (<u>https://screening.environment.gov.za</u>) is compulsory for the submission of applications in terms of Regulation 19 and 21 of the 2014 EIA Regulations.

The screening tool assessments were undertaken for the project study area and the results of the screening tool assessments are presented in Table 1-2 and Table 1-3 below.

Table 1-2: Development Site Environmental Sensitivities assigned by the DFFE Screening To	ol
Assessment	

Theme	Development Site Environmental Sensitivities	
Agriculture	High	
Animal Species	Medium	
Aquatic Biodiversity	Low	
Archaeological and Cultural Heritage	Very High	
Civil Aviation	High	

Theme	Development Site Environmental Sensitivities
Defence	Low
Palaeontology	Medium
Plant Species	Medium
Terrestrial Biodiversity	Very High

Table 1-3: Specialist assessments identified in terms of the DFFE Screening Tool Assessment

Specialist	Development Site		
Assessment			
Landscape/Visual	A site verification assessment was undertaken by the EAP. Refer to the		
Impact Assessment	photos of the site in Photoplate 1 of Appendix D).		
	The nature of the development (additional lanes for the proposed road		
	upgrade next to the existing R33) will not alter the character, nor sense of		
	place of the study area, as the R33 already exists. Furthermore, visual		
	impacts will only occur during the construction period which will be of a		
	short-term duration. With the implementation of mitigation measures		
	(Section 7.2 of the EMPF in Appendix J) to minimise the impacts on a		
	the southern portion of the study area, the visual character of the site will		
	not be compromised by views by these receptors. A Landscape / Visual		
	Impact Assessment is therefore not deemed necessary.		
Archaeological and	An Archaeological and Cultural Heritage Impact Assessment is provided		
Cultural Heritage	in Appendix H8. The Screening Tool Report identified the site to have a		
	'very high' sensitivity.		
Delegentelegy Impost	The Delegental price I impact Appagement of the development site and is		
	included in Appendix H9. The Screening Tool Report identified the site to		
A3363511611	have a 'medium' sensitivity.		
Terrestrial Biodiversity	A site sensitivity verification assessment was undertaken.		
Impact Assessment	A Terrestrial Biodiversity Impact Assessment (Floral and Faunal		
	A refrestrial blockersity impact Assessment (ribial and radial Assessments) of the development site was undertaken and is included in		
	Appendix H6 and H7.		
Aquatic Biodiversity	The Site Verification Assessment was undertaken by an Aquatic Scientist		
Impact Assessment	with experience in Aquatic Assessments.		
	An Aquatic Biodiversity Impact Assessment of the development site was		
	undertaken and is included in Appendix H4.		
Socio-Economic	The Site Verification Assessment was undertaken by the EAP.		
Assessment			
	A specialist Socioeconomic Impact Assessment is not deemed necessary,		
	due to the limited extent and short-term duration of the proposed project.		
	as appropriate. There will be closure/relocation of the some of the access		
	roads along the R33. This is due to the requirement for compliance with		
	SANRAL and TRH, TMH and UTG design guidelines and standards. road		
	safety improvement and access management policies. The affected		
	landowners were contacted regarding the potential closure of the		
	accesses by the Engineering Team, and they have understood the		
	reasons for the proposed upgrades and relocation of some of the		

Specialist	Development Site		
Assessment			
	accesses. Alternate access will be provided for landowners on affected properties with the final design. Access to their respective properties during the construction period will be obtained through the existing road network.		
	A limited number of jobs will be provided during the construction phase which will be of a short-term duration that will have a positive impact on the local community residing the local municipal area.		
	Comments received during public review of the Draft Basic Assessment Report will be included in the Comments and Responses Report of the Final BAR. Comments received during the public review period will be addressed by the EAP directly with the Interested and Affected Parties (I&APs).		
Plant Species Assessment	A Plant Species Assessment was included with the Terrestrial Biodiversity Impact Assessment (Floral Assessment) that has been undertaken and included as Appendix H6.		
Animal Species Assessment	An Animal /Faunal Species Assessment was included with the Terrestrial Biodiversity Impact Assessment (Faunal Assessment) that has been undertaken and included as Appendix H7.		

The DFFE Screening Tool Assessments are presented in Appendix C. Refer to the Site Verification Assessment in Appendix D.

1.8 Specialist Team

Specialist input in the fields of Terrestrial Ecology (flora and fauna), Freshwater and Aquatic Ecology, Soil Science, Hydrology, Traffic Engineering, Geotechnical Engineering, Archaeology and Palaeontology were identified to undertake the Specialist Studies for the proposed R33 road upgrade. These specialists were appointed by Zitholele to undertake the necessary assessments to identify, assess impacts and propose appropriate mitigation and management measures for the identified impacts in their respective fields. The specialists commissioned for the project, including qualifications and professional registrations are provided in Table 1-4.

Specialist Field	Company	Specialist	Qualifications and Professional Registration
Terrestrial Ecology (Flora)	Biosphere Enviro Solutions	Mr. Arno van den Berg	M.Sc. Environmental Sciences SACNASP Reg number: 400036/15
Terrestrial Ecology (Fauna)		Ms. Chantel Bowyer	B.Sc. (Hons) in Environmental Science SACNASP- Pr. Sci. Nat. Reg number: 129647 Member of the Zoological Society of Southern Africa (ZSSA) No. 753 Member of the International Association for Impact Assessment South Africa (IAIAsa) No. 5885

Table 1-4: Specialist tear	n commissioned for the proposed	l upgrade of the R33
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Specialist	Company	Specialist	Qualifications and Professional Registration
		Mr. Justin	PA Environmental Management
Aqualic Ecology		Rezuidenhout	Accredited Aquatic Ecologist
Agricultural and	The	Dr Matthew	PhD in Soil Science, Soil Hydropedology
Soil Science	Biodiversity	Mamera	Water and Sanitation Management
	Company	Mr. Andrew	MSc. Aquatic Science
		Husted	SACNASP: <i>Pr. Nat. Sci.,</i> Registration No. 400213/11: Ecological Science, Environmental Science and Aquatic Science.
Heritage and	Beyond	Mr. Jaco van	MA Archaeology
Archaeology	Heritage	der Walt	Accredited Professional Archaeologist
			(ASAPA) - 159
			Accredited Professional Heritage Practitioner (APHP) - 114
Palaeontology	Beyond	Prof Marion	PhD (University of Witwatersrand, 1990)
	Heritage	Bamford	FRSSAf, mASSAf
Geotechnical	ARQ Geotech	Mr Coert van	B Eng (Hons), B Eng (Civil)
Engineering	(Pty) Ltd	Dyk	Professional Engineer: PR ENG 202202137
Traffic	V3 Consulting	Ms. Anisa	Bachelor of Engineering Honours
Engineering	Engineers	Meyer	(Transportation Engineering), University of Pretoria
			Bachalor of Engineering (Civil Engineering)
			Liniversity of Pretoria
			Professional Engineer, Engineering Council of
			South Africa (202202367)
Hydrological	V3 Consulting	Mr. Robinson	BSc, Civil Engineering, Lafayette College,
Assessment	Engineers	Balarka	Professional Engineer, Engineering Council of
		David	South Africa (20150263)

The specialist Declaration of Interests are provided in Appendix D.

1.9 Assumptions and Limitations

The following assumptions and limitations were applicable to the studies undertaken within this BA Process:

- All information provided by the developer and I&APs to the environmental team was correct and valid at the time it was provided.
- It is assumed that the development site identified by the Applicant represents a suitable site for the proposed upgrade of the R33.
- Studies assume that any potential impacts on the environment associated with the proposed development will be avoided, minimised or mitigated.
- This report and its investigations are project-specific.

- This report was informed by the information provided by the Applicant, project engineers and findings of various specialist studies and site investigations undertaken at the time of compilation of this report.
- The specialist studies conducted meet the minimum requirements, and as such, no additional studies were undertaken.
- All spatial data available to the EAP was utilised in the assessment of the proposed development. It was not deemed necessary for additional spatial data to be obtained.

1.9.1 Terrestrial Biodiversity Impact Assessment (floral assessment)

The following assumptions and limitations are relevant to the floral assessment:

The study was conducted in summer and evidence suggest that rain has fallen. It should therefore be noted that historical transformation can be plotted using historical arial images combined with physical site characteristics.

Red and orange list species are, by their nature, very rare and difficult to locate. It is important to note that, although the predicted impacts are mostly concerned with Red Data species, any sensitive non-Red Data species will also benefit from the proposed mitigation measures as they share the same habitat and face the same potential impacts as the Red Data species.

Discussions and proposed mitigations are to some extent made on reasonable and informed assumptions built on bone fide information sources, as well as deductive reasoning. Deriving a 100% factual report based on field collecting and observations can only be done over several years and seasons to account for fluctuating environmental conditions and migrations. Since environmental impact studies deal with dynamic natural systems additional information may come to light at a later stage.

1.9.2 Terrestrial Biodiversity Impact Assessment (faunal assessment)

The following assumptions and limitations are relevant to the faunal assessment:

To conduct a comprehensive, completely factually based faunal study, requires an extensive amount of time over different seasons. Typical surveys provide only a snapshot of the existing faunal community and should only be used as a general guideline.

Important Bird and Biodiversity Areas (IBA) were highlighted at desktop level. Furthermore, it should be noted that the findings of this study were largely based on desktop/historical assessments and findings of one site visit within which to identify faunal habitat availability.

Furthermore, this study, mainly focuses on the faunal habitat directly related to the study area and does not include any areas outside of this scope.

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1.9.3 Wetland Impact Assessment

The following assumptions and limitations are relevant to the Wetland Impact Assessment:

- The fieldwork component of the assessment comprised of one assessment only, during the wet season in April. No temporal trends for the respective seasons have been assessed.
- Mainly physical structure, augering and presence of vegetation associated with watercourses were used to indicate wetland boundaries.
- Deriving a 100% factual report based on field collecting and observations can only be done over several years and seasons to account for fluctuating environmental conditions and migrations. Since environmental studies deal with dynamic natural systems, additional information may come to light at a later stage.
- Due to the scale of the remote imagery used (Google Earth Imagery), as well as the accuracy of the handheld GPS unit used to delineate wetland areas in the field, the delineated boundaries cannot be guaranteed beyond an accuracy of about 10m on the ground.
- It was not possible to delineate all the natural wetlands, as the road is securely fenced, and the gates are locked. The position of the wetlands is noted on the Google Earth map illustrated in Figure 7 of the Wetland Impact Report.
- Despite these limitations, a comprehensive desktop study was conducted, in conjunction with the detailed results from the current survey, and as such there is a high confidence in the information provided.

1.9.4 Aquatic Ecological Assessment

The following assumptions and limitations are relevant to the Wetland Impact Assessment:

Culverts 1 to 26 were assessed; however, majority of these areas had no suitability to sustain any form of Aquatic life. The Aquatic Ecological Assessment was carried out at sites which had available biotypes to support and maintain aquatic life.

1.9.5 Archaeological and Heritage Impact Assessment

The following assumptions and limitations are relevant to the Archaeological and Heritage Impact Assessment:

Due to the subsurface nature of heritage resources, the possibility of discovery of heritage resources during the construction phase cannot be excluded. Any limitations are successfully mitigated with the implementation of a Chance Finds Procedure (CFP) and monitoring of the study area by the Environmental Control Officer (ECO). This report only deals with the current layout of the proposed development and consisted of non-intrusive surface surveys that focussed on tangible resources. This study did not assess the impact on medicinal plants and

intangible heritage as it is assumed that these components would have been highlighted through the public consultation process if relevant.

Field data were recorded by handheld GPS and Mobile GPS applications. It must be noted that during the process of converting spatial data to final drawings and maps the accuracy of spatial data may be compromised. Printing or other forms of reproduction might also distort the spatial distribution in maps. Due care have been taken to preserve accuracy. It is possible that new information could come to light in future, which might change the results of this Impact Assessment.

1.9.6 Palaeontological Impact Assessment

The following assumptions and limitations are relevant to the Palaeontological Impact Assessment:

Based on the geology of the area and the palaeontological record, it can be assumed that the formation and layout of the dolomites, sandstones, shales and sands are typical for the country, and only some might contain trace fossils, fossil plant, insect, invertebrate and vertebrate material. The overlying soils and sands of the Quaternary period would not preserve fossils.

1.9.7 Soil and Agricultural Potential Assessment

The following assumptions and limitations are relevant to the Soils and Agricultural Impact Assessment:

- The information contained in this report is based on auger points taken and observations on site;
- There may be variations in terms of the delineation of the soil forms across the area; and
- The GPS used for delineations is accurate to within five meters. Therefore, the delineation plotted digitally may be offset by at least five meters to either side.

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2 PROJECT DESCRIPTION

This chapter provides an overview of the proposed project and details the project scope which includes details relating to the planning/design, construction, operation, and decommissioning activities.

2.1 Regional Setting

The proposed upgrade of the R33 commences at km0.6 at Modimolle and will end at km13.6 at Witklip in Limpopo Province. The site falls within the jurisdiction of the Modimolle-Mookgophong Local Municipality, which is located within the Waterberg District Municipality. Refer to Figure 2-1. Table 2-1 provides the description of the study area of the proposed road upgrade.

Table 2-1: Details	s relating to	o project	location
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Farm/Frf/Portion	Portion 81 of the Farm Nylstroom Town and Townlands		
	Remainder of Portion 3 of the Farm Donkerpoort No. 406		
	Portion 2 of the Farm Donkerpoort No. 406		
	Remainder of the Farm Thaba Metsi No. 858		
	Portion 13 of the Farm Rhenosterfontein No. 407		
	Portion 11 of the Farm Rhenosterfontein No. 407		
	Portion 16 of the Farm Rhenosterfontein No. 407		
	Portion 9 of the Farm Rhenosterfontein No. 407		
	Portion 2 of the Farm Flandspoort No. 411		
	Remainder of Farm Flandspoort No. 411		
	Portion 100 of Farm Nylstroom Town and Townlands		
	Portion 145 of Farm Nylstroom Town and Townlands		
	Portion 144 of Farm Nylstroom Town and Townlands		
	Portion 95 of Farm Nylstroom Town and Townlands		
	Portion 156 of Farm Nylstroom Town and Townlands		
	Portion 10 of Farm Elandspoort No. 411		
	Portion 1 of Farm Nylstroom Town and Townlands		
	Refer to Appendix E for the property details.		
Co-ordinates	Start at km0,6		
	Latitude: 24°41'49.93"S, Longitude: 28°24'04.15"E		
	Middle at km6.5		
	Latitude: 24°39'38.65"S, Longitude: 28°22'01.91"E		
	End at km13.6		
	Latitude: 24°37'09.11"S, Longitude: 28°19'27.36"E		
District Municipality	Waterberg District Municipality		
Local Municipality	Modimolle-Mookgophong Local Municipality		
Land Zoning	Road reserve		
Ward No.	2, 6 and 12		
Physical address of the	R33 from km0.6 to km13.6		
study area			
Nearest Towns	Modimolle		
	Witklip		
	Atoom		

2.2 **Project Site Description**

The proposed road upgrade of the R33 will be located within the existing road reserve. There will be additional land that will be required outside the road reserve of the existing SANRAL road reserve. The extent of land that is required, will be influenced by the standard of road improvement accepted.

The process for the land acquisition will be aligned and integrated with the SANRAL Land Acquisition Guidelines Manual. The property report details the properties adjacent to and within the project battery limits which are affected by the project. A total of 2,121 ha of land will be acquired through the land acquisition process from the identified properties to accommodate widening of the existing carriageway. The Property Report has been submitted to SANRAL for approval. Once approved the compilation of the land acquisition diagrams can be commenced with.

The site for the proposed development occurs within Wards 2, 6 and 12 of Modimolle-Mookgophong Local Municipality within the Waterberg District Municipality in Limpopo Province.

2.3 Surrounding Land Uses

The municipality is well-known for its scenic lodges and game farms. Apart from game farms and lodges, the areas hold vast opportunities in terms of all forms of tourism due to the undisturbed natural environment as well as its proximity to other tourist destinations such as Bela-Bela and Mookgophong.

The land uses along the R33 are as follows, viz, correctional services, Koro Creek Golf Estate (residential area), vacant land, agricultural holdings, lodges/resorts/game ranches, place of leisure/restaurants and craft markets, retirement villages, place of worship and railway lines.

Tourism within the Municipality plays a very important role in terms of local economic development with a variety of linkages to the surrounding areas. Modimolle -Mookgophong as a tourism destination occupies a strategic position from the main markets of the country by being at the entrance of the Limpopo Province from the south.

Refer to the Photoplate of the study area below.

Start of the proposed R33 road upgrade at km0.6 near Modimolle Department of Correctional Services. Single lane carriageway in both directions was observed along the R33.
Erosion along drainage channel towards Klein Nyl River, adjacent to the existing Koro Creek Golf Estate at km1.12 was observed.
Drainage line entering the Klein Nyl River at km 1.12.

Riparian vegetation occurring the Klein Nyl River Bridge at km1.12 obstructs flow of water under the bridge.
Upstream of Klein Nyl River indicating the riparian reeds.
Existing intersection at Koro Creek Golf Estate (km1.445) to be upgraded.
Existing intersection at Kokanje Retirement Village to be upgraded at km2.425.

Intersection at Weesgerus Holiday Resort at km3.135 to be upgraded.
Existing intersection at the road to Donkerpoort at km4.745 to be upgraded.
Vegetation that will be cleared for the proposed road upgrade. A Terrestrial Biodiversity Impact Assessment will be undertaken to determine the protection status of the vegetation and the level of degradation.
Existing pipe culvert that will be upgraded. Vegetation overgrowth blocks the flow of water through the culvert.

Intersection at Elandsfontein to be upgraded at km10.035.
Existing intersection at Alma to be upgraded at km12.075.
Wetland/watercourse in the vicinity of the road upgrade at km 12.3.
Pipe culvert at approximately km12.9. and drainage channel downstream of the culvert.
End of the R33 upgrade at approximately km13.6.

Photoplate 1: Site observations along R33 upgrade



Figure 2-1: Locality map

2.4 Description of the Planned Activities

SANRAL proposes to upgrade of the R33 from Modimolle km0.6) to Witklip (km13.6) in Limpopo Province.

The total length of the road upgrade is 13km. The road upgrade will entail the following:

- Widening of the existing road to provide paved shoulders
- Provide new pavement structure on widenings
- Upgrading and strengthening of existing pavement layers
- Surfacing of road constructed to new levels
- Upgrading side drains
- Continuous or selective vertical and/or horizontal realignment inclusive of new pavement layers including drainage.
- Geometric/safety/capacity improvements at intersections.

The R33 is currently a single carriageway road with 3.7m lanes and 0.3m to 0.5m surfaced shoulders. There is an existing climbing lane on the west bound (LHS) of the road from km5.6 to km6.2. The proposed upgrade requires a four-lane facility up to the Kokanje Retirement Village. The following cross-sections for the R33 are proposed:

- km 0.6 km 2.4: 4-lane undivided single carriageway, including sidewalks in both directions up to the roundabout at Kokanje Retirement Village.
- km 2.4 km 6.8: 2-lane single carriageway with climbing lane from the roundabout through the "pass" section.
- km 6.8 13.6: 2-lane single carriageway with climbing/passing lanes

The position of the new carriageway relative to the existing carriageway was investigated with the aim of having to widen only to the one side to keep land acquisitions and relocation of services to a minimum. Most of the construction will be on one side thus will improve the safety of the road user as well as constructability for the contractor. It was subsequently concluded that the new carriageway will alternate between being on the LHS or RHS of the existing carriageway as summarized below:

- km 0.600 to km 0.730 keep on existing centreline
- RHS from km 1.000 to km 1.620 5.5m offset due to new bridge
- RHS from km 1.800 to km 4.960 2.7m offset
- km 5.400 to km 6.620 keep on the existing centreline through the "pass"
- LHS km 6.740 to km 8.300 2.7m offset
- RHS km 8.560 to km 11.540 2.7m offset
- km 11.940 to km 13.600 keep on existing centreline

- Koro Creek Golf Estate at km1.445
- Kokanje Retirement Village at km2.425
- Weesgerus Holiday Resort at km3.135
- Road to Donkerpoort at km4.745
- Road to Elandsfontein at km10.035
- Road to Alma at km12.075

2.4.1 km 1.445: T-junction (LHS) – Koro Creek Golf Estate

The existing Butterfly intersection at the access to Koro Creek Golf Estate will be upgraded to match the new 4-lane cross-section along the R33. The upgraded intersection is shown schematically in Figure 2-2.

2.4.2 km 2.425: Staggered intersection- LHS Kokanje Retirement Village, RHS farm access (possible future developments)

The access to Kokanje Retirement Village will be upgraded to a roundabout (Figure 2-3) which will improve the existing staggered intersection configuration and provide access to the future development to the west.

2.4.3 7.4.3.1.3 km 3.135: T-junction (LHS) – Weesgerus Holiday Resort

It is proposed to replace Weesgerus Holiday Resort's existing intersection with a butterfly intersection (Figure 2-4). The acceleration lane to Modimolle will merge with the single lane to provide 1 lane, with 1 lane going to Vaalwater:

2.4.4 7.4.3.1.4 km 4.745: T-junction (LHS) – Road to Donkerpoort (gravel)

It is proposed to convert this intersection to a butterfly intersection with a protected lane for vehicles turning right onto the R33 and an exclusive right-turn lane from the R33 to the gravel road towards Donkerpoort (Figure 2-5).

2.4.5 7.4.3.1.5 km 10.035: T-junction (LHS) – Road to Elandsfontein (gravel)

It is proposed to add an exclusive right-turn and left turn lane from the R33 to the gravel road towards Elandsfontein (Figure 2-6).

2.4.6 7.4.3.1.6 km 12.075: T-junction (LHS) – Road to Alma (gravel)

It is proposed to retain the exclusive right-turn and left turn lane from the R33 to the gravel road towards Alma with an added climbing lane direction Vaalwater (Figure 2-7).

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Figure 2-2: Proposed Upgrade of Koro Creek Gold Estate Intersection

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Figure 2-3: Proposed Kokanje Retirement Village Intersection



Figure 2-4: Proposed Weesgerus Holiday Resort Intersection

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Figure 2-5: Proposed Donkerpoort Intersection

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Figure 2-6: Proposed Elandsfontein Intersection



Figure 2-7: Proposed Alma Intersection

2.4.7 Surface and roadside drainage

The following surface drainage and roadside drainage is proposed:

- Surface drainage along the 4-lane dual carriageway section involves the provision of a combination of kerb and channel, kerbside drainage inlets, pipe culverts and drainage outlets. The high fill sections will include the provision of stormwater downchute pipes;
- Rural road high fill sections will include guardrails, kerb and channel, drainage inlets and downchute pipes. In instances of fills without guardrails, the kerb and channel detail will be replaced with a narrow V-drain 800mm wide combined with downchute pipes;
- Roadside drainage immediately adjacent to the surfaced road edge (generally along the flatter and/or road cut sections) will entail the provision of concrete-lined side drains to SANRAL's "Type F" concrete side channel detail, to widths which will vary between 1.5m and 2.5m wide, depending on the catchment area of the section of side drain. All concrete-lined drains will terminate standard dissipator sections in accordance with the SANRAL standard detail;
- In some instances existing earth drains located away from the edge of the road will be retained but will need to be reshaped/reconstructed to align with the new alignment of the road; and
- The existing earth drains exhibiting severe erosion damage (located beyond the edge of the road of the existing road) will be reinstated in terms drain-bed preparation following which the earth drains will be stone pitched or alternatively lined with gabion mattresses.

2.4.8 Climbing or Passing Lanes

Climbing lanes have been provided to match the level of service on an upgrade with that of the flatter grades on either side of it. Passing lanes have been provided to improve the operational efficiency of the road as a whole by increasing its capacity and hence the LOS experienced at various flow levels and also reducing delays resulting from inadequate passing opportunities.

Table 2-2 below show the characteristics of the provided climbing/passing lanes based on a reduction in speed of 15km/h or more. These lengths do not include entry and exit tapers.

Start (km)	End (km)	Length (m)	Grade (%)	Side	Туре
5.400	6.900	1500	6.3	LHS	Climbing lane (existing)
7.440	8.400	1040	-2.0	RHS	Passing lane
11.140	12.400	1060	8.8	LHS	Climbing lane

Table 2-2: Provided Climbing or Passing Lanes

design speeds respectively. The provided tapers comply with associated standards and SANRAL drawing specifications.

2.4.9 Bus and Taxi Lay-Bye

The existing R33/13 route between km 0.6 and km 13.6 did not provide for any pedestrian drop off or pick up facilities.

The South African Road Classification and Access Management Manual (TRH 26) provides guidelines on the provision of public transport facilities on the road network in order to enhance public transport and improve traffic flow and road safety. These are:

- Public transport stops on Class 2 roads are restricted to intersections, preferably downstream of intersections.
- Public transport stops on Class 3 roads are restricted to intersections, preferably downstream and should be in lay byes.
- There is no restriction on public transport stops on Class 4 and 5 streets and lay byes are not required.

All the intersections located within the R33 Section 13 project limits have been provided with public transport stops at major intersections near settlement developments. Table 2-3 below indicates the positions the facilities.

(km)	Length (m)	Side
1.380	20	RHS
1.520	20	LHS
2.340	20	RHS
2.500	20	LHS
3.080	20	RHS
3.200	20	LHS

Table 2-3: Location of Bus and Taxi Lay-bye Areas

The existing Klein Nyl River Bridge (Bridge B1272) is the only major drainage structure along the R33 and is located at km1.12. The existing structure consists of two spans of 5.35m each (10.7m in total) and has a skew of approximately 30°. As part of the road upgrade, the existing bridge will be replaced with a new, larger structure with a 32.52m total span and a 22.250 width between the parapets

- 2.5m raised sidewalk on LHS and RHS
- 3.6m slow lane
- 3.4m fast lane
- 2.8m raised median

The bridge cross section is therefore similar with a clear distance of 22.25m between the edges of the handrail coping which becomes 21.8m between the faces of the parapets, should there ever be a requirement to widen the road with one additional lane in each direction. The design allows for a further 3.5m lane if the sidewalks are removed.

The barrier is to protect pedestrians where the traffic exceeds 60km/h. The guardrails on the edge are provided only where the fill is high.

The bridge horizontal alignment is on a straight, with the bridge crossing the river at a skew of 30°.

The bridge will consist of 3 spans, with the end spans being 11.060m long and the central span being 15.40m long measured along the centreline of the road. The deck soffit will be at a maximum height of 5.4m above the river. The bridge construction will use traditional building materials and techniques. The use of reinforced concrete as the main construction material, specifying high durability mixes, will ensure that the bridge will require minimal maintenance over the design life.

The river bridge is downstream from the Coro Kreek Golf estate and will be visible from the golf course. The road towards Modimolle is near the edge of town approaching residential areas.

The appearance of the bridge should look functional with clean lines across the river.

The proposed bridge will be built along a new vertical profile which is approximately 1.7m higher than the existing bridge. The new bridge will be wider than the existing bridge which leaves sufficient space to accommodate the two-way traffic in stages. Referring to Figure 2-8 and Figure 2-9, phased construction is proposed whereby the new bridge is built in half-widths up to a particular point allowing traffic to be transferred from one road alignment to the next before demolition of the existing bridge allowing completion of the second half of the bridge.

The proposed phased construction allows for sufficient working space and considers the approach to the bridge which will require an embankment constructed at a slope of 1:1 near the bridge, flattening out further away from the bridge as the vertical alignment of the new converges to the original alignment. Referring to Figure 2-9, a return wingwall will be constructed in phase 1 to provide working space and facilitate subsequent completion of the abutment walls in phase 2.



Figure 2-8: Traffic Accommodation – Phased Construction, Deck and Approaches



Figure 2-9: Traffic Accommodation - Phased Construction, Abutments

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Figure 2-10: Proposed bridge B1272 cross section km 1.120

There will be closure/relocation of some access roads to comply with SANRAL and TRH, TMH and UTG design guidelines and standards, road safety improvement and access management policies. Alternate access will be provided for landowners on affected properties during the final design.

Commercial material sources will be obtained for the proposed construction, therefore, there will be no application for any borrow pits.

2.5 Traffic information and analysis

The following information regarding traffic analysis of the proposed road upgrade was extracted from the Detailed Design Report compiled by V3 Consulting (Pty) Ltd:

The following is a summary of the sources from which available traffic data was obtained from SANRAL for National Road R33 Section 13:

- SANRAL Comprehensive Traffic Observations (CTO) Count Stations; and
- Ad-hoc Traffic Counts conducted by Syntell (Contractor appointed to collect traffic data on behalf of SANRAL)

The actual location and type of the various stations used for the collection of traffic count data is presented in in Figure 2-11: Location of permanent and secondary CTO Counting Stations

. There are three (3) 12-hour manual traffic counts, four (4) 12-hour traffic and pedestrian counts and three (3) secondary CTO stations along the route.



Figure 2-11: Location of permanent and secondary CTO Counting Stations

The traffic volume data recorded from the abovementioned stations in 2015 and 2017 respectively, is summarised in Table 2-4 and Table 2-5 below.

CTO Station	ADT	ADTT	% HV	Total Vehicle Split NB/SB
19096 (km 9.8)	3,061	324	11%	50/50
19114 (km 12.3)	3,215	459	14%	50/50
19097 (km 60.0)	3,306	339	10%	49/51

Table 2_1 · 2015 Traffic	Count Data Recorded at	Tomporary CTO Stations
Table 2-4. 2013 Trainc	Count Data Necolueu at	

Conclusions drawn from the received data indicate that all four CTO Stations are temporary counters, as short-term traffic data is collected or provided over two weeks. As a result, only the Average Daily Traffic (ADT) volume is available over the route. The ADT volume is less reliable

CTO Station	ADT	ADTT	% HV	Total Vehicle Split NB/SB During a Normal Day Peak Hour
19826 (km 1.5)	6,116	644	11%	54/46
19096 (km 9.8)	3,491	490	14%	55/45
19114 (km12.3)	3,332	383	11%	55/45
19097 (km60.0)	3,562	480	13%	58/42

The percentage of heavy vehicles is moderately high, being in the region of 11-14%. The 2017 data, which includes a CTO Counter at km 1.5 which is within the influence of the CBD, indicates a higher ADT of 6116 vehicles per day over this section, which is discussed in more detail below.

The directional split between NB and SB vehicles is provided in Table 2-5 above as per the format of data. For Year 2015 the directional split is calculated from the ADT and for Year 2017 a normal day peak hour directional split is provided.

Based on the ADT data over the study area, the route can be divided into two distinct sections referred to as homogenous segments. These are described as follows:

Segment 1: Peri-urban or rural-urban transition zone from km 0.6 to km 3.5, 2-lane section with access intersections to 3 major developments namely Koro Creek Golf Course, Kokanje Retirement Village and Weesgerus Holiday Resort. The interaction between these nodes and the CBD results in a higher ADT over this section.

Segment 2: Rural section flanked by low density developments such as game farms and agricultural holdings on either side, starting at km 3.5 and continuing to the end of the project limits (km 13.6).

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2.5.1 Obtaining New Data

Manual classified traffic counts were conducted at 7 intersections along the R33, on Friday, 23 November 2018.

The scope of the project requires safety and capacity upgrades to 6 intersections, starting from the R33/Koro Creek Golf Estate intersection. For completeness the R33/Van Niekerk intersection, located before the R33/Koro Creek Golf Estate intersection, is included in the traffic count analysis. The positions of traffic counts are as follows:

- Site 1: R33 and Van Niekerk St. Intersection (not part of the study area but included due to its proximity to the project start limit)
- Site 2: R33 and Koro Creek Golf Estate Access Intersection
- Site 3: R33 and Kokanje Retirement Resort Access Intersection
- Site 4: R33 and Weesgerus Vakansieoord Holiday Resort Access Intersection
- Site 5: R33 and gravel road towards Donkerpoort Intersection
- Site 6: R33 and D180 gravel road towards Elandsfontein Intersection
- Site 7: R33 and gravel road towards Alma Intersection

2.5.2 Past Traffic Loading

The R33 section under consideration has several temporary counters, most of which have only been in operation since 2015. The CTO Station 19096, however, was historically recorded under Station No. 5903, which was a secondary counter. Data for the years 2005 to 2008 is available and the AADT and ADTT volumes are provided for this station, alongside data from Station 19096 in Table 2-6.

Year	No. of Hours of Data	ADT	% Growth ADT	ADTT	% Growth ADTT
2005	189	2,398		314	
2006	207	2,446	2%	254	-19%
2007	188	2,408	-2%	313	23%
2008	191	2,299	-5%	348	11%

T	-	A A		0T0 (40000			
Table 2-6:	I rattic	Growth	i rend –	0103	Station	5093 &	19096	located	on th	e K33
Year	No. of Hours of Data	ADT	% Growth ADT	ADTT	% Growth ADTT					
---	-------------------------	-------	--------------	------	---------------					
2015	367	3,061		324						
2017	336	3,491		490						
Growth calculated from 2005 & 2017 volumes over 12 years			3.2%		3.8%					

This section of the R33 has no permanent CTO counter, which can provide consistent data over a number of years. The closest permanent counter, on a similar route, with sufficient, historic data is CTO Station 1133 located on the R101 Pienaarsrivier.

The AADT and ADTT volumes for this station are provided in Table 2-7 below, including the % growth calculated per annum and over the entire period. The corresponding growth in GDP is also shown per annum and extended to 2019.

Year	No. of Hours of Data	ADT	% Growth ADT	ADTT	% Growth ADTT	% GDP Growth
2002	5,272	4,659		725		3.7%
2003	8,462	4,883	5%	713	-2%	2.9%
2004	8,268	5,040	3%	715	0%	4.6%
2005	8,523	5,122	2%	708	-1%	5.3%
2006	8,718	4,599	-10%	666	-6%	5.6%
2007	8,405	5,160	12%	719	8%	5.4%
2008	8,691	4,919	-5%	722	0%	3.2%
2009	8,628	5,756	17%	762	6%	-1.5%

Table 2-7: Traffic Growth Trend – Permanent CTO Station 1133 located on the R104

Year	No. of Hours of Data	ADT	% Growth ADT	ADTT	% Growth ADTT	% GDP Growth
2010	5,461	5,691	-1%	786	3%	3.0%
2011	7,460	6,425	13%	838	7%	2.3%
2012	8,782	6,933	8%	849	1%	2.5%
2013	8,748	7,153	3%	824	-3%	2.5%
2014	8,722	6,917	-3%	753	-9%	1.9%
2015						1.2%
2016						0.4%
2017						1.4%
2018						0.8%
2019						0.2%
Average Year-on-Year Growth		3.6%		0.4%		
Growth calculated from 2002 & 2014 volumes over 12 years		3.1%		0.3%		

Based on Table 2-7, the ADT recorded at the permanent counter is growing at 3.6% which is in line with normative values of 3.5%, whereas there is a drop in the HV growth. This could be due to the sustained economic downturn in the last 3 to 4 years, as shown in the GDP growth in Table 2-7, reflecting in the reduction in freight activity in the area.

2.5.3 Future Traffic Growth Rates

The larger proportion of people in Modimolle travel by bicycle or by foot. Bus services are not significant, neither are minibus taxi movements along the route. Private vehicle travel is limited to the higher income areas of the urban core. Thus, traffic growth is realistically expected to come

from regional trips, therefore an average ADT growth rate of 2.5% pa. has been used, which was decided upon at a co-ordination and integration meeting between V3, SANRAL and Nyeleti Consulting who are responsible for upgrading the R33 adjacent to this section.

This growth rate is in line with the growth rate projected nationally on SANRAL routes.

2.5.4 Estimated Future Traffic Volumes

The estimated future daily traffic over a 25-year period is provided in Table 2-8 for Segment 1 (urban transition section) and Segment 2 (rural section), for the abovementioned growth scenario. An Opening Year of 2023 was assumed.

Traffic	Base Year Opening Year 2017 (2023)		10 Year Horizon (2033)	20 Year Horizon (2043)	25 Year Horizon (2048)	
Average Weekly ADT	6,116	7,093	9,079	11,622	13,150	
ADLV	5,472	6,345	8,123	10,398	11,764	
ADTT	644	747	957	1,224	1,385	

Table 2-8: Segment 1 Urban Transition Area - ADT calculated at 2.5% pa growth rate

Table 2-9: Segment 2 Rural section - ADT calculated at 2.5% pa growth rate

Traffic	Base Year	Opening Year	10 Year Horizon	20 Year Horizon	25 Year Horizon	
	2017	(2023)	(2033)	(2043)	(2048)	
Average Weekly ADT	3,458	4,011	5,134	6,572	7,435	
ADLV	3,014	3,495	4,474	5,727	6,480	
ADTT	445	515	660	845	956	

2.5.5 Traffic Capacity and Level of Service on Main Route

The HTM model was used to evaluate the current operating characteristics of the highway, with the Base Year being 2017.

The study area was broken down into homogenous sections as previously discussed. Traffic data used in the model is provided in the tables below for the normal day peak and subsequently provided in the tables below for the 30th HHF. Data was sourced from the temporary CTO Station traffic highlights for 2017.

Table 2-10: HTM	Traffic Data for	Peak Hour Flow
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HTM Model Segment	Start Chainage	End Chainage	AADT	Q (Peak Hour Flow)	Q/AADT	% Directiona I Split (K)	% HV	Speed Limit
Segment 1	km 0.6	km 3.5	6,116	644	0.10	60/40	11%	60km/hr
Segment 2	km 3.5	km 13.6	3,462	305	0.09	60/40	13%	80km/hr

2.5.6 Analysis of Base Year 2017 HTM Model Results

A summary of the model results for the Base Year 2017 scenario is shown in the table below. The Level of Service is defined in terms of percentage followers. Traffic volumes were projected to the Design Year 2043 (the route was subsequently analysed for 25 years) showing a "Do Nothing" scenario.

Year	Normal Day Pe	Normal Day Peak Hour										
	LOS A	LOS B	LOS C	LOS D	LOS E	LOS F						
2017	11.4%	57.7%	17.6%	13.3%	0.0%	0.0%						
2043	4.1%	0.2%	0.1%	46.5%	20.7%	28.4%						

Table 2-11: HTM Model Results for Base Year 2017 & Design Year 2043

The results indicate that the majority of the road currently operates at a LOS B. The high LOS could be as a result of the relatively low volume of vehicles that use this road, allowing for added

opportunities for overtaking of slow-moving vehicles. The pass operates at a LOS A in the NB direction due to the presence of the climbing lane from km 5.5 to km 6.7.

2.5.7 Link Analysis of Segment 1 – Urban Transition Area

Segment 1 was analysed in significant depth in order to balance the need for capacity improvements with sustaining safe operating conditions for local motorists.

Three cross-section scenarios namely do nothing, additional and dropped lanes were developed and analysed in detail for the road alignment including intersections. Table 2-12 below summarises the scenario criteria utilised during the analysis.

Table 2-12: HTM Modelled Scenarios

Option No.	Description
Option 1	"Do Nothing" - provide 1 lane per direction, assume that the 400 coal trucks do not materialise
Option 2	Provide 2 lanes per direction from km 0.6 – km 3.1, with 400 coal trucks, drop the 4 th lane in the NB direction after the Weesgerus Resort.
Option 3	Provide 2 lanes per direction from km 0.6 – km 2.6, with 400 coal trucks, drop the 4 th lane in the NB direction after the Kokanje Retirement Village.

The results of the three analyses are presented in Figures 2-12, 2-13 and 2-14 respectively.



Figure 2-12: Lane diagram for Options 1

The analysis results confirm the existing route alignment requires a new intersection on the southbound lane between Koro Creek and Kokanje intersections.



Figure 2-13: Lane diagram for Options 2



Figure 2-14: Lane diagram for Options 3

Based on extensive discussions with SANRAL and analysis of the above three options (documented in the Concept Report), Option 3 was adopted. The HTM Model results are shown below for Segment 1 only, the peri-urban section between km 0.6 – km 3.1. Since this section is considered to be urban in nature, the LOS Results for the Normal Day Peak Hour are deemed to be acceptable.

Percentage of road length operating at a level of service: NRA Criteria											
		Normal Day Peak Hour				30th Highest Peak Hour					
Year	2017 (BY)	2017 2023 2033 2043 2048 2017 2023 2033 2043 (BY) (OY) YR) YR) YR) YR) (BY) (OY) YR) YR) YR) YR) YR) YR) YR) YR) YR YR) YR YR) YR YR </th <th>2048 (25- YR)</th>								2048 (25- YR)	
AVE LOS NB (KM 0.6-3.1)	С	С	D	Е	Е	D	D	Е	F	F	

Table 2-13: HTM Results for Option 1 Do Nothing - Segment 1

Percentage of road length operating at a level of service: NRA Criteria											
		Normal Day Peak Hour					30th Highest Peak Hour				
Year	2017 (BY)	2023 (OY)	2033 (10- YR)	2043 (20- YR)	2048 (25- YR)	2017 (BY)	2023 (OY)	2033 (10- YR)	2043 (20- YR)	2048 (25- YR)	
AVE LOS SB (KM 0.6-3.1)	С	С	D	E	Е	D	D	Е	F	F	

Based on the results for Option 1 Do Nothing Scenario, segment 1 fails from Design Year 2033 onwards, implying that the cross-section needs to be upgraded.

Percentage of road length operating at a level of service: NRA Criteria										
	Normal Day Peak Hour					30th Highest Peak Hour				
Year	2017 (BY)	2023 (OY)	2033 (10- YR)	2043 (20- YR)	2048 (25- YR)	2017 (BY)	2023 (OY)	2033 (10- YR)	2043 (20- YR)	2048 (25- YR)
AVE LOS NB (KM 0.6- 3.1)	С	С	D	E	Е	D	D	F	F	F
AVE LOS SB (KM 0.6- 3.1)	С	С	D	E	Е	D	D	Е	F	F

Option 2, with a four-lane facility from km 0.6 - km 3.1 shows satisfactory results in both the NB and SB direction.

Table 2-15: HTM Results for Option 3 - Segment 1

Percentage of road length operating at a level of service: NRA Criteria											
		Normal Day Peak Hour					30th Highest Peak Hour				
Year	2017 (BY)	2023 (OY)	2033 (10- YR)	2043 (20- YR)	2048 (25- YR)	2017 (BY)	2023 (OY)	2033 (10- YR)	2043 (20- YR)	2048 (25- YR)	
AVE LOS NB (KM 0.6-3.1)	С	А	А	В	В	D	В	В	В	С	
AVE LOS SB (KM 0.6-3.1)	С	А	А	А	А	D	А	А	В	В	
AVE LOS NB (KM 2.0-3.1)	С	В	В	В	С	D	В	В	С	С	
AVE LOS SB (KM 2.0-3.1)	С	А	А	А	А	D	A	А	В	В	

Option 3, which is a four-lane facility up to the Kokanje Retirement Village, whereafter the fourth lane in the NB direction is dropped, still operates within acceptable SANRAL standards of LOS C.

2.5.8 Discussion on mainline link capacity analysis results and recommendations

Based on the HTM Model, the following discussion and recommendations can be made:

- The peri-urban section of the route carries significantly higher traffic volumes than the rural section, and when projected 30 years into the future, the segment fails from a capacity perspective (even when analysed at low growth rates of 2.5% pa projected until the end of the design life).
- Thus, it is recommended that the road is widened to a four-lane facility, that accommodates the local interaction between the town and the 3 major developments in a safe manner. The latter is accommodated through the provision of butterfly intersections at all existing and future junctions on this section of the road.
- Based on the traffic modelling, the fourth lane can effectually be dropped in the NB direction after the Kokanje Retirement Village without a significant impact to the LOS.

2.5.9 Link Analysis of Segment 2 – Rural Section

With Option 3 above selected for Segment 1, the following positions for climbing lanes along the rest of the route were analysed:

Section	Chainage	Left	Right
	600	2	2
	2,600	1	1
Urban	3,100	1	1
	5,360	2	1
Pass	7,080	1	1
	7,300	1	2
	8,500	1	1
Rural	11,080	2	1

Table 2-16: Climbing Lane Positions

Section	Chainage	Left	Right
	12,580	1	1
	13,600	1	1

The HTM input parameters for the Design Year 2048 is provided below to demonstrate the differences between the inputs for the 30th HHF and the normal day peak hour. Note that the normal day peak hour volume is used for the peri-urban area (Segment 1, with results shown above) analysis and the 30th HHF is used for the rural area (Segment 2) analysis.

HTM Model Segment	Start Chainage	End Chainage	AADT	% Directional Split (K)	% HV	Q/AADT	PHF
Segment 1				60/40	13%	0.09	0 920
Peak Hour	600	2,600	13,550	00,10	10,0	0.00	0.020
30 th HHF				60/40	15%	0.130	0.940
Segment 2				60/40	170/	0.00	0.000
Peak Hour	2,600	13,600	7,835	00/40	17 /0	0.09	0.900
30 th HHF				60/40	22%	0.140	0.930

The HTM Model results from the opening year until the end of the design life is shown below:

Table												
Percentage of road length operating at a level of service: NRA Criteria												
Voor	Normal Day Peak Hour 30 th Highest Peak Hour											
rear	LOS A	LOS B	LOS C	LOS D	LOS E	Total	LOS A	LOS B	LOS C	LOS D	LOS E	Total
2023	46.4%	49.3%	4.3%	0.0%	0.0%	100.0%	32.3%	20.1%	40.9%	5.5%	1.2%	100.0%
2033	32.7%	54.3%	9.0%	4.0%	0.0%	100.0%	30.6%	1.9%	27.8%	33.5%	6.2%	100.0%

Table 2-18: HTM Model Results for Segment 1 & 2

	Percentage of road length operating at a level of service: NRA Criteria											
Maan	Normal Day Peak Hour 30 th Highest Peak Hour											
rear	LOS A LOS B LOS C LOS D LOS E Total				LOS A	LOS B	LOS C	LOS D	LOS E	Total		
2043	32.3%	10.6%	48.2%	6.8%	2.0%	100.0%	13.8%	18.5%	2.6%	50.5%	10.4%	95.8%
2048	32.0%	3.8%	51.2%	9.0%	4.0%	100.0%	12.1%	20.3%	0.0%	16.4%	44.6%	93.4%

Based on the results, the route performs well under the normal day peak hour until the end of the design life. Under the 30th HHF the route performs satisfactorily until Year 2043 when approximately half the route operates at LOS D. In the next 5 years these portions deteriorate to a LOS E, which might be acceptable given the long period of forecasting being undertaken (starting from a base of 2018). A 2.5% traffic growth rate may never be achieved over this route hence the results could be deemed acceptable.

2.5.10 Traffic Capacity and Level of Service for Intersections

Based on the 12-hour traffic counts, the AM and PM peak hours over this section of the route was determined as follows (most intersections, rural and urban conform to this except for Weesgerus Holiday Resort):

- AM Peak Hour: 08:45 09:45
- PM Peak Hour: 15:45 -16:45

The AM and PM Peak turning movement count data for 2018 was provided in the Project Assessment Report. The turning movement volumes at each of the intersections during the critical AM and PM Peak hours for Design Year 2048, projected at a rate of 2.5%pa (over-optimistic since developments such as the retirement village are not likely to grow), are instead shown in Figure 2-15 and Figure 2-16. The 12-hour movements, from 06:00 – 18:00 are shown in Figure 2-17.

The intersections were analysed in the SIDRA software analysis programme which is used to determine the capacity of the intersection based on the level of delay experienced. The results are presented in Level of Service format, with letters A through to F used as discussed previously.



Figure 2-15: AM Peak Hour Traffic Volumes – Design Year 2048



Figure 2-16: PM Peak Hour Traffic Volumes – Design Year 2048

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Figure 2-17: 12-Hour Traffic Volumes – Design Year 2048

The Concept Report details the various intersection configurations that were modelled to improve capacity and safety conditions, especially for vulnerable road users that frequently use the Kokanje Retirement Village access intersection. For the purposes of this report, only the final intersection upgrade strategy is presented as follows:

Site 2 (Koro Creek Golf Estate): This intersection is converted into a butterfly intersection with a protected lane for vehicles turning right onto the R33; an exclusive right-turn lane from the R33 to the golf estate is incorporated into the intersection; an acceleration lane is added for the traffic turning left onto the R33.

Site 3 (Kokanje Retirement Village): This intersection has been converted to a roundabout with the staggered gravel road aligned with the intersection, formalizing it as the fourth leg; an acceleration lane is added for vehicles turning left onto the R33 from the retirement resort; a public transport layby lane is incorporated after the intersection, in the direction towards Modimolle town; a deceleration lane is added at the access road into the retirement resort for the vehicles turning left from the R33.

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Site 5 (Road to Donkerpoort): An exclusive right-turn lane from the R33 to the gravel road towards Donkerpoort is incorporated into the intersection.

intersection with a protected lane for vehicles turning right onto the R33.

Site 6 (Road to Elandsfontein): An exclusive right-turn lane from the R33 to the gravel road towards Elandsfontein is incorporated into the intersection.

Site 7 (Road to Alma): No improvements.

All access roads leading onto the R33 will have an extended stop line for left-turning vehicles so that they may bypass any delay caused by vehicles waiting to turn right onto the R33. For this option, layby lanes initially provided at Sites 2 and 4, were consolidated to Site 3 only (at the proposed roundabout).



Figure 2-18: R33 and Van Niekerk Street Intersection Upgrade



Figure 2-19: R33 and Koro Creek Golf Estate Intersection Upgrade



Figure 2-20: R33 and Kokanje Retirement Resort Intersection Upgrade

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Figure 2-21: R33 and Weesgerus Holiday Resort Intersection Upgrade



Figure 2-22: R33 and Donkerpoort Intersection Upgrade



Figure 2-23: R33 and Elandsfontein Intersection Upgrade





The corresponding SIDRA level of service results are presented below for the Design Year 2048.

V/C Delay LOS V/C Delay LOS V/C Delay LOS V/C Delay LOS	V/C Delay LOS
1/0 2000 1/0 2000 1/0 2000 200 1/0 200 1/0 200 1/0 200	
AM 0.98 A 0.28 0.40 A 0.49 32.80 D 0.23 1.10 A	0.5 3.2 A
Image: Van Niekerk St. PM 0.97 A 0.37 0.40 A 0.70 56.20 F 0.25 1.00 A	0.7 3.9 A
Int. Description Peak Nutr North Fost Approach South East South West North West	Overall Intersection
No. Description Hour Phr Notit Last Approach Approach Approach Approach	Overall Intersection
V/C Delay LOS V/C	V/C Delay LOS
Koro Creek Gold Estate AM 0.97 0.20 0.40 A 0.67 79.50 F 0.18 0.10 A	0.7 3.5 A
Access PM 0.94 0.24 0.40 A 0.72 130.10 F 0.19 0.10 A	0.7 3.3 A
Int. Peak Peak North Factor South East South West North West	0
No. Description Hour PHF North East Approach Approach Approach Approach Approach	Overall Intersectio
V/C Delay LOS	V/C Delay LOS
Kokanje Retirement Resort AM 0.99 0.61 9.90 A 0.22 4.80 A 0.24 10.60 B 0.50 6.40 A	0.5 6.5 A
Access PM 0.95 0.80 12.30 B 0.37 4.90 A 0.19 12.10 A 0.68 6.40 A	0.7 6.2 A
Int. Peak Peak South East South West North West	
No. Description PHF North Last Approach Approach Approach Approach Approach	Overall Intersection
V/C Delay LOS	V/C Delay LOS
Weesgerus Vakansieoord AM 0.95 0.23 0.50 A 0.31 24.60 C 0.25 0.10 A	0.3 1.9 A
4 Holiday Resort Access PM 0.99 0.35 0.50 A 0.72 67.50 F 0.33 0.10 A	0.7 4.1 A
Int. Peak South East North West	
No. Description PHF East Approach Approach Approach Approach Approach	Overall Intersection
V/C Delay LOS	V/C Delay LOS
Road C Gravel Road AM 1 A 0.23 0.20 A 0.07 21.90 C 0.26 0.10 A	0.3 0.6 A
5 towards Donkerpoort PM 0.98 A 0.39 0.30 A 0.26 45.30 E 0.29 0.10 A	0.4 1.2 A
Int. Peak South East South West North West	
No. Description PHF North East Approach Approach Approach Approach Approach	Overall Intersection
V/C Delay LOS	V/C Delay LOS
Road B Gravel Boad AM 0.96 A 0.21 0.30 A 0.04 15.90 B 0.24 0.10 A	0.2 0.4 A
6 towards Elandsfontein PM 0.97 A 0.40 0.20 A 0.05 30.20 D 0.30 0.10 A	0.4 0.4 A
Int. Peak	
No. Description PHF East Approach South Approach West Approach North Approach North Approach	Overall Intersection
V/C Delay LOS	V/C Delay LOS
Road A Gravel Road AM 0.97 A 0.20 0.40 A 0.11 15.90 B 0.21 0.10 A	0.2 1.0 A
7 towards Alma PM 0.97 A 0.37 0.20 A 0.71 161.10 F 0.27 0.10 A	0.7 3.9 A

 Table 2-19: SIDRA LOS Results for Design Year 2048

Note that the LOS E/F at the side roads for the Design Year 2048 scenario was given due consideration. However, the minimal traffic volumes, even when projected over 30 years (and some of these developments are not likely to grow at the rate discussed above), does not warrant exclusive turning lanes (SIDRA could also be overestimating the delay based on the critical gap value used).

It is therefore recommended that an extended stop line be provided to increase stop line capacity such that the left turner is able to bypass the right turn traffic movement.

2.5.11 Pedestrian Movement and Non-motorised Transport

The intersections falling within the urban transition section of the route were also surveyed for pedestrian activity. 12-Hour pedestrian movement counts were undertaken at the first 4 intersections (including Van Niekerk Street). The count data is shown in Figure 2-25 below.



Figure 2-25: 12-Hour Pedestrian Volumes

It was initially recommended that sidewalks are only provided on the LHS of the roadway as developments are concentrated on this side of the road only. Based on the almost equal distribution of trips to both sides of the roadway, 2.5m sidewalks are provided on both sides of the road.

This amendment is applicable to the following cross sections:

- New and widened bridge at km 1.120,
- Butterfly intersection at km 1.390 with bus stop,
- Butterfly intersection at km 1.500 with bus stop,
- Roundabout at km 2.419,
- Widened intersection at km 3.132,
- New cross section between km 0.600 and km 3.100 on the south bound slow lane, and;
- New cross section between km 0.600 and km 3.200 on the north bound slow lane.

A median of 2.8m is provided from km 0.6 to km 3.3 which serves as a pedestrian refuge area, where pedestrians may safely wait for a gap in the traffic to finish crossing the road. In addition,

the roundabout proposed at the Kokanje Retirement Village also serves as an effective traffic calming tool, slowing down long-distance motorists as they approach the town section.

2.5.12 Estimated Future Traffic Loading

From the above section the following data shown in Table 2-20 was used to calculate the Million Equivalent Standard Axle (MESA) loads that the road pavement would experience.

Section	HV design direction (incl. additional	Axle Split				
	200 HV from future mine)	2-3 axle	4-5 axle	6-7 axle		
Section 1: km 0.6 – km 3.5	507	42%	17%	41%		
Section 2: km 3.5 – km 13.6	426					

Table 2-20: MESA information from CTO

Due to the limited historic traffic counts, the heavy vehicle growth rate of 3.5% per annum is proposed to calculate the future traffic loading. The proposed 3.5% growth in heavy vehicles is based on similar roads which showed a similar yearly growth rate.

It is however possible that there could be changes in the future, such as changes in the economy that can have an influence on the traffic growth rate and vehicle loading. Therefore, a sensitivity analysis was carried out on the E80s per heavy vehicle and the heavy vehicle growth rate.

The result from the 20-year heavy vehicle traffic analysis is shown in Figure 2-26 for Section 1 and Figure 2-27 for Section 2.

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Figure 2-26: Section 1 (km 0.6 - km 3.5) MESA calculations

Average Axle Split (%) Short/Medium/Lor	g	42% 17% 41%		
Description of Heavy Vehicle Loading		Fully and partially laden vehicles		
E80/Axle Loading (SAPEM, 2nd, Table 21))	0.7		
Average Axle per Heavy Vehicle split (S:	M:L)	2.5 4.5 6.5		
E80/Heavy Vehicle		3.14		
INPUT PARAMETERS:				
AADTT (Truck Traffic): Design Direction	426	TOTAL ESTIMATED E80 TRAFFIC (MILLION)		
DESIGN LIFE PERIOD (Years)	20	35		
Grow th Rate to Opening Year (%)	3.5%	20		
Base Year	2017	30 0		
Year of Opening	2019	25		
Years to Opening	2			
E80s / Heavy	3.14	20		
Number of Lanes: Design Direction	2	6		
		15		
TRAFFIC LOADING CALCULATIO	<u>N</u>	10		
E80s / Heavy 2.5 2.8 3.1	3.3 3.5			
2.25% 10.8 12.0 13.3	14.2 15.0	5		
шё 2.75% 11.4 12.7 14.1	15.0 15.9			
5 ₩ 3.25% 12.0 13.4 14.9	15.8 16.8	0		
Q H 3.75% 12.7 14.2 15.7	16.7 17.7	2.25% 2.75% 3.25% 3.75% 4.25% 4.75%		
<u>0</u> <u>1</u> 4.25% 13.5 15.1 16.6	17.7 18.8			
ш 4.75% 14.3 15.9 17.6	18.7 19.9	\cdots 1.9 2.2 -2.5 2.7 \cdots 2.9		
THE MOST LIKELY TOTAL	ESTIMATED E8	30 = 14.4 MILLION		

Figure 2-27: Section 2 (km 3.5 - km 13.6) MESA calculations

The MESA was also calculated for various design periods. The results are summarised in Table 2-21.

Design Period	Range (MESA)		Most likely (MESA)			
(Years)	Section 1	Section 2	Section 1	Section 2		
10	5.7 – 9.1	4.8 - 7.7	7.1	6.0		
15	9.1 – 15.5	7.6 – 13.1	11.7	9.8		
20	12.8 – 23.6	10.8 – 19.9	17.1	14.4		

Table 2-21: Summary of MESA calculations

Design Range (MESA) Period			Most likely (MESA)		
(Years)	Section 1	Section 2	Section 1	Section 2	
25	17.0 – 33.9	14.3 – 28.5	23.6	19.8	

The above results show that Section 1 will most likely receive 17.1 MESA over a period of 20 years and 14.4 MESA for Section 2. In terms of pavement design, these MESA results are close enough to be considered equal. It is therefore recommended to design the pavement structure over the full length for 17 MESA.

2.6 Actions to be undertaken during each lifecycle phase

2.6.1 **Pre-Construction and Construction Process for proposed development**

The pre-construction and construction of the proposed development will be undertaken in the following steps:

- Undertaking and completion of proposed detail design drawings;
- Obtain the relevant permits and siting approval (Undertake the BA and Water Use Authorisation (WUA) Processes);
- Finalisation of the land acquisition process;
- Undertaking of, and compliance with pre-construction activities and conditions in terms of the Environmental Authorisation and WUA;
- Demarcation of the no-go areas and the construction footprint areas;
- Site preparation (vegetation clearance) and excavations for the above proposed infrastructure;
- Foundations for the construction of the bridge at the Klein Nyl River;
- Upgrade of the existing culverts; and
- Testing and commissioning.

The construction phase for the proposed project will take approximately 2 years.

2.6.2 Operational and Maintenance Activities

Maintenance of the upgraded R33 must take place on a regular basis. Operation of the upgraded carriageway is expected to start in November 2026. As a general principle, SANRAL commences with maintenance and monitoring as soon as the upgraded road becomes operational.

2.6.3 Decommissioning and Recycling Activities

The decommissioning and closure phases are not applicable to the proposed upgrade of the R33 because the upgraded road will be permanent infrastructure, as per the future traffic growth and demand.

2.7 **Project Need and Desirability**

The decision to upgrade the R33 is motivated by the projected traffic growth in the next 25 years, based on a growth rate of 2.5% per annum that is projected nationally on SANRAL routes. Furthermore, economic development and infill and densification, future growth in housing establishments at the Modimolle area and expansion of the Koro Creek Golf Estate will require an upgrade of the R33, which also serves as a primary pedestrian route. There are several intersections occurring along the R33 that will be upgraded to accommodate the widening of the R33 and to meet safety of pedestrians and motorists alike. The existing Klein River Bridge and several culverts along the R33 will also be upgraded.

Job opportunities may be created during the construction phase that will benefit the local community on a short-term basis for several construction activities such as, the clearing and grubbing, installation of subsoil drains, installation of new culverts and lengthening of the existing culverts, construction of concrete lining for open drains, installation of guard rails, erection of fencing and road signs, road markings, cleaning of the hydraulic structures, excavation for open drains, clearing and shaping of existing open drains and excavations.

The upgrade of the R33 will create economic opportunities and skills transfer to the local communities during the construction phase. The R33 will provide for an improved traffic road network to cater for the increased traffic flow in the next 25 years, noting that this is also a significant tourist route in the Province.

3 CONSIDERATION OF ALTERNATIVES

In terms of the EIA Regulations, reasonable and feasible alternatives are required to be considered within the EIA process. All identified, feasible alternatives are required to be assessed in terms of social, biophysical, economic and technical factors. A key challenge of the EIA process is the consideration of alternatives. Most guidelines use terms such as 'reasonable', 'practicable', 'feasible' or 'viable' to define the range of alternatives that should be considered. Essentially there are two types of alternatives:

- Incrementally different (modifications) alternatives to the project; and
- Fundamentally (totally) different alternatives to the project.

Fundamentally different alternatives are usually assessed at a strategic level, and EIA practitioners recognise the limitations of project specific EIA's to address fundamentally different alternatives.

Incrementally different alternatives relate specifically to the project under investigation. "Alternatives", in relation to a proposed activity, means different ways of meeting the general purposes and requirements of the activity, which may include alternatives to:

- the property on which, or location where, it is proposed to undertake the activity;
- the type of activity to be undertaken;
- the design or layout of the activity;
- the technology to be used in the activity; and
- the operational aspects of the activity.

These alternatives are discussed below.

3.1 Approach to the assessment of alternatives

This section discusses the alternatives that will be considered as part of the EIA. NEMA requires that alternatives to a proposed activity must be considered (NEMA, Section 24). Alternatives are different means of meeting the general purpose and need of a proposed activity. In the BA process, the consideration of alternatives is always important, should the proposed site not fit into the parameters of the EIA framework. The alternatives can be categorised as follows.

- Location / Site alternatives
- Layout Alternatives
- Technology Alternatives
- No-Go alternative

3.2 Location / Site Alternatives

The proposed project involves the upgrade of the existing 13.0km of the R33, Section 13 between Modimolle (km0.6) and Witklip (km13.6). Alternate sites have not been addressed in the Basic Assessment Report, as this site has been predetermined during the planning stage.

The original design for the proposed R33 upgrade between the Modimolle and Witklip was carried out to accommodate additional lanes for future traffic growth and demand, noting that this is a major tourist route. Therefore, there are no alternative sites, as the proposed road upgrade is required in its current location as per past planning initiatives.

The implication of providing additional lanes and intersection upgrades on the R33 will result in greater width of the road prism over certain sections. Majority of the proposed road upgrade will occur within the existing road reserve, however, there will be land acquisition of privately-owned properties outside the existing SANRAL road reserve.

The process for the land acquisition will be aligned and integrated with the SANRAL Land Acquisition Guidelines Manual. The property report details the properties adjacent to and within the project battery limits which are affected by the project. A total of 2,121 ha of land will be acquired through the land acquisition process from the identified properties to accommodate widening of the existing carriageway. The Property Report has been submitted to SANRAL for approval. Once approved the compilation of the land acquisition diagrams can be commenced with.

Given the reasons outlined above, there are no other site alternatives for the proposed R33 road upgrade.

3.3 Design / Layout Alternatives

3.3.1 Proposed Road Upgrade

No alternative layouts have been addressed in the Basic Assessment Report as the proposed road upgrade was recommended as the preferred layout, based on the geometry of the road.

The R33 is currently a single carriageway road with 3.7m lanes and 0.3m to 0.5m surfaced shoulders. There is an existing climbing lane on the west bound (LHS) of the road from km5.6 to km6.2. The proposed upgrade requires a four-lane facility up to the Kokanje Retirement Village. The following cross-sections for the R33 are proposed:

• km 0.6 – km 2.4: 4-lane undivided single carriageway, including sidewalks in both directions up to the roundabout at Kokanje Retirement Village.

- km 2.4 km 6.8: 2-lane single carriageway with climbing lane from the roundabout through the "pass" section.
- km 6.8 13.6: 2-lane single carriageway with climbing/passing lanes

The four lane undivided single carriageway layout is provided in Figure 3-1. This provides for 1 x 3.5m and 1 x 3.5m lanes per direction, an inside kerbed median 2.8m wide with no outside shoulders.



Figure 3-1: Four lane undivided single carriageway layout

The two (2)-lane single carriageway with climbing / passing lanes is illustrated in Figure 3-2. This provides for 2 x 3.7m lanes and 2 x 3m surfaced shoulders with a total surfaced width of 13.4m. Where a climbing /passing lane is added, the cross section will comprise of 1 x 3.7m and 1 x 3.5 lanes with 1m surfaced shoulder in one direction whilst the opposing lane will be 1 x 3.7m with a 3m surfaced shoulder.



Figure 3-2: Two (2)-lane single carriageway with climbing / passing lanes

3.3.2 Proposed Bridge Upgrade

Following a Preliminary Design Investigation for the Klein Nyl River Bridge, Bridge B0576, it is recommended that the existing bridge (B1272) be demolished and replaced with a new, larger structure so as to comply with SANRAL's design standards.

- Loading: TMH7, Parts 1 and 2 as amended 1988
- Concrete Design: TMH7, Part 3
- Hydraulic design: SANRAL Road Drainage Manual 6th edition
- Integral Bridge Design: PD 6694-1:2011 Recommendation for the design of structures subject to traffic loading to BS EN 1997-1:2004

The design loads applicable to the bridge are as follows:

- Dead Loads:
- Reinforced concrete: 25.0 kN/m³
- Asphalt surfacing: 22.0 kN/m³
- Road Fill: 20.0 kN/m³
- Horizontal earth pressure:
- Soil density: 20.0 kN/m³
- Existing bridge:
 - Ka (yielding elements): 0.33
 - Ko (unyielding elements): 0.50
 - Internal friction angle: 30°
 - Wall friction: 0°
- New integral bridge option:
 - Earth pressure coefficients according to PD 6694-1:2011
 - Internal friction angle: 30°
 - Wall friction: 0°
- Live loads:
- NA normal traffic loading
- NB36 abnormal traffic loading
- NC 30 x 5 x 40 super-load
- Flood loads.

It is recommended to design and construct the fully integral bridge because it is anticipated to be the most economical solution with further maintenance cost savings over the lifespan of the bridge, since there are no bearings and deck joints.

The bridge superstructure will be supported on wall type abutments and piers with rounded ends enabling smoother transition between the river flow before and through the bridge. The maximum pier height is estimated at 5.1 m, with abutments having similar heights.

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The bridge superstructure will be a solid slab deck. The deck will be cast monolithically with the piers and abutments.

Owing to the skew, the detailed design must consider the tendency of the deck to rotate in plan and the abutment foundations will be sized accordingly.

Figure 3-3 and Figure 3-4 below includes diagrams of the proposed design, The bridge report is included in Appendix H3.



Figure 3-3: Longitudinal Section through the Fully Integral Bridge



Figure 3-4: Deck Cross Section

The proposed bridge will be built along a new vertical profile which is approximately 1.7m higher than the existing bridge. The new bridge will be wider than the existing bridge which leaves sufficient space to accommodate the two-way traffic in stages. Referring to Figure 3-5 and Figure 3-6, phased construction is proposed whereby the new bridge is built in half-widths up to a particular point allowing traffic to be transferred from one road alignment to the next before demolition of the existing bridge allowing completion of the second half of the bridge.

The proposed phased construction allows for sufficient working space and considers the approach to the bridge which will require an embankment constructed at a slope of 1:1 near the

bridge, flattening out further away from the bridge as the vertical alignment of the new converges to the original alignment. Referring to Figure 3-6, a return wingwall will be constructed in phase 1 to provide working space and facilitate subsequent completion of the abutment walls in phase 2.

The concept confirms that the option selected would not be influenced by accommodation of traffic. It does however influence the duration of construction.



Figure 3-5: Traffic Accommodation – Phased Construction, Deck and Approaches



Figure 3-6: Traffic Accommodation - Phased Construction, Abutments

3.3.3 Preferred Option for the Bridge Construction

It is recommended to design and construct the fully integral bridge because it is anticipated to be the most economical solution with further maintenance cost savings over the lifespan of the bridge.

3.4 Technology Alternatives

There are no alternative technologies relevant to the proposed road upgrade.

3.5 No-go Alternatives

The do-nothing' alternative (i.e. no-go alternative) is the option of not constructing the development and operation of the proposed R33 upgrade. Should this alternative be selected, the status quo of the environment will remain. Should the DFFE decline the application, the biophysical and socio-economic impacts (as indicated in Section 7) would not occur.

There would be a lack of road infrastructure to meet the traffic growth demand in the next 25 years, based on a growth rate of 2.5% per annum that is projected locally, on SANRAL routes. There could be a traffic congestion due to the future growth in housing establishments at the Modimolle area and expansion of the Koro Creek Golf Estate and the increase in motorists travelling along the tourist route.

There would be no job opportunities that would be created during the construction phase, to benefit the local community on a short-term basis for several construction activities. Therefore, there would be no short-term economic opportunities created, and skills transfer to the local communities during the construction phase.

Therefore, the no-go alternative is not considered to be feasible.

4 POLICY AND LEGISLATIVE CONTEXT

This chapter provides an overview of the legal context of the proposed project, including the applicable legislation, guidelines and information that will inform the BA process.

4.1 Requirement for an EIA

In terms of Sections 24 and 24D of NEMA, as read with Government Notices R982, as amended, a Basic Assessment process is required for the proposed development. The table below contains the listed activities in terms of the EIA Regulations of December 2014, as amended, which apply to the proposed development, and for which an application for an EA has been applied. Table 4-1 and Table 4-2 also includes a description of those project activities, which relate to the applicable listed activities.

Activity	Basic Assessment Activity(ies) as	Applicability of listed activities to the
No(s):	set out in Listing Notice 1 of the EIA	proposed development
	Regulations, 2014 as amended	
12 of GNR No. 983	 (ii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs— a) within a watercourse; c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse; 	The existing Klein River Bridge will be upgraded as a result of the proposed upgrade of the R33. Several existing culverts will also be upgraded. These and the proposed road upgrade sections occurs within the watercourse and within 32m of a watercourse/wetland.
	excluding— (aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour; (bb) where such development activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies; (cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies; (dd) where such development occurs within an urban area;	
	(ee) where such development occurs	
	within existing roads, road	

Table 4.4. Listed activities of Listing	Nation 4	بطله معمدها الم			
Table 4-1: Listed activities of Listing	g Notice 1	triggered by	y the p	proposea	project

Activity No(s):	Basic Assessment Activity(ies) as set out in Listing Notice 1 of the EIA Regulations, 2014 as amended	Applicability of listed activities to the proposed development
	reserves or railway line	
	(ff) the development of temporary infrastructure or structures where such infrastructure or structures will be removed within 6 weeks of the commencement of development and where indigenous vegetation will not be cleared.	
19 of GNR No. 983	The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse. but excluding where such infilling, depositing, dredging, excavation,	There may be infilling or depositing of material into, or the dredging, excavation, removal or moving of soil, sand, pebbles or rock from a watercourse with regard to the construction of the bridge upgrade, upgrade of the culverts, and upgrade of the R33 within the existing wetlands and watercourses.
	 depositing, dredging, excavation, removal or moving— a) will occur behind a development setback; b) is for maintenance purposes undertaken in accordance with a maintenance management plan; c) falls within the ambit of activity 21 in this Notice, in which case that activity applies; d) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or e) where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies. 	
27 of GNR No. 983	The clearance of an area of 1 hectares or more, but less than 20 ha of indigenous vegetation, except where such clearance of indigenous vegetation is required for- (i) the undertaking of a linear activity (ii) maintenance purposes undertaken in accordance with a maintenance management plan.	There may be clearance of vegetation for stockpiling, within and outside the road reserve.
56 of GNR	The widening of a road by more than 6	The proposed road upgrade to accommodate
INO. 983	metres, or the lengthening of a road by more than 1 kilometre—	additional lanes and the shoulder will be more than 6m.

Activity No(s):	Basic Assessment Activity(ies) as set out in Listing Notice 1 of the EIA Regulations, 2014 as amended	Applicability of listed activities to the proposed development
	 (i) where the existing reserve is wider than 13,5 meters; or (ii) where no reserve exists, where the existing road is wider than 8 metres; excluding where widening or lengthening occur inside urban areas. 	

Table 4-2: Listed activities of Listing Notice 3 triggered by the proposed project

Activity No(s):	Basic Assessment Activity(ies) as set out in Listing Notice 3 of the EIA Regulations, 2014 as amended	Applicability of listed activities to the proposed development
12 of GNR No. 985	The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan. e. Limpopo ii. Within critical biodiversity areas identified in bioregional plans	There may be more than 300m ² of indigenous vegetation that will be impacted as a result of the proposed road upgrade which will occur within CBA 1 and 2 and ESA 1 and 2.
14 of GNR No. 985	The development of— ii. infrastructure or structures with a physical footprint of 10 square metres or more; where such development occurs— (a) within a watercourse; (c)if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse; excluding the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour. e. Limpopo i. Outside urban areas: (dd) Sensitive areas as identified in an environmental management framework (EMF) as contemplated in chapter 5 of the Act and as adopted by the comptant authority:	The existing Klein River Bridge will be upgraded as a result of the proposed upgrade of the R33. Several existing culverts will also be upgraded. These and the proposed road upgrade sections may occur within a watercourse, and/or within 32m of a watercourse. The road upgrade will occur outside an urban area. The road upgrade occurs within Zone 1, 2 and 9 of the Waterberg District Municipality EMF and within CBA 1 and 2 and ESA 1 and 2.

Activity No(s):	Basic Assessment Activity(ies) as set out in Listing Notice 3 of the EIA	Applicability of listed activities to the proposed development
	(ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;	
18 of GNR No. 985	The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre.	The existing R33 will be upgraded by more than 4m which may occur within a watercourse or within 100m from the edge of a watercourse.
	 (e)Limpopo Outside urban areas: Outside urban areas: Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; (hh) Areas within a watercourse; or within 100 metres from the edge 	The road upgrade will occur outside an urban area. The road upgrade occurs within Zone 1, 2 and 9 of the Waterberg District Municipality EMF and within Critical Biodiversity Area (CBA) 1 and 2 and Ecological Support Area (ESA) 1 and 2.
23 of GNR No. 985	of a watercourse. The expansion of— (iii) infrastructure or structures where the physical footprint is expanded by 10 square metres or more; where such expansion occurs— (a) within a watercourse; (c)if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse; excluding the expansion of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the harbour. (e) Limpopo i. Outside urban areas: (cc) Sensitive areas as identified in an	The proposed upgrade involves upgrade of the existing R33. The road will be widened, including the existing Klein River Bridge and the existing culverts. The upgrade may occur within a watercourse or 32m from the edge of a watercourse. The road upgrade will occur outside an urban area. The road upgrade occurs within Zone 1, 2 and 9 of the Waterberg District Municipality EMF and within CBA 1 and 2 and ESA 1 and 2.
	 (cc) Sensitive areas as identified in an environmental management 	

Activity No(s):	Basic Assessment Activity(ies) as set out in Listing Notice 3 of the EIA Regulations, 2014 as amended	Applicability of listed activities to the proposed development
	framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; (ee) Critical biodiversity areas as	
	identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans.	

4.2 Regulatory and Legal Context

4.2.1 Legislation and Guidelines that have informed the preparation of this Basic Assessment Report

The following legislation and guidelines have informed the scope and content of this BAR:

- National Environmental Management Act (NEMA) 107 of 1998
- EIA Regulations, published under Chapter 5 of NEMA (GNR R982 in Government Gazette No 40772 of December 2014, as amended)
- Guidelines published in terms of the NEMA EIA Regulations, in particular:
 - i. Public Participation in the EIA Process
 - ii. Integrated Environmental Management Information Series (published by DFFE)

Several other Acts, standards or guidelines have also informed the project process and the scope of issues assessed in this report. A listing of relevant legislation is provided in Table 4-3.
Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
National Legislation			
The Constitution of the Republic of South Africa, Section 24 (Environmental Right)	1) Everyone has the righta) to an environment that is not harmful to their health or well-being; andb) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:	National Government of South Africa	The current environmental laws in South Africa concentrate on protecting, promoting, and fulfilling the Nation's social, economic and environmental rights; while encouraging public participation, implementing cultural and traditional knowledge and benefiting previously
	 i) prevent pollution and ecological degradation; ii) promote conservation; and iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development." 		disadvantaged communities.
National Environmental Management Act (Act No 107 of 1998)	 The EIA Regulations have been promulgated in terms of Chapter 5 of the Act. Listed activities which may not commence without an environmental authorization are identified within these Regulations. In terms of S24(1) of NEMA, the potential impact on the environment associated with these listed activities must be assessed and reported on to the competent authority charged by NEMA with granting of the relevant environmental authorization. In terms of GN R982, R983 and R985 of December 2014, a Basic Assessment Process is required to be undertaken for the proposed project. 	DFFE – Competent Authority.	An Environmental Authorisation (EA) is required, by way of a BA process. The relevance of potential activities that may be triggered in terms of GNR No. 983 and GNR No. 985 is provided in Table 4-1. The BAR report has been submitted to the DFFE.
National Environmental	In terms of the Duty of Care Provision in S28(1) the project proponent must ensure that reasonable measures are taken throughout the life	DFFE	The licensing requirements above applies to the project. The Duty of

Table 4-3: Relevant legislative permitting requirements applicable to the proposed development

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
Management Act (Act No 107 of 1998)	cycle of this project to ensure that any pollution or degradation of the environment associated with this project is avoided, stopped or minimized. In terms of NEMA, it has become the legal duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts.		Care Provision will continue to be applied throughout the life cycle of the project.
Environment Conservation Act (Act No 73 of 1989)	National Noise Control Regulations (GN R154 dated 10 January 1992)	DFFE – lead authority.	There is no requirement for a noise permit, in terms of the legislation. Noise impacts may result from specific construction activities carried out during the construction phase, which will be of a short- term duration. With the implementation of noise mitigation measures, the significance of the impact may be low.
National Water Act (Act No 36 of 1998)	Water uses under S21 of the Act must be licensed, unless such water uses falls into one of the categories listed in S22 of the Act or falls under the general authorization (and then registration of the water use is required). Consumptive water uses may include the taking of water from a water resource and storage - Sections 21a and b. Non-consumptive water uses may include impeding or diverting of flow in a water course - Section 21c; and altering of bed, banks or characteristics of a watercourse – Section 21i.	Department of Water and Sanitation (DWS)	The proposed road upgrade occurs within the 500m regulated area of the wetland and within the Klein Nyl River. Therefore, a General Authorisation (GA) will be required in terms of Section 21(c) and 21 (i) of the National Water Act, 1998 (Act No. 36 of 1998). Note: The Applicant is SANRAL and Appendix D2 of the GNR No. 509 of 2016: General Authorisation in terms of section 39 of the National Water Act, 1998 (Act No. 36 of 1998) for water uses as defined in Section 21(c) or Section 21(i) shall apply.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
National Environmental Management: Air Quality Act (Act No 39 of 2004)	Sections 18, 19 and 20 of the Act allow certain areas to be declared and managed as "priority areas" in terms of air quality. Declaration of controlled emitters (Part 3 of Act) and controlled fuels (Part 4 of Act) with relevant emission standards. Section 32 makes provision for measures in respect of dust control. Section 34 makes provision for: i. the Minister to prescribe essential national noise standards – (a) for the control of noise, either in general or by specified machinery or activities or in specified places or areas; or (b) for determining – (i) a definition of noise (ii) the maximum levels of noise (2) When controlling noise, the provincial and local spheres of government are bound by any prescribed national standards.	DFFE – air quality Local Municipality - Noise	No permitting or licensing requirements applicable for air quality aspects. The section of the Act regarding noise control is in force, but no standards have yet been promulgated. Draft regulations have however, been promulgated for adoption by Local Authorities. An atmospheric emission license issued in terms of Section 22 may contain conditions in respect of noise. This will, however, not be relevant to the facility, as no atmospheric emissions will take place. The Act provides that an air quality officer may require any person to submit an atmospheric impact report if there is reasonable suspicion that the person has failed to comply with the Act.
National Heritage Resources Act (Act No 25 of 1999)	 Section 38 states that Heritage Impact Assessments (HIAs) are required for certain kinds of development including: the construction of a road, power line, pipeline, canal or other similar linear development or barrier exceeding 300 m in length. any development or other activity which will change the character of a site exceeding 5 000 m² in extent. The relevant Heritage Resources Authority must be notified of developments such as linear developments (such as roads and power lines), bridges exceeding 50 m, or any development or other activity which will change the character of a site exceeding 5 000 m²; or the rezoning of a site exceeding 10 000 m² in extent. This notification must be provided in the early stages of initiating that development, and details 	South African Heritage Resources Agency (SAHRA) is the authority that will provide statutory comment on the Heritage Impact Assessment.	The HIA was submitted to SAHRIS on the SAHRIS (online portal) to obtain statutory comment on the proposed road upgrade. No heritage resources were identified during the site survey by the Archaeologist. However, if heritage resources are uncovered during the construction phase, the CFP must be implemented and a permit must be obtained from

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	regarding the location, nature and extent of the proposed development must be provided. Standalone HIAs are not required where an EIA is carried out, as long as the EIA contains an adequate HIA component that fulfils the provisions of Section 38. In such cases only those components not addressed by the EIA should be covered by the heritage component.		SAHRA if the heritage resource is to be moved, altered or destroyed.
National Environmental Management: Biodiversity Act (Act No 10 of 2004)	 Provides for the MEC/Minister to identify any process or activity in such a listed ecosystem as a threatening process (S53) A list of threatened and protected species has been published in terms of S 56(1) - Government Gazette 29657. Three government notices have been published, i.e. GN R 150 (Commencement of Threatened and Protected Species Regulations, 2007), GN R 151 (Lists of critically endangered, vulnerable and protected species) and GN R152 (Threatened or Protected Species Regulations). Provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The first national list of threatened terrestrial ecosystems has been gazetted, together with supporting information on the listing process including the purpose and rationale for listing ecosystems, the criteria used to identify listed ecosystems, the implications of listed ecosystems (National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection, (G 34809, GN 1002), 9 December 2011). DFFE published Regulations on Alien and Invasive Species (AIS) in terms of the National Environmental Management: Biodiversity Act; on Friday 1st August2014. A total of 559 alien species are now listed as invasive, in four different categories. A further 560 species are listed as prohibited, and may not be introduced into the country 	DFFE Application for tree removal permit	Under this Act, a permit would be required for any activity which is of a nature that may negatively impact on the survival of a listed protected species. A Terrestrial Biodiversity Impact Assessment (Floral Assessment has been undertaken as part of the Basic Assessment Process. No Species of Conservation Concern (SCC) occurs within the road reserve earmarked for the proposed road upgrade.
Conservation of Agricultural Resources Act (Act No 43 of 1983)	• Regulation 15 of GNR1048 provides for the declaration of weeds and invader plants, and these are set out in Table 3 of GNR1048. Declared Weeds and Invaders in South Africa are categorized according to one of the following categories:	DFFE	While no permitting or licensing requirements arise from this legislation, this Act will find application during the

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
National Forests Act (Act No. 84 of 1998)	 Category 1 plants: are prohibited and must be controlled. Category 2 plants: (commercially used plants) may be grown in demarcated areas providing that there is a permit and that steps are taken to prevent their spread. Category 3 plants: (ornamentally used plants) may no longer be planted; existing plants may remain, as long as all reasonable steps are taken to prevent the spreading thereof, except within the floodline of watercourses and wetlands. These regulations provide that Category 1, 2 and 3 plants must not occur on land and that such plants must be controlled by the methods set out in Regulation 15E. Protected trees: According to this act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that 'no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a license granted by the Minister'. » Forests: Prohibits the destruction of indigenous trees in any natural forest without a license. 	DFFE	 BA process and will continue to apply throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies must be developed and implemented. In addition, a weed control and management plan must be implemented. Specimens of Marula trees (<i>Sclerocarya birrea</i>) currently occurring in the road reserve must be avoided by the construction activities where possible. Specimens of Marula tree (<i>Sclerocarya birrea</i>) that must be removed, will have to be done as such with specific permissions. A permit application must be submitted to the DFFE for approval before construction begins.
National Veld and Forest Fire Act (Act 101 of 1998)	In terms of S12 the applicant must ensure that the firebreak is wide and long enough to have a reasonable chance of preventing the fire from spreading, not causing erosion, and is reasonably free of inflammable material. In terms of S17, the applicant must have such equipment, protective clothing, and trained personnel for extinguishing fires.	DFFE	No permitting or licensing requirements arise from this legislation, as fires will not occur on site.
National Protected Areas Expansion Strategy (NPAES), 2009	The need for the development of the NPAES was established in the National Biodiversity Framework in 2009. South Africa's protected area network currently falls far short of representing all ecosystems and maintaining healthy functioning ecological processes. In this context, the goal of the NPAES is to achieve cost effective protected area expansion	DFFE	The project area does not overlap with priority focus areas for expansion according to the 2016 NPAES dataset.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	thus enabling better ecosystem representation, ecological sustainability, and resilience to climate change. A comprehensive set of priority areas was compiled based on the priorities identified by provincial and other agencies in their respective		
	protected area expansion strategies. These focus areas are generally large, intact and unfragmented and are therefore of high importance for biodiversity, climate resilience and freshwater protection (DEA, 2016).		
National List of Ecosystems that are threatened and in need of Protection, No 1002 of 2011.	A national list of threatened terrestrial ecosystems and provides supporting information to accompany the list, including the purpose and rationale for listing ecosystems, the criteria used to identify listed ecosystems, the implications of listing ecosystems, and summary statistics and national maps of listed terrestrial ecosystems. It also includes individual maps and detailed information for each listed ecosystem.	DFFE	The project area was superimposed on the terrestrial ecosystem threat status database, and it largely falls across a Vulnerable (VU) ecosystem.
Hazardous Substances Act (Act No 15 of 1973)	This Act regulates the control of substances that may cause injury, or ill health, or death by reason of their toxic, corrosive, irritant, strongly sensitizing or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products.	Department of Health	It is necessary to identify and list all the Group I, II, III and IV hazardous substances that may be on the site and in what operational context they are used, stored or handled. If applicable, a license is required to be obtained from the Department of Health.
	 » Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive etc., nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared to be Group I or Group II hazardous substance; » Group IV: any electronic product; » Group V: any radioactive material. The use, conveyance or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force. 		

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
Occupational Health and safety Act, 1993 (Act No.85 of 1993)	Relevant sections include Section 8. General duties of employers to their employees. Relevant sections include Section 9. General duties of employers and self-employed persons to person other than their employees.	Department of labour	A permit or a license is not required, however the Applicant must take note and implement Section 8 and 9 of the Occupational Health and Safety Act.
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)	The Minister may by notice in the Gazette publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment. The Minister may amend the list by – » Adding other waste management activities to the list. » Removing waste management activities from the list. » Making other changes to the particulars on the list. In terms of the Regulations published in terms of this Act (GN 921), a Basic Assessment or Environmental Impact Assessment is required to be undertaken for identified listed activities. Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that: » The containers in which any waste is stored, are intact and not corroded or in any other way rendered unlit for the safe storage of waste. » Adequate measures are taken to prevent accidental spillage or leaking. » The waste cannot be blown away. » Nuisances such as odor, visual impacts and breeding of vectors do not arise; and » Pollution of the environment and harm to health are prevented	DFFE	N/A
NEM:WA: National Waste Management Strategy (GN 344 of 4 May 2012)	The objects of the NEM:WA and National Waste Management Strategy (NWMS) are structured around the steps in the waste management hierarchy, which is the overall approach that informs waste management in South Africa. The waste management hierarchy consists of options for waste management during the lifecycle of waste, arranged in descending order of priority: waste avoidance and reduction, re-use and recycling, recovery, and treatment and disposal as the last resort.	DFFE	It is therefore necessary to consider the re-use and recycling of all waste products by SANRAL.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements	
National Road Traffic Act (Act No 93 of 1996)	» The technical recommendations for highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in	Provincial Department of Transport (Provincial Roads)	An abnormal load / vehicle permit may be required to transport the various components to site for construction.	
	 applying for exemption permits are described and discussed. » Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges, and culverts. » The general conditions, limitations, and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power/mass ratio, mass distribution, and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations. 	South African National Roads Agency Limited (SANRAL) (National Roads)	These include: Route clearances and permits will be required for vehicles carrying abnormally heavy or abnormally dimensioned loads. Transport vehicles exceeding the dimensional limitations (length) of 22m. Depending on the trailer configuration and height when loaded.	
Promotion of Access to Information Act, 2000 (Act No. 2 of 2000)	The Act recognises that everyone has a Constitutional right of access to any information held by the state and by another person when that information is required to exercise or protect any rights. The purpose of the Act is to foster a culture of transparency and accountability in public and private bodies and to promote a society in which people have access to information that enables them to exercise and protect their rights.	DFFE	The Public Participation Process (PPP) has been undertaken in an open and transparent manner to ensure all stakeholders have access to information regarding the proposed development and have the opportunity to register and comment on the application (refer to the Public Participation Process that was undertaken in Section 6).	
Provincial Legislation				
Limpopo Bioregional Plan, 2019 and Limpopo Conservation Plan (LCP) v2 (September 2013)	 Protection of the priority areas identified in the LCP and bioregional plans would contribute to meeting national biodiversity targets for the South African vegetation types. Critical Biodiversity Areas (1) (CBA1): Irreplaceable Sites. Areas required to meet biodiversity pattern and/or ecological processes 	Limpopo Department of Economic Development,	The Limpopo Critical Biodiversity Areas (CBA) database indicates the site as running through CBA 1, CBA2 and Ecological Support Area (ESA 2). It will be important to take into consideration that the	

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	 targets. No alternative Sites are Available to Meet targets. Maintain In a natural state with limited or no biodiversity loss. Rehabilitate degraded areas to a natural or near natural state and manage for no further degradation. Critical Biodiversity Area (2) (CBA2): Best Design Selected Sites. Areas selected to meet biodiversity pattern and/or ecological process targets. Alternative sites may be available to meet targets. Maintain in a natural state with limited or no biodiversity loss. Ecological Support Areas (1) (ESA1): Natural, near natural and degraded areas supporting CBAs by maintaining Ecological processes. Maintain ecosystem functionality and connectivity allowing for limited loss of biodiversity pattern. Ecological Support Areas (2) (ESA2): Areas with no natural habitat that is important for supporting ecological processes. Avoid additional / new impacts on ecological processes. Other Natural Areas (ONA): Natural and intact but not required to meet targets or identified as CBA or ESA. No management objectives, land management recommendations or land-use guidelines are prescribed. No natural habitat remaining: Areas with no significant direct biodiversity value. Not Natural or degraded natural areas that are not required as ESA, including intensive agriculture, urban, industry. 	Environment and Tourism (LDEDE&T)	Limpopo CBA map does not account for the existing R33 road that transverse through these CBA areas as part of the existing Road.
	and human infrastructure. No management objectives, land management recommendations or land-use guidelines are propertied.		
Provincial Legislation	on, Policy and Other Guidelines	l	l
Modimolle Local Municipality Integrated Development Plan (IDP) 2021 - 2026	According to the Modimolle Local Municipality IDP (2022-2026), land parcels have been identified in the Modimolle area for housing development over the next ten years.	Modimolle– Mookgophong Local Municipality	Therefore, infill and densification within the current development footprint is intended to limit urban sprawl. This growth scenario would require major road networks such as the R33 to be upgraded to

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
			accommodate the future growth in housing that is expected.
SANRAL Land Acquisition Guidelines Manual	Additional land will be required outside the road reserve of the existing SANRAL road reserve. The extent of land that is required, will be influenced by the standard of road improvement accepted. The process for the land acquisition will be aligned and integrated with the SANRAL Land Acquisition Guidelines Manual. Following approval of the horizontal alignment offsets, vertical alignment and the final road reserve requirements, landowners will be consulted, and their inputs will be included in the property reports.	SANRAL	The Property Reports must be submitted to SANRAL and Propsol JV for approval. SANRAL will deal with the land acquisition process.
National Environmental Management Act (NEMA), (Act No. 107 of 1998)	Sustainable development is required to ensure the integration of social economic and environmental factors in decision-making so that development serves present and future generations. Furthermore, sustainable development requires that a risk-averse and cautious approach be applied to decision-making.	DFFE	SANRAL must ensure that the proposed road upgrade meets the requirements of sustainable development.
Municipal Bylaws	 "By-laws are laws passed by the Executive Council of a municipality to regulate the affairs and the services it provides within its area of jurisdiction". A municipality derives the powers to pass a by-law from the Constitution of the Republic of South Africa, which gives certain specified powers and competencies to local government as set out in Part B of Schedules 4 and Part B of 5 to the Constitution." By-laws for the following may be applicable for the project: Advertising signs Encroachment on Property Public Space; Public Roads & Miscellaneous; Relating to Nuisances; Cemetery; Street Trading; 	Modimolle– Mookgophong Local Municipality	SANRAL must consider the above during the implementation of the project.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	 Disaster Management Bylaws; Electricity Supply Bylaws; Environmental Health; Keeping of Animals; Storm Water Management Bylaws; and Water Services Bylaws. 		

5 DESCRIPTION OF THE AFFECTED ENVIRONMENT

This section of the report provides a description of the environment that may be affected by the proposed Project. This information is provided in order to assist the reader in understanding the receiving environment within which the proposed Project is situated. Features of the biophysical, social and economic environment that could directly, or indirectly be affected by, or could affect, the proposed development has been described. This information has been sourced from existing information available for the area, and aims to provide the context within which this BA is being conducted. A comprehensive description of each aspect of the affected environment is included within the Specialist Report contained within the Appendices.

5.1 Biophysical Environment

5.1.1 Climate

The project area is characterised by summer rainfall with very dry winters. The area has three seasons namely a cool dry season between May to mid-August, hot dry season from mid-August to October and wet season from November to April. According to Mucina & Rutherford (2006), the mean annual precipitation (MAP) is at 596 mm ranging from 500-700 mm. The area has mean daily maximum and minimum temperatures of 35.3°C and -3.1°C for November and June, respectively (see Figure 5-1).



Figure 5-1: Climate diagram for the region (Mucina & Rutherford, 2006)

5.2 Soil and Agricultural Potential

A Soils and Agricultural Potential Impact Assessment was undertaken by The Biodiversity Company (refer to Appendix H1).

The area is characterised with granite of the Lebowa Granite Suite, granophyre of the Rashoop Granophyre Suite and the sedimentary rocks of the Waterberg Group (Mokolian Erathem) geology. According to the land type database (Land Type Survey Staff, 1972 - 2006) the project area to be focused on falls within the Ac 70, Bb 88, Bb 93, Fa 284 and Ib 282 land type (see Figure 5-2).

The Ac 70 land types mostly consist of Hutton and Cartref soil forms following the South African soil classification working group (1990) with the possibility of other soils occurring throughout.

The Bb 88 land type is commonly characterised with Hutton, Clovelly soil forms with stream beds also associated to other soils and rocky areas occurring in the landscape.

The Bb 93 land type mostly consist of Mispah, Clovelly and Fernwood soil forms with also the occurrence of other soils in the terrain.

The Fa 284 and Ib 282 land types commonly have Mispah soil forms with stream beds and also associated to other soil forms in the landscape and rocky areas.

The Ac land types are characterised with red to yellow apedal and freely drained soils. The soils have a high base status with profiles deeper than 300 mm without any occurrence of dunes. Lime is rare or absent in the upper terrain soils and generally present in the low-lying terrain soils.

The Bb land types are characterised with plinthic catena, duplex and margalitic soils are rare. The soils are categorised as dystrophic or mesotrophic.

The Fa land type has shallow profiles and occurrence of rocky areas. Lime is rare or absent in the entire landscape. The lb land types have miscellaneous land classes and the rocky areas. The expected soils are shown in Table 5-1.



Figure 5-2: Land type map for the project area

5.2.1 Agricultural Potential

Agricultural potential is determined by a combination of soil, terrain and climate features. Land capability classes reflect the most intensive long-term use of land under rain-fed conditions. The land capability is determined by the physical features of the landscape including the soils present. The land potential or agricultural potential is determined by combining the land capability results and the climate capability for the region.

5.2.2 Land Capability

The land capability was determined by using the guidelines described in "The farming handbook" (Smith, 2006). The delineated soil forms were clipped into the four different slope classes (0-3%, 3-7%, 7-12% and >12%) to determine the land capability of each soil form. Accordingly, the most sensitive soil forms associated with the project area are restricted to land capability 3 and 4 classes.

Table 5-1: Land capability for the soils within the project area

Land Capability Class	Definition of Class	Conservation Need	Use-Suitability	Land Capability Group	Sensitivity
3	Moderate limitations. Some erosion hazard	Special conservation practice and tillage methods	Rotation crops and ley (50%)	Arable	High
4	Severe limitations. Low arable potential.	Intensive conservation practice	Long term leys (75%)	Arable	Moderate

5.2.3 Site verification

The following land potential levels has been determined;

• Land potential level 6 (this land potential level is characterised by a very restricted potential).

Regular and/or severe limitations occur due to soil, slope, temperatures or rainfall. Non arable.

Fifteen land capabilities have been digitised by (DALRRD, 2017) across South Africa, of which five potential land capability classes are located within the project area, including;

- Land Capability 1 to 5 (Very Low to Low Sensitivity)
- Land Capability 6 to 8 (Low Moderate to Moderate Sensitivity)
- Land Capability 9 to 10 (Moderate High Sensitivity)

The baseline findings and the sensitivities as per the Department of Agriculture, Land Reform and Rural Development (DALRRD, 2017) national raster file concur with most of the portions in the project area.

The proposed R33 Road Upgrade Project and associated infrastructure is characterised with "Low Moderate" to "Moderate" land capability sensitivities in the project area (see Figure 5-3). A few

portions within the project area are characterised with areas of "Very Low" and "Moderate High" sensitivities.

Most areas are also characterised with non-arable soils. This area is characterised with shallow soil profiles, with hard rocks, that can limit the cropping potential of the area. The DFFE screening tool, (2023) shows that there are crop fields with "High" sensitivity within the buffer of the project area. Such crop fields must be treated as no-go areas for the project to preserve them. If avoidance of the crop fields is not feasible for the project suitable compensation must be considered during the stakeholder engagement process.



Figure 5-3: Land Capability Sensitivity (DALRRD, 2017)



Figure 5-4: Field Crop Boundary Sensitivity (DFFE, 2023)

5.2.4 Summary of Specialist Findings

The proposed activities are expected to have a limited residual impact on land potential resources. There are "High" sensitivity crop field areas identified within the project area(Figure 5-4), but these areas are predominately associated with shallow and hard rock substratum, characterised with the Glenrosa and Mispah soils. Such soils are associated with a significantly low agricultural potential. Thus, it is the specialist's opinion that these areas can be used for the planned upgrades.

Four main soil forms were identified within the assessment area, namely the Clovelly, Hutton, Glenrosa and Mispah soil forms. The land capability sensitivities (DALRRD, 2017) indicate land capabilities with "Very Low" to "Moderate high" sensitivities. The identified soil baseline findings on-site concur with some of the areas which were identified as "Moderate High" sensitivity. Overall, using the soil forms identified on-site, the project area can be assigned within a "Low" to "Moderate" agricultural land capability potential.

The assessment area is associated with both non-arable and arable soils. However, the available climatic conditions of low annual rainfall and high evapotranspiration potential severely limits crop production significantly in the arable soils resulting in land capabilities with "Low" and "Moderate" sensitivities. The land capabilities associated with the assessment area are suitable for cropping, livestock grazing and gaming, which corresponds with the current land uses.

It is the specialist's opinion that the proposed R33 Road Upgrade Project and associated infrastructure will have limited residual impact on the agricultural production ability of the land. It is the specialist's opinion that the proposed R33 Road Upgrade Project and associated infrastructure maybe favourably considered as has been planned.

5.3 Topography

The slope percentage of the project area has been calculated and is illustrated in Figure 5-5. Most of the regulated area is characterised by a slope percentage between 0 to 3% with some few portions with irregularities in areas with slopes reaching 5%. This illustration indicates a uniform and gentle topography with occurrence of some few sloping areas being present. The Digital Elevation Model (DEM) of the project area (Figure 5-6) indicates an elevation of 1 153 to 1 409 Metres Above Sea Level (MASL).



Figure 5-5: Slope percentage map for the project area



Figure 5-6: Digital Elevation Model of the project area (Metres above sea level)

5.4 Geology

A Geotechnical Assessment was undertaken by Mukona Geotechnics (Pty) Ltd. Refer to Appendix H2. The Geotechnical Assessment was undertaken to inform the design of the proposed upgrades to an existing bridge on the R33 between Modimolle and Witklip.

The aim of the investigation is to assess the geotechnical conditions on site allowing insight into appropriate founding solutions for the proposed bridge across the Klein Nyl River.

The investigation comprised the drilling of seven (7) boreholes at the bridge in accordance with the Client's requirements and SAICE's Site Investigation Code of Practice (SICOP, 2010). The drilling investigation was conducted between the 8 and 15 December 2022.

The material profile encountered on site is generally characterised by layers of transported material underlain by residual material which overlays sandstone bedrock associated with the Alma Formation, Waterberg Group.

It is recommended that the structure be founded on strip footings with an allowable bearing pressure of 1 000kPa on the soft rock sandstone or better. Should water conditions and/or space restrictions preclude the use of strip footings, then pile foundations can be used. A combination of the proposed founding methods may also be used for the different foundations, depending on the conditions at each foundation.

5.5 Hydrology

A Hydraulics and Hydrological Assessment was carried out on the bridge (as per the Structures Report for the B0576 – Klein Nyl River Bridge in Appendix H3), taking into account the confluence of a major tributary approximately 1.0km downstream of the bridge.

Two catchments were included in the hydrological analysis as follows:

- The catchment at Bridge B1272 where the R33 crosses the Klein Nyl River; and
- The catchment downstream of B1272 where a major tributary enters the Klein Nyl River. The confluence of this tributary with the Klein Nyl River was within the modelled reach for the HECRAS hydraulic model. The downstream node of this catchment was taken as the Road R101 (approximately 1.0 km downstream), as it was initially intended that the model be extended downstream as far as this point.

The Standard Design Flood (SDF) method is considered the most appropriate flood peak estimation method for this application. It is generally considered to be more reliable for catchments of this size than the Rational method and is more widely used for bridge analysis than the HRU method.

5.5.1 Hydraulic Analysis

Hydraulic modelling for this project was undertaken using HEC-RAS 5.0.6. Modelling was undertaken under steady state conditions and using a one-dimensional (1D) model.

The existing bridge consists of approximately 2 x 5.35 m spans and the existing bridge soffit level is approximately 1155.257 m. The deck level of the existing bridge varies from 1155.525 m to 1155. 567 m.

The river invert level at the bridge varies from 1153.762 m to 1152.825 m and the bridge crosses the Klein Nyl River at a 30° skew.

Approximately 40 m upstream of Bridge B1272, another road crossing over the Klein Nyl River has been constructed for access within the Koro Creek Golf Estate and this crossing was included in the Bridge B1272 hydraulic model. The length of the modelled reach of the Klein Nyl River was approx. 500 m. The Koro Creek Golf Estate Road crossing was modelling in HEC-RAS as a culvert, while Bridge B1272 on the R33 was modelled as a bridge.

5.5.2 Results

The analysis results shown in Table 5-2 show that the existing Bridge B1272 does not have adequate hydraulic capacity to pass the required design peak floods for Class 2 and Class 3 roads.

Description	Unit	Class 2	Class 3
Catchment Area	km²	140.1	140.1
Hydrological 20-year indicator flood calculation method:	-		
HRU	m²/s	142	142
Rational Method	m²/s	181	181
Standard Design Flood	m²/s	171	171
20-year indicator flood used (SDF)	m²/s	171	171
Design flood recurrence interval T for capacity and deck soffit freeboard criteria requirements	yrs.	50	20
Design flood ${\rm Q}_{\rm T}$ for capacity and deck soffit freeboard criteria requirements	m³/s	257	171
Design flood Q_{2T} for shoulder break point overtopping criteria requirements	m³/s	330	228
Regional Maximum Flood (RMF)	m²/s	937	937
Regional Maximum Flood (RMF) level (without bridge)	m.a.s.l	1158.04	1158.04
Regional Maximum Flood (RMF) level (with bridge)	m.a.s.l	1158.18	1158.18
Average slope of stream bed at structure	m/m	0.01	0.01
Natural design flood level (without bridge) with Q_{T}	m.a.s.l	1155.91	1155.25
Highest flood level to date	m.a.s.l	Unknown	Unknown
Date of highest flood level	yr.	N/A	N/A
Natural design flow depth (without bridge) with $Q_{\rm T}$	m	3.11	2.45
Natural design flow velocity (without bridge) with \mathbf{Q}_T	m/s	2.57	2.54
Backwater caused by bridge (<0.0m preferred) – note: bridge is overtopped in both cases	m	0.99	1.32
Design high flood level for QT	m.a.s.l	1156.90	1156.57
Minimum bridge upstream soffit level	m.a.s.l	1155.257	1155.257
Design high flood level for Q27	m.a.s.l	1157.09	1156.90
Design flow velocity through new bridge for $Q_{\rm T}$ (< 4m/s preferred)	m/s	1.43	1.21
Design flow velocity increase factor (< 1.67 preferred)	-	0.55	0.48
Required freeboard to deck soffit (F = 0.78 log (Q_3) – 1.26)	m	0.62	0.48

Table 5-2: Hydraulic Analysis Results - Existing Bridge B1272

Available (existing) freeboard to deck soffit	m	-1.64	-1.31	
Freeboard excess	m	None	None	
Shoulder breakpoint (SBP) level	m.a.s.l	1155.575		
Shoulder breakpoint (SBP) excess	m	-1.515	-1.325	
Freeboard dictated by bridge geometry	Y/N	Y	Y	
Design flood levels influenced by dams	Y/N	N	N	

A new structure that meets the required design criteria has been sized and checked in HEC-RAS. A 3-span bridge structure having 8.75-12.5-8.75 opening is proposed and the hydraulic results of the proposed structure are shown in Table 5-3 below.

Table 5-3:	Hydraulic	Analysis	Results	for pro	posed i	new bridge
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Description	Unit	Class 2	Class 3
Catchment Area	km ²	140.1	140.1
Hydrological 20-year indicator flood calculation method:	-		
HRU	m²/s	142	142
Rational Method	m²/s	181	181
Standard Design Flood	m²/s	171	171
20-year Indicator flood used (SDF)	m²/s	171	171
Design flood recurrence interval T for capacity and deck soffit freeboard criteria requirements	yrs.	50	20
Design flood ${\sf Q}_T$ for capacity and deck soffit freeboard criteria requirements	m²/s	257	171
Design flood Q_{27} for shoulder break point overtopping criteria requirements	m²/s	330	228
Regional Maximum Flood (RMF)	m²/s	937	937
Regional Maximum Flood (RMF) level (without bridge)	m.a.s.l	1158.04	1158.04
Regional Maximum Flood (RMF) level (with bridge)	m.a.s.l	1159.32	1159.32
Average slope of stream bed at structure	m/m	0.01	0.01
Natural design flood level (without bridge) with \mathbf{Q}_T	m.a.s.l	1155.91	1155.25
Highest flood level to date	m.a.s.l	Unknown	Unknown
Date of highest flood level	yr.	N/A	N/A
Natural design flow depth (without bridge) with \mathbf{Q}_T	m	3.11	2.45
Natural design flow velocity (without bridge) with \mathbf{Q}_{T}	m/s	2.57	2.54
Backwater caused by bridge (<0.6m preferred)	m	0.13	0.05
Design high flood level for \mathbf{Q}_T	m.a.s.l	1156.04	1155.30
Minimum required bridge soffit level	m.a.s.l	1156.66	1155.78
Design high flood level for Q27	m.a.s.l	1156.63	1156.04
Design flow velocity through bridge for $Q_{\rm T}$ (< 4m/s preferred)	m/s	4.02	3.05
Design flow velocity increase factor (< 1.67 preferred)	-	1.50	1.20
Required freeboard to deck soffit $(F=0.78\log(Q_T)-1.26) \label{eq:result}$	m	0.62	0.48
Available (existing) freeboard to deck soffit	m	0.62	0.48
Freeboard excess	m	0	0
Shoulder breakpoint (SBP) level	m.a.s.l	1157.	708
Shoulder breakpoint (SBP) excess	m	0.62	0.81
Freeboard dictated by bridge geometry	Y/N	Y	Y
Design flood levels influenced by dams	Y/N	N	N

5.5.3 Recommendations

The existing structure does not pass the design peak floods in accordance with SANRAL's design criteria and thus warrants the construction of a new, larger structure. A structure with a 30m total opening measured perpendicular to the flow (*or individual spans opening perpendicular to the*

direction of flow measuring 8.75m, 12.50m and 8.75m) and a deck soffit level of 1.40m higher than the existing is proposed.

5.6 Freshwater Ecosystems

5.6.1 Aquatic Environment

An Aquatic Ecological Impact Assessment was undertaken by Biosphere Enviro Solutions (refer to Appendix H4). The main drainage lines and rivers which were assessed, were the Loubadspruit Upstream and Downstream (US and DS) i.e. a non-perennial watercourse and Klein Nyl River (US and DS) which is a perennial river, as well as a single DS point at Culvert 19.

(a) Loubadspruit (US and DS):

This monitoring station had fair potential to sustain an aquatic ecosystem, more so than the other stations assessed. The diversity and sensitivity of macro-invertebrates sampled concluded however that the US site has a health class of D and DS site had a health class of E/F.

The overall habitat assessment for both US and DS indicate potential to accommodate for macroinvertebrates particularly the Odonata, Ephemeroptera, Hemiptera and Coleoptera species. A total of 2 sensitive species were recorded (Hydracarina and Aeshnidae). A total Average Score Per Taxa (ASPT) of 5.0 US and 4.5 DS were scored. The total integrated habitat functionality of both sites scored a 53% US and 44% DS.

(b) Klein Nyl River (US and DS):

These particular monitoring stations are situated within the Klein Nyl River system. This river is a perennial river with constant flow of water all year round. Overall, these two stations (US and DS) indicate that it is able to support a variety of macro-invertebrates with a total of 2 sensitive species were recorded (Atyidae and Elmidae). Access to a better suited stretch of river was a constraint however, given the habitat availability at the selected monitoring stations the river system certainly has the potential to reach a health class of D.

A total ASPT of 4.3 US and 4.1 DS were scored. The total integrated habitat functionality of both sites scored a 40% US and 38% DS.

(c) <u>Culvert 19 (DS):</u>

The DS station was assessed using both SASS5 and IHAS methodologies however upstream had insufficient water available to undertake such assessment. The monitoring station had water available, however it is not expected to have sufficient water available during the dry season, thus this Site is not ideal to use as monitoring station in future monitoring events.

A total ASPT of 3.7 was scored. The total integrated habitat functionality scored was 36%.



Refer to the monitoring stations in Figure 5-7.

Figure 5-7: Monitoring Stations Map

Refer to the Figures 5-8 to 5-12 for the photographic images of the monitoring stations.





Figure 5-8: Loubadspruit US



Figure 5-9: Loubadspruit DS



Figure 5-10: Klein Nyl US



Figure 5-11: Klein Nyl DS



Figure 5-12: Culvert 19 DS

Table 5-4: Summary of results compared to previous assessments

VARIAI	17 March 2023	
	Loubadspruit US	18
	Loubadspruit DS	17
NO OF TAXA	Klein Nyl US	17
	Klein Nyl DS	16
	Culvert 19	10

100

VARIA	17 March 2023	
	Loubadspruit US	90
	Loubadspruit DS	76
SASS5 SCORE	Klein Nyl US	73
	Klein Nyl DS	65
	Culvert 19	37
	Loubadspruit US	5.0
	Loubadspruit DS	4.5
ASPT	Klein Nyl US	4.3
	Klein Nyl DS	4.1
	Culvert 19	3.7
	Loubadspruit US	5
	Loubadspruit DS	5
STONES IN CURRENT (SIC)	Klein Nyl US	4
	Klein Nyl DS	2
	Culvert 19	5
	Loubadspruit US	11
	Loubadspruit DS	11
VEGETATION (VG)	Klein Nyl US	10
	Klein Nyl DS	10
	Culvert 19	7
OTHER HABITAT	Loubadspruit US	14

VARIA	17 March 2023		
	Loubadspruit DS	12	
	Klein Nyl US	6	
	Klein Nyl DS	6	
	Culvert 19	4	
	Loubadspruit US	30	
	Loubadspruit DS	28	
HABITAT TOTAL	Klein Nyl US	20	
	Klein Nyl DS	18	
	Culvert 19	16	
	Loubadspruit US	44%	
	Loubadspruit DS	40%	
BIOTYPE SUITABILITY	Klein Nyl US	31%	
	Klein Nyl DS	29%	
	Culvert 19	22%	
	Loubadspruit US	53%	
	Loubadspruit DS	44%	
TOTAL IHAS%	Klein Nyl US	40%	
	Klein Nyl DS	38%	
	Culvert 19	36	
STREAM CONDITIONS	Loubadspruit US	23	
	Loubadspruit DS	16	

VARIA	17 March 2023	
	Klein Nyl US	20
	Klein Nyl DS	20
	Culvert 19	20

Overall, the data in Table 5-4 above indicates baseline data for all the sites assessed. Overall, the Loubadspruit US had the most suitable SASS habitats and has been classified to be of a class D health class, compared to all other sites assessed, scoring a health class of E/F.

The Invertebrate Habitat Assessment System (IHAS) (McMillan, 1998) scores were calculated as per the IHAS sheets, taking into consideration various habitat types. The overall habitat suitability and stream conditions for all the sites were classified as "poor - Habitat is considered to be inadequate and unable to support a diverse macroinvertebrate community assemblage".

All samplings were undertaken by a suitably experienced specialist using calibrated in-situ data meters. Overall, the data demonstrates what the water qualities were at the time of the monitoring event (acts only as a snapshot of conditions within the river/streams). The data correlates with results obtained from the ecological assessment and the catchment Water Quality Standards. The majority of concentrations (refer to Table 5-6: Water Quality Results and DWS TWQR) appear to be within the limits expected in the catchment.

HABITAT TYPE	LOUBADSPRUIT US	LOUBADSPRUIT DS	KLEIN NYL US	KLEIN NYL DS	CULVERT 19 DS
Stones in Current (SIC)	5	5	4	2	5
Vegetation (VG)	11	11	10	10	7
Other Habitat	14	12	6	6	4
HABITAT TOTAL	30	28	20	18	16
Stream Conditions	23	16	20	20	20
Total IHAS%	53%	44%	40%	38%	36%

Table 5-5: IHAS Scores of sites assessed

5.6.2 Water quality observations and results

Overall, the sites have very little exceedances of in-situ data. No cause of concern has been raised with the results obtained and should serve as baseline references prior to construction activities.

SUBSTANCE VARIABLE	UNIT	LOUBADSPRUIT US	LOUBADSPRUIT DS	KLEIN NYL US	KLEIN NYL DS	CULVERT 19 DS	TWQR
Temperature	°C	24.1	22.8	25.4	25.1	20.9	5 - 30
pH @ 25°C	pH Units	7.4	8.5	7.6	7.7	7.3	6.5 - 9.0
Electrical Conductivity (EC) @ 25°C	mS/m	29	26	105	103	54	<700
Total Dissolved Solids	ppm	14	13	53	54	27	*
Oxygen Reduction Potential	mV	264	210	232	232	172	*
Dissolved Oxygen	Mg/L	7.8	7.3	6.9	6.9	6.4	>5.00

Table 5-6: Water Quality Results and DWS TWQR

5.6.3 Current eco-status and management responses

The overall Eco-Status of the rivers and streams assessed can be classified as largely to severely impacted with a moderate Ecological Importance and Sensitivity for the catchment.

The number of functional habitat types and species diversity are low due to the alterations of channel morphology and the natural flow regime. The aquatic species diversity is functioning in a poor condition and is expected to remain in this state.

It is therefore recommended that all management measures should aim to improve the health class from the current class E/F to a Class D (refer to Section 7 of this report for general recommendations).

5.6.4 Wetland Environment

A Wetland Impact Assessment was undertaken by Biosphere Enviro Solutions (refer to Appendix H5). The findings of the assessment is provided below.

(a) Quaternary catchments and water management areas

The surface water study area falls within the A61A and A42A Quaternary Catchment Limpopo Water Management Area (WMA).

The Limpopo WMA, as defined by the National Water Resources Strategy (NWRS) 2nd Edition (DWS, 2013a), comprises the former Crocodile West and Marico WMA (*but excluding the Upper Molopo*), the original Limpopo WMA, and the Luvuvhu Catchment (*previously part of the Luvuvhu/Letaba WMA*).



Figure 5-13: Catchment and Water Management Area Map

(b) National Freshwater Ecosystem Priority Areas (NFEPAS) and National Wetland Map 5

NFEPA responds to the need to ensure that representative natural examples of the different ecosystems that make up the natural heritage of this country is conserved for sustainable development, providing strategic spatial priorities for conserving South Africa's freshwater ecosystems and supporting sustainable use of water resources (Driver et al., 2011)

The National Wetland Map version 5 (NWM5) shows the distribution of inland wetland ecosystem types across South Africa and includes estuaries and the extent of some rivers (CSIR, 2018).

The wetland discussed in this report is both a NFEPA wetland (Nel et al., 2011) and a National Wetland Map 5 wetland (Figure 5-14).



Figure 5-14: NFEPA Wetlands in the vicinity of the study area

(c) Critical Biodiversity Areas (CBA's) and Ecological Support Areas (ESA's)

Critical Biodiversity Areas are areas required to meet biodiversity targets for ecosystems, species, and ecological processes, as identified in a systematic biodiversity plan. Ecological Support Areas are not essential for meeting biodiversity targets but play an important role in supporting the ecological functioning of Critical Biodiversity Areas and/or in delivering ecosystem services. Critical Biodiversity Areas and Ecological Support Areas may be terrestrial or aquatic.

The primary purpose of a map of Critical Biodiversity Areas and Ecological Support Areas is to guide decision-making about where best to locate development. It should inform land-use planning, environmental assessment and authorisations, and natural resource management, by a range of sectors whose policies and decisions impact on biodiversity. It is the biodiversity sector's input into multi-sectoral planning and decision-making processes (SANBI Biodiversity Advisor, 2017).

According to the Limpopo Biodiversity Conservation Plan, the study area is traversed by Critical Biodiversity Area (CBA) 1 and 2 and Ecological Support Area (ESA) 1 and 2 (Figure 5-15).



Figure 5-15: CBA Map

(d) Wetland Classification

The desktop survey indicated that there are some National Freshwater Ecosystem Priority Area (NFEPA) and National Wetland Map 5 wetlands in the 500m buffer area surrounding the project area. Wetlands can be classified into different hydrogeomorphic (HGM) types based on the geomorphic setting of the wetland in the landscape (e.g., valley bottom, floodplain, whether the wetland is open or closed), water source (*surface water or groundwater*), how water flows through the wetland (*diffusely or channelled*) and how water exits the wetland (Macfarlane et al., 2009). The HGM type of a wetland gives an indication of the structure and processes of the wetland.

The wetlands in the 500m buffer zone of the proposed upgrade were assessed, and four natural wetlands were encountered, of which two were depression wetlands and two were unchanneled valley bottom wetlands. Some borrow pits were encountered and one impoundment. The manmade wetlands present on the site are dams (impoundments) and borrow pits from which material were taken for the road construction (refer to Figures 5-16 to 5-19).

All wetlands assessed were infested with alien and invasive plants. The most common of these were *Lantana* and *Eucalyptus* and other *Dicotyledon* trees toward the northern sections of the study area. The large unchanneled valley bottom wetland at the northern end of the study area is clear of invasive vegetation.



Figure 5-16: Location of the wetlands within the study area (Note: numbers 12 and 13 are at the same location)


Figure 5-17: Wetland 1 and 2 delineation and buffer



Figure 5-18: Wetland 3 to 7 delineation and buffer



Figure 5-19: Wetland 8 to 12 delineation and buffer

Watland Number	Description
	Description
(Irom Figure 7)	
4	Impoundment
1	Impoundment
•	
2	Borrow pit
<u> </u>	
3	Impounament
4	Impoundment
E	Porrow pit
5	Borrow pit
6	Borrow pit
0	
7	
1	
8	Depression wetland
9	Depression wetland
10	Depression wetland
11	Unchanneled valley bottom wetland
12	Unchanneled valley bottom wetland
13	Unchanneled valley bottom wetland

Table 5-7: Types of wetlands found in the study area



Figure 5-20: Man-made wetlands near the southern end of the transect



Figure 5-21: Borrow pits towards the southern end of the transect



invasive vegetation

Item 9: Depression wetland: Colonised by invasive Eucalyptus trees

Figure 5-22: Depression wetlands which are invade by alien vegetation



Figure 5-23: Aspects of the unchanneled valley bottom wetland at the northern end of the transect

Refer to Table 5-8 for the description of the assessed impoundment and borrow pit areas on site.

Table 5-8: Descri	ption of the assessed	impoundment and	l borrow pit areas on site
14010 0 01 200011	p	in pour anone and	i son on pit arous on one

Feature	1. Borrow pit landscaped for a housing estate	2. Impoundment
Catchment features and current impacts	The borrow pit is in a housing estate with a golf course. Fully transformed and landscaped.	The catchment area of this assessed Impoundment is located within a watercourse.

Feature	1. Borrow pit landscaped for a housing estate	2. Impoundment	
		Consist of invasive and natural vegetation used for game farming water source.	
Wetland Type	Borrow Pit	Impoundment	
Downstream Features	None – there is no outflow from the borrow pit	Smaller Impoundment – the smaller impoundment outflows to a riparian area	
Vegetation characteristics	Vegetation consists of weeds (<i>Phragmites, Pennisetum clandestinum</i>) and landscaped vegetation	Fringing vegetation consist of reeds and infested with Lantana	
Algae presence	No	No	
Aquatic faunal impacts	Man made borrow pit	No, manmade dam for game drinking water and water supply for the lodge	
Depth characteristics	Not determined but visibly deep. Too deep for reeds to grow in the middle.	Not determined but visibly deep	
Flow conditions	No flow	Yes - Outflow observed	
Water clarity	Visibly clear	Moderate turbidity	
Water odour	None detected	None detected	
Erosion impacts	Low erosion potential as the banks are vegetated.	Low erosion potential as the impoundment vegetation is moderately dense.	
Soil characteristics	Old quarry for road material. Still road material visible.	Impoundment dam	

F. sture	5 Democratik	C. Daman it	
reature	5. Borrow pit	6. Borrow pit	
Catchment features and current impacts	The borrow pit is close to the R33.	The borrow pit is close to the R33.	
Wetland Type	Borrow Pit	Impoundment	
Downstream Features	None – there is no outflow from the borrow pit	None – there is no outflow from the borrow pit	
Vegetation characteristics	Vegetation consists of normal bushveld vegetation on the buffer and sedges within the wet soils.	Vegetation consists of normal bushveld vegetation on the buffer and sedges within the wet soils.	
	There were some alien invasive species present close to site.	There were some alien invasive species present close to site.	
Algae presence	No	No	
Aquatic faunal impacts	Man made borrow pit	Man made borrow pit	
Depth characteristics	Not determined but visibly shallow.	Not determined but visibly shallow.	
Flow conditions	No flow	No flow	
Water clarity	Moderate turbidity	Moderate turbidity	
Water odour	None detected	None detected	
Erosion impacts	Low erosion potential as the banks are vegetated.	Low erosion potential as the banks are vegetated.	
Soil characteristics	Old quarry for road material. Still road material visible.	Old quarry for road material. Still road material visible.	

Table 5-9: Description of the assessed borrow pit areas on site

Feature	7. Depression wetland	8. Depression wetland	
Catchment features and current impacts	The Depression wetland is within a watercourse.	The Depression wetland is within a watercourse.	
Wetland Type	Depression wetland	Depression wetland	
Downstream Features	On the edge of an unchanneled valley No access bottom wetland		
Vegetation characteristics	Wetland is colonised by reeds.	Vegetation invaded by Eucalyptus trees.	
Algae presence	Unsure- no access.	Unsure- no access.	
Aquatic faunal impacts	Unknown-no access to site	Unknown-no access to site	
Depth characteristics	Unknown-no access to site	Unknown-no access to site	
Flow conditions	Has an outflow but not flowing at the time	Unknown-no access to site	
Water clarity	Unknown-no access to site	Unknown-no access to site	
Water odour	Unknown-no access to site	Unknown-no access to site	
Erosion impacts	Low erosion potential as the banks are vegetated.	Unknown-no access to site	
Soil characteristics	Unknown-no access to site	Unknown-no access to site	

Table 5-10: Description of the assessed depression wetland areas on site

Table 5-11: Description of the assessed unchanneled valley bottom wetland areas on site

Feature	11. Unchanneled Valley Bottom Wetland	12. Unchanneled Valley Bottom Wetland
Catchment features and current impacts	The unchanneled wetland is within a watercourse. The extent of the wetland footprint was extended due to the impact of the constructed dam downstream.	The unchanneled wetland is within a watercourse . Drain constructed to keep the adjacent road dry.
Wetland Type	Unchanneled valley bottom	Unchanneled valley bottom

Feature	11. Unchanneled Valley Bottom Wetland 12. Unchanneled Valley Bottom		
Downstream Features	Man made dam downstream Drains into an Unchanr bottom (item 11)		
Vegetation characteristics	Wetland is colonised by reeds.	Overgrown by invasive plants.	
Algae presence	Unsure- no access.	No	
Aquatic faunal impacts	Unknown-no access to site	No	
Depth characteristics	Unknown-no access to site	Unknown	
Flow conditions	Has an outflow but not flowing at the time	Flows through a culvert into wetland no. 11. This area was noticeably wetter than the area to the South. A channel had been dug to divert the flow from the road.	
Water clarity	Unknown-no access to site	Clear	
Water odour	Unknown-no access to site	No	
Erosion impacts	Low erosion potential as the banks are No vegetated.		
Soil characteristics	Unknown-no access to site	Sandy soils	

(e) Present Ecological Status (PES) of wetlands

The EIS assessment was applied to all wetland features within the study area to ascertain the levels of sensitivity and ecological importance of the features. The results of these assessments are summarized Table 5-12 below. The PES and EIS for these sub-catchments are given in Table 5-12.

Sub-catchment	PES	EI	ES
A61A (520)	D	High	High

A42A (488)	С	High	Very high

The rating of PES, EI and ES have been obtained from the DWS assessments. The EI and ES are both rated high for the portion of the road in sub-catchment A61A. In sub-catchment A42A the EI is rated as high and the ES as very high.

5.4.1 PES calculations of the different wetlands and borrow pits

The wetlands and borrow pits were grouped into 4 headings for purposes of this assessment.

- Group 1- Depression wetlands.
- Group 2- Unchanneled valley bottom wetland.
- Group 3- Borrow pits.
- Group 4 Impoundment (only one item in this group).

Group 1 Assessment: Depression wetlands

Table 5-13: WET-Health assessment: Present Ecological State (PES) – Group 1

FINAL PES SCORES GROUP 1						
PES ASSESSMENT	HYDROLOGY GEOMORPHOLOGY WATER QUALITY VEGETATION					
Impact Score	4,4	4,4	4,0	7,0		
PES Score (%)	55%	55%	60%	30%		
Ecological Category	D	D	С	E		
Trajectory of change	+	+	+	→		
Confidence (revised results)	Medium	Medium	Medium	Medium		
Combined Impact Score	5,0					
Combined PES Score (%)	50%					
Combined Ecological Category	D					
Hectare Equivalents	1,0 Ha					

The combined PES Category for Group 1 depression wetlands is D, meaning that the wetland is Largely modified. A large loss of natural habitat and basic ecosystem function has occurred.

Based on the Trajectory of change, the wetlands PES is likely to remain stable over the next 5 years. It is expected that alien vegetation will increase without intervention.

Group 2 Assessment: Unchanneled valley bottom wetland

FINAL PES SCORES GROUP 2					
PES ASSESSMENT	HYDROLOGY	GEOMORPHOLOGY	WATER QUALITY	VEGETATION	
IMPACT SCORE	2,5	1,8	3,5	4,4	
PES SCORE (%)	75%	82%	75%	56%	
ECOLOGICAL CATEGORY	с	В	с	D	
TRAJECTORY OF CHANGE	÷	→	→	→	
CONFIDENCE (REVISED RESULTS)	Medium	Medium	Medium	Medium	
COMBINED IMPACT SCORE	3,05				
COMBINED PES SCORE (%)	69%				
COMBINED ECOLOGICAL CATEGORY	c				
HECTARE		15,5 Ha			

Table 5-14: WET-Health assessment: Present Ecological State (PES) – Group 2

The combined PES Category for Group 1 depression wetlands is a D, meaning that the wetland is Largely modified. A large loss of natural habitat and basic ecosystem function has occurred.

Based on the Trajectory of change, the wetlands PES is likely to remain stable over the next 5 years. It is expected that alien vegetation will increase without intervention.

Group 3 Assessment- Borrow pits

Group 3 was not assessed as the borrow pits are artificial and modified by human activities.

Group 4 Assessment- Impoundment

Group 4 was not assessed as it is artificial dams.

5.6.5 Ecological Importance and Sensitivity

An Ecological Importance and Sensitivity Assessment (EIS) was conducted for the wetlands along the route. The borrow pits were included in this assessment to determine if they contribute to the conservation targets of the area.

5.6.5.1 Results of the Ecological Impact and Sensitivity Assessment

ECOLOGICAL IMPORTANCE AND SENSITIVITY								
Determinant	1. Dep wet	bression Bands	2.Unchannaled valley bottom wetlands		3. Borrow Pits		4. Impoundment	
Determinant	Score	Confiden ce	Score	Confidence	Score	Confidence	Score	Confidence
		-	BIOTIC	DETERMINANTS				
Rare and endangered biota	0	2	0	2	0	2	0	2
Unique biota	0	2	0	2	0	2	0	2
Intolerant biota	0	2	0	2	0	2	0	2
Species/taxon richness	1	2	2	2	0	2	0	2
		HABITAT (IN	STREAM A	ND RIPARIAN) D	ETERMIN	IANTS		
Diversity of aquatic habitat types or features	1	4	2	з	0	3	1	3
Refuge value of habitat types	2	4	3	3	0	3	1	3
Sensitivity of habitat to flow changes	2	4	3	3	0	3	1	З
Sensitivity to flow related water quality	3	4	3	3	0	3	1	з
Migration route/corridor for instream and riparian biota	1	4	2	4	0	3	0	3
National parks, Wilderness areas, Nature reserves Natural Heritage sites Natural areas	0	4	1	З	0	3	0	3
TOTAL		10		16	0			4
AVERAGE SCORE		1		1,6	0		0.4	
CATEGORY	Mod	lerate	Moderate		Low		Low,	/ marginal

Table 5-15: EIS scores obtained for the Wetlands (DWAF, 1999)

The Ecological Importance and Sensitivity of the depression and unchanneled wetlands is medium. This means they are ecologically important and sensitive on a provincial or local scale.

The biodiversity of these Wetlands is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers (DWAF, 1999). The Ecological Importance and Sensitivity of the borrow pits and impoundment are Low to Marginal low. Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these Wetlands is ubiquitous and not sensitive to flow and habitat modifications.

They play an insignificant role in moderating the quantity and quality of water of major rivers. The borrow pits had an EIS of Low and has no ecological importance.

5.6.5.2 Recommended Ecological Category (REC)

The Recommended Ecological Category for the length of road to be upgraded is C. This means that the buffer zone on the portion of the road in sub-catchment A61A should be ungraded. This may be achieved by the removal of alien vegetation.

The Recommended Ecological Category is:

- Group 1 D Improve.
- Group 2 C Maintain.
- Group 3 Not assessed.
- Group 4 Not assessed.

Table 5-16: Summary of results

CLASSIFICATION	Depression Wetland (Group 1)	Unchanneled valley bottom Wetland (Group 2)	Borrow pits (Group 3)	Impoundment (Group 4)
PES	D: Largely modified	C: Moderately modified	-	-
EIS	1,0: Moderate	1,6: Moderate	-	-
REC	D: Upgrade	C: Maintain	-	-
BUFFER	32m	32m	32m	32m

A buffer of 32m was applied to all delineated wetlands as any activity within 32m of a watercourse would require Environmental Authorization. This was applied to all wetlands within the development footprint of the R33 and the surrounding 500m. Any activity within 500m of a wetland requires a Water Use License Authorisation.

5.5.5.3 Summary

The wetlands inside the development area are classified as depression wetlands and unchanneled valley bottom wetlands. Wetlands in the development area and 500m buffer around the development area were divided into four groups and assessed accordingly.

A wetland functionality assessment was completed, including Present Ecological State (PES), Ecological Importance and Sensitivity (EIS) and Recommended Ecological Category (REC). The results are summarised in the table below:

c	CLASSIFICATION	Depression Wetland (Group 1)	Unchanneled valley bottom Wetland (Group 2)	Borrow pits (Group 3)	Impoundment (Group 4)
	PES	D: Largely modified	C: Moderately modified	Not assessed	Not assessed
	EIS	1,0: Moderate	1,6: Moderate	0: Low	0,4: Low / marginal
	REC	D: Upgrade	C: Maintain	Not assessed	Not assessed
	BUFFER	32m	32m	32m	32m

Table 5-17: Summary of results on EIS, PES and REC

5.7 Terrestrial Biodiversity

A Terrestrial Biodiversity and Plant Species Impact Assessment was undertaken by Biosphere Enviro Solutions (refer to Appendix H6). The findings of this study is provided herein:

5.7.1 Regional vegetation

a) Waterberg Mountain Bushveld

Waterberg Mountains, including the foothills, escarpment, and tablelands south of the line between Lephalale and Marken and north of Bela-Bela and west of Mokopane and with outliers in the southwest such as the Boshofsberge and Vlieëpoortberge near Thabazimbi. Altitude about 1 000–1 600 m and generally at a lower altitude than the Gm 29 Waterberg-Magaliesberg Summit Sourveld.

Rugged mountains with vegetation grading from *Faurea saligna–Protea caffra* bushveld on higher slopes (in turn grading into the Gm 29 Waterberg-Magaliesberg Summit Sourveld) through broad-leaved deciduous bushveld (dominated by *Diplorhynchus condylocarpon*) on rocky mid- and footslopes to *Burkea africana–Terminalia sericea* savanna in the lower-lying valleys as well as on deeper sands of the plateaus. The grass layer is moderately developed or well developed.

b) Central Sandy Bushveld

Undulating terrain occurs mainly in a broad arc south of the Springbokvlakte from the Pilanesberg in the west through Hammanskraal and Groblersdal to GaMasemola in the east. A generally narrow irregular band along the northwestern edge of the Springbokvlakte (including Modimolle) extending into a series of valleys and lower-altitude areas within the Waterberg including the upper Mokolo River Valley near Vaalwater, the corridor between Rankins Pass and the Doorndraai Dam, and the lowlands from the Mabula area to south of the Hoekberge. Some isolated sandy rises are found on the Springbokvlakte. Altitude about 850–1 450m.

Low undulating areas, sometimes between mountains, and sandy plains and catenas supporting tall, deciduous Terminalia sericea and *Burkea africana* woodland on deep sandy soils (with the

former often dominant on the lower slopes of sandy catenas) and low, broadleaved Combretum woodland on shallow rocky or gravelly soils.

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Species of *Acacia, Ziziphus* and *Euclea* are found on flats and lower slopes on eutrophic sands and some less sandy soils. A. tortilis may dominate some areas along valleys. Grass-dominated herbaceous layer with relatively low basal cover on dystrophic sands.



Figure 5-24: Vegetation Units relevant to the Study Area

5.7.2 Conservation status in terms of Mucina and Rutherford (2006)

This Central Sandy Bushveld vegetation type is classified as vulnerable according to Mucina and Rutherford (2006), and less than 3% is statutorily conserved. Some 24% has been transformed for cultivation and urban sprawl.

The Waterberg Mountain Bushveld vegetation type is classified as Least Concerned according to Mucina and Rutherford (2006), and around 9% is statutorily conserved. Some 9% has been transformed for cultivation.

5.7.3 Threatened Ecosystem Status

Both the Central Sandy Bushveld vegetation and Waterberg Mountain Bushveld vegetation are listed as Least Concerned in the List of Threatened Ecosystems published in 2011. This classification replaced the classification listed in Mucina and Rutherford (2006).



Figure 5-25: Threatened Ecosystem status

5.7.4 Limpopo Bioregional Plan

The Limpopo Critical Biodiversity Areas database indicates the study area as running through CBA 1, CBA2 and ESA 2 areas. It will be important to take into consideration that the Limpopo CBA map does not account for the existing R33 road that transverse through these CBA and ESA areas and therefore also through the terrestrial biodiversity of the area. The impacts on biodiversity of the current R33 will be included in the results for this study as a baseline for the proposed upgrade.

5.7.5 EIA Screening Tool

The EIA screening tool awarded the entire site as a high sensitivity area and indicated the entire site as being located within CBA and ESA areas. The plant species sensitivity theme indicated the site as being of medium sensitivity and listed six potential SCC plants of medium sensitivity. As per the best practice guideline that accompanies the protocol and screening tool, the name of the sensitive species may not appear in the final BAR report nor any of the specialist reports released into the public domain.



Figure 5-26: (a) Screening tool Plant species theme and (b) Screening tool Terrestrial Biodiversity theme

5.7.6 Critical Biodiversity Areas and Ecological Support Areas

Critical Biodiversity areas and Ecological Supported areas are contained in a map produced by the Limpopo Conservation Plan V2 (LCPv2, 2013).

Based on the Limpopo Conservation Plan V2, 40% of the province is designated as a Critical Biodiversity Area. These CBAs have been split into CBA 1 and CBA 2 based on selection frequency and the underlying characteristics of the biodiversity features which are being protected (i.e., location fixed features such as sites for CR species and flexible ones such as Least Cost Corridors). Most of the CBAs in the province are CBA 1 (22 %), which can be considered "irreplaceable" in that there is little choice in terms of areas available to meet targets. If CBA 1 areas are not maintained in a natural state, then targets cannot be achieved. CBA 2's is considered "optimal" as there is significant design involved in their identification, make up 18% of the province. CBA 2's represents areas where there are spatial options for achieving targets and the selected sites are the ones that best achieve targets within the landscape design objectives of the plan.

An additional 23% of the province is designated as Ecological Support Area. This category has also been split based on land-cover into ESA 1 (16%) and ESA 2 (7%), with ESA 1 being in a largely natural state while ESA 2 areas are no longer intact but potentially retain significant importance from a process perspective (e.g., maintaining landscape connectivity). Other Natural Areas make up 20% of the province and just over 11% is designated as formal Protected Area.

5.7.7 Classification of CBA and ESA areas

CBA and ESA classifications from the LCPv2 is explained below. The explanation indicates the basis on which the LCPv2 was drawn up. Each classification is listed with justification in terms of targets and proposed mitigations.

- Critical Biodiversity Areas (1) (CBA1):
 - Irreplaceable Sites.
 - Areas required to meet biodiversity pattern and/or ecological processes targets. No alternative Sites are Available to Meet targets.
 - Maintain In a natural state with limited or no biodiversity loss. Rehabilitate degraded areas to a natural or near natural state and manage for no further degradation.
- Critical Biodiversity Area (2) (CBA2):
 - Best Design Selected Sites.
 - Areas selected to meet biodiversity pattern and/or ecological process targets.
 Alternative sites may be available to meet targets.
 - Maintain in a natural state with limited or no biodiversity loss.
 - Maintain current agricultural activities. Ensure that land use is not intensified and that activities are managed to minimize impact on threatened species.
- Ecological Support Areas (1) (ESA1):
 - Natural, near natural and degraded areas supporting CBAs by maintaining Ecological processes.
 - Maintain ecosystem functionality and connectivity allowing for limited loss of biodiversity pattern.
- Ecological Support Areas (2) (ESA2):
 - Areas with no natural habitat that is important for supporting ecological processes.
 - Avoid additional / new impacts on ecological processes.
- Other Natural Areas (ONA):
 - Natural and intact but not required to meet targets or identified as CBA or ESA.
 - No management objectives, land management recommendations or land-use guidelines are prescribed.
- No natural habitat remaining:
 - Areas with no significant direct biodiversity value.
 - Not Natural or degraded natural areas that are not required as ESA, including intensive agriculture, urban, industry, and human infrastructure.
 - No management objectives, land management recommendations or land-use guidelines are prescribed.

The LCPv2 data retrieved for the study area is represented in Figure 5-27. The data is based on the classification of CBA and ESA areas as described above.



Figure 5-27: CBA Map in terms of the LCPv2

5.7.8 Red data plants

South Africa has adopted the IUCN Red List Categories and Criteria to provide an objective, rigorous, scientifically founded system to identify Red List species. A published list of the Red List species of South African plants (Raimondo et al. 2009) contains a list of all species that are at risk of extinction. This list is updated regularly to take new information into account, but these are not published in book/paper format. Updated assessments are provided on the SANBI website (http://redlist.sanbi.org/). According to the website of the Red List of Southern African Plants (http://redlist.sanbi.org/), the conservation status of plants indicated on the Red List of South Africa's borders.

This means that when a species is not endemic to South Africa, only the portion of the species population occurring within South Africa has been assessed. The global conservation status, which is a result of the assessment of the entire global range of a species, can be found on the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species: http://www.iucnredlist.org.za. The South African assessment is used in this study. An explanation of the conservation categories is provided in Table 2 of the Terrestrial Biodiversity Impact Assessment. The purpose of listing Red List plant species is to provide information on the potential occurrence of species at risk of extinction in the study area that may be affected by the proposed infrastructure. Species appearing on these lists can then be assessed in terms of their

habitat requirements to determine whether any of them have a likelihood of occurring in habitats that may be affected by the proposed infrastructure.

Lists were compiled specifically for any species at risk of extinction (Red List species) previously recorded in the area. Historical occurrences of threatened plant species were obtained from the South African National Biodiversity Institute (http://.sanbi.org) for the quarter degree square/s (2428CB) within which the study area is situated). Habitat information for each species was obtained from various published sources. The probability of finding any of these species will then be assessed by comparing the habitat requirements with those habitats that occur on site.

For all listed plant species that occur in the general geographical area of the site, a rating of the likelihood of it occurring on site is given in Table 3 of the Terrestrial Biodiversity Impact Assessment.

5.7.9 Protected trees

Regulations published for the National Forests Act (Act 84 of 1998) as amended, provide a list of protected tree species for South Africa. The species on site and surrounding the site was checked against the list provided. The protected species list was also referenced against historical recorded data for the quarter degree grit cell to see if any of the species have been recorded historically. One protected tree species namely *Sclerocarya birrea* (Marula tree) was found to occur within the study area. Twelve (12) Marula tree specimens were found within the road reserve. It is from the Anacardiaceae family.

Although this tree species is of Least concern in terms of South African distribution (SANBI), it is protected in terms of the National Forests Act (Act No. 84 OF 1998). The trees can be found at the following coordinates:

Protected tree	Coordinates
1. Sclerocarya birrea	-24.682049° 28.388703°
2. Sclerocarya birrea	-24.678651° 28.384578°
3. Sclerocarya birrea	-24.658541° 28.362859°
4. Sclerocarya birrea	-24.654509° 28.355758°
5. Sclerocarya birrea	-24.653715° 28.354447°
6. Sclerocarya birrea	-24.642886° 28.333329°
7. Sclerocarya birrea	-24.642675° 28.332906°
8. Sclerocarya birrea	-24.642576° 28.332732°
9. Sclerocarya birrea	-24.642552° 28.332609°
10. Sclerocarya birrea	-24.644116° 28.335772°
11. Sclerocarya birrea	-24.643926° 28.335428°
12. Sclerocarya birrea	-24.643616° 28.334831°

Table 5-18: Coordinates of protected trees found within the development footprint area

5.7.10 Protected ecosystems

A literature review was conducted to investigate previous vegetation classification studies carried out on / near the study site. These studies were investigated before the field visit. To describe broad vegetation patterns within the study area, Mucina and Rutherford (2006) were used.

A literature review was conducted to investigate previous vegetation classification studies carried out on / near the study site. These studies were investigated before the field visit. To describe broad vegetation patterns within the study area, Mucina and Rutherford (2006) were used.



Figure 5-28: Classifications of vegetation types in accordance with their ecological status (Driver et al., 2005)

To describe the conservation status of the vegetation units occurring within the study area, Mucina and Rutherford (2006), The National List of Ecosystems that need Protection (NEMBA, 2004) and the method described in Strelitzia 17 (Driver et al., 2005) is used. This method classifies vegetation types into four categories, according to the percentage of untransformed natural habitat remaining (Figure 5-29).

A survey was conducted on rare and protected plants that might possibly occur in the study area. For this investigation, the South African National Biodiversity Institute (SANBI), PRECIS and SIBIS websites and databases were consulted. The possible and actual presence of rare and protected species were recorded during the field visit. A field assessment was conducted to classify vegetation zones, identify rare and protected species, and identify sensitive habitats. This was done by doing a survey of the site.

Vegetation communities were identified during the survey and a vegetation assessment was carried out at sites within each vegetation zone.

5.7.11 Broad vegetation types of the study area

According to the Mucina and Rutherford (2006) vegetation map of the country, the study area falls partially within two main vegetation types of namely Central Sandy Bushveld and Waterberg Mountain Bushveld which falls into the Savannah Biome.

A list of expected common and dominant species in undisturbed Central Sandy Bushveld includes the following (those with a "d" are dominant):

- Tall Trees: Acacia burkei (d), A. robusta, Sclerocarya birrea subsp. caffra.
- Small Trees: Burkea africana (d), Combretum apiculatum (d), C. zeyheri (d), Terminalia sericea (d), Ochna pulchra, Peltophorum africanum, Rhus leptodictya.
- **Tall Shrubs:** *Combretum hereroense, Grewia bicolor, G. monticola, Strychnos pungens.* Low
- **Shrubs**: Agathisanthemum bojeri (d), Indigofera filipes (d), Felicia fascicularis, Gnidia sericocephala. Geoxylic Suffrutex: Dichapetalum cymosum (d).
- Woody Climber: Asparagus buchananii.
- Graminoids: Brachiaria nigropedata (d), Eragrostis pallens (d), E. rigidior (d), Hyperthelia dissoluta (d), Panicum maximum (d), Perotis patens (d), Anthephora pubescens, Aristida scabrivalvis subsp. scabrivalvis, Brachiaria serrata, Elionurus muticus, Eragrostis nindensis, Loudetia simplex, Schmidtia pappophoroides, Themeda triandra, Trachypogon spicatus.
- Herbs: Dicerocaryum senecioides (d), Barleria macrostegia, Blepharis integrifolia, Crabbea angustifolia, Evolvulus alsinoides, Geigeria burkei, Hermannia lancifolia, Indigofera daleoides, Justicia anagalloides, Kyphocarpa angustifolia, Lophiocarpus tenuissimus, Waltheria indica, Xerophyta humilis.
- Geophytic Herb: Hypoxis hemerocallidea.
- Succulent Herb: Aloe greatheadii var. davyana.

A list of expected common and dominant species in undisturbed Waterberg Mountain Bushveld includes the following (those with a "d" are dominant):

- Tall Tree: Acacia robusta.
- Small Trees: Acacia caffra (d), Burkea africana (d), Combretum apiculatum (d), Croton gratissimus (d), Cussonia transvaalensis (d), Faurea saligna (d), Heteropyxis natalensis (d), Ochna pulchra (d), Protea caffra (d), Albizia tanganyicensis, Combretum molle, Englerophytum magalismontanum, Ficus burkei, F. glumosa, Ochna pretoriensis, Pseudolachnostylis maprouneifolia, Rhus lancea, Terminalia sericea, Vangueria infausta, V. parvifolia.
- **Tall Shrubs:** Diplorhynchus condylocarpon (d), Elephantorrhiza burkei (d), Combretum moggii, C. nelsonii, Dichrostachys cinerea, Euclea crispa subsp. crispa, Gnidia kraussiana, Olea capensis subsp. enervis, O. europaea subsp. africana, Rhus pyroides var. pyroides, Strychnos pungens, Vitex rehmannii.
- Low Shrubs: Anthospermum rigidum subsp. rigidum, Barleria affinis, Felicia muricata, Helichrysum kraussii, Protea welwitschii subsp. welwitschii, Rhus rigida var. dentata.
- Geoxylic Suffrutices: Dichapetalum cymosum, Parinari capensis subsp. capensis.
- Succulent Shrubs: Aloe chabaudii, Lopholaena coriifolia.
- Woody Climbers: Ancylobotrys capensis (d), Rhoicissus revoilii.
- **Graminoids:** Loudetia simplex (d), Schizachyrium sanguineum (d), Trachypogon spicatus (d), Brachiaria serrata, Digitaria eriantha subsp. eriantha, Elionurus muticus, Enneapogon scoparius, Setaria sphacelata, Themeda triandra, Tristachya leucothrix.
- Herbs: Berkheya insignis, Chamaecrista mimosoides, Geigeria elongata, Hibiscus meyeri subsp. transvaalensis, Xerophyta retinervis.

• Geophytic Herbs: Haemanthus humilis subsp. humilis, Hypoxis rigidula.

5.7.12 Habitat assessment

The study area is situated within a savannah setting with undulating hills and flat areas along the route. A large portion of the study site has been historically altered by means of cultivation, transformation for development purposes, farms, and access roads. The road reserve of the R33 have been cleared historically except for some individual trees, leaving the road reserve with mostly a grass vegetation cover as illustrated in Figure 5-29 below.

The habitat assessment included indigenous vegetation, transformed areas due to cultivation, roads and homesteads, Eucalyptus stands and wet areas.

The habitat assessment noted a clear transformation of vegetation within the current road reserve for the R33 that is not currently applied to bioregional spatial plans of the area. The road reserve has been cleared and tree stands were gradually replaced with grass species. The road reserve at the mountain pass section (roughly km 4.5-6.0) is narrower than at other areas along the route resulting in more natural vegetation being vulnerable for the road upgrade.

The results of an edge effect could clearly be observed within the dynamics between the road reserve and adjacent natural vegetation as more grass species and other plants encroached onto the vegetation units.



Figure 5-29: Site Characteristics



Figure 5-30: Habitat Assessment

5.7.13 Vegetation found on site

Species encountered directly adjacent to the existing road is listed below from the study conducted in March 2023. It must be noted that this list is not a comprehensive list of all species that occurs along the route. The purpose of this list was to determine if the species present can be associated with the specific vegetation type as described in Mucina and Rutherford (2006).

GENUS	SPECIES	SUB	Plant status	AREA AND SPECIAL
		SPECIE		NOTE
		TREES AND	SHRUBS	
Burkea	africana		Indigenous	Widespread
Combretum	apiculatum		Indigenous	Mountain pass outside
				road reserve
Combretum	molle		Indigenous	Mountain pass outside
				road reserve
Eucalyptus	grandis		Alien invasive	
			Category 1b	

Table 5-19: Vegetation found on site

Ficus	burkei		Indigenous	Mountain pass outside
				road reserve
Gleditsia	triacanthos		Alien invasive	River areas
			Category 1b	
Grewia	bicolor		Indigenous	Widespread
Lantana	camara		Alien invasive	Widespread
			Category 1b	
Melia	azedarach		Alien invasive	River crossings
			Category 1b	
Morus	nigra		Alien invasive	River areas
			Category 2	
Ochna	pulchra		Indigenous	Mountain pass outside
				road reserve
Vachellia	caffra		Indigenous	Mountain pass outside
				road reserve
				Along route just
				outside road reserve
Sclerocarya	birrea	caffra.	Indigenous	Widespread also inside
				road reserve
Searsia	lancea		Indigenous	Mountain pass outside
				road reserve
Searsia	leptodictya		Indigenous	Widespread
Terminalia	sericea		Indigenous	Widespread mostly
				outside Mountain pass

SUCCULANTS				
Aloe	greatheadii	var.	Indigenous	Wetland area
		davyana.		
Cereus	jamacaru		Alien invasive	Widespread
			Category 1b	
Opuntia	Ficus-indica		Alien invasive	Widespread
			Category 1b	
Vangueria	infausta		Indigenous	Mountain area
		HERB	S	
Alternanthera	pungens		Indigenous	Widespread
Alysicarpus	rugosus		Indigenous	Widespread
Amaranthus	spinosus		Indigenous	River areas
Bidens	pilosa		Indigenous	River areas/
				widespread
Canna	indica		Alien invasive	Within properties along
			Category 1b	the route
Cirsium	vulgare		Alien invasive	River areas
			Category 1b	
Flaveria	bidens		Alien invasive	River areas
			Category 1b	
Gomphrena	celosioides		Indigenous	Widespread in road
				reserve
(pomoea	purpurea		Alien invasive	Widespread/river area
			Category 1b	
Richardia	brasiliensis		Indigenous	River areas
Solanum	nigrum		Indigenous	Widespread
Solanum	elaeagnifolium		Alien invasive	River areas
			Category 1b	
Tagetes	minuta		Indigenous	Widespread inside road
				reserve
Taraxacum	officinale		Indigenous	Road reserve
Richardia	brasiliensis		Indigenous	Widespread
Verbena	aristigera		Indigenous	Road reserve
Verbena	Donariensis		Alien invasive	River areas
the states			Category 1b	
Xantrium	strumanum		Allen invasive	River area
			Category ID	
4.000		GRASSES AN	D SEDGES	Presidence of
Anstida	congesta		Alian investor	Road reserve
Arundo	donax		Category 1b	ruver areas
Chlorite	Wonata		Indigenous	Widespread
Combanaaaa	eyravatus		Indigenous	Widespread
Orpanie	esculentus		Indigenous	River area
cyperus	e actives ittela		margenous	

Cynadan	dactylon	Indigenous	Widespread
Eragrostis	chloromelas	Indigenous	Grassland
Eragrostis	curvula	Indigenous	Widespread
Eragrostis	plana	Indigenous	Widespread
Eragrostis	plana	Indigenous	Widespread
Heteropogon	contortus	Indigenous	Widespread and in the road reserve
Hyparthenia	hirta	Indigenous	Road reserve
Imperata	cylindrica	Indigenous	River area
Kyllinga	alba	Indigenous	River area
Melinis	repens	Indigenous	Widespread
Pennisetum	clandestinum	Alien invasive Category 1b	River areas
Phragmites	australis	Indigenous	Dams
Themeda	triandra	Indigenous	Widespread
Thypa	capensis	Indigenous	River areas
Trachyandra	salitii	Indigenous	Grassland

The above-mentioned species were recorded directly adjacent to the study site with a drive through site visit. Out of 58 species observed on the site, 16 of the plants were NEMBA listed Alien Invasive plants (AIP) and are subject to actions as stipulated under the NEMBA Act.

- 15 NEMBA Category 1b AIP plants were identified and must be controlled.
- 1 NEMBA Category 2 AIP plant was recorded and must be controlled.
- No prohibited species were recorded on or around the site.

The above table was used to make some conclusions in terms of the study area.

The species list produced confirmed that areas of natural vegetation do corresponds with the vegetation associated with the two vegetation types, namely Central Sandy Bushveld and Waterberg Mountain Bushveld.

5.7.14 Sensitivity assessment

The sensitivity assessment determines which parts of the study area have a high conservation value and / or may be sensitive to disturbance caused by the proposed project.

Areas containing untransformed natural vegetation of conservation concern, high diversity, habitat complexity, red list organisms and / or systems vital to sustaining ecological function are considered sensitive. In contrast, areas that are transformed and have little importance for ecological functioning are of low sensitivity.

- CBA 2 "critical biodiversity areas".
- Habitat with low ability to recover from disturbance as indicated in green in Figure 5-31.
- Habitat with exceptionally high diversity (richness or turnover) as indicated in green in Figure 5-31.
- Ecosystem providing high value ecosystem goods and services.

Transformed areas within the road reserve has a Low sensitivity due to the following:

- The proposed widening of the road will mostly be undertaken within the existing road reserve of the existing R33 road. The road reserve has previously been cleared when the road was constructed, leaving mostly grass species and regrowth in the road reserve.
- The 12 recorded Maroela trees in the road reserve has a protected tree status. These tree species was avoided by contractors when the R33 was constructed. These tree species do not form part of the red list of plant species in South Africa and has a national status of "Least Concern".
- No natural habitat remaining.



Figure 5-31: Floral Sensitivity Map

5.7.15 Summary of Findings of Terrestrial Biodiversity (Plant Species) Assessment

The project area lies within the Savanna Biome. Two vegetation types, according to the National Vegetation Map (SANBI, 2006 – 2018), occur in the project area, namely Waterberg Mountain Bushveld and the Central Sandy Bushveld.

Site Ecological characteristics:

- The Waterberg Mountain Bushveld and Central Sandy Bushveld are both not listed in the "National List of Ecosystems that are Threatened and in need of protection" and are classified as Least Concern by the 2018 National Biodiversity Assessment.
- The study area is situated in an area categorized as a Critical Biodiversity Area (CBA1 and CBA2), Ecological Support Area (ESA 1 and ESA 2) in terms of the Limpopo Biosector plan.
 - CBA 1 areas are deemed irreplaceable and are required to meet biodiversity patterns and ecological processes targets.
 - CBA2 areas selected to meet biodiversity targets.
 - ESA 1 areas Natural, near natural and degraded areas supporting CBAs by maintaining Ecological processes.
 - ESA 2 areas Areas with no natural habitat that is important for supporting ecological processes.

Two broad vegetation units were identified to occur mostly outside of the proposed project footprint, i.e., Waterberg Mountain Bushveld and Central Sandy Bushveld. The planned upgrades are largely focused on the existing road reserve where the two vegetation units have already been impacted and mostly transformed.

Areas associated with the mountain pass (as illustrated in the habitat map in Figure 12 in pink) has more concentrated indigenous vegetation closer to the road reserve due to historical road cuts into the mountain sides, which will probably be impacted on most.

Although the site is located within designated CBA areas in accordance with bioregional information of Limpopo (LCPv2), the existing R33 road impact was not considered in these maps which would have resulted in a lower conservation status. The road reserve did contribute to an edge effect on adjacent vegetation compositions historically and the existing road reserve is mostly transformed.

Summary of Floral species findings:

- A total of 58 plant species were recorded in the study area during the time of the study and indicates moderate species diversity. The purpose of the species assessment was to identify any SCC plants and to determine vegetation unit association.
- 12 specimens of the protected tree species Sclerocarya birrea (Marula) was found to occur on the project footprint where the road upgrade will most likely have an impact.

These tree species are protected in terms of the National Forest Act 84 of 1998. These trees are of Least Concern but protected.

- No SCC was identified to occur on the project footprint during the site survey.
- 16 NEMBA listed Alien Invasive plants were listed that need to be controlled.

5.7.16 Faunal features

A Terrestrial Biodiversity Impact Assessment with a focus on the Faunal Assessment was undertaken by Biosphere Enviro Solutions (refer to Appendix H7). The findings from this study is described herein.

a) Important Bird and Biodiversity Areas

Important Bird and Biodiversity Areas (IBAs) are sites of global significance for bird conservation, identified nationally through multi-stakeholder processes using globally standardised, quantitative and scientifically agreed criteria. Essentially, these are the most important sites for conserving. As indicated in below, a section of the proposed road upgrade project falls within the Waterberg System IBA. As indicated by BirdLife SA (Marnewick et al. 2015), there are surprisingly few threats to this large IBA. Refer to Figure 5-32. Agricultural activities are declining, and large areas of agricultural land have been converted to game farms. Uncontrolled fires are probably the biggest threat to the trigger species and their habitats.



Figure 5-32: Study area in relation to Important Bird and Biodiversity Areas (IBAs)

b) Habitat types

The study site, together with an extended study area of 200 m surrounding the site, consists of three main land use types (refer to Figure 5-33), namely:



Figure 5-33: Habitat types observed within the study area (and extended study area)

(i) Indigenous Vegetation (Bushveld)

Along the existing R33 Road, the remaining natural vegetation has been impacted on by current and historic anthropogenic activities including fencing and property access. It is however noted that, within the road reserve itself, limited natural vegetation have remained intact. Indigenous vegetation is nonetheless in good condition further from the existing R33 Road.

Refer to Figure 5-34 below for an indication of Central Sandy Bushveld, and to Figure 5-34 for an indication of Waterberg Mountain Bushveld adjacent to the proposed road upgrade route.



Figure 5-34: (a) and (b) Central Sandy Bushveld adjacent to the proposed road upgrade route; (c) and (d) Waterberg Mountain Bushveld adjacent to the proposed road upgrade route

(ii) Aquatic Systems

Considering the study area extent, aquatic features are limited in comparison to the other available habitat types. These should nonetheless be regarded as important, especially since it acts as corridors whereby species move through the landscape and could also be important for foraging purposes. Refer to Figure 5-35 for an indication of aquatic habitat within the study area.



Figure 5-35: Aquatic habitat within the study area

(b) Transformed Areas

The existing road and reserve are significantly impacted by traffic movement and was observed to be extremely busy. Other than the existing road, within the extended study area, transformation has taken place in the form of development, land clearing and landscaping, agriculture, farm roads, an airfield, mining/quarrying, alien vegetation stalls and littering closer to town. Some of the existing impacts are shown in Figure 5-36 below.



Figure 5-36: Existing impacts within study area

5.7.16.1 Species of conservation concern

It is noted that not all of the species listed in this section of the report may necessarily occur on the study site as suitable habitats or microhabitats may not be present, or the levels of disturbance may be too high. Conversely, it is equally likely that additional species, not listed here, may be present within the study area. The information provided here is based on the greater area and not specifically to the study area.
The main purpose of this report is therefore to determine the level of site sensitivity based on the likelihood of important or sensitive species to occur. This section of the report focusses specifically on Red Data species potentially occurring within the study area. To compile a list of conservation worthy species, numerous literature sources were investigated. Refer to below for an indication of sensitive species potentially occurring within the study area.

Species	Common name	Status	Comments/References	Potential to occur in the region	Potential to occur within the study site
Kinixys lobatsiana	Lobatse Hinged Tortoise	VU	IUCN	Likely	Unlikely
Dasymys robertsii	Robert's shaggy rat	VU	Mammal Red List	Possible	Unlikely
Crocidura maquassiensis	Maquassie Musk Shrew	VU	Mammal Red List	Possible	Unlikely

Table 5-20: Species of Conservation Concern (SCC) potentially occurring within the study area

*VU: Vulnerable

5.7.16.2 Species identified or derived to reside on site

Typical surveys provide only a snapshot of the existing faunal community and should/can only be used as a general guideline. The snapshot provides an indication of species types which the habitat can support. Table 5-21 below summarises species positively identified or derived to reside within the study site at the time of the site investigation.

Table 5-21: Faunal species	s identified or derived to re	side within the study area

Class	Scientific name	Common name
Insecta	Pseudagrion sp.	Sprite
Insecta	Diplacodes lefebvrii	Black Percher
Insecta	<i>Trithemis</i> sp.	Dropwing
Insecta	Acraea axina	Little Acraea

Class	Scientific name	Common name
Mammalia	Thryonomys swinderianus	Greater Cane Rat
Mammalia	Papio ursinus	Chacma Baboon
Mammalia	Pronolagus randensis	Red Rock Hare

5.7.16.3 Sensitivity assessment

(a) Habitat Availability for Sensitive Faunal Species

Some faunal species of conservation concern could potentially occur within the vicinity of the study area. A brief description of the habitat preference for each listed species of conservation concern is provided in Table 5-22 below. Note that, where species are listed by more than one resource, its highest sensitivity rating has been applied.

Status	Species and common name	Habitat preference within the study area	Potential to occur on the study site preconstruction
VU	<i>Kinixys lobatsiana</i> VU (Lobatse Hinged Tortoise)	Savanna species that inhabits rocky hillsides in habitats of mixed Acacia and Combretum woodland, tropical Bushveld and Thornveld where vegetation ranges from dense, short shrubland to open tree savanna.	Unlikely
VU	<i>Dasymys robertsii</i> (African Marsh Rat)	 Wide variety of habitats but rely on intact wetlands in these areas. They have not been recorded 	Unlikely

Table 5-22: Habitat preference for species of conservation concern

Status	Species and common name	Habitat preference within the study area	Potential to occur on the study site preconstruction
		from agricultural landscapes or dam areas. • They occur specifically in reed beds and among semi-aquatic grasses in wetlands or swampy areas or along rivers and streams, as well as in grassy areas close to water.	
VU	Crocidura maquassiensis (Maquassie Musk Shrew)	 Little is known about the habitats and ecology of this species. The type specimen was collected in a house and the Motlateng specimen from a grassy mountainside beneath a rock. Other specimens have also been found on rocky or montane grassland. The Chase Valley Heights specimen was brought in by a cat from the garden. The Royal Natal specimen was collected in mixed bracken and 	Unlikely

Status	Species and common name	Habitat preference within the study area	Potential to occur on the study site preconstruction
		grasslands along the Tugela River and a single specimen has been collected from coastal forest. • Thus, it may tolerate a wide range of habitats, including urban and rural landscapes.	

5.7.16.4 Site Ecological Importance

The Site Ecological Importance was calculated and is summarised in the tables to follow.

Table 5-23: Summary of Site Conservation Importance	e, Functional Integrity and Resilience
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Aspect	Habitat type	Result
Conservation Importance	Transformed Areas	Low
	Bushveld	Medium
	Aquatic Features	Medium
Functional Integrity	Transformed Areas	Very Low
	Bushveld	Medium
	Aquatic Features	Medium
Resilience	Transformed Areas	Very Low
	Bushveld	Medium
	Aquatic Features	Medium

Aspect	Habitat type	Result
Biodiversity Importance	Transformed Areas	Very Low
	Bushveld	Medium
	Aquatic Features	Medium

Table 5-24: Summary of Site Biodiversity Importance

Table 5-25: Summary of Site Ecological Importance

Aspect	Habitat type	Result
Site Ecological Importance	Transformed Areas	Very Low
	Bushveld	Medium
	Aquatic Features	Medium

5.7.16.5 Sensitivity Mapping

The sensitivity assessment determines the status and ecological quality of the study area. Areas consisting of natural vegetation of conservation concern, high species diversity, habitat complexity, red list organisms and/or systems vital to sustaining ecological function are considered sensitive. In contrast, areas that are transformed and have little importance for ecological functioning are considered to be of low sensitivity (Refer to Figure 5-37).



Figure 5-37: Faunal Sensitivity Map

5.8 Composite Sensitivity Map

The site for the proposed development, occurs within a 'vulnerable' ecosystem (Ecosystem Threat Status (NBA, 2018) and according to the Limpopo Biodiversity Conservation Plan: Version 2, the study area is traversed by Critical Biodiversity Area (CBA) 1 and 2 and Ecological Support Area (ESA) 1 and 2.

Two broad vegetation units were identified to occur mostly outside of the proposed project footprint, i.e., Waterberg Mountain Bushveld and Central Sandy Bushveld. The planned upgrades are largely focused on the existing road reserve where the two vegetation units have already been impacted and mostly transformed.

Although the site is located within designated CBA areas in accordance with bioregional information of Limpopo (LCPv2), the existing R33 road impact was not considered in these maps which would have resulted in a lower conservation status. The road reserve did contribute to an edge effect on adjacent vegetation compositions historically and the existing road reserve is mostly transformed.

Areas associated with the mountain pass (as illustrated in the habitat map in Figure 5-30 in pink) has more concentrated indigenous vegetation closer to the road reserve due to historical road cuts into the mountain sides, which will probably be impacted on most.

The impact assessment indicated that all impacts in terms of terrestrial biodiversity and plant species is of medium to low significance after mitigation. The impact on threatened plants is deemed to be low as most of the site has been disturbed historically and no SCC plants were found. All areas identified as part of the development is suitable for development.

Some faunal species of conservation concern could potentially occur within the natural areas adjacent to the study area. However, the road and road reserve area itself (study area) is of Low Sensitivity for terrestrial animal species. Without any mitigation, the proposed development is expected to have a Medium to High impact on faunal habitat and species. However, with the implementation of the mitigation measures recommended in this report, the impact will be reduced to a Low significance and will be limited to the development footprint area as far as possible.

No adverse impact on heritage and fossil heritage resources are expected by the project and it is recommended that the project can commence on the condition that the recommendations of the Palaeontological Impact Assessment are implemented as part of the EMPr.

Refer to the composite sensitivity map in Figure 5-38.



Figure 5-38: Composite Sensitivity Map

5.9 Socio-Economic Aspects

5.9.1 Social characteristics

The Modimolle-Mookgophong Municipality is situated in the Limpopo Province and covers an area of 10 497 square kilometres with a population of 110 000 people and contributes 20.2% of the population of the Waterberg District Municipality.

Modimolle -Mookgophong is located within the Waterberg District Municipality situated in the Limpopo Province. The municipality is situated in the south-eastern corner of the district municipality and is bordered by Bela-Bela municipality in the South-west; Mogalakwena Municipality in the north and by the Capricorn District Municipality in the north and north-east and the Sekhukhune District Municipality in the south and south-east.

5.9.1.1 Demographic Profile

Statistics SA 2016 community survey indicated that the population was at 107 699, with 28 977 households. The average size per household is four persons. It could be assumed that the average population growth rate in for our Municipality will be similar to the provincial population growth rate of 0.94% per year. The higher population growth rate of the past decade was caused by people migrating from rural areas to Modimolle and Mookgophong towns, but this migration process has now stabilized.

5.9.1.2 Educational Levels

The education levels in the Municipality is very low, with only 10% of the population having progressed beyond Grade 12, while 0.08% having progressed beyond Grade 10. Effectively, this implies that 97% of the population has not progressed beyond Grade 12. There are, however, efforts from some members of the community to improve their schooling situation by attending adult education, this represent another 3% of the population.

5.9.1.3 Employment levels

Approximately 36% of the total population in the municipality is employed. Modimolle-Mookgophong is an urban municipality, with evident unstructured settlement and economic infrastructure development patterns. It is a Bushveld area and strongly characterized by tourism and hospitality facilities. Other sectors where the population is employed is agriculture and manufacturing

5.10 Aesthetic Environment

A site visit was undertaken by the EAP on 16 January 2023.

The land uses along the R33 are as follows, *viz*, correctional services, Koro Creek Golf Estate (*residential area*), vacant land, agricultural holdings, lodges/resorts/game ranches, place of leisure/restaurants and craft markets, retirement villages, place of worship and railway lines. These land uses will not have direct views of the construction site earmarked for the proposed road upgrade.

The nature of the development (*additional lanes for the proposed road upgrade next to the existing R33*) will not alter the character, nor sense of place of the study area, as the R33 already exists. Furthermore, visual impacts will only occur during the construction period which will be of a short-term duration. With the implementation of mitigation measures (Section 7.2 of the EMPr in Appendix J) to minimise the impacts on a limited number of sensitive receptors, occurring in proximity to the site in the southern portion of the study area, the visual character of the site will not be compromised by views by these receptors.

The proposed construction activities will be at-ground level and the study area is relatively flat. Refer to Photoplate 1 of the Site Verification Assessment (Appendix D) for the existing condition of the site.

5.11 Heritage

As per the Screening Tool Report generated by the web-based DFFE Screening Tool, the archaeological and cultural heritage theme of the site has a high sensitivity. As such, a Heritage Impact Assessment (HIA) was submitted to SAHRA. Refer to the HIA in Appendix H8.

The findings below summarises the findings of the site observation undertaken by the archaeologist.

- The existing road servitude and associated construction activities of the upgrade of the R33 would have impacted on surface evidence of heritage features if any ever existed in the servitude and the Project area is considered to be of low heritage significance;
- This was confirmed during the survey whereby no heritage resources were identified within the road servitude;

The HIA confirmed that the impact on heritage resources is low, and the proposed road upgrade can commence provided that the recommendations in this report are adhered to, based on the South African Heritage Resource Authority (SAHRA) 's approval.

5.12 Palaeontological Resources

A Palaeontological Impact Assessment was undertaken by Beyond Heritage (refer to Appendix H9). As per the Screening Tool Report generated by the web-based DFFE Screening Tool, the palaeontological theme of the site has a medium sensitivity. The findings of this study is summarised below.

The palaeontological sensitivity of the area under consideration is presented in Figure 5-38. The site for development is in the Nylstroom Subgroup of the Waterberg Group. The Waterberg Group sandstones represent four phases of sedimentary infilling of the three ancient basins. There is some evidence for periodic arid conditions indicated in the Makgabeng Formation from the dunes and cross-bedding, and the braided streams channel sandstones in the Mogalakwena Formation (Corcoran et al., 2013). In contrast, Simpson et al. (2013) advocate the presence of microbial mats using the terminology of Noffke et al. (2001). Microbial activity is recognised by the very subtle sedimentary structures such as roll-up structures, sand cracks, wrinkle structures, tufted microbial mats, biological soils crusts and gas-escape features. These structures have only been found in the Makgabeng Formation but the SAHRIS palaeosensitivity map, based on the Palaeotechnical Report for Limpopo (Groenewald et al., 2014), suggests that they may be more widespread.

Microbialites (sensu Burne and Moore, 1987) are organo-sedimentary deposits formed from interaction between benthic microbial communities (BMCs) and detrital or chemical sediments. In addition, microbialites contrast with other biological sediments in that they are generally not composed of skeletal remains. Archean carbonates mostly consist of stromatolites. These platforms could have been the site of early O2 production on our planet. Stromatolites are the laminated, organo-sedimentary, non-skeletal products of microbial communities, which may have included cyanobacteria, the first photosynthetic organisms to produce oxygen. Another type of trace fossil has been termed Microbially-induced sedimentary structures (MISS sensu Noffke et al., 2001) or simply 'fossil mats' (sensu Tice et al., 2011). These include swirls, rip-ups, crinkled surfaces and wrinkles that were formed by the mucus extruded by littoral algae or microbes and bound together sand particles. Davies et al. (2016) caution against the assumption that all such structures are microbially induced unless there is additional evidence for microbes in the palaeoenvironment.

Nonetheless, stromatolites and microbialites are accepted as trace fossils of algal colonies. MISS could be microbially or abiotically formed. The oldest stromatolites have been recorded from the Barberton Supergroup that was deposited between 3.55 to ca. 3.20 Ga, and stromatolites still form today in warm, shallow seas (Homan, 2019).



Figure 5-39: SAHRIS palaeosensitivity map for the site for the proposed R33 Witklip Road upgrade

N.B. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero

From the SAHRIS map above, the area is indicated as having moderate sensitivity (green) for the Waterberg Group and with no sensitivity (grey) for the diabase.

Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The geological structures suggest that the rocks are either much too old to contain body fossils, but might have trace fossils of early microbes or microbial activity. Since there is an extremely small chance that trace fossils may occur in the Nylstroom Subgroup and may be disturbed, a Fossil Chance Find Protocol (CFP) must be implemented if trace fossils are encountered during construction. Taking account of the defined criteria, the potential impact to fossil heritage resources is extremely low.

6 PUBLIC PARTICIPATION PROCESS

The Basic Assessment process refers to that process (in line with the EIA Regulations) which involves the identification and assessment of direct, indirect, and cumulative environmental impacts associated with a proposed project/ activity. The BA process culminates in the submission of a Final BAR (including an Environmental Management Programme (EMPr)) to the Competent Authority for decision-making. The BA process is illustrated below:



Figure 6-1: Basic Assessment flowchart

6.1 Draft Basic Assessment Report for public review and comment

This Basic Assessment Report for public review has been prepared by Zitholele, to assess the potential significance of environmental impacts associated with proposed upgrade of the R33, near Modimolle in Limpopo Province. This process will be undertaken in support of an application for Environmental Authorisation, to the DFFE. The 30-day period for review will be from 19 June 2023 to 19 July 2023. The report will be available for public review at the following locations:

- Modimolle Library, Cnr Harry Gwala Street and Kerk Street, Modimolle, 0510
- Zitholele's website: www.zitholele.co.za/environmental, under heading "SANRAL R33 Road Upgrade".

The Draft BAR is aimed to provide Interested and Affected Parties (I&APs) with the opportunity to receive information regarding the proposed project, participate in the process, and raise issues of concern. The Draft BAR is aimed at detailing the nature and extent of the proposed development, identifying potential issues associated with the proposed project, and defining the extent of studies required within the BA Process. This is achieved through an evaluation of the proposed project, involving the project proponent, appointment of specialist consultants, and a

consultation process with key stakeholders that included both relevant government authorities and I&APs.

6.1.1 Tasks completed during the Basic Assessment Process

The EIA Phase for the proposed development has been undertaken in accordance with the EIA Regulations published in GN 40772 in December 2014, in terms of NEMA, as amended. Key tasks undertaken within the EIA phase included:

- Consultation with relevant decision-making and regulating authorities (at National, Provincial and Local levels);
- Undertaking a Public Participation Process throughout the BA process, in accordance with Chapter 6 of EIA regulations 2014 (as amended) to identify any issues and concerns associated with the proposed project. Preparation of a Comments and Response Report detailing key issues raised by I&APs as part of the BA Process;
- Undertaking of independent Specialist Studies, in accordance with Appendix 6 of EIA regulations 2014 (as amended) and the Gazetted Protocols for Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts, and
- Preparation of a Draft BAR in accordance with Appendix 1 of EIA regulations 2014 (as amended) for public review and comment for a period of 30 days.

The above tasks are discussed in detail below.

6.1.2 Authority Consultation

The DFFE is the Competent Authority for this application. A record of all authority consultation undertaken, is included within this BAR. Consultation with the Competent Authorities (i.e. DFFE) has continued throughout the BA Process. On-going consultation included the following:

- A request for a Pre-Application Meeting with the DFFE was sent to the Department on 16 March 2023. However, the DFFE was not available for a meeting and confirmed that the Application for Environmental Authorisation Form can be submitted to the DFFE via the online platform (refer to the email in Appendix I1).
- Notification and Consultation with Organs of State that may have jurisdiction over the project, including:
 - i. Provincial departments
 - ii. Local Municipality
- The draft BAR will be submitted to the DFFE for review on 19 June 2023 for comments, simultaneously with public review of the Draft BAR.
- Similarly, the draft BAR will be submitted to the organs of state during the public review of the draft BAR.

A record of the authority consultation is included within Appendix I1 of the draft BAR.

6.1.3 Public Involvement and Consultation

The aim of the Public Participation Process is primarily to ensure the following:

- Information containing all relevant facts, in respect of the proposed project are made available to potential stakeholders and I&APs.
- Participation by potential I&APs is facilitated in such a manner that all potential stakeholders and I&APs will be provided with a reasonable opportunity to comment on the proposed project and the Draft BAR for public review and comment.
- Comments received from stakeholders and I&APs during public review of the Draft BAR are to be recorded and incorporated into the Final BAR that will be submitted to the DFFE for review and decision-making.

In order to accommodate the varying needs of stakeholders and I&APs within the study area, as well as to capture their inputs regarding the project, various opportunities for stakeholders and I&APs to be involved in the BA Process will be provided as follows:

- Telephonic consultation sessions (consultation with various parties from the BA Project Team, including the Project Participation Consultant, lead Environmental Consultant as well as Specialist Consultants).
- Written, faxed or e-mail correspondence.
- The Draft BAR is available for a 30-day public review period from 19 June 2023 to 19 July 2023. The comments received from I&APs will be captured within a Comments and Response Report (CRR), which will be included within the final Basic Assessment Report, for submission to the DFFE for decision-making.

The following key public participation tasks will be, or have been undertaken in terms of the requirement of Chapter 6 of the EIA Regulations of December 2014, as amended:

- Fixing a notice board at a place conspicuous to the public at the boundary or on the fence of:
 - i. the site where the activity to which the application relates is or is to be undertaken; and
 - ii. any alternative site mentioned in the application;
- Giving written notice to:
 - i. the owner or person in control of that land if the applicant is not the owner or person in control of the land;
 - ii. the occupiers of the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
 - iii. owners and occupiers of land adjacent to the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
 - iv. the municipal councilor of the ward in which the site or alternative site is situated and any organization of ratepayers that represent the community in the area;
 - v. the municipality which has jurisdiction in the area;

- vi. any organ of state having jurisdiction in respect of any aspect of the activity; and
- vii. any other party as required by the competent authority.
- Placing an advertisement in:
 - i. one local newspaper; and
- I&APs registry is open and maintained throughout the BA process.
- The Draft BAR will be made available for Public Review.
- Comments received will be collated and addressed accordingly.

Identification of I&APs was undertaken by Zitholele through existing contacts and databases, recording responses to site notices and the newspaper advertisement, as well as through the process of networking. The key stakeholder groups identified include authorities, local and district municipalities, public stakeholders, Parastatals and Non-Governmental Organizations (refer to *Appendix I-2*).

6.1.4 Protection of Personal Information Act, No.4 of 2013

The Protection of Personal Information Act (POPIA), No 4 of 2013, promote the protection of personal information that is processed by public and private bodies while introducing certain conditions to establish minimum requirements for the processing of personal information. Pertinent sections of the Act became effective on 1 July 2021.

Zitholele drew all I&APs attention to the fact that the PPP team will collect, maintain and store personal information from Interested and Affected Parties that register an interest in this BA and WUA process for the purpose of executing this process only. Collected I&AP information managed by Zitholele Consulting is furthermore available to the applicant, SANRAL SOC Ltd, during the course of the BA and WUA process.

Zitholele Consulting (Pty) Ltd further acknowledge that this BA and WUA process is a public process and all stakeholders were informed that some personal information limited to I&AP name, surname, affiliation, declaration of interest and comments and opinions provided will be included in the BA and WUA documentation that will be made available for public review and comment. Full contact details will however only be made available to the DFFE and the DWS, upon submission of the final BAR.

6.1.5 Draft BAR for public review and comment

The Draft BAR is available for public review and comment from 19 June 2023 to 19 July 2023.

Interested and Affected Parties were notified of the availability of the draft BAR for public review and comment as follows (refer to notification documents in Appendix I):

 An English and Sepedi newspaper advertisement was placed in the 'Die Pos' on 16 June 2023 (refer to Appendix I-3);

- English site notices were be placed at strategic locations on 19 June 2023 (refer to Appendix I-4 for the site notice text); and
- A Background Information Document (BID) was sent to I&APs on the database via email on 19 June 2023 (refer to Appendix I-5).

Refer to the Preliminary I&AP database in Appendix I-2.

6.1.6 Identification and Recording of Issues and Concerns

Issues and comments raised by I&AP's over the duration of the public review of the Draft BAR will be incorporated into the Comments and Response Report (CRR). The Comments and Response Report will include responses from members of the EAP project team and/or the project proponent.

The CRR will be included in the Final BAR that will be submitted to the DFFE for consideration and decision-making after the conclusion of the PPP. Correspondences will include any telephonic queries fielded and emails received from stakeholders. The CRR will also include the responses by the EAP to the comments raised by the I&APs. Proof of correspondence between the stakeholders and Zitholele Consulting will be included as an Appendix to the Comments and Responses Report.

6.1.7 Notifying I&APs of the decision

All the stakeholders will be notified via email and SMS of the decision made by the DFFE on the EA, once it is issued by the DFFE.

7 IMPACT IDENTIFICATION AND ASSESSMENT

This chapter serves to assess the significance of the positive and negative environmental impacts (direct, indirect, and cumulative) expected to be associated with the proposed Project.

The planning phase of this project will evaluate the following phases:

- Pre-Construction / Construction will include pre-construction surveys, site preparation, construction site demarcation, vegetation clearance, transportation of material to site; excavations, stockpiling on site, waste management, and undertaking site rehabilitation including implementation of a stormwater management plan.
- Operation will include operation and maintenance of the stormwater drainage and associated infrastructures.
- Decommissioning –Note that impacts associated with decommissioning are expected to be similar to those associated with construction activities. Therefore, these impacts are not considered separately within this chapter.

7.1 Impact Assessment Rating Methodology

7.1.1 Impact Assessment Methodology

The impacts will be ranked according to the methodology described below. Where possible, mitigation measures will be provided to manage impacts. In order to ensure uniformity, a standard impact assessment methodology will be utilised so that a wide range of impacts can be compared with each other. The impact assessment methodology makes provision for the assessment of impacts against the following criteria, as discussed below.

a. DIRECT, INDIRECT & CUMULATIVE

Descriptor	Definition
Direct Impact	Direct impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.
Indirect Impact	Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken, or which occur at a different place as a result of the activity.
Cumulative Impact	Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the

Descriptor	Definition
	collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.

b. IMPACT DIRECTION

Descriptor	Definition
Positive	Environment overall will benefit from the impact/risk
Negative	Environment overall will be adversely affected by the impact/risk
Neutral	Environment overall will not be affected

c. SPATIAL EXTENT OF IMPACT

Extent Descriptor	Definition	Rating
Site	Impact footprint remains within the boundary of the site.	1
Local	Impact footprint extends beyond the boundary of the site to the adjacent surrounding areas.	2
Regional	Impact footprint includes the greater surrounds and may include an entire municipal or provincial jurisdiction.	3
National	The scale of the impact is applicable to the Republic of South Africa.	4
Global	The impact has global implications	5

d. DURATION OF IMPACT

Duration descriptor	Definition	Rating
Construction / Decommissioning phase only	The impact endures for only as long as the construction or the decommissioning period of the project activity. This implies that the impact is fully reversible.	1
Short term	The impact continues to manifest for a period of between 3 and 5 years beyond construction or decommissioning. The impact is still reversible.	2
Medium term	The impact continues between 6 and 15 years beyond the construction or decommissioning phase. The impact is still reversible with relevant and applicable mitigation and management actions.	3
Long term	The impact continues for a period in excess of 15 years beyond construction or decommissioning. The impact is only reversible with considerable effort in implementation of rigorous mitigation actions.	4
Permanent	The impact will continue indefinitely and is not reversible.	5

e. POTENTIAL INTENSITY OF IMPACT

Criteria for impact rating of potential intensity of a negative impact.

Potential Intensity Descriptor	Definition of negative impact	Rating
Low	Negative change with no associated consequences.	1
Moderate-Low	Nuisance impact	2
Moderate	Substantial alteration and/or reduction in environmental quality/loss of habitat/loss of heritage/loss of welfare amenity	4
Moderate-High	Severe alteration to faunal or floral populations/loss of livelihoods/individual economic loss.	8
High	Extreme alteration to human health linked to mortality/loss of a species/endemic habitat.	16

Criteria for the impact rating of potential intensity of a positive impact.

Potential Intensity Descriptor	Definition of positive impact	Rating
Low	Positive change with no other consequences.	1
Moderate-Low	Economic development	2
Moderate	Improved environmental quality/improved individual livelihoods.	4
Moderate-High	Net improvement in human welfare	8

f. PROBABILITY / LIKELYHOOD OF IMPACT

Likelihood Descriptor	Definition	Rating
Improbable	The possibility of the impact occurring is negligible and only under exceptional circumstances.	0.1
Very Unlikely	The possibility of the impact occurring is low with a less than 30% chance of occurring.	0.2
Unlikely	The impact has a 30% to 50% chance of occurring.	0.5
Likely	The impact has a 51% to 90% chance of occurring.	0.75
Definite	The impact has a >90% chance of occurring regardless of preventative measures.	1

g. SIGNIFICANCE RATING SCALE

Score	Implications for Decision-making	Rating
< 3	The risk/impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures and will not have an influence on decision-making. Project can be authorised with low risk of environmental degradation	Low
3 - 9	The risk/impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures and will only have an influence on the decision-making if not	Moderate

Score	Implications for Decision-making	Rating
	mitigated. Project can be authorised but with conditions and routine inspections. Mitigation measures must be implemented.	
10 - 20	The risk/impact will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making. Project can be authorised but with strict conditions and high levels of compliance and enforcement. Monitoring and mitigation are essential.	High
21 - 26	The risk/impact will result in very major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making. The project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating.	Fatally Flawed

Reversibility of the Impacts: The extent to which the impacts/risks are reversible assuming that the project has reached the end of its life cycle (decommissioning phase):

Descriptor	Definition
High reversibility	Impact is highly reversible at end of project life.
Moderate reversibility	Moderate reversibility of impacts.
Low reversibility	Low reversibility of impacts.
Impacts are non- reversible	The impact is permanent, i.e., this is the least favourable assessment for the environment.

Irreplaceability of Receiving Environment/Resource Loss caused by impacts/risks: The degree to which the impact causes irreplaceable loss of resources assuming that the project has reached the end of its life cycle (decommissioning phase):

Descriptor	Definition
High irreplaceability	The project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment

Descriptor	Definition
Moderate irreplaceability	Moderate irreplaceability of resources
Low irreplaceability	Low irreplaceability of resources.
Resources are replaceable	The affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment.

Confidence: The degree of confidence in predictions based on available information and specialist knowledge

Descriptor	Definition
Low	EAP / Specialist has low confidence in assessment due to significant limitations such as unavailability of data or information
Medium	EAP / Specialist has medium confidence in assessment due to some limitations such as unavailability of data or information
High	EAP / Specialist has high confidence in assessment.

7.2 Design, Planning and Pre-Construction Phase

7.2.1 Heritage Resources

No impacts on heritage resources have been identified during the Pre-Construction Phase of the proposed development.

7.2.2 Palaeontological Resources

No impacts on palaeontological resources have been identified during the Pre-Construction Phase of the proposed development.

7.2.3 Surface water and wetlands

No impacts on surface water and wetlands have been identified during the Pre-Construction Phase of the proposed development.

7.2.4 Groundwater

No impacts on groundwater have been identified during the Pre-Construction Phase of the proposed development.

7.2.5 Visual

No impacts on the aesthetic environment have been identified during the Pre-Construction Phase of the proposed development.

7.2.6 Socio-economic

No impacts on the socio-economic environment have been identified during the Pre-Construction Phase of the proposed development.

7.2.7 Loss or fragmentation of indigenous natural vegetation

Impacts identified

Construction of infrastructure may lead to direct loss of vegetation. This may lead to localised or more extensive reduction in the overall extent of vegetation. There are factors that may aggravate this potential impact. For example, where this vegetation has already been stressed due to degradation and transformation at a regional level, the loss may lead to increased vulnerability (susceptibility to future damage) of the habitat and a change in the conservation status (current conservation situation).

Consequences of the potential impact of loss of indigenous natural vegetation occurring may include the following:

- Negative change in conservation status of habitat (Driver et al. 2005).
- Increased vulnerability of remaining portions to future disturbance.
- General loss of habitat for sensitive species.
- Loss in variation within sensitive habitats due to loss of portions of it.
- General reduction in biodiversity.
- Increased fragmentation (depending on location of impact).
- Disturbance to processes maintaining biodiversity and ecosystem goods and services; and
- Loss of ecosystem goods and services.

Impact Assessment

The impact of this disturbance was rated as 'moderate' prior to the mitigation and is 'low' postmitigation. See Impact Assessment Table 7-1.

Impa	act Description	Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact	Direct Impact:		Sign	ificance	without	Mitigation	
Impact Direction:	Negative	Existing Impact	2	2	4	0.75	6 - MOD
Aspect:	Clearance of vegetation within a CBA area	Project Impact	2	1	4	0.75	5 - MOD
Potential Im	pact:	Significance with Mitigation					
Loss or	fragmentation of	Residual Impact	2	1	2	0.2	1 - LOW
indigenous	natural vegetation due	Reversibility			Мо	derate reve	rsibility
to clearance	e of vegetation, for the	Irreplaceability			Mode	erate irrepla	ceability
culverts and bridges.			•	Cumu	ative Im	pact	
		Cumulative Impact	2	1	4	0.75	5 - MOD
		Confidence		High			

Table 7-1: Impacts on loss and fragmentation of indigenous natural vegetation during Pre-Construction

Proposed Mitigation Measures (Impact Management Actions)

- Clearance of vegetation to be limited to areas detrimental for the road upgrade.
- No unnecessary expanded areas to be cleared due to misinformation or a lack of project scope.
- Areas historically cleared due to the existing R33 road reserve must be used as far as possible without extending outside of the road reserve.
- No unnecessary vehicle movement within the river and natural areas must be allowed.
- Vehicle movements must be limited to specific construction roads and vehicles may not drive into any natural vegetated areas that is not part of the project scope.
- Any spillages of hydrocarbon materials must be prevented from reaching drainage ways as this may affect the broader vegetation communities.
- Rehabilitation must be undertaken for affected areas. He use of indigenous vegetation and grasses must be prioritized.

7.2.8 Loss of protected tree species

Impacts identified

Some tree species in South Africa is protected in terms of the National Forest Act (Act No. 84 of 1998). These tree species require special permits to remove.

Consequences may include the following:

- Change in age profile of trees in the area.
- Reduction in area of occupancy of affected species; and
- Loss of genetic variation within affected species.

No person may cut, disturb, damage, or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a licence or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated.

Impact Assessment

The impact of this disturbance was rated as 'high' prior to the mitigation and is 'moderate' postmitigation. See Impact Assessment Table 7-2.

Impa	ct Description	Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)	
Impact	Direct Impact:		Signi	ficance	without	Mitigation		
Impact Direction:	Negative	Existing Impact	2	3	8	1	13 - HIGH	
Aspect:	Clearance of vegetation	Project Impact	2	3	8	1	13 - HIGH	
Potential Im	pact:	Significance with Mitigation						
Loss of prot	ected tree species	Residual Impact	2	1	4	0.75	5 - MODERATE	
		Reversibility			l	ow reversil	bility	
		Irreplaceability			Lc	w irreplace	ability	
		Cumulative Impact						
		Cumulative Impact	1	1	1	0.1	1 - LOW	
		Confidence		High				

Table 7-2: Impacts on loss of protected tree species during Pre-Construction

Proposed Mitigation Measures (Impact Management Actions)

- All Marula trees found on site must be surveyed and recorded.
- Marula trees removal are subject to a permit application.
- Prior to construction, a vegetation ecologist or suitably qualified ECO must undertake a walk-down of the road upgrade section to tag Marula trees to be removed.

- Each Marula tree to be removed must be included in a permit application. Permit applications must be lodged with the Department of Forestry, Fisheries, and the Environment (DFFE).
- Small Marula trees must be considered as landscaping in any areas to be landscaped.

7.2.9 Loss of individuals of threatened plants

Impacts identified

Plant species are especially vulnerable to development since they cannot move out of the path of the construction activities but are also affected by overall loss of habitat. Threatened species include those classified as critically endangered, endangered, or vulnerable. For any other species, a loss of individuals or localised populations is unlikely to lead to a change in the conservation status of the species. However, in the case of threatened plant species, loss of a population or individuals could lead to a direct change in the conservation status of the species, possibly extinction. This may arise if the proposed infrastructure is located where it will impact on such individuals or populations.

Consequences may include:

- Fragmentation of populations of affected species.
- Reduction in area of occupancy of affected species; and
- Loss of genetic variation within affected species.

These may all lead to a negative change in conservation status of the affected species, which implies a reduction in the chance of survival of the species. No red data plants were recorded within the road study area. One protected tree species (12 samples of Maroela trees) were recorded in the road reserve that may likely be impacted on due to the road upgrade.

Impact Assessment

The impact of this disturbance was rated as 'low' prior to the mitigation and is 'low' post-mitigation. See Impact Assessment Table 7-3.

Table 7-3: Impacts on loss of individuals of threatened plants during Pre-Construction

Impa	act Description	Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact	Direct Impact:		Significance without Mitigation				
Impact Direction:	Negative	Existing Impact	2	1	2	0.2	1 - LOW
Aspect:	Clearance vegetation	Project Impact 2 1 2 0.2 1 - LOW					
Potential Impact:			Sig	nificanc	e with N	litigation	

Impact Description	Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)	
Loss of individuals of threatened plants	Residual Impact	2	1	2	0.2	1 - LOW	
	Reversibility	Moderate reversibility					
	Irreplaceability	Moderate irreplaceability					
	Cumulative Impact						
	Cumulative Impact	1 1 1 0.1 1-LOW					
	Confidence			•	High		

Proposed Mitigation Measures (Impact Management Actions)

The current transformed status of the road reserve makes it very unlikely that and plants of conservation concern resides within the study area. Any plants with distinct character found onsite during construction must be reported to the ECO and inspected.

7.2.10 Impact on faunal species habitat

Impacts identified

Inadequate planning for the demarcation of the construction footprint, and non-compliance with the relevant legislative and monitoring requirements may lead uncontrolled construction and operation, which will impact on faunal species habitat.

Impact Assessment

The impact on faunal species habitat is rated as 'high' prior to the mitigation and is 'low' postmitigation. See Impact Assessment in Table 7-4.

Table 7-4: Impact on faunal species during construction

Impa	act Description	Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact	Direct Impact:	Significance without Mitigation					
Impact Direction:	Negative	Existing Impact					n/a
Aspect:	Inadequate planning not taking layout, sensitive receptors and legislation into account.	Project Impact	3	4	4	1	11 - HIGH
Potential Impact:			Sig	nificanc	e with N	litigation	

Impact Description	Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)	
Impact on faunal species habitat	Residual Impact	1	2	2	0.2	1 - LOW	
	Reversibility	High reversibility					
	Irreplaceability	Low irreplaceability					
	Cumulative Impact						
	Cumulative Impact	3	4	4	1	11 - HIGH	
	Confidence		•	•	High		

Proposed Mitigation Measures (Impact Management Actions)

- No land clearing or construction activities is to take place prior to obtaining the necessary authorisations.
- Appoint an engineer to appropriately design all storm water facilities.
- Implement climb-out aids where practicable within all relevant construction trenches/foundations to prevent drowning of smaller faunal species or conduct daily inspections of all trenches to ensure removal of trapped species.

7.3 Construction Phase

7.3.1 Heritage Resources

Impacts identified

No heritage resources or sensitive heritage areas were identified within the study area. However, potential exists for heritage resources to be uncovered during excavations. Potential impacts include destruction or partial destruction of non-renewable heritage resources. During the construction phase, activities resulting in disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position archaeological material or objects.

Impact Assessment

The impact on heritage resources is rated as 'low' prior to the mitigation and is 'low' postmitigation. See Impact Assessment in Table 7-5.

Im	pact Description	Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)		
Impact	Direct Impact:		5	Significa	ince withou	ıt Mitigatior	n		
Impact Direction:	Negative	Existing Impact	1	1	1	0.1	0 - LOW		
Aspect:	Uncovering of heritage resources during excavation activities	Project Impact	1	1	1	0.1	0 - LOW		
Potential Imp	act:	Significance with Mitigation							
Destruction o	f heritage resources	Residual Impact	1	1	1	0.1	0 - LOW		
		Reversibility		Moderate reversibility					
		Irreplaceability			Modera	ate irreplace	ability		
				Cı	umulative Ir	npact			
		Cumulative Impact	1	1	1	0.1	0 - LOW		
			High						

Table 7-5: Impact on heritage resources during construction

Proposed Mitigation Measures (Impact Management Actions)

If, during construction any possible finds such as stone tool scatters, artefacts or bone and fossil remains are made, the operations must be stopped, and a qualified archaeologist must be contacted for an assessment of the find and therefore the CFP should be put in place as part of the EMPr (refer to the EMPr in Appendix J). A short summary of chance find procedures is discussed below and monitoring guidelines applicable to the CFP is discussed below and monitoring guidelines for this procedure are provided in Section 10.5.

This procedure applies to the developer's permanent employees, its subsidiaries, contractors and subcontractors, and service providers. The aim of this procedure is to establish monitoring and reporting procedures to ensure compliance with this policy and its associated procedures. Construction crews must be properly inducted to ensure they are fully aware of the procedures regarding chance finds as discussed below.

- If during the pre-construction phase, construction, operations or closure phases of this Project, any person employed by the developer, one of its subsidiaries, contractors and subcontractors, or service provider, finds any artefact of cultural significance or heritage site, this person must cease work at the site of the find and report this find to their immediate supervisor, and through their supervisor to the senior on-site manager.
- It is the responsibility of the senior on-site Manager to make an initial assessment of the extent of the find and confirm the extent of the work stoppage in that area.

• The senior on-site Manager will inform the ECO of the chance find and its immediate impact on operations. The ECO will then contact a professional archaeologist for an assessment of the finds who will notify the SAHRA.

There must be regular monitoring of the development footprint by the ECO, to implement the Chance Find Procedure (CFP) for heritage resources (outlined in Section 10.2) in case heritage resources are uncovered during construction.

Day to day monitoring can be conducted by the Environmental Control Officers (ECO). The ECO or other responsible persons should be trained along the following lines:

- Induction training: Responsible staff identified by the developer should attend a short course on heritage management and identification of heritage resources.
- Site monitoring and watching brief: As most heritage resources occur below surface, all earth-moving activities need to be routinely monitored in case of accidental discoveries. The greatest potential impacts are from pre-construction and construction activities. The ECO should monitor all such activities daily. If any heritage resources are found, the chance finds procedure must be followed as outlined above.

If risks are manifested (accidental discovery of heritage resources) the chance find procedure should be implemented:

- Cease all works immediately;
- Report incident to the Sustainability Manager;
- Contact an archaeologist/ palaeontologist to inspect the site;
- Report incident to the competent authority;
- Employ reasonable mitigation measures in accordance with the requirements of the relevant authorities;
- Only recommence operations once impacts have been mitigated.

7.3.2 Palaeontological Resources

Impacts identified

Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The geological structures suggest that the rocks are either much too old to contain body fossils but might have trace fossils of early microbes or microbial activity. Since there is an extremely small chance that trace fossils in the Nylstroom Subgroup and may be disturbed during excavations, the Chance Finds Procedure must be implemented.

Impact Assessment

The impact on fossil heritage resources is rated as 'low' prior to the mitigation and is 'low' postmitigation. See Impact Assessment in Table 7-6.

Im	pact Description	Impact type	Е	D	Р	L	IR&S	
Impact	Direct Impact:		Significance without Mitigation					
Impact Direction:	Negative	Existing Impact	1	1	1	0.1	0 - LOW	
Aspect:	Uncovering of fossil heritage resources during excavation activities	Project Impact	1	1	1	0.1	0 - LOW	
Potential Impact:		Significance with Mitigation						
Destruction palaeontolog	of fossil heritage / gical resources	Residual Impact	1	1	1	0.1	0 - LOW	
		Reversibility	Moderate reversibility					
		Irreplaceability			Mod	erate irre	eplaceability	
				Cu	mulative	e Impact		
			1	1	1	0.1	0 - LOW	
		Confidence	High					

Table 7-6: Impact on fossil heritage resources during construction

Proposed Mitigation Measures (Impact Management Actions)

• If fossils are found by the contractor, environmental officer or other responsible person once clearing of vegetation, excavations or drilling have commenced, then they should be rescued, and a Palaeontologist called to assess and collect a representative sample.

7.3.3 Impact on degradation of soil resources

Impacts identified

Although the soils along the study area are associated with a significantly low agricultural potential, soil degradation may occur as a result of construction activities.

Impact Assessment

The impact on soil resources is rated as 'low' prior to the mitigation and is 'low' post-mitigation. See Impact Assessment in Table 7-7.

Impact Description		Impact type	Е	D	Р	L	IR&S
Impact	Direct Impact:	Significance without Mitigation					
Impact Direction:	Negative	Existing Impact	1	1	1	0.1	0 - LOW
Aspect:	Construction activities	Project Impact	1	1	1	0.1	0 - LOW
Potential Impact:		Significance with Mitigation					

Table 7-7: Impact on degradation of soil resources during construction

Degradation of soil resources	Residual Impact	1	1	1	0.1	0 - LOW		
	Reversibility			Мс	derate r	eversibility		
	Irreplaceability		Moderate irreplaceability					
	Cumulative Impact							
	Cumulative Impact	1	1 1 1 0.1 0-LOW					
	Confidence	High						

Proposed Mitigation Measures (Impact Management Actions)

The following mitigation measures must be implemented:

- Vegetate or cover all stockpiles after stripping/removing soils;
- Storage of potential contaminants should be undertaken in bunded areas
- All contractors must have spill kits available and be trained in the correct use thereof.
- All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good "housekeeping".
- No cleaning or servicing of vehicles, machines and equipment may be undertaken in water resources.
- Have action plans on site, and training for contractors and employees in the event of spills, leaks and other impacts to the soil resources.

7.3.4 Impact on wetland degradation

Impacts identified

There may be impacts on wetlands as a result of upgrade to the culverts and bridges on the section of road that is to be upgraded. The following activities may cause degradation of the wetlands:

- Encroachment of construction vehicles into the wetland areas;
- Accidental spillage of hydrocarbons into the wetlands;
- Poor management of solid waste;
- Poor management of ablution facilities;
- Poor management of topsoil and overburden;
- Increased sediment loads;
- Increase in spread of alien invasive vegetation;
- Increase in dust emissions during construction;
- Increase in impermeable surfaces (e.g. road surfaces) may increase runoff from the site and may erode the wetlands; and
- Construction activities encroach into wetland areas.

Impact Assessment

The impact on wetland resources is rated as 'moderate' prior to the mitigation and is 'low' postmitigation. See Impact Assessment in Table 7-8.

Table 7-8: Impact on degradatio	n of wetlands during construction
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Impact Description		Impact type	E	D	Р	L	IR&S		
Impact	Direct Impact:	Significance without Mitigation							
Impact Direction:	Negative	Existing Impact	1	2	8	0.5	6 - MODERATE		
Aspect:	Encroachment of construction activities and vehicles into the wetland areas; Accidental spillage of hydrocarbons, poor management of solid waste, ablution facilities; topsoil and overburden into the wetlands. Increased sediment loads, increase in spread of alien invasive vegetation, Increase in dust emissions during construction and increase in impermeable surfaces (e.g. road surfaces) may increase runoff from the site and may erode the wetlands.	Project Impact	1	2	8	0.5	6 - MODERATE		
Potential Impact:		Significance with Mitigation							
Degradation of wetlands		Residual Impact	1	2	2	0.2	1 - LOW		
		Reversibility	Moderate reversibility						
		Irreplaceability	Low irreplaceability						
			Cumulative Impact						
		Cumulative Impact	1	1	1	0.1	0 - LOW		
		Confidence	High						

Proposed Mitigation Measures (Impact Management Actions)

The following mitigation measures must be implemented:

- Culvert and bridge upgrades should be done during the dry season, where possible.
- Traffic control must be implemented away from wetland areas.
- Provide vehicles with defined routes to be used when servicing the work and ensure that vehicles stick to these. Overflows or spills detected should be attended to promptly and a record of these should be kept up to date for audit purposes.

- Use scheduled construction times.
- Roads must be watered to ensure dust does not form and settle in the wetland area.
- Provide vehicles with defined routes to be used when servicing the work and ensure that vehicles stick to these. These routes must be ripped and planted with suitable indigenous vegetation once they are no longer needed. Vehicle movement must be closely controlled and kept out of the wetland areas as far as possible.
- Drainage must be designed to cope with estimated runoff and water calming measures must be constructed with outflow into the wetlands. Well-designed infrastructure with water calming devices will reduce the risks.
- Management to ensure that personnel are properly trained and supervised around wetland areas.
- Strict control should be exercised over the correct waste disposal procedure.
- Ablution facilities conforming to SABS standards must be provided and may only be placed far away from wetlands.
- There must be properly trained and equipped personnel on site to clean up any spillage. In addition, the reporting procedures must be clearly spelt out and followed. Close supervision of all staff involved in this activity is essential.
- Care must be taken to keep topsoil separate from subsoil when excavations are undertaken. This must be replaced in the correct way once the work is complete. Topsoil must not be stored in wetland areas where they can limit wetland function.
- Any overburden should be handled in the same way as the topsoil. Work should be planned for a time when the chance of rain is reduced.
- In addition, sediment traps must be in place to contain any sediment in the runoff. Sediment pollution must be adequately controlled.
- There must be an ongoing programme of removing invasive vegetation in the wetland areas affected. This will require ongoing monitoring and control activities after the completion of the construction phase.

7.3.5 Impact on the associated river systems and degradation of aquatic habitat

Impacts identified

Construction activities within the associated river systems may lead to the lowering of the PES and EIS of the associated river systems and the degradation of aquatic habitat.

Impact Assessment

The significance ratings of the impacts on the aquatic resources before mitigation is rated as 'moderate'. With the implementation of mitigation and management measures as proposed by the aquatic specialist, the impact significance will be 'moderate', as is evident from Table 7-9.

Impact Description		Impact type	E	D	Р	L	IR&S		
Impact	Direct Impact:	Significance without Mitigation							
Impact Direction:	Negative	Existing Impact	1	1	1	0.1	0 - LOW		
Aspect:	Construction activities within the associated river systems	Project Impact	2	3	4	0.5	5 - MODERATE		
Potential Impact:		Significance with Mitigation							
Lowering of PES and EIS of the associated river systems and degradation of the aquatic habitat		Residual Impact	1	2	2	0.5	3 - MODERATE		
		Reversibility	Moderate reversibility						
		Irreplaceability	Low irreplaceability						
		Cumulative Impact							
		Cumulative Impact	1	1	1	0.1	0 - LOW		
		Confidence	High						

Table 7-9: Impact on associated river systems and degradation of the aquatic habitat during construction

Proposed Mitigation Measures (Impact Management Actions)

The following mitigation measures must be implemented:

- Ensure that an ECO be present during the construction activities within the regulated areas of the river systems.
- During construction, the appointed ECO must undertake monthly In-Situ water quality samples at the effected drainage line/river crossings. Should there be significant changes in the water quality during construction, an Aquatic Ecologist must be appointed to provide recommendations to minimise the impacts on the watercourses. The first and last samples of the construction monitoring must be taken to a laboratory for analysis.
- Biomonitoring is required to be undertaken in the event of an incident, in order to identify the extent of the said incident on the effected watercourse.

7.3.6 Impact on alteration of aquatic habitat

Impacts identified

The operation of heavy machinery and equipment (including excavations) in close proximity to the watercourse may cause removal and excavation of the aquatic habitat, compaction of soil and altering of hydromorphic soils.

Impact Assessment

The significance ratings of the impacts on the aquatic resources before mitigation is rated as 'high'. With the implementation of mitigation and management measures as proposed by the aquatic specialist, the impact significance will be 'low', as is evident from Table 7-10.
Imp	oact Description	Impact type	E	D	Р	L	IR&S		
Impact	Direct Impact:		Significa	nce witho	ut Mitiga	tion			
Impact Direction:	Negative	Existing Impact	1	1	1	0.1	0 - LOW		
Aspect:	Operation of heavy machinery and equipment (including excavations) in close proximity to the watercourse	Project Impact	2	3	8	1	13 - HIGH		
Potential Impa	act:	Significance with Mitigation							
Removal and	d excavation of aquatic	Residual Impact	1	1	1	0.5	2 - LOW		
habitat, com	paction of soil, altering	Reversibility			Moderate	reversibil	ity		
nyaromorphic	SOIIS	Irreplaceability			Low irrep	placeabilit	у		
			Cu	mulative	Impact				
		Cumulative Impact	1	1	1	0.1	0 - LOW		
		Confidence		High					

Table 7-10: Impact on alteration of the aquatic habitat during construction

Proposed Mitigation Measures (Impact Management Actions)

The following mitigation measures must be implemented:

- Ensure that an ECO be present during the construction activities within the regulated areas of the river systems.
- During construction, the appointed ECO must undertake monthly In-Situ water quality samples at the effected drainage line/river crossings. Should there be significant changes in the water quality during construction, an Aquatic Ecologist must be appointed to provide recommendations to minimise the impacts on the watercourses. The first and last samples of the construction monitoring must be taken to a laboratory for analysis.
- Biomonitoring is required to be undertaken in the event of an incident, in order to identify the extent of the said incident on the effected watercourse.

7.3.7 Impact on water quality impairment of drainage lines and river systems

Impacts identified

Water quality impairment of the drainage lines and river systems may occur due to poor management use of ablution facilities, domestic and industrial waste, storage of chemicals and accidental spillage of hydrocarbons from construction vehicles and machinery within or close to the watercourses. This may have long-term impacts on fauna and flora.

Impact Assessment

The significance ratings of the impacts on the aquatic resources before mitigation is rated as 'moderate'. With the implementation of mitigation and management measures as proposed by the aquatic specialist, the impact significance will be 'low', as is evident from Table 7-11.

Im	pact Description	Impact type	E	D	Р	L	IR&S	
Impact	Direct Impact:	In the second se	Significa	nce witho	out Mitiga	tion		
Impact Direction:	Negative	Existing Impact	2	1	2	0.2	1 - LOW	
Aspect:	Ablution facilities domestic and industrial waste, storage of chemicals, mixes and fuel of machinery working within or close to the watercourses	Project Impact	1	2	8	0.5	6 - MODERATE	
Potential Imp	act:	Significance with Mitigation						
Water quality	impairment of the drainage	Residual Impact	1	2	2	0.2	1 - LOW	
lines and rive	r systems	Reversibility	Moderate reversibility					
		Irreplaceability			Low irre	olaceabilit	у	
			Cu	mulative	Impact			
		Cumulative Impact	1	1	1	0.1	0 - LOW	
		Confidence	High					

Table 7-11: Impact on water quality impairment of drainage lines and river systems during construction

Proposed Mitigation Measures (Impact Management Actions)

The following mitigation measures must be implemented:

- Ensure that an ECO be present during the construction activities within the regulated areas of the river systems.
- During construction, the appointed ECO must undertake monthly In-Situ water quality samples at the effected drainage line/river crossings. Should there be significant changes in the water quality during construction, an Aquatic Ecologist must be appointed to provide recommendations to minimise the impacts on the watercourses. The first and last samples of the construction monitoring must be taken to a laboratory for analysis.
- Biomonitoring is required to be undertaken in the event of an incident, in order to identify the extent of the said incident on the effected watercourse.
- Appropriate sanitary facilities must be provided for the duration of the proposed development and all waste removed to an appropriate waste facility.
- Excess waste or chemicals should be removed from site and discarded in an environmentally friendly way. The Environmental Control Officer (ECO) should enforce this rule rigorously.

- Hazardous chemicals to be stored on an impervious surface protected from rainfall and stormwater runoff.
- Spill kits should be on-hand to deal with spills immediately.
- Ensure that regular inspection of vehicles and ablution facilities are done.
- All vehicles should be inspected for oil and fuel leaks on a regular basis. Vehicle maintenance yards on site should make provision for drip trays to capture spills. Drip trays should be emptied into a holding tank and returned to the supplier.
- Keep the site camps with ablution facilities out of the regulated areas where possible.
- Implement standard dust control measures, including periodic spraying (frequency will depend on many factors including weather conditions, soil composition and traffic intensity and must thus be adapted on an on-going basis) and chemical dust suppressants of construction areas and access roads, and ensure that these are continuously monitored to ensure effective implementation.
- Limit pesticide use to non-persistent, immobile pesticides and apply in accordance with the label and application permit directions and stipulations for terrestrial and aquatic applications.
- No dumping of waste should take place within the aquatic features or their buffer zones.
- Ensure that all activities impacting on groundwater and surface water resources are managed according to the relevant DWS Licensing regulations and monitoring and management requirements.

7.3.8 Impacts on noise

Impacts identified

Construction activities and the movement of construction vehicles may increase the ambient noise levels within the area during the construction phase.

Impact Assessment

The impact of noise is rated as 'low' prior to the mitigation and is 'low' post-mitigation. See Impact Assessment in Table 7-12.

In	pact Description	Impact type	Е	D	Р	L	IR&S			
Impact	Direct Impact:		Significance without Mitigation							
Impact Direction:	Negative	Existing Impact	1	1	1	0.1	0 - LOW			
Aspect:	Construction activities and the movement of construction vehicles	Project Impact	1	1	1	0.1	0 - LOW			
Potential Im	<u>pact:</u>			Signific	ance wi	th Mitiga	ation			
Increased ambient noise levels		Residual Impact	1	1	1	0.1	0 - LOW			
		Reversibility	Moderate reversibility							

Table 7-12: Impact of noise during construction

Irreplaceability			Mod	erate irre	placeability		
Cumulative Impact							
Cumulative Impact	1	1	1	0.1	0 - LOW		
Confidence	High						

Proposed Mitigation Measures (Impact Management Actions)

- Construction times must be restricted to working hours (06:00-18:00).
- All construction equipment or machinery should be switched off when not in use.
- Construction equipment must be kept in good working condition.

7.3.9 Impacts on air quality

Impacts identified

Changes to the ambient air quality in the immediate vicinity of the project can be expected during the construction phase. During construction, this will primarily be a result of land clearance, construction vehicles travelling on exposed surfaces and earthworks in the form of dust generation. This impact will be of a short-term duration.

Impact Assessment

The impacts on the ambient air quality is rated as 'low' prior to the mitigation and is 'low' postmitigation. See Impact Assessment in Table 7-13.

In	pact Description	Impact type	Е	D	Р	L	IR&S	
Impact	Direct Impact:		S	ignificar	nce with	out Miti	gation	
Impact Direction:	Negative	Existing Impact	1	1	1	0.1	0 - LOW	
Aspect:	Transportation vehicles travelling over exposed surfaces, earthworks and the wind	Project Impact	1	1	1	0.1	0 - LOW	
Potential Im	<u>pact:</u>	Significance with Mitigation						
Increased le	evels of ambient dust	Residual Impact	1	1 1 1 0.1 0-LOW				
		Reversibility			Мс	oderate r	eversibility	
		Irreplaceability			Mod	erate irre	eplaceability	
				Cu	mulative	e Impact	:	
		Cumulative Impact	1	1	1	0.1	0 - LOW	
		Confidence	High					

Table 7-13: Impact on ambient air quality during construction

Proposed Mitigation Measures (Impact Management Actions)

- Appropriate dust suppression methods must be applied.
- Exposed soil stockpiles shall be covered, kept damp or protected using organic binding agents or alternative techniques that are not water intensive.
- The clearing of vegetation must be kept to a minimum and only where required.
- Avoid unnecessary movement of construction vehicles.
- Vehicles travelling on unsurfaced roads must travel at a speed that creates minimal dust entrainment.

7.3.10 Impacts on traffic congestion

Impacts identified

Due to construction activities and associated machinery movement, the traffic patterns of the surrounding roads network will be affected. Peak hour ranges from 07h00 to 08h00.

Impact Assessment

The impact of traffic congestion is rated as 'high' prior to the mitigation and is 'low' post-mitigation. See Impact Assessment in Table 7-14.

Table 7-14: Impact of traffic congestion during construction

Im	pact Description	Impact type	Ε	D	Р	L	IR&S	
Impact	Direct Impact:		S	ignificar	nce with	out Miti	gation	
Impact Direction:	Negative	Existing Impact	1	2	2	0.5	3- MODERATE	
Aspect:	Construction activities associated with the upgrade of the R33	Project Impact	2	3	8	1	13 - HIGH	
Potential Im	pact:		Significance with Mitigation			ation		
Increased tr	affic congestion	Residual Impact	1	1	1	0.1	0 - LOW	
		Reversibility			Мс	derate r	eversibility	
		Irreplaceability			Mod	erate irre	eplaceability	
				Cu	mulative	e Impact	:	
		Cumulative Impact	1	1	1	0.1	0 - LOW	
		Confidence	High					

Proposed Mitigation Measures (Impact Management Actions)

The accommodation of traffic strategy would typically consist of the half-width construction for the proposed road upgrade.

Traffic must be accommodated as follows, where possible:

- Two-way traffic proceeds on the existing road.
- Construct widening for traffic accommodation,
- Two-way traffic then proceeds on the temporary widening and a portion of the existing road.
- The right-hand or left-hand side is then construction to final level.
- Two-way traffic then proceeds on the newly completed right-hand or left-hand side.
- The left-hand or right-hand side is then constructed to final level.

The new bridge will be built in half-widths up to a particular point, allowing traffic to be transferred from one road alignment to the next before demolition of the existing bridge allowing completion of the second half of the bridge. The proposed stage construction allows for sufficient working space and considers the approach to the bridge which will require an embankment constructed at a slope of 1:1 near the bridge, flattening out further away from the bridge as the vertical alignment of the new converges to the original alignment.

The concept confirms that the option selected would not be influenced by accommodation of traffic.

7.3.11 Potential increase in erosion due to clearance of vegetation

Impacts identified

Vegetation cover establishes areas of soil stability. Clearance of vegetation may lead to rapid soil erosion. Consequences of this may include:

- Loss of indigenous vegetation.
- Change in plant species composition.
- Change in soil chemical properties.
- Fragmentation of sensitive habitats.
- Hydrological impacts due to increased transpiration and runoff; and
- Loss of soil layers.

Impact Assessment

The significance ratings of the impacts on erosion before mitigation is rated as 'moderate'. With the implementation of mitigation and management measures as proposed by the ecologist, the impact significance is 'high', as is evident from Table 7-15.

Table 7-15: Impact on terrestrial biodiversity during construction

Impact Description		Impact type E E		D	Р	L	IR&S
Impact	Direct Impact:	Significance without Mitigation					

Impact	Description	Impact type	Ε	D	Р	L	IR&S	
Impact Direction:	Negative	Existing Impact	2	1	4	0.75	5 - MOD	
Aspect:	Clearance of vegetation	Project Impact	2	1	4	0.75	5 - MOD	
Potential Impac	<u>t:</u>	Significance with Mitigation						
Increased erosion due to clearance of		Residual Impact	1	1	1	0.5	2 - LOW	
vegetation as so	bils are highly erodible	Reversibility	Moderate reversibility					
vegetation cove	r absence of	Irreplaceability		L	ow irrepla	ceability		
		Cumulative Impact						
		Cumulative Impact	1	1	1	0.1	0 - LOW	
		Confidence	Medium					

Proposed Mitigation Measures (Impact Management Actions)

- Do not clear large areas of indigenous vegetation at a time, without work being conducted in that specific area.
- Erosion control must be implemented where vegetation cover is removed by strict monitoring and implementing erosion control measures where needed.
- Use of siltation bags, berms or gabions can reduce erosion by slowing the run of water.
- Revegetation of cleared areas must be undertaken as soon as possible. Reseed any areas where earthworks have taken place with indigenous grasses to prevent further erosion.
- Topsoil stockpiles must be protected from erosion.
- Topsoil must be protected from getting washed into drainage ways.
- Compaction of soils should be limited and / or avoided as far as possible. Compaction will reduce water infiltration and will result in increased runoff and erosion. Where any disturbance of the soil takes place (have taken place in the past), these areas must be stabilised and any alien plants which establish should be cleared and follow-up undertaken for at least 2 years thereafter and preferably longer.
- Where compaction becomes apparent, remedial measures must be taken (e.g., "ripping" the affected area).
- A stormwater plan must be developed with the aid of an engineer to ensure that water runoff is diverted off the site without pooling and stagnation or erosion.
- The use of machinery within the aquatic areas area will lead to compaction of soils and destruction of vegetation and must therefore be strictly controlled.
- Appropriate buffer zones should be implemented around the aquatic areas, where required, to prevent sediment changes.

7.3.12 Fragmentation of vegetation continuity

Impacts identified

Vegetation continuity is needed to ensure that fragmentation is avoided. Fragmented vegetation is susceptible to change from invasive plant species and the edge effect.

Consequences of this may include the following:

- Loss of indigenous vegetation.
- Change in plant species composition.
- Fragmentation of sensitive habitats.

Impact Assessment

The significance ratings of the impacts of fragmentation of vegetation continuity before mitigation is rated as 'moderate'. With the implementation of mitigation and management measures as proposed by the ecologist, the impact significance is low', as is evident from Table 7-16.

Impact	Description	Impact type	E	D	Р	L	IR&S	
Impact	Direct Impact:	Si	ignificanc	e without N	litigation			
Impact Direction:	Negative	Existing Impact	2	1	4	0.75	5 - MOD	
Aspect:	Clearance of vegetation	Project Impact	2	1	4	0.75	5 - MOD	
Potential Impact	<u>t:</u>		Significance with Mitigation					
Disruption of co	ontinuity of vegetation	Residual Impact	1 1 1 0.1 0-LOW				0 - LOW	
communities		Reversibility	Moderate reversibility					
		Irreplaceability		L	ow irrepla	aceability		
		Cumulative Impact						
		Cumulative Impact	1	1	1	0.1	0 - LOW	
		Confidence	Medium					

Table 7-16: Impact on fragmentation of vegetation community during construction

Proposed Mitigation Measures (Impact Management Actions)

Ensure that new temporary access roads are not established parallel to the existing R33 and road reserve that may contribute to fragmentation of existing intact vegetation communities.

7.3.13 Loss of faunal habitat

Impacts identified

Site clearing and destruction of faunal habitat leading to increased habitat loss, disturbance of sensitive species and alteration of natural food webs. Fire hazards as result of cooking by construction personnel will lead to loss in habitat, especially if an overnight camp will be located on the site and also if security is allowed to make fires during night patrols. Inadequate solid waste management could attract scavenging animals into the footprint area. Habitat loss will lead to disturbance of sensitive species and alteration of food webs.

Impact Assessment

The significance ratings of the impacts before mitigation is rated as 'moderate'. However, with the implementation of mitigation and management measures as proposed by the specialist, the impact significance will be reduced to 'low', as is evident from Table 7-17.

Impact	Description	Impact type	Е	D	Р	L	IR&S	
Impact	Direct Impact:	Si	gnificand	e without N	<i>l</i> itigation			
Impact Direction:	Negative	Existing Impact					n/a	
Aspect:	Habitat loss, disturbance of sensitive species and alteration of food webs	Project Impact	2	2	8	0.75	9 - MOD	
Potential Impact	<u>t:</u>	Significance with Mitigation						
Loss of faunal h	abitat	Residual Impact	1	2	4	0.2	1 - LOW	
		Reversibility	Low reversibility					
		Irreplaceability		Mo	derate irre	placeabili	ty	
		Cumulative Impact						
		Cumulative Impact	3	4	8	0.75	11 - HIGH	
		Confidence			Medi	um		

 Table 7-17: Impact on loss of faunal habitat during the construction phase

Proposed Mitigation Measures (Impact Management Actions)

The following mitigation measures must be implemented:

- Only areas targeted for the proposed development should be cleared of vegetation, no other areas.
- Access to the site must only be through existing roads or authorised roads and as approved by the engineer and the Environmental Control Officer (ECO).

- Continuous rehabilitation and maintenance of the construction site should occur during construction. Seed mixes should match the surrounding vegetation types.
- Animals may under no circumstances be handled, removed, killed or interfered with by the Contractor, his employees, his Sub-Contractors or his Subcontractors' employees. This includes foraging, food and wood collecting outside of the road construction site.
- If animals become trapped in trenches and diggings, a specialist must be contacted to adequately and safely remove these and relocate them to the adjacent habitat.
- Implement speed limits on access roads to prevent unnecessary killing of animals by vehicles.
- No burning of material should be allowed on site. If required, access road maintenance should include cutting and removal of vegetation rather than seasonal burning.
- Snaring and poaching by employees are strictly forbidden. Regular snare assessment and removal actions are recommended.
- Suitable terrestrial movement corridors such as the watercourse areas should be demarcated as no-go areas where possible to facilitate safe movement of animals.
- Measures must be taken to ensure that workers are aware of laws and restrictions governing the hunting, capturing or trapping of animals and should be advised on the penalties associated with the needless destruction of wildlife.
- Conservation orientated clauses should be built into Contracts for personnel, complete with penalty clauses for non-compliance.
- The surface infrastructure site should be well demarcated, and workers should not enter into adjacent areas.
- Limit artificial lighting, which attracts faunal species. Yellow Sodium lighting is recommended as they do not attract invertebrates at night and will not disturb the existing wildlife within the study area.
- The site must be kept clean and tidy and free from litter that could attract rodents and other animal species.

7.3.14 Visual

Impacts identified

The proposed development will occur along the existing road reserve of the R33. There are several land uses occurring adjacent to the R33 i.e. Department of Correctional Services, Koro Creek Golf Estate (residential area), vacant land, agricultural holdings, lodges/resorts/game ranches, place of leisure/restaurants and craft markets, retirement villages, place of worship and railway lines.

There are limited visual receptors in a small portion of the southern part of the study area who may have sight of the proposed construction activities. However, construction activities will be of a short-term duration.

Impact Assessment

The significance ratings of the visual impacts before mitigation is rated as Low. With the implementation of mitigation and management measures, the impact significance will be low, as is evident from Table 7-18.

Ir	npact Description	Impact type	E	D	Р	L	IR&S
Impact	Indirect Impact:		Significa	nce without	t Mitigatio	on	
Impact Direction:	Negative	Existing Impact	1	1	1	0.5	2 - LOW
Aspect:	Construction activities and placement of construction equipment on site	Project Impact	1	1	1	0.5	2 - LOW
Potential Im	pact:	Significance with Mitigation					
Alteration of	f visual character of the site	Residual Impact	1	1	1	0.1	0 - LOW
		Reversibility	High reversibility				
		Irreplaceability		Reso	ources are	replacea	ble
		Cumulative Impact					
		Cumulative Impact	1	1	1	0.1	0 - LOW
		Confidence	High				

Proposed Mitigation Measures (Impact Management Actions)

The following mitigation measures must be implemented:

- The construction area must at all times be neat and tidy.
- All litter must be collected and removed (daily) and disposed of appropriately.
- Equipment and construction vehicles must be stored or parked in designated areas.
- The construction camp must be screened with shade cloth.
- If construction is necessary during night-time, light sources should be directed inwards and downwards to prevent obtrusive lighting and light pollution.
- Dust suppression techniques should be implemented especially on windy days. Exposed soil stockpiles shall be covered, kept damp or protected using organic binding agents or alternative techniques that are not water intensive.

7.3.15 Socio-economic

Impacts identified

Due to the high percentage of unemployment in the area, sufficient unskilled labour is available for the project and the community in which the labour resides in close proximity to the development site. The project must be used from the start to train people and transfer skills as far as possible. The tender specifications for any construction work on the project must include a

compulsory utilisation of a certain percentage of local labour and the compulsory training of local labour.

Construction activities will be a short duration temporary employment opportunity will be created. Job opportunities may be created during the construction phase that will benefit the local community on a short-term basis for several construction activities such as, the clearing and grubbing, installation of subsoil drains, installation of new culverts and lengthening of the existing culverts, construction of concrete lining for open drains, installation of guard rails, erection of fencing and road signs, road markings, cleaning of the hydraulic structures, excavation for open drains, clearing and shaping of existing open drains and excavations.

Impact Assessment

In light of the above, the project will positively impact on the surrounding community and local economy due to possible skills development and income generation. This impact is predicted to have a low positive significance. Refer to Table 7-19.

Impact Description		Impact type	Е	D	Р	L	IR&S	
Impact	Direct Impact:		Significa	nce without	Mitigatio	n		
Impact Direction:	Positive	Existing Impact	1	1	1	0.1	0 - LOW	
Aspect:	Construction activities	Project Impact 1 1		1	1	0.1	0 - LOW	
Potential Impact:		Significance with Mitigation						
Temporary job creation		Residual Impact	1	1	1	0.5	2 - LOW	
		Reversibility	/ High irreplaceability					
		Irreplaceability		Reso	ources are	replace	able	
		Cumulative Impact						
		Cumulative Impact	1	1	1	0.1	0 - LOW	
		Confidence	Medium					

Table 7-19: Temporary job creation on site during construction

Proposed Mitigation Measures (Impact Management Actions)

The following mitigation measures must be implemented to enhance the positive impact:

- As far as possible, employ local residents during construction, where applicable. This will ensure a reduced dependency on temporary employment in addition to enhancing the living standards of local people.
- Use manual labour where possible and practical.
- Ensure recruitment measures are aimed particularly at construction workers classified as designated employees in terms of the Employment Equity Act (black people, as defined in the Act, women, and disabled people). A local employment procedure and recruitment process should be developed in consultation with local authorities and representatives.

Eskom should ensure that a transparent process of employment is followed to limit opportunities for conflict situations.

• Ensure that the Labour Relations Amendment Act, 2002 (Act No. 12 of 2002) as well as the necessary policies and procedures are taken into consideration to ensure the correct procurement procedures.

7.4 Operational Phase

7.4.1 Heritage Resources

No impacts are expected during the operation phase. As such, no impact assessment was undertaken.

7.4.2 Palaeontological Resources

No impacts are expected during the operation phase. As such, no impact assessment was undertaken.

7.4.3 Impact on wetland degradation

Impacts identified

There may be degradation of the wetlands as a result of the following activities:

- Spills of fuel, pesticide, or other chemicals.
- Spread of alien invasive vegetation.
- Maintenance activities.

Impact Assessment

The impact on wetland resources is rated as 'moderate' prior to the mitigation and is 'low' postmitigation. See Impact Assessment in Table 7-20.

Table 7-20: Impact on degradation of wetlands during construction

Impact Description		Impact type	E	D	Р	L	IR&S
Impact	Direct Impact:		Significa	nce witho	ut Mitiga	tion	
Impact Direction:	Negative	Existing Impact	1	2	8	0.5	6 - MODERATE
Aspect:	Spills of fuel, pesticide, or other chemicals. Spread of alien invasive vegetation. Maintenance activities.	Project Impact	1	2	8	0.5	6 - MODERATE
Potential Impact:		Significance with Mitigation					
Degradation of wetlands		Residual Impact	1	2	2	0.2	1 - LOW
		Reversibility	Moderate reversibility				

Impact Description	Impact type	Ε	D	Р	L	IR&S	
	Irreplaceability	ability Low irreplaceability					
	Cumulative Impact						
	Cumulative Impact	1	1	1	0.1	0 - LOW	
	Confidence	High					

Proposed Mitigation Measures (Impact Management Actions)

The following mitigation measures must be implemented:

- A protocol must be in place by the applicant regarding spillages of fuels, pesticides or chemicals into the wetland areas. These refer to protocols that will be in place in an emergency situation. The protocol must outline actions to be taken and must be widely communicated to all staff. Where necessary, the appropriate authorities must be notified. This is normally required within 24 hours but must be stated in the protocol.
- There must be an ongoing programme to control invasive vegetation.
- All problems identified should be attended to timeously and the wetland should be protected.
- The upgraded road must be properly maintained and kept clean.

7.4.4 Socio-economic

No impacts are expected during the operation phase. As such, no impact assessment was undertaken.

7.4.5 Visual

No impacts are expected during the operation phase. As such, no impact assessment was undertaken.

7.4.6 Impacts on traffic

Impacts identified

An improved Level of Service (LOS) in terms of traffic flow along the R33 (positive impact) is expected.

The upgraded R33 will have a positive impact in terms of traffic safety and improved levels of service in the next 25 years due to increased road capacity to accommodate ease of traffic flow.

Impact Assessment

In light of the above, the project will positively impact on the flow of traffic due to the projected improvement in LOS. This impact is predicted to have a low positive significance. Refer to Table 7-21.

Impact Description		Impact type	Е	D	Р	L	IR&S	
Impact	Direct Impact:	Significance without Mitigation						
Impact Direction:	Positive	Existing Impact	1	1	1	0.1	0 - LOW	
Aspect:	Operation of the upgraded R33	Project Impact	1	1	1	0.1	0 - LOW	
Potential Impact:		Significance with Mitigation						
Improved level of service in terms of traffic flow along the R33		Residual Impact	1	1	1	0.1	0 - LOW	
		Reversibility	Moderate reversibility					
		Irreplaceability	Moderate irreplaceability					
			Cumulative Impact					
		Cumulative Impact	1	1	1	0.1	0 - LOW	
		Confidence	High					

Table 7-21: Impact on traffic flow during the operational phase

Proposed Mitigation Measures (Impact Management Actions)

The recommendation of the preliminary traffic assessment is that the existing R33 be upgraded as per the Project Description in Section 2.4, based on traffic flow and safety considerations.

7.4.7 Increase in erosion and sedimentation of aquatic resources

Impacts identified

The use of heavy machinery during maintenance of the development will result in the compaction of soil, resulting in decreased infiltration of rainwater and increased surface run-off volumes and velocities leading to a greater erosion risk. The hardened surfaces of the road and compacted soils of the proposed development area will also lead to an increase in surface run-off during storms.

This can lead to erosion in the cleared areas until vegetation has been re-established and sedimentation in the aquatic features.

The impact of soil erosion and sedimentation on aquatic resources is rated as 'moderate' prior to the mitigation and is 'low' post-mitigation. See Impact Assessment in Table 7-22.

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Impact Description		Impact type	Е	D	Р	L	IR&S		
Impact	Direct Impact:	Significance without Mitigation							
Impact Direction:	Positive	Existing Impact	2	2	2	0.2	1 - LOW		
Aspect:	Soil erosion as result of cleared areas in the process of being rehabilitated and increased runoff. Potential sedimentation of aquatic features.	Project Impact	2	2	4	0.5	4 - MODERATE		
Potential Im	<u>pact:</u>	Significance with Mitigation							
Erosion and features	sedimentation of aquatic	Residual Impact	1	1	1	0.1	0 - LOW		
		Reversibility		High reversibility					
		Irreplaceability	Low irreplaceability						
			Cumulative Impact						
		Cumulative Impact	3	4	4	0.75	8 - MODERATE		
		Confidence	High						

Table 7-22: Impact of erosion and sedimentation on aquatic resources during the operational phase

Proposed Mitigation Measures (Impact Management Actions)

Compaction of soils should be limited and / or avoided as far as possible. Compaction will reduce water infiltration and will result in increased runoff and erosion. Where any disturbance of the soil takes place (have taken place in the past), these areas must be stabilised and any alien plants which establish should be cleared and follow-up undertaken for at least 2 years thereafter and preferably longer. Where compaction becomes apparent, remedial measures must be taken (e.g., "ripping" the affected area).

Continuously reseed any exposed or hardened areas (excluding the road itself) during maintenance with indigenous grasses to prevent erosion.

Erosion control mechanisms must be established where necessary.

The stormwater plan must be implemented and must be kept clean and free of debris build-up.

The indiscriminate use of machinery or movement within the aquatic areas area will lead to compaction of soils and destruction of vegetation and must therefore be strictly controlled.

7.4.8 Increase in spread of declared weeds and alien invader plants

Impacts identified

Major factors contributing to invasion by alien invader plants includes inter alia high disturbance (such as clearing for construction activities) and negative grazing practices. Exotic species are often more prominent near infrastructural disturbances than further away.

Consequences of this may include:

- Loss of indigenous vegetation.
- Change in vegetation structure leading to change in various habitat characteristics.
- Change in plant species composition.
- Change in soil chemical properties.
- Loss of sensitive habitats.
- Loss or disturbance to individuals of rare, endangered, endemic and/or protected species.
- Fragmentation of sensitive habitats.
- Change in flammability of vegetation, depending on alien species.
- Hydrological impacts due to increased transpiration and runoff; and
- Impairment of wetland function.

There are several alien species that may become problematic in the study area. There is therefore the potential for alien plants to spread or invade following disturbance on site. Drainage features are important faunal corridors and habitat within the study area enabling movement through the landscape and past the road as well as for permanent establishment. Alien vegetation establishment might displace less tolerant species that prefers natural habitat.

Impact Assessment

The significance ratings of the impacts before mitigation is rated as 'high'. However, with the implementation of mitigation and management measures as proposed by the specialist, the impact significance will be reduced to 'low', as is evident from Table 7-23.

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)	
Impact	Direct Impact:	S	ignificand	ce without I	Vitigation			
Impact Direction:	Negative	Existing Impact	2	2	8	1	12 - HIGH	
Aspect:	Clearance of vegetation	Project Impact	2	2	8	1	12 - HIGH	
Potential Impa	act:	Significance with Mitigation						
Establishment	t and spread of declared	Residual Impact	1	1	1	0.1	0 - LOW	
weeds and ali	en invader plants	Reversibility	High reversibility					
		Irreplaceability	Low irreplaceability					
		Cumulative Impact						
		Cumulative Impact	2	1	4	0.75	5 - MODERATE	
		Confidence		Medium				

Table 7-23: Impact on increase in spread of declared weeds and alien invader plants during the operational phase

Proposed Mitigation Measures (Impact Management Actions)

Alien Invasive plants on site must be controlled by physical or chemical control. Physical removal is advised and when chemical removal is considered, only registered herbicides must be used. Use of herbicides close to watercourses must be avoided and if needed, only approved herbicides for use close to water may be used. An on-going monitoring programme should be implemented to detect and quantify any alien invasive plants that may establish on site. Patches of Giant Spanish reeds that infested the river areas must be controlled by means of an alien invasive management programme. This plan must set specific targets for treatment and follow-ups.

7.5 Decommissioning Phase

Decommissioning of the proposed upgraded R33 is not envisaged as it will be permanent infrastructure, as per the future traffic growth and demand in the region for the next 25-year horizon.

7.6 Assessment of 'Do Nothing' Alternative or 'No-Go' Alternative

The do-nothing' alternative (i.e. no-go alternative) is the option of not constructing the development and operation of the proposed R33 upgrade. Should this alternative be selected, the status quo of the environment will remain. Should the DFFE decline the application, the biophysical and socio-economic impacts (as indicated in Section 7) would not occur.

There would be a lack of road infrastructure to meet the traffic growth demand in the next 25 years, based on a growth rate of 2.5% per annum that is projected nationally on SANRAL routes. There could be a traffic congestion due to the future growth in housing establishments at the Modimolle area and expansion of the Koro Creek Golf Estate and the increase in motorists travelling along the tourist route.

There would be no job opportunities that would be created during the construction phase, to benefit the local community on a short-term basis for several construction activities. Therefore, there would be no short-term economic opportunities created, and skills transfer to the local communities during the construction phase.

Therefore, the no-go alternative is not considered to be feasible.

8 ASSESSMENT OF POTENTIAL CUMULATIVE IMPACTS

One of the key information requirements as set out in Appendix 1 of the NEMA EIA regulations, 2014, as amended is the assessment of potentially significant cumulative impacts and risks that may be associated with a proposed development.

The definition of "cumulative impact" in terms of the NEMA EIA Regulations, 2014, as amended state that cumulative impact: "in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities". A key aspect of considering cumulative impacts is therefore the consideration of project impacts together with impacts that may arise from similar developments within a reasonable proximity to the proposed development that is being assessed.

The proposed R33 road upgrade is required to address the growth in traffic projected for the 25 - year horizon. The proposed development is therefore site-specific. Potential cumulative impacts associated with the proposed road upgrade project are discussed in this chapter.

8.1 Degradation of aquatic resources

Impacts from other developments such as the existing roads, resorts and other infrastructure may have a 'low' cumulative impact on aquatic resources. A baseline assessment was done taking into consideration these cumulative impacts. The mitigation measures associated with the following impacts (Section 7.3.5 to 7.3.7) must be implemented:

- Impact on the associated river systems and degradation of aquatic habitat
- Impact on alteration of aquatic habitat
- Impact on water quality impairment of drainage lines and river systems

8.2 Terrestrial Biodiversity

8.2.1 Loss and Fragmentation of indigenous natural vegetation

The current road reserve shows signs of secondary vegetation growth mainly consisting of grass vegetation which is a buffer for the edge effect that impacts adjacent indigenous vegetation. Clearance of vegetation adjacent to the existing R33 will lead to an extension of the edge effect and will impact on the bushveld vegetation cumulatively. The impacts on loss and fragmentation of indigenous vegetation is 'moderate'. The mitigation measures as listed in Section 7.5.12 must be implemented.

8.2.2 Loss of individuals of threatened plants

The loss of plants of conservational concern may lead to pressure in the conservation status of those plants and could increase its protection status. The impacts on loss of individuals of threatened plants is 'low'. The mitigation measures as listed in Section 7.2.9 must be implemented.

8.2.3 Loss of protected tree species

Marula trees are Least Concerned, but they are protected trees. These trees can easily be grown from seed and the loss of clearance of vegetation impacts the age factor of the trees in the area. The impacts on loss of protected tree species is 'low'. The mitigation measures as listed in Section 7.2.8 must be implemented.

8.2.4 Impact on faunal species habitat

Inadequate planning and design could have a ripple effect causing impacts on disturbance of faunal habitat throughout the life of the activity. The impacts on the disturbance of faunal habitat is 'high'. The mitigation measures as listed in Section 7.2.10 and Section 7.3.13. must be implemented.

8.2.5 Increase in spread of declared weeds and alien invader plants

Alien invasive plants left unmanaged will eventually outcompete indigenous vegetation in the direct area and neighbouring areas in an escalating manner over a period of time. The impacts on spread of declared weeds and alien invader plants is 'moderate'. The mitigation measures as listed in Section 7.4.8 must be implemented.

8.2.6 Increased erosion

Erosion of topsoil will lead to difficulty of establishment of vegetation cover as topsoil contains seeds and organic materials needed for cover establishment. The impacts on erosion is 'low-moderate'. Erosion and siltation could over a longer period of time cause significant faunal habitat

damage which, if left unmitigated, could continue to deteriorate the area indefinitely. Site clearing, if not appropriately rehabilitated, could lead to habitat deterioration via continued erosion and alien vegetation establishment. The mitigation measures as listed in Section 7.3.11 and Section 7.4.7 must be implemented.

8.2.7 Disruption of continuity of vegetation communities

Geographical distribution of vegetation communities will be disrupted on a regional scale if continuous disruption of vegetation communities is allowed to take place. The impacts on disruption of continuity of vegetation communities is 'low'. The mitigation measures as listed in Section 7.3.12 must be implemented.

9 SUMMARY OF KEY ENVIRONMENTAL FINDINGS

In accordance with the EIA Regulations (GN No. 982), this section provides a summary of the key findings of the Basic Assessment (BA) Process, including Specialist Study findings. This section also provides a reasoned opinion as to whether the activity should or should not be authorised and conditions that should be made in respect of that authorisation, as necessary.

This chapter provides a summary of the impacts identified and significance ratings, summary of key findings and recommendations from specialists and a motivation for the proposed development.

9.1 Summary of key findings and recommendations

This section summarises the key findings and recommendations from the respective specialist assessments that has materially contributed to the conclusions and overall recommendations made by the EAP for this application.

9.1.1 Terrestrial Biodiversity (Vegetation Assessment)

Two broad vegetation units were identified to occur mostly outside of the proposed project footprint, i.e., Waterberg Mountain Bushveld and Central Sandy Bushveld. The planned upgrades are largely focused on the existing road reserve where the two vegetation units have already been impacted and mostly transformed.

Areas associated with the mountain pass (as illustrated in the habitat map in Figure 5-30 in pink) has more concentrated indigenous vegetation closer to the road reserve due to historical road cuts into the mountain sides, which will probably be impacted on the most.

Although the site is located within the designated CBA areas in accordance with bioregional information of Limpopo (LCPv2), the existing R33 road impact was not considered in these bioregional maps, which would have resulted in a lower conservation status. The road reserve did contribute to an edge effect on adjacent vegetation compositions historically, and the existing road reserve is mostly transformed.

Areas containing untransformed natural vegetation of conservation concern, high diversity, habitat complexity, red list organisms and / or systems vital to sustaining ecological function are considered sensitive. In contrast, areas that are transformed and have little importance for ecological functioning are of low sensitivity.

A sensitivity rating of 'High' sensitivity was given to areas outside of the existing road reserve in Figure 5-31. This is due to the following:

- CBA 2 "critical biodiversity areas".
- Habitat with low ability to recover from disturbance as indicated in green in Figure 5-31.

- Habitat with exceptionally high diversity (richness or turnover) as indicated in green in Figure 5-31.
- Ecosystem providing high value ecosystem goods and services.

Transformed areas within the road reserve has a 'Low' sensitivity due to the following:

- The proposed widening of the road will mostly be undertaken within the existing road reserve of the existing R33 road. The road reserve has previously been cleared when the road was constructed, leaving mostly grass species and regrowth in the road reserve.
- The 12 recorded Marula trees in the road reserve has a protected tree status. These tree species was avoided by contractors when the R33 was constructed. These tree species do not form part of the red list of plant species in South Africa and has a national status of "Least Concern".
- No natural habitat remaining.

Summary of Floral species findings:

- A total of 58 plant species were recorded in the study area during the time of the study and indicates moderate species diversity. The purpose of the species assessment was to identify any SCC plants and to determine vegetation unit association.
- Twelve (12) specimens of the protected tree species *Sclerocarya birrea* (Marula) was found to occur on the project footprint where the road upgrade will most likely have an impact. These tree species are protected in terms of the National Forest Act 84 of 1998. These trees are of Least Concern but protected.
- No SCC was identified to occur on the project footprint during the site survey.
- 16 NEMBA listed Alien Invasive plants were listed that need to be controlled.

The impact assessment indicated that all impacts in terms of terrestrial biodiversity and plant species is of medium to low significance after mitigation. The impact on threatened plants is deemed to be low as most of the site has been disturbed historically and no SCC plants were found.

All areas identified as part of the development is suitable for development. Areas within the mountain pass section as illustrated in pink in Figure 5-30, contains concentrated bushveld vegetation as the road reserve is narrow, due to cutting of the road into the mountain sides.

From a Terrestrial Biodiversity (floral assessment) perspective, the proposed upgrade of the R33 should be approved. The findings of the Specialist Study, for impacts on terrestrial biodiversity and plants, would be within acceptable limits if all mitigation measures are implemented. Should the Protected tree (Marula trees) be removed/destroyed for the proposed R33 road upgrade, a permit must be obtained from the DFFE prior to any such undertaking.

9.1.2 Terrestrial Biodiversity (Faunal Assessment)

Some faunal species of conservation concern could potentially occur within the natural areas adjacent to the study area. However, the road and road reserve area itself (study area) is of 'Low Sensitivity' for terrestrial animal species. Without any mitigation, the proposed development is expected to have a 'Medium to High' impact on faunal habitat and species. However, with the implementation of the mitigation measures recommended in this report, the impact will be reduced to a 'Low significance' and will be limited to the development footprint area as far as possible.

At the time of the assessment, all aquatic features within the study area were deemed to be of a 'moderate sensitivity' due to extensive anthropogenic impacts to these areas over the last ten years.

Some Vulnerable species could potentially occur within the study area. From a Terrestrial Biodiversity perspective (faunal assessment), the proposed upgrade of the R33 should be approved. The findings of the Specialist Study, for impacts on terrestrial biodiversity and fauna, would be within acceptable limits if all mitigation measures are implemented.

9.1.3 Wetlands

According to the national web-based environmental screening tool, in terms of National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998), the site has a Low sensitivity for Aquatic Biodiversity. During the site visit, it was confirmed that the site has a Low sensitivity from a wetland perspective. This was evident from the assessed wetlands PES and EIS calculations, based on the site-specific information gathered.

The desktop survey indicated that there are some National Freshwater Ecosystem Priority Area (NFEPA) and National Wetland Map 5 wetlands in the 500m buffer area surrounding the project area. The wetlands within the 500m buffer zone of the proposed upgrade were assessed and four (4) natural wetlands were encountered, of which two (2) were depression wetlands and two (2) were unchanneled valley bottom wetlands. Some borrow pits were encountered and one impoundment.

The wetlands inside the development area are classified as depression wetlands and unchanneled valley bottom wetlands. Wetlands in the development area and 500m buffer around the development area were divided into four groups and assessed accordingly.

A wetland functionality assessment was completed, including Present Ecological State (PES), Ecological Importance and Sensitivity (EIS) and Recommended Ecological Category (REC). Results are summarised in the table below:

Table 9-1: Summary of results on EIS, PES and REC	
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CLASSIFICATION	Depression Wetland (Group 1)	Unchanneled valley bottom Wetland (Group 2)	Borrow pits (Group 3)	Impoundment (Group 4)
PES	D: Largely modified	C: Moderately modified	Not assessed	Not assessed
EIS	1,0: Moderate	1,6: Moderate	0: Low	0,4: Low / marginal
REC	D: Upgrade	C: Maintain	Not assessed	Not assessed
BUFFER	32m	32m	32m	32m

Three impacts were rated using the DWS Risk Matrix Assessment and also the NEMA Impact Assessment approach. These impacts are:

- Compaction, soil erosion and sedimentation,
- Soil and water pollution,
- Spread of alien invasive vegetation.

The risk assessment rated all risks / impact as 'Low' after mitigation except for one risk that stayed as medium. The 'low' risk of the risk assessment is due to the fact that the proposed development will mostly be undertaken within an existing road reserve, and impacts will occur with the upgrade of culverts and bridges. Most identified risks are engineering related, and management orientated and can be reduced my implementation of proper mitigation measures.

The environment must be protected during the construction operations, and any disturbed areas must be revegetated with indigenous vegetation to prevent the establishment of invasive vegetation.

A buffer of 32m was applied to all delineated wetlands as any activity within 32m of a watercourse would require Environmental Authorization. This was applied to all wetlands within the development footprint of the R33 and the surrounding 500m. Any activity within 500m of a wetland requires a Water Use Authorisation process.

Parts of the study area are infested with alien and invasive vegetation. This should be cleared, and the clearing should be routinely followed-up with a programme to keep the area clear.

From a wetland perspective this development can be supported, provided that mitigation measures and general good practice are adhered to.

9.1.4 Heritage Resources

The construction and maintenance of the existing R33 road, would have impacted on any heritage resources if any were present. The study area lacks any focal points like pans or rocky outcrops that would have attracted human occupation in antiquity, and with the degraded nature of the road servitude, it is considered to be of 'low' heritage potential. This was confirmed during the survey, whereby no heritage resources were identified within the road servitude.

The impact on heritage resources is 'low', and it is recommended that the proposed road R33 upgrade commence on the condition that the following recommendations are implemented as part of the EMPr and based on approval from SAHRA.

If during construction, any possible finds such as stone tool scatters, artefacts or bone and fossil remains are made, the operations must be stopped, and a qualified Archaeologist must be contacted for an assessment of the find, and therefore the Chance Find Procedures should be put in place as part of the EMPr.

9.1.5 Palaeontological Resources

Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The geological structures suggest that the rocks are either much too old to contain body fossils but might have trace fossils of early microbes or microbial activity. Since there is an extremely small chance that trace fossils may occur in the Nylstroom Subgroup and may be disturbed, a Fossil Chance Find Protocol has been added to the EMPr.

If fossils are found by the Contractor, Environmental Officer or other responsible person once clearing of vegetation, excavations or drilling have commenced, then they must be rescued, and a Palaeontologist must be called to assess and collect a representative sample. The impact on the palaeontological heritage would be very low, so as far as the palaeontology is concerned, the project should be authorised.

9.1.6 Aquatic resources

The main drainage lines and rivers which were assessed, were the Loubadspruit (US and DS) and Klein Nyl River (US and DS) as well as a single DS point at Culvert 19.

These results portray the spatial variability from the upstream and the downstream monitoring station within the above-mentioned waterways with regards to:

- Habitat availability and suitability for aquatic invertebrates during dry and wet periods; and
- Pollution is a noticeable impacting factor within the catchment, leading to erosion, sedimentation and lowered water quality within the river system overall.

A total of 26 culvert sections were assessed and only 5 sites had sufficient habitat, water availability and potential to sustain macro invertebrates.

Overall, it is the opinion of the Aquatic Ecologist that the construction activities will not have a negative high impact on the Aquatic Biodiversity (*specifically referring to the macro-invertebrates*), provided that the Contractors adhere to the mitigation measures, as stipulated within the Risk Assessment. Additionally, this project will be beneficial for the area as it will create job opportunities.

9.1.7 Soils and Agricultural Potential

Four main soil forms were identified within the assessment area, namely the Clovelly, Hutton, Glenrosa and Mispah soil forms. The land capability sensitivities (DALRRD, 2017) indicate land capabilities with "Very Low" to "Moderate high" sensitivities. The identified soil baseline findings on-site concur with some of the areas which were identified as "Moderate High" sensitivity. Overall, using the soil forms identified on-site, the project area can be assigned within a "Low" to "Moderate" agricultural land capability potential.

The assessment area is associated with both non-arable and arable soils. However, the available climatic conditions of low annual rainfall and high evapotranspiration potential severely limits crop production significantly in the arable soils resulting in land capabilities with "Low" and "Moderate" sensitivities. The land capabilities associated with the assessment area are suitable for cropping, livestock grazing and gaming, which corresponds with the current land uses.

It is the Soil Specialist's opinion that the proposed R33 Road Upgrade Project and associated infrastructure will have limited residual impact on the agricultural production ability of the land and has therefore recommended that the proposed R33 Road Upgrade Project and associated infrastructure be favourably considered, as has been planned.

9.1.8 Geotechnical Investigation

The aim of the investigation is to assess the geotechnical conditions on site allowing insight into appropriate founding solutions for the proposed upgrades.

The material profile encountered on site, is generally characterised by layers of transported material underlain by residual material which overlays sandstone bedrock associated with the Alma Formation, Waterberg Group.

A geotechnical evaluation of the site conditions is provided in Section 3 and foundation recommendations are provided in Section 3.2 of the Geotechnical Assessment.

It is recommended that the structure be founded on strip footings with an allowable bearing pressure of 1 000kPa on the soft rock sandstone or better. Should water conditions and/or space restrictions preclude the use of strip footings, then pile foundations can be used. A combination

of the proposed founding methods may also be used for the different foundations, depending on the conditions at each foundation.

9.1.9 Hydrological Environment

A Hydrological Assessment was undertaken for the proposed design B0576 that will be upgraded as part of the upgrade of the R33. The results of this assessment indicated that the existing bridge does not have adequate hydraulic capacity to pass the required design peak floods for Class 2 and Class 3 roads.

A new bridge structure that meets the required design criteria has been recommended to be sized and checked in HEC-RAS. A 3-span bridge structure having 8.75-12.5-8.75 opening has therefore been proposed for construction.

As mentioned earlier, the existing structure does not pass the design peak floods in accordance with SANRAL's design criteria and thus warrants the construction of a new, larger structure. A structure with a 30m total opening measured perpendicular to the flow (or individual spans opening perpendicular to the direction of flow measuring 8.75m, 12.50m and 8.75m) and a deck soffit level of 1.40m higher than the existing is therefore proposed.

9.1.10 Traffic

The traffic information and analysis was undertaken by V3 Consulting (Pty) Ltd to inform the detailed design of the proposed upgrade of the R33. The results of the proposed road upgrade informed the intersections that require upgrading and the intersections that require closure.

The recommendations for the proposed road upgrade are as follows:

- Km0.6 to km2.4: Four (4)-lane undivided single carriageway
- Km2.4 to km6.8: Two (2)-lane single carriageway with climbing / passing lanes
- Km6.8 to km13.6: Two (2) lane single carriageway with climbing /passing lanes

The proposed upgraded R33 is anticipated to have an improved LOS in terms of safety and capacity of the road network, based on future traffic growth projected for the next 25-year horizon.

9.1.11 Visual Environment

The proposed development will occur along the existing road reserve of the R33. There are several land uses occurring adjacent to the R33 i.e. Department of Correctional Services, Koro Creek Golf Estate (residential area), vacant land, agricultural holdings, lodges/resorts/game ranches, place of leisure/restaurants and craft markets, retirement villages, place of worship and railway lines.

There are limited visual receptors in a small portion of the southern part of the study area who may have sight of the proposed construction activities. However, construction activities will be of a short-term duration. With the implementation of good house-keeping methods during construction, the impacts will be mitigated to acceptable levels.

9.1.12 Noise Pollution

Construction activities and the movement of construction vehicles may increase the ambient noise levels within the area during the construction phase. With the implementation of noise abatement methods during construction, the impacts will be mitigated to acceptable levels.

9.1.13 Air Quality

Changes to the ambient air quality in the immediate vicinity of the project can be expected during the construction phase. During construction, this will primarily be a result of land clearance, construction vehicles travelling on exposed surfaces and earthworks in the form of dust generation. This impact will be of a short-term duration. With the implementation of dust suppression methods during construction, the impacts will be mitigated to acceptable levels.

9.1.14 Socio-economic environment

The site is located in an area where there are high levels of unemployment. Temporary jobs may be created during the construction phase which would have positive impacts through skills transfer and a generation of income. However, the positive impacts will be enhanced should unemployed people from the local area be recruited for the construction activities.

Some of the intersections along the R33 will be closed-off, due to compliance with SANRAL and TRH, TMH and UTG design guidelines and standards, road safety improvement and access management policies. The affected landowners were contacted by the Design Engineers, and they have understood the reasons for the proposed upgrades and relocation of some of the accesses. Alternate access will be provided for landowners on the affected properties. The landowners will have access to their respective properties during the construction period through the existing road network.

9.2 Summary of impacts and significance ratings

A concise summary of the impacts that has been identified for the proposed stormwater drainage and associated infrastructure, as well as the residual impact significance ratings after the implementation of the proposed mitigation measures (impact management actions) are provided in Table 9-2.

Overall, successful mitigation of the majority of identified impacts resulted in a residual impact of LOW (-). Furthermore, none of the residual impacts remained with a moderate (negative), high

(negative) or very high (negative) impact rating after the implementation of the proposed mitigation measures (impact management actions).

The positive residual impacts associated with the proposed development are low (positive) attributed to temporary job creation during the construction phase.

Phase	Environmental Component / Impact	Impact identified	Residual Impact
Pre-Construction	Heritage resources	No impacts identified	-
Pre-Construction	Palaeontological resources	No impacts identified	-
Pre-Construction	Surface water resources and wetlands	No impacts identified	-
Pre-Construction	Groundwater resources	No impacts identified	-
Pre-Construction	Visual	No impacts identified	-
Pre-Construction	Socio-economic	No impacts identified	LOW (-)
Pre-Construction	Terrestrial Biodiversity (flora)	Loss or fragmentation of indigenous natural vegetation	LOW (-)
Pre-Construction	Terrestrial Biodiversity (flora)	Loss of protected tree species	MODERATE (-)
Pre-Construction	Terrestrial Biodiversity (flora)	Loss of individuals of threatened plants	LOW (-)
Pre-Construction	Terrestrial Biodiversity (fauna)	Impact on faunal species habitat	LOW (-)
Construction	Heritage resources	Loss of heritage resources	LOW (-)
Construction	Palaeontological resources	Loss of palaeontological resources	LOW (-)
Construction	Soil and Agricultural Resources	Degradation of soil resources	LOW (-)
Construction	Surface water resources and wetlands	Impact on wetland degradation	LOW (-)

Table 9-2: Summary of impacts and residual impact significance ratings for the proposed development

Phase	Environmental Component / Impact	Impact identified	Residual Impact
Construction	Aquatic resources	Lowering of PES and EIS of the associated river systems and degradation of the aquatic habitat	MODERATE (-)
Construction	Aquatic resources	Impact on alteration of aquatic habitat	LOW (-)
Construction	Aquatic resources	Impact on water quality impairment of drainage lines and river systems	LOW (-)
Construction	Nuisance impacts	Impacts of noise pollution	LOW (-)
Construction	Nuisance impacts	Impact on ambient air quality	LOW (-)
Construction	Road network	Impacts on traffic congestion	LOW (-)
Construction	Surface water resources and wetlands	Potential increase in erosion due to clearance of vegetation	LOW (-)
Construction	Terrestrial Biodiversity (flora)	Fragmentation of vegetation continuity	LOW (-)
Construction	Terrestrial Biodiversity (fauna)	Loss of faunal habitat	LOW (-)
Construction	Aesthetic environment	Impact on change of visual character	LOW (-)
Construction	Socio-economic	Temporary job creation	LOW (+)
Operational	Heritage resources	No impacts identified	-
Operational	Palaeontological resources	No impacts identified	-
Operational	Surface water resources and wetlands	Impact on wetland degradation	LOW (-)
Operational	Socio-economic	No impacts identified	-
Operational	Visual	No impacts identified	-
Operational	Road network	Improved level of service for traffic flow	LOW (+)
Operational	Surface water resources and wetlands	Increase in erosion and sedimentation of aquatic resources	LOW (-)

Phase	Environmental Component / Impact	Impact identified	Residual Impact
Operational	Terrestrial Biodiversity (flora)	Increase in spread of declared weeds and alien invader plants	LOW (-)

10 CONCLUSION AND RECOMMENDATIONS

10.1 Impact Statement

SANRAL SOC Ltd is proposing to upgrade the 13.6km of the R33, Section 13, between Modimolle (km0.6) to Witklip (km13.6) in Limpopo Province.

Environmental sensitivities were identified through the DFFE online screening tool, as well as a desktop screening independently undertaken by the EAP and a site visit. Several specialist studies were identified as a result of the screening undertaken for the proposed road upgrade and the following studies were commissioned for the Application for Environmental Authorisation:

- Terrestrial Biodiversity Impact Assessment (including Floral and Faunal Assessment)
- Archaeological and Cultural Heritage Impact Assessment
- Palaeontological Impact Assessment
- Hydrological Impact Assessment
- Wetland Impact Assessment
- Geotechnical Assessment
- Traffic Impact Assessment
- Aquatic Ecological Impact Assessment
- Soil and Agricultural Potential Assessment

A summary of the specialist assessments was compiled in Chapter 5, 7, 8 and 9 of this BAR. It was concluded that no fatal flaws were identified that hinder the proposed development from proceeding.

The following impacts were given 'moderate negative' significance ratings after the implementation of mitigation measures during the pre-construction phase:

• Loss of protected tree species

The following impacts were given 'low negative' significance ratings after the implementation of mitigation measures during the pre-construction phase:

- Loss or fragmentation of indigenous natural vegetation
- Loss of individuals of threatened plants
- Impact on faunal species habitat

The following impacts were given 'moderate negative' significance ratings after the implementation of mitigation measures during the construction phase:

 Lowering of PES and EIS of the associated river systems and degradation of the aquatic habitat

The following impacts were given 'low negative' significance ratings after the implementation of mitigation measures during the construction phase:

- Degradation of soil resources
- Impact on wetland degradation
- Impact on alteration of aquatic habitat
- Impact on water quality impairment of drainage lines and river systems
- Impacts of noise pollution
- Impact on ambient air quality
- Impacts on traffic congestion
- Fragmentation of vegetation continuity
- Loss of faunal habitat
- Impact on change of visual character

The following impacts were given 'low positive' significance ratings after the implementation of mitigation measures during the construction phase:

• Temporary job creation

The following impacts were given 'low negative' significance ratings after the implementation of mitigation measures during the operational phase:

- Impact on wetland degradation
- Increase in erosion and sedimentation of aquatic resources
- Increase in spread of declared weeds and alien invader plants

The following impacts were given 'low positive' significance ratings after the implementation of mitigation measures during the operational phase:

• Improved level of service for traffic flow

The findings of the impact assessment are considered to be within acceptable limits of change. On balance of social, economic, cultural and biophysical impacts, the impacts of the proposed development are considered acceptable if the mitigation measures discussed in this report and the EMPr (Appendix J) are strictly implemented.

10.2 EAP's reasoned opinion

It is the opinion of the EAP that should the project proceed, as impacts on the receiving environment can be minimised through the careful adherence to suggested mitigation measures.

The findings of the Specialist Studies undertaken together with the broader environmental assessment conclude that there are no fatal flaws that should prevent the project from proceeding. However, the following key impacts (Table 9-2) have been identified which will require the

application of site and activity specific mitigation measures. These mitigation measures are included within the Environmental Management Programme (EMPr) (refer to Appendix J) to ensure that they receive the necessary attention.

Having assessed all the potential environmental impacts associated with the proposed development, it is the opinion of the EAP that the project is issued with a positive Environmental Authorisation from DFFE, based on the following reasons:

- The decision to upgrade the R33 is motivated by the projected traffic growth in the next 25 years, based on a growth rate of 2.5% per annum that is projected nationally on SANRAL routes. Furthermore, economic development and infill and densification, future growth in housing establishments at the Modimolle area and expansion of the Koro Creek Golf Estate will require an upgrade of the R33, which also serves as a primary pedestrian route. The R33 occurs within a tourist route, and added with the future growth in housing, upgrade of the R33 is deemed necessary. There are several intersections occurring along the R33 that will be upgraded to accommodate the widening of the R33 and to meet safety of pedestrians and motorists alike.
- A project-specific draft EMPr (*legally binding*) has been compiled according to (*but not limited to*) the impacts and mitigation measures included in this assessment.
- The proposed development will have minimal impacts on the receiving biophysical and socio-cultural and socio-economic environment. There are no fatal flaws that hinder the proposed development from proceeding.

10.3 Proposed recommendations for inclusion in EA

To ensure that the identified negative impacts are minimised, and the positive impacts are enhanced, the following clauses are recommended as conditions of the Environmental Authorisation:

- The EMPr is a legally binding document and the mitigation measures stipulated within the document and Basic Assessment Report must be implemented.
- An independent Environmental Control Officer (ECO) must be appointed to manage the implementation of the EMPr during the construction phase. Environmental Audit Reports must be compiled and made available for inspection.
- Rehabilitation of the construction areas must take place soon after construction is completed.
- The environment must be protected during the construction operations, and any disturbed areas must be revegetated with indigenous vegetation to prevent the establishment of invasive vegetation.
- Parts of the study area are infested with alien and invasive vegetation. This should be cleared, and the clearing should be routinely followed up with a programme to keep the area clear.
- As part of the construction team's rehabilitation strategy/plan, it is advised to ensure that a "clean up" strategy is implemented after construction. Other general rehabilitation

• The ECO must be present during the construction activities within the regulated areas of the river systems.

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- During construction, the appointed ECO must undertake monthly In-Situ water quality samples at the effected drainage line/river crossings. Should there be significant changes in the water quality during construction, an Aquatic Ecologist must be appointed to provide recommendations to minimise the impacts on the watercourses. The first and last samples of the construction monitoring must be taken to a laboratory for analysis.
- Biomonitoring is required to be undertaken in the event of an incident, in order to identify the extent of the said incident on the effected watercourse.
- If during construction, any possible finds such as stone tool scatters, artefacts or bone and fossil remains are made, the operations must be stopped, and a qualified archaeologist must be contacted for an assessment of the find and therefore the Chance Find Procedures should be put in place as part of the EMPr.
- If fossils are found by the Contractor, Environmental Officer or other responsible person once clearing of vegetation, excavations or drilling have commenced, then they should be rescued, and a Palaeontologist must be called to assess and collect a representative sample.
- All Marula trees found on site must be surveyed and recorded. Should the Marula trees
 require removal, a permit for this must be obtained from the DFFE. Prior to construction,
 a Vegetation Ecologist or ECO with applicable knowledge or experience, must undertake
 a walk-down of the road upgrade section to tag Marula trees to be removed. Each Marula
 tree to be removed must be included in a permit application. Permit applications must be
 lodged with the DFFE. Small Marula trees must be considered as landscaping an any
 areas to be landscaped.
- Areas that have been disturbed during construction must be rehabilitated with species naturally occurring in the study area, and the disturbed areas should be monitored to detect any alien plant species and measures must be taken immediately to eradicate it from spreading.
- All parties involved in the construction and ongoing maintenance of the proposed road upgrade (including Contractors, Engineers, and the Developer) are, in terms of NEMA's "Duty of Care" and "Remediation of Damage" principals (Section 28), required to prevent any pollution or degradation of the environment, be responsible for preventing impacts occurring, continuing or recurring and for the costs of repair of the environment.

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Ms. Natasha Lalie **Project Manager**

DOCUMENT1
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