

APPENDIX J:

IMPACT ASSESSMENT REPORT



Environmental Management Group (Pty) Ltd

Specialists in Environmental Management Integrating Industry and Infrastructure with the Environment

Impact Assessment Report



Proposed upgrade from gravel to surface standard (tar) of road D1954, from D158 to D565 and D156 near Makwassie, North West Province

NORTH WEST DEPARTMENT OF PUBLIC WORKS AND ROADS

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Report details

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Broad scale locality	North West Province
Site area	Makwassie

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1. Introduction

The social, economic and environmental impacts assessment of the proposed upgrade of **D1954 road** is presented as the assessment methodology and associated results. This process aims to identify possible impacts associated with the proposed upgrade and evaluate their significance to ensure appropriate mitigations are applied. The recommendations of suitable mitigation measures that should be implemented to reduce the consequences of impacts associated with the project have been formulated by industry best practice principles, professional experience, and relevant legislation.

2. Methodology

Management and risk assessment plays a key role in the proponent's business. Managing the risks must be integrated into day-to-day business-related processes to ensure that both operational and strategic decisions are risk-based. The risk management system provides a framework to identify both threats and opportunities. The system then compensates and initiates resources that are allocated to treat the risks. It is required to review the risks as an ongoing process and then proceed to review the efficacy of the controls.

The risk assessment comprises quantifying the magnitude of potential impacts and the likelihood of these impacts to occur. The Consequence (**C**) and Likelihood (**L**) matrix combine the qualitative and or semi-quantitative ratings of consequence and the likelihood that a specific consequence will occur to calculate a risk score and risk rating (Equation 1). Essentially, the greater a probability of an adverse impact occurring, the greater the risk level associated with it will be.

C = Overall consequence

L = Likelihood of occurrence

Equation 1: Calculation of environmental significance.

$$\text{Environmental Significance} = C \times L$$

2.1 Determination of consequence:

Consequence analysis is a combination of quantitative and qualitative information, and the outcome can be positive or negative. Several factors can be used to determine consequence. To determine the environmental significance in terms of consequence, the following factors were chosen:

- **Severity/Intensity;**
- **Duration;** and
- **Extent/Spatial Scale.**

Each factor is assigned a rating between 1 to 5, as described in the tables below.

2.1.1 Determination of intensity:

Intensity relates to the nature of the event, aspect or impact to the environment and describes how intense a given aspect's impact on the biophysical and socio-economic environment will be.

Table 1: Rating criteria describing the intensity of a given aspect.

Type of criteria	Rating				
	1	2	3	4	5
Quantitative	0-20%	21-40%	41-60%	61-80%	81-100%
Qualitative	Insignificant / non-harmful	Small / Potentially harmful	Significant / Harmful	Great / Very harmful	Disastrous Extremely harmful
Social/ Community response	Acceptable / I&AP satisfied	Slightly tolerable / Possible objections	Intolerable/ Sporadic complaints	Unacceptable / Widespread complaints	Totally unacceptable / Possible legal action
Irreversibility	Very low cost to mitigate/ High potential to mitigate impacts to level of insignificance / Easily reversible	Low cost to mitigate	Substantial cost to mitigate / Potential to mitigate impacts / Potential to reverse impact	High cost to mitigate	Prohibitive cost to mitigate / Little or no mechanism to mitigate impact Irreversible
Biophysical (Air quality, water quantity and quality, waste production, fauna and flora)	Insignificant change / deterioration or disturbance	Medium change / deterioration or disturbance	Significant change / deterioration or disturbance	Very significant change / deterioration or disturbance	Disastrous change / deterioration or disturbance

2.1.2 Determination of duration:

Duration refers to the amount of time the receiving environment will be exposed to a given aspect, risk or impact, given the absence of intervention/mitigation.

Table 2: Rating criteria for determination of duration

Rating	Description
1: Low	1 Month
2: Low-Medium	1 – 3 Months
3: Medium	More than 3 Months
4: Medium-High	5 – 10 Years
5: High	More than 10 Years

2.1.3 Determination of extent/spatial scale:

Extent refers to the spatial influence of an impact, be it contained to the immediate surroundings (site), extending to the surrounding area, regional (will have an impact on the region), national (will have an impact on a national scale) or international (impact across international borders).

Table 3: Rating criteria for the determination of extent/spatial scale

Rating	Description
1: Low	Immediate, fully contained area (site)
2: Low-Medium	Surrounding area
3: Medium	Regional
4: Medium-High	National
5: High	International

2.1.4 Determination of overall consequence:

The overall consequence is determined by calculating the sum of all impact factors described above and those summarised below, divided by the total number of impact factors (three) (Equation 2).

I = Intensity

D = Duration

E = Extent

n = number of factors

Equation 2: Calculation of overall consequence.

$$\text{Overall Consequence} = \frac{\sum(I+D+E)}{n}$$

2.1.5 Determination of likelihood:

Likelihood refers to the probability of a given aspect/impact to occur given that no mitigation measures are implemented.

Table 4: Rating Criteria for the determination of likelihood.

Rating	Description
1: Low	< 30% chance of occurrence
2: Low-Medium	30% - 50% chance of occurrence
3: Medium	50% - 70% chance of occurrence
4: Medium-High	70 – 90% chance of occurrence
5: High	>90% of occurrence

2.2. Determination of overall environmental significance:

2.2.1. Quantitative analysis of the overall environmental significance:

The overall environmental significance is determined by multiplying the overall consequence (C) by the likelihood of occurrence (L) (Equation 1). The rationale of the overall environmental significance relates to identifying and quantifying the sum of environmental impacts arising from the proposed project and the recommendation of appropriate mitigation measures.

Table 5: Environmental significance evaluation score sheet.

Aspect Specific Environmental significance	Low	Low-Medium	Medium	Medium-High	High
Overall Consequence x Overall Likelihood (Equation 1)	1-5	6-10	11-15	16-20	21-25

2.2.2. Qualitative description or magnitude of the environmental significance:

The qualitative description of environmental significance attempts to provide an indication of the nature and or magnitude associated with the proposed project. It also guides the prioritisation and decision-making process related to this event, aspect or impact.

Table 6: Rating criteria for impact significance.

Significance	Low	Low-Medium	Medium	Medium-High	High
Impact Magnitude	Impact is of very low order and therefore likely to have very little real effect. Acceptable.	Impact is of low order and therefore likely to have little real effect. Acceptable.	Impact is real, and potentially substantial in relation to other impacts. Can pose a risk to the company	Impact is real and substantial in relation to other impacts. Pose a risk to the company and environment. Unacceptable	Impact is of the highest order possible. Unacceptable. Fatal flaw.
Action Required	Maintain current management measures. Where possible improve.	Maintain current management measures. Implement monitoring and evaluate to determine potential increase in risk. Where possible improve	Implement monitoring. Investigate mitigation measures and improve management measures to reduce risk, where possible.	Improve management measures to reduce risk.	Implement significant mitigation measures or implement alternatives.

3. Impact Assessment of the preferred site

3.1 Environmental Impact Assessment of the proposed activity

3.1.1 Ecological Impacts

The Terrestrial Ecology Compliance Statement takes into consideration the site's natural condition and any sensitivities, in terms of habitat diversity, species diversity and ecological diversity. The flora impact assessment refers to the vegetative component of the assessed area and focuses on the degree of infestation by exotics, vegetation structure, endemics, and protected species.

Habitat loss						
Impact		Loss of habitat and species diversity as a result of the removal of natural elements				
		Destruction of flora and fauna				
Activities (not an all-inclusive list)		Physical clearance of vegetation			Introduction of alien and invasive species	
		Habitat fragmentation leading to edge effects			Soil compaction reducing re-establishment success	
		Trampling			Soil erosion	
		Accidental events such as fire			Reduced biodiversity	
		Loss of protected species			Disrupted general animal behaviour	
Status		Negative				
Construction Phase						
Before Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	-	-	-	-	-	Low <i>*Refer to specialist report</i>
Mitigation		Removal of indigenous flora should be kept at a minimum.				
		No collection of plants other than for holding for use in rehabilitation is allowed.				
		Disturbance-related activities may only occur in the authorised area.				
		Vehicle movement should strictly be kept on designated dirt/gravel roads and/or bypasses.				
		Soil erosion mitigation measures need to be implemented.				
		Post-development open/barren areas should be revegetated and kept free of exotic plant species.				
		Vehicles may only move within the demarcated space of the development area.				
		Any other relevant recommendations listed in this report should be implemented.				

After Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	-	-	-	-	-	Very low <i>*Refer to specialist report</i>
Operational Phase						
Before Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	0	0	0	0	0	0
Mitigation	Not applicable due to loss of definitive characteristics of habitats in the construction phase. Additionally, no greater impact during operation can occur than those impacts occurring during construction.					
After Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	0	0	0	0	0	0
Cumulative Impacts	 Loss of local biodiversity.  The insignificant, but noteworthy minor deterioration of fringe habitat areas due to edge effects.					
Notes:	*** Due to methodology constraints, the EAP elected to adopt the specialist study's impact significance rating for this aspect. Refer to the specialist report for more details.					

The impacts associated with habitat loss are evaluated to be of **Low** significance before mitigation, and **Very Low** significance after mitigation since the proposed development is linear, which is somewhat occurring on / near existing roads. However, minimisation and restoration mitigation must be implemented.

Loss of CBAs, ESAs and (potentially) protected areas	
Impact	The deterioration of habitats leading to the impaired functioning of ecological support areas (ESAs) and in turn CBAs (critical biodiversity areas), leading to a loss of particularly sensitive areas vital for ecosystem functioning
Activities (not an all-inclusive list)	 Physical clearance of vegetation  Loss of protected species  Habitat fragmentation  Accidental events such as fire  Increased anthropogenic movement  Loss of biomass and biodiversity  Introduction of alien and invasive species  Soil compaction reducing re-establishment success  Soil erosion  Thinning of local genetic diversity  Increased ecological disturbance  Loss in ecological functionality

Status	Negative					
Construction Phase						
Before Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	-	-	-	-	-	Low <i>*Refer to specialist report</i>
Mitigation	 Limit the removal of vegetation in these CBA/ESA/Protected areas.  Vegetation and topsoil must be kept for use in rehabilitation.  Holding areas for plants and soil must be demarcated and utilised.  Topsoil storage must be prevented from contamination and invasion by alien and invasive species.  The excavated ground should be separated into piles of topsoil, subsoil and other material.  General works should, where possible, take place from the edge of any existing road to the side opposite a watercourse. In cases where the watercourses intersect the development, care must be taken to limit the distance across affected by construction activities.  No heavy machinery or material storage should occur on the side closest to a water course or within 100m of a watercourse.  A comprehensive fire management plan and alien invasive management plan needs to be drafted prior to construction.  Removal of indigenous flora should be kept at a minimum.  Disturbance related activities may only occur in the authorised area.  No unnecessary clearance of vegetation or topsoil may take place outside of the development area.  No other activity than that authorised may be taken within the authorised area.  Post-development open areas should be revegetated and kept free of exotic plant species.  Vehicles may only move within the demarcated space of the development area.  Any other relevant recommendations listed in this report should be implemented.					
After Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	-	-	-	-	-	Very Low <i>*Refer to specialist report</i>
Operational Phase						
Before Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	-	-	-	-	-	<i>*Refer to specialist report</i>
Mitigation	 Minimally applicable due to loss of definitive characteristics of CBA and ESA areas in the construction phase and the limited impact of operation on CBA, ESA and Protected areas.  The alien invasive management plan should be strictly adhered to as introduction of invasive species into a protected environment can cause habitat degradation if not properly managed.					
After Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance

	-	-	-	-	-	*Refer to specialist report
Cumulative Impacts	 Incremental loss or degradation of natural and semi-natural vegetation where widening or construction extends beyond the existing disturbed road footprint.  Cumulative reduction in habitat condition when the project's disturbance is considered together with existing agricultural activities, historical mining, the existing road and other surrounding land-use pressures.  Localised increase in habitat fragmentation and edge effects within mapped CBAs and ESAs.  Possible localised reduction in ecological connectivity where remaining natural habitat is cleared or disturbed.  Increased risk of alien and invasive plant establishment along disturbed road verges and construction areas.  Additional soil compaction and erosion that may inhibit vegetation recovery and contribute to habitat degradation.  Temporary increases in disturbance to fauna from construction vehicles, machinery, noise and human activity.					
Notes	*** Due to methodology constraints, the EAP elected to adopt the specialist study's impact significance rating for this aspect. Refer to the specialist report for more details.					

The anticipated impact on this aspect without mitigation is considered **Low**. Mitigation is necessary and would be easily achieved. After mitigation measures are implemented, the anticipated impact on the loss of CBA, ESA and Protected areas is **Very Low**, and due to the minimal impact of the development and the anticipated impacts on CBAs and ESAs are likely low.

Loss of indigenous floral and faunal diversity			
Impact	 Loss of indigenous vegetation and subsequent stable networks of energy transfer.  Loss of localised fauna		
Activities (not an all-inclusive list)	 Physical clearance of vegetation  Loss of protected species  Trampling  Habitat fragmentation  Accidental events such as fire, oil spills etc  Unlawful harvesting of plants  Unlawful hunting/ poaching of animals  Road mortalities	 Introduction of unnatural competitors, i.e. alien and invasive species  Reduced fecundity through reduced reproductive ability and success  Reduced survivability  Disrupted general animal behaviour  Disrupted circadian rhythms  Noise pollution (construction phase)	

	 Accidental entrapment  Accidental injury					
Status	Negative					
Construction Phase						
Before Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	-	-	-	-	-	Very low <i>*Refer to specialist report</i>
Mitigation	 Development may only occur within the clearly demarked area.  Monitoring for the emergence of exotic species should be conducted.  An alien invasive species management plan must be drafted.  Vehicle movement should remain within the authorised boundary.  A comprehensive rehabilitation plan must be adhered to.  No unnecessary destruction or removal of vegetation is allowed.  Wildlife elements such as nests and burrows should be carefully inspected, and animals responsibly removed by a relevant specialist.  Post-development open areas should be revegetated and kept free of exotic plant species by way of an alien and invasive management plan (AIMP). The AIMP should be developed to avoid the possibility of invasions and supply eradication techniques should they arise in the development area.  Quarterly alien and invasive species monitoring should take place according to the AIMP.  Any other relevant recommendations listed in this report should be implemented.					
After Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	-	-	-	-	-	Very low <i>*Refer to specialist report</i>
Operational Phase						
Before Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	-	-	-	-	-	<i>*Refer to specialist report</i>
Mitigation	 The presence of a built-up road may result in an increase in anthropogenic movement through the area resulting in the increased introduction of alien invasive species and the increase of poaching of indigenous species.  The above AIMP should be extended to reduce the establishment of alien invasive species and should be added as a condition for the post development monitoring (such as environmental audits done by an ECO).  Bi-yearly alien and invasive species monitoring should take place according to the AIMP for the first 2 years.					

	 This plan should be implemented and enforced till such time as the environment shows signs of recovery.  Long term monitoring may not be feasible and therefore the affected land owners should be informed of the possibility of alien invasive species establishment and should be properly informed on the proper removal and disposal techniques of these species effectively reducing the mass spread of these species.					
After Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	-	-	-	-	-	<i>*Refer to specialist report</i>
Cumulative Impacts	 Incremental loss or degradation of indigenous vegetation where construction extends beyond the existing disturbed road footprint.  Cumulative reduction in available fauna habitat when project-related vegetation clearance is considered together with existing agricultural activities, historical mining, the existing road and other surrounding land-use pressures.  Localised increase in habitat fragmentation and edge effects, potentially affecting fauna movement and habitat use.  Increased risk of alien and invasive plant establishment along disturbed road verges and temporarily disturbed construction areas.  Additional disturbance or displacement of fauna due to construction noise, machinery, lighting, vehicle movement and increased human activity.  Increased risk of wildlife injury or mortality from construction activities and operational traffic.  Possible cumulative decline in local floral and faunal diversity if vegetation clearance, road mortality, unlawful harvesting, hunting or other disturbance is not effectively controlled.  The project's residual cumulative contribution is expected to be localised because the upgrade predominantly follows an existing disturbed road corridor, provided that clearance is confined to the authorised footprint and the prescribed rehabilitation, fauna-protection and alien-plant-management measures are effectively implemented.					
Notes	*** <i>Due to methodology constraints, the EAP elected to adopt the specialist study's impact significance rating for this aspect. Refer to the specialist report for more details.</i>					

During the construction and operational phases, the anticipated impact on the loss of indigenous floral and faunal diversity will be of **Very Low** significance whether or not mitigation measures are implemented. However, the implementation of mitigation measures is required for minimisation and restoration mitigation.

Loss of floral CC						
Impact	 Destruction of species of conservation concern  Loss of biodiversity					
Activities (not an all-inclusive list)	 Clearance of vegetation  Loss of protected species  Habitat fragmentation  Poaching, unlawful hunting and gathering of plants and animals  Careless and reckless behaviour  Trampling  Accidental road mortalities  Accidental events such as fire Thinning of local genetic diversity  Reduced fecundity through reduced reproductive ability and success  Disrupted circadian rhythms  Interruption of lifecycle patterns due to noise pollution					
Status	Negative					
Construction Phase						
Before Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	-	-	-	-	-	Low *Refer to specialist report
Mitigation	 A suitably qualified botanist must survey the final construction footprint during the appropriate flowering or active-growth period for Sensitive Species 459 and 1231 before vegetation clearance.  Any individuals recorded must be mapped and clearly demarcated, with the construction footprint adjusted to avoid them wherever practicable.  No sensitive or protected plant may be disturbed, removed or translocated without the required provincial permit and specialist guidance.  Translocation may only be considered where avoidance is impracticable and must be undertaken in accordance with an approved species-specific method and monitoring programme.  Construction activities, vehicle movement, material storage and temporary infrastructure must remain within the authorised and demarcated footprint.  Construction personnel must be informed of the prohibition on collecting, damaging or removing indigenous plants.  If a suspected floral SCC is encountered during construction, work within the immediate area must cease until the plant has been assessed by a suitably qualified botanist.  Temporarily disturbed areas must be rehabilitated using locally appropriate indigenous vegetation, followed by alien-plant control and monitoring until vegetation cover is re-established.					

	 All avoidance areas must be inspected by the ECO during construction to confirm that demarcation remains intact and that no unauthorised disturbance has occurred.					
After Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	-	-	-	-	-	Very low <i>*Refer to specialist report</i>
Operational Phase						
Before Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	-	-	-	-	-	<i>*Refer to specialist report</i>
Mitigation	 Limited mitigation measures can be implemented for the operation phase of this road development as loss of SCC is possible due to anthropogenic movement and poaching.  Border fencing should be properly maintained to act as deterrents to poachers.					
After Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	-	-	-	-	-	<i>*Refer to specialist report</i>
Cumulative Impacts	 The loss of rare and vulnerable species.					
	 Loss of biodiversity.					
	 Secondary deterioration and loss of species engaging in species specific interactions with species of conservation concern.					
Notes	*** Due to methodology constraints, the EAP elected to adopt the specialist study's impact significance rating for this aspect. Refer to the specialist report for more details.					

Anticipated environmental impacts on the loss of floral SCC during the construction phase and operational phase is expected to be **Low**. After the efficient implementation of mitigation measures during the construction phase the anticipated impact on the loss of floral SCC is expected to be **Very low**. Strict mitigation measures are required to lower the overall impact

Loss of faunal CC-Avifauna						
Impact	 Destruction of species of conservation concern  Loss of biodiversity					
Activities (not an all-inclusive list)	 Clearance of vegetation  Loss of protected species  Habitat fragmentation  Poaching, unlawful hunting and gathering of plants and animals  Careless and reckless behaviour  Trampling  Accidental road mortalities  Accidental events such as fire Thinning of local genetic diversity  Reduced fecundity through reduced reproductive ability and success  Disrupted circadian rhythms  Interruption of lifecycle patterns due to noise pollution					
Status	Negative					
Construction Phase						
Before Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	-	-	-	-	-	Low *Refer to specialist report
Mitigation	 A preconstruction inspection must be undertaken within the final disturbance footprint and immediately adjoining vegetation to identify active nests of avifaunal SCC.  The inspection must be completed by a suitably qualified specialist during the breeding season where vegetation clearance is scheduled to occur during a period of potential nesting activity.  Mature trees and thorny scrub suitable for nesting must be retained wherever practicable.  Where an active or potentially active SCC nest is identified, vegetation clearance and construction in its vicinity must cease until it has been assessed by an avifaunal specialist.  A species-specific exclusion buffer must be established around any active nest. The buffer must be determined by the specialist according to the species, nesting stage, surrounding habitat and expected disturbance.  No active nest, egg, nestling or adult bird may be removed, handled or disturbed without the required authorisation and specialist supervision.  Construction activities, vehicle movement and material storage must remain within the demarcated development footprint.  Construction personnel must be prohibited from hunting, trapping, collecting or deliberately disturbing birds and their nests.					

	 If an injured avifaunal SCC is encountered, it must not be handled by untrained personnel. The ECO must contact an appropriate wildlife rehabilitation facility or avifaunal specialist.  Vehicle speeds must be controlled along construction access routes and during operation, particularly through natural habitat and near wetland crossings.					
After Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	-	-	-	-	-	Very low *Refer to specialist report
Operational Phase						
Before Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	-	-	-	-	-	*Refer to specialist report
Mitigation	Operational impacts on Caspian Tern are expected to be negligible. Although the species may occasionally occur at permanent waterbodies in the broader region, the upgraded road will not result in the loss or substantial alteration of suitable aquatic foraging or breeding habitat.					
After Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	-	-	-	-	-	*Refer to specialist report
Cumulative Impacts	 The loss of rare and vulnerable species.  Loss of biodiversity.  Secondary deterioration and loss of species engaging in species specific interactions with species of conservation concern.					
Notes	*** Due to methodology constraints, the EAP elected to adopt the specialist study's impact significance rating for this aspect. Refer to the specialist report for more details.					

Anticipated environmental impacts on the loss of Avifauna SCC during the construction phase and operational phase is expected to be **Low**. After the efficient implementation of mitigation measures during the construction phase the anticipated impact on the loss of Avifauna SCC is expected to be **Very Low**. Strict mitigation measures are required to lower the overall impact

Loss of faunal CC- Mammals						
Impact	 Destruction of species of conservation concern  Loss of biodiversity					
Activities (not an all-inclusive list)	 Clearance of vegetation  Loss of protected species  Habitat fragmentation  Poaching, unlawful hunting and gathering of plants and animals  Careless and reckless behaviour  Trampling  Accidental road mortalities  Accidental events such as fire Thinning of local genetic diversity  Reduced fecundity through reduced reproductive ability and success  Disrupted circadian rhythms  Interruption of lifecycle patterns due to noise pollution					
Status	Negative					
Construction Phase						
Before Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	-	-	-	-	-	Low <i>*Refer to specialist report</i>
Mitigation	General mammalian SCC measures  A preconstruction inspection of the final disturbance footprint must be undertaken by a suitably qualified specialist or trained ECO, focusing on burrows, refuges, tracks, scats and other evidence of mammalian SCC.  Construction personnel must receive environmental induction covering mammalian SCC, reporting procedures and the prohibition on hunting, trapping, handling or collecting fauna.  Vegetation clearance must proceed progressively to allow mobile fauna to move away from construction activity.  No animal may be chased, captured or relocated by construction personnel.  If a mammalian SCC or potentially occupied refuge is encountered, work must stop locally and a suitably qualified fauna specialist must determine the appropriate response.  Open excavations must be inspected daily and provided with suitable escape ramps. Excavations must be closed as soon as practicable.  Driving outside designated access routes and the authorised construction footprint must be prohibited.  Vehicle speeds must be controlled during construction and operation, particularly through natural habitat and near watercourse crossings.  All mammalian SCC observations and mortalities must be recorded and reported to the ECO.					

	Sensitive Species 29  Potentially occupied burrows or refuges must not be excavated, collapsed or disturbed before specialist inspection.  The location of any observation must be treated as sensitive and must not be disclosed to construction personnel beyond those responsible for implementing protection measures.  Construction camps must implement access control and anti-poaching measures.  Night-time driving should be restricted to essential activities, and vehicle speeds must be reduced after dark.  If an individual is encountered, it must not be handled by untrained personnel. Work must stop and an appropriate conservation authority, wildlife veterinarian or suitably qualified specialist must be contacted.  Repeated roadkill or sightings during operation must trigger a specialist review and the implementation of additional site-specific measures.					
After Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	-	-	-	-	-	Very low <i>*Refer to specialist report</i>
Operational Phase						
Before Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	-	-	-	-	-	<i>*Refer to specialist report</i>
Mitigation	Operational impacts are limited to Sensitive Species 29, as the field-verified habitat does not support the likely occurrence of Spotted-necked Otter within the project footprint. Sensitive Species 29 may move across the road while foraging or travelling between suitable thornveld habitats. Paving of the existing gravel road may increase vehicle speeds and consequently increase the existing risk of collision-related mortality. The risk will persist throughout the operational life of the road, although its likelihood is considered low because no individuals or signs of activity were recorded and the project does not introduce a new road through previously continuous habitat. The operational impact is therefore expected to be of very low significance. Mitigation can reduce the probability of mortality through appropriate speed control, roadkill monitoring and responsive management, but cannot reduce the duration or reversibility of an actual SCC mortality event.					
After Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	-	-	-	-	-	<i>*Refer to specialist report</i>

Cumulative Impacts	 The loss of rare and vulnerable species.  Loss of biodiversity.  Secondary deterioration and loss of species engaging in species specific interactions with species of conservation concern.
Notes	*** Due to methodology constraints, the EAP elected to adopt the specialist study's impact significance rating for this aspect. Refer to the specialist report for more details.

Anticipated environmental impacts on the loss of Mammals SCC during the construction phase and operational phase is expected to be **Low**. After the efficient implementation of mitigation measures during the construction phase the anticipated impact on the loss of Mammals SCC is expected to be **Very Low**. Strict mitigation measures are required to lower the overall impact.

3.1.2 Heritage

Heritage involves culturally significant finds including, but not limited to fossils, artefacts and certain culturally relevant infrastructure.

Archaeological and Heritage Resources						
Impact	Destruction of any archaeological artefacts or fossils such as remains, graves and buildings older than 60 years					
Activities (not an all-inclusive list)	 Excavation within lower geological strata  Illegal collecting of loose chance finds (e.g. Stone age artefacts)  Grubbing  Trenching					
Status	Negative					
Constructional Phase						
Before Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	4	3	2	3	1	3
Mitigation	 Implement a standard Chance Find Protocol in accordance with Sections 35 and 36 of the National Heritage Resources Act (Act No. 25 of 1999), whereby any archaeological material, fossil material or human remains unexpectedly exposed during earthworks must be reported to the South African Heritage Resources Agency (SAHRA) or the relevant Provincial Heritage Resources Authority (PHRA), and work in the affected area halted pending professional assessment.  Although the identified building ruins are not legally protected, the ruins lie immediately adjacent to the proposed deviation. The ruin complex must be demarcated as a no-go area for the duration of construction, and that no vehicle movement, material stockpiling or turning activity be permitted within its footprint.					

	 Although the identified farmstead complex lies outside the road reserve and beyond the proposed construction footprint, the complex must be demarcated as a no-go area for the full duration of construction, with a minimum 15 m buffer maintained between construction activity and the outermost walling. No vehicle movement, turning, material stockpiling, borrow activity or temporary infrastructure may be established within the demarcated area. Should any alteration, damage or demolition of these structures become unavoidable, construction must cease in that area and a Section 34 permit application submitted to the relevant heritage resources authority prior to any further work.  The alteration, removal or demolition of the distance beacons identified along the gravel road is prohibited.  The identified cemetery must be demarcated as a no-go area for the duration of construction, with existing fencing left intact and undisturbed. No vehicle access, stockpiling, spoil placement or ablution facilities may be established within 50 m of the fenced boundary. Existing access to the cemetery by descendant or local community members must not be obstructed at any stage of construction. Should human remains or unmarked grave features be exposed during earthworks, all work in the vicinity must cease immediately, the find must be secured, and SAHRA/PHRA and the South African Police Service notified in terms of the Chance Find Protocol.  Should any intangible or living heritage concerns be raised through the public participation process, these must be referred to the Environmental Assessment Practitioner for resolution in consultation with the affected parties.					
After Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	3	3	1	2	1	2
Operational Phase						
Before Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	1	5	1	2	1	2
Mitigation	Institute a maintenance plan for the upkeep of the road to prevent commuters from creating by-passes thus destroying potential undiscovered artefacts adjacent to the proposed development area.					
After Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	1	5	1	2	1	2
Cumulative Impacts	N/A					

The construction and operational phase impacts are expected to remain **Low** both before and after mitigation, resulting in an overall Low impact on heritage and paleontological resources. As such, impacts on artefacts and fossils are considered negligible

Palaeontological Resources

Impact	Destruction of undiscovered artefacts of palaeontological significance					
Activities (not an all-inclusive list)	 Excavation  Grubbing  Trenching					
Status	Negative					
Constructional Phase						
Before Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	4	3	1	3	1	3
Mitigation	 Implement traffic control to ensure that commuters remain in bypasses in the development area and do not create bypasses adjacent to the development area.  Implement the chance finds protocol included in the HIA  Train all construction personnel (and new personnel) on the contents of the chance finds protocol during toolbox talks.					
After Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	4	3	1	3	1	3
Operational Phase						
Before Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	2	5	1	3	1	3
Mitigation	Institute a maintenance plan for the upkeep of the road to prevent commuters from creating by-passes, thus destroying any potential palaeontological remains.					
After Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	1	5	1	2	1	2
Cumulative Impacts	The destruction and loss of artefacts of palaeontological significance					

3.1.3 Water resources

Water resources encompass groundwater and surface water systems, as well as the aquatic and riparian ecosystems associated with these resources. The proposed road project has the potential to affect water resources through construction and operational activities, including vegetation clearance, earthworks, excavation, increased runoff, erosion, sediment mobilisation, and the potential release or migration of pollutants. The assessment therefore considers the potential impacts on groundwater and surface water quality, aquatic and riparian ecosystems, and the alteration of natural hydrology and flow regimes, including changes to drainage patterns, runoff and infiltration, sedimentation, and the physical and ecological functioning of watercourses, wetlands and associated riparian areas.

Ground and surface water quality						
Impact		Spills or leaks of fuel, oil, lubricants and other hazardous substances during construction may infiltrate the soil and contaminate groundwater.				
		Runoff from construction areas may transport sediment, cement residues and other pollutants into nearby wetlands, watercourses and drainage lines, resulting in deterioration of surface water quality.				
						
		Improper storage and handling of hazardous substances, as well as inadequate sanitation facilities, may result in groundwater and surface water contamination.				
		Excavation and earthworks near wetlands or watercourses may increase sediment loads and turbidity in surface water.				
		Poor stormwater management may alter natural drainage patterns and increase the risk of erosion and sedimentation in nearby watercourses.				
Activities (not an all-inclusive list)	Removal of wetland vegetation for construction of culverts					
Status	Negative					
Construction Phase						
Before Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	3	3	2	3	4	12
Mitigation		No littering must be allowed and all litter must be removed from the site.				
		The timeframe for construction through the wetlands should be kept to a minimum.				
		Any disturbance or removal of vegetation within these wetlands should be kept to a minimum.				
		Construction should be limited to the construction footprint and should not encroach into the adjacent natural areas.				

	 The disturbance caused by construction will also cause susceptible conditions for further establishment of exotics. It is therefore recommended that weed eradication be initiated at the construction site prior to construction and continued until rehabilitation of the road reserve has been completed.  When excavating through any of the wetlands, the upper 30 cm, or topsoil, should be removed together with the vegetation and stored as sods on the site. These should then be replaced when rehabilitating the construction area.  Subsoil should be used as backfilling and not as top dressing. Only removed sods and topsoil should be utilised to rehabilitate the soil surface.  The construction site must be inspected for erosion. This is particularly relevant to the banks and steep slopes of affected wetlands. Where erosion is evident, this must be remedied.  Where steep banks occur and erosion is evidently problematic, it is recommended that geotextiles be utilised to stabilise soils. Available options include contouring, berms, gabions and geotextile netting.  The soil surface should be re-instated to the virgin soil level and not depressed or elevated, as this will promote erosion and cause flow barriers. After rehabilitation, any excess soil or material should be removed and disposed of at a registered disposal facility.  Where concrete is utilised, the detrimental impacts of uncured cement on watercourses must be taken into consideration.  Problematic weeds must be eradicated where these establish on the proposed road section. The affected watercourses should particularly be monitored for the establishment of weeds, particularly the invasive <i>Prosopis glandulosa</i> (Mesquite), which is highly problematic in this region.  Adequate monitoring of weed establishment and its continued eradication must be maintained. Where category 1 and 2 weeds occur, they require removal by the proponent according to the Conservation of Agricultural Resources Act, No. 43 of 1983 and National Environmental Management: Biodiversity Act, No. 10 of 2004.					
After Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	2	3	2	2	3	6
Operational Phase						
Before Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	2	2	1	2	2	4
Mitigation	 Any maintenance work should be undertaken in accordance with an approved environmental management programme, in order to ensure that the disturbed area is rehabilitated to acceptable standards.					

	 After construction of the road section, the area must be rehabilitated. This includes removal of all construction material. Excavated rock may not be left in heaps and must be removed and disposed of at a registered facility. Compacted areas must be ripped. Construction roads not being utilised must afterwards be rehabilitated.					
After Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	1	1	1	1	2	2
Cumulative Impacts	The cumulative impact associated with ground and surface water pollution arising from the upgrade is assessed as manageable and is not expected to result in any significant residual effects, provided that all recommended mitigation and management measures are implemented effectively.					

Aquatic and Riparian Ecosystems						
Impact	Construction of culverts will take place at all listed wetlands and this will result in removal of vegetation and disturbance of the system.					
Activities (not an all-inclusive list)	Upgrading of the road, including clearing of vegetation within the road reserve					
Status	Negative					
Construction Phase						
Before Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	4	3	2	3	4	12
Mitigation	 Adequate monitoring of weed establishment and its continued eradication must be maintained.					
	 Problematic weeds must be eradicated where these establish on the proposed road section.					
	 The timeframe for construction through the watercourses should be kept to a minimum.					
	 Any disturbance and removal of vegetation within these watercourses should be kept to a minimum.					
	 Construction should be limited to the existing road reserve.					
	 Weed eradication should be initiated at the construction site prior to construction and be continued until rehabilitation of the road reserve has been completed.					
	 When excavating through any of the watercourses, the upper 30 cm, or topsoil, should be removed together with the vegetation and stored as sods on the site. These should then be replaced when rehabilitating the construction area.					
	 Subsoil should be used as backfilling and not as top dressing. Only removed sods and topsoil should be utilised to rehabilitate the soil surface.					
	 Compliance monitoring should be implemented.					

	 Problematic weeds must be eradicated where these establish on the proposed road section. The affected watercourses should particularly be monitored for the establishment of weeds, particularly the invasive <i>Prosopis glandulosa</i> (Mesquite), which is highly problematic in this region.  Adequate monitoring of weed establishment and its continued eradication must be maintained. Where category 1 and 2 weeds occur, they require removal by the proponent according to the Conservation of Agricultural Resources Act, No. 43 of 1983 and National Environmental Management: Biodiversity Act, No. 10 of 2004.					
After Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	2	3	2	2	3	6
Operational Phase						
Before Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	2	4	1	2	2	4
Mitigation	 Any maintenance work should be undertaken in accordance with an approved environmental management programme, in order to ensure that the disturbed area is rehabilitated to acceptable standards.					
	 After construction of the road section, the area must be rehabilitated. This includes removal of all construction material. Excavated rock may not be left in heaps and must be removed and disposed of at a registered facility. Compacted areas must be ripped. Construction roads not being utilised must afterwards be rehabilitated.					
After Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	1	1	1	1	1	1
Cumulative Impacts	Grubbing and clearing in the riparian and immediate terrestrial habitats will result in the loss of aquatic biodiversity. The disturbance of soils may result in the proliferation of alien and invasive vegetation. The loss of biodiversity through active clearing as well as the indirect loss of biodiversity by introducing greater competition for resources in the form of alien and invasive vegetation, will result in impaired ecosystem function. This will make the aquatic ecosystems less capable of absorbing disturbances and less capable of supporting ecosystem functions.					

Alteration of hydrology and flow regimes	
Impact	 Construction and excavations will impede flow.  Disturbance of the bed and banks will promote sedimentation.  Use of concrete may also affect the wetlands.

Activities (not an all-inclusive list)	Construction of culverts, including excavation and disturbance of wetlands					
Status	Negative					
Construction Phase						
Before Mitigation	Severity 3	Duration 3	Extent 2	Consequences 3	Likelihood 4	Significance 12
Mitigation	 No littering must be allowed and all litter must be removed from the site.  The timeframe for construction through the wetlands should be kept to a minimum.  Subsoil should be used as backfilling and not as top dressing. Only removed sods and topsoil should be utilised to rehabilitate the soil surface.  The construction site must be inspected for erosion. This is particularly relevant to the banks and steep slopes of affected wetlands. Where erosion is evident, this must be remedied.  Where steep banks occur and erosion is evidently problematic, it is recommended that geotextiles be utilised to stabilise soils. Available options include contouring, berms, gabions and geotextile netting.  The soil surface should be re-instated to the virgin soil level and not depressed or elevated, as this will promote erosion and cause flow barriers. After rehabilitation, any excess soil or material should be removed and disposed of at a registered disposal facility.  The wetland geomorphology should also be re-instated as far as possible, which will also speed up the stabilisation of the bed and banks.  Where concrete is utilised, the detrimental impacts of uncured cement on watercourses must be taken into consideration.  Installation of culverts through any of the wetlands should preferably be undertaken during the winter months (July to September) when flooding and saturated soils are less likely to occur.  The larger wetland systems, which include the Bamboesspruit and its main tributary, are likely to contain surface water throughout the year. Here the construction of culverts is likely to require blocking of the active flow and dewatering of a portion of the wetland where construction may be required. Where this will be done, only half or a portion of the wetland should be blocked for construction, whilst the remaining half should be allowed to maintain flow.					
After Mitigation	Severity 2	Duration 3	Extent 2	Consequences 2	Likelihood 3	Significance 6
Operational Phase						
Before Mitigation	Severity 2	Duration 2	Extent 1	Consequences 2	Likelihood 2	Significance 4

Mitigation	 Any maintenance work should be undertaken in accordance with an approved environmental management programme, in order to ensure that the disturbed area is rehabilitated to acceptable standards.  After construction of the road section, the area must be rehabilitated. This includes removal of all construction material. Excavated rock may not be left in heaps and must be removed and disposed of at a registered facility. Compacted areas must be ripped. Construction roads not being utilised must afterwards be rehabilitated.					
After Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	1	1	1	1	2	2
Cumulative Impacts	The cumulative impact associated with the alteration of hydrology and flow regimes arising from the upgrade is assessed as manageable and is not expected to result in any significant residual effects, provided that all recommended mitigation and management measures are implemented effectively.					

The main risk to water resources will be associated with activities such as removal of wetland vegetation for construction of culverts, including excavation and disturbance of wetlands. If not managed correctly, pollutants can infiltrate into the aquifer over time, potentially contaminating the entire aquifer and altering its flow regime. Implementing mitigation measures during such incidents is crucial to prevent these impacts.

During the construction phase of the road, it is estimated that the impact is of **Medium** significance before mitigation and **Low-Medium** after mitigation. Operational risks are minimal and confined to the proposed site. The significance of the risks is **Low** before and after mitigation measures. Risks can be fully mitigated through best-practice controls.

3.1.4 Soil erosion

Soil erosion refers to the detachment and transport of soil particles by water, wind, or other processes. The proposed road project has the potential to increase soil erosion during construction and operation through vegetation clearance, earthworks, excavation, stockpiling, and the alteration of natural drainage patterns. The assessment considers the potential for these activities to increase soil loss, cause sedimentation of surrounding areas and water resources, and result in the degradation of soil stability and land surfaces.

Soil erosion	
Impact	Erosion of topsoil due to construction and operational activities.
Activities (not an all-inclusive list)	 Site clearing and removal of vegetation
	 Earthworks and excavation for infrastructure installation

	 Construction activities and disturbance of soil surfaces  Movement of heavy vehicles and machinery causing soil compaction  Stockpiling and exposure of loose soil materials  Increased stormwater runoff and altered drainage patterns					
Status	Negative					
Construction Phase						
Before Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	3	3	2	3	4	12
Mitigation	 Implement an adequate stormwater and erosion management measures.  Limit clearance to within the demarcated areas for upgrade.  Install sediment control measures (e.g., silt fences, sediment traps) prior to any earthworks to prevent runoff into adjacent watercourses or sensitive areas.  The topsoil is regarded as the top 300 mm of the soil profile irrespective of the fertility appearance.  Strip and stockpile topsoil separately for later use in rehabilitation; ensure stockpiles are protected from wind and water erosion.  Topsoil is to be stripped when it is in as dry a condition as possible in order to prevent compaction.  The topsoil, including the existing grass cover is to be shallowly ripped (only the depth of the topsoil) before removal. This is to ensure that organic plant material, and the natural seed base is included in the stripping process.  As far as is possible, vegetation should be retained to prevent soil erosion.  Revegetate disturbed areas promptly after construction phase, using indigenous plant species.  All barren/unvegetated spaces cleared during construction, which also includes the creation of topsoil stockpiles should be kept clear of vegetation.  Topsoil should not be accidentally mixed with waste or other contaminants. Scarification of compacted soil should be performed during rehabilitation.  Weed eradication must be initiated at the construction site prior to construction and continued until rehabilitation.  Construction must have contingency plans for high rainfall events during construction.  Monitor erosion control structures frequently and after heavy rains.  Avoid topsoil compaction by restricting heavy machinery movement to designated access routes.  The contractor shall apply soil conservation measures to the stockpiles to prevent erosion. This can include the use of erosion control fabric or grass seeding.  If possible, construction activities must be scheduled for the dry winter months to decrease the risk of erosion during heavy thunderstorms.					

	 The construction site must be inspected for erosion. This is particularly relevant to the banks and steep slopes of affected wetlands. Where erosion is evident, this must be remedied.  Where steep banks occur and erosion is evidently problematic, it is recommended that geotextiles be utilised to stabilise soils. Available options include contouring, berms, gabions and geotextile netting.  Monitoring of the project activities is essential to ensure the mitigation measures are implemented. Compliance with the mitigation recommendations must be audited by a suitably qualified independent ECO with an appropriately timed audit report.					
After Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	2	3	2	2	3	6
Operational Phase						
Before Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	2	5	2	3	2	6
Mitigation	 Ensure that all stormwater drainage infrastructure is appropriately designed and maintained to safely convey runoff and prevent concentrated flows from causing erosion.  Stabilise and revegetate disturbed areas, road verges, embankments and cut-and-fill slopes with suitable indigenous vegetation as soon as practicable.  Regularly inspect road drainage channels, culverts, outlets, berms and embankments for signs of erosion, scouring or instability.  Repair and stabilise eroded areas promptly using appropriate erosion-control measures.  Maintain vegetation cover along road verges and within the road reserve and avoid unnecessary vegetation clearing during maintenance activities.  Ensure that maintenance activities do not result in unnecessary exposure or disturbance of soil, particularly during periods of heavy rainfall.  Monitor areas adjacent to watercourses, wetlands and riparian zones for increased sedimentation or erosion and implement corrective measures where required.					
	Severity	Duration	Extent	Consequences	Likelihood	Significance
	1	5	2	3	1	3
Cumulative Impacts						
The cumulative impact associated with erosion, is assessed as manageable and is not expected to result in any significant residual ecological impact, provided that all recommended mitigation measures are fully implemented						

The proposed road project will result in some disturbance and exposure of surface soils, particularly during the construction phase, thereby increasing the potential for soil erosion. The erosion risk is therefore rated as **Medium** during construction and **Low-Medium** during operation

before mitigation. However, the impacts can be effectively managed through standard erosion and stormwater control measure. Following implementation of the recommended mitigation measures, the residual erosion risk is expected to be **Low-Medium** during construction and **Low** during the operational phases, provided that appropriate measures are implemented and maintained.

3.1.5 Aesthetics

The risk to the visual character of the environment will be based on a cumulative contribution of all the specialists and site visits done by the Environmental Assessment Practitioner.

Visual Impacts						
Impact	The alteration of landscape appreciation, visual deterioration, and visual impacts from the road upgrade					
Activities (not an all-inclusive list)	 Grubbing and clearing					
	 Trenching					
	 Stockpiling					
	 Movement of construction vehicles					
	 Road surface preparation					
Status	Negative					
Constructional Phase						
Before Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	2	3	2	2	4	8
Mitigation	 Construction debris should be removed regularly and not allowed to pile up.					
	 A designated construction waste area should be allocated away from the stockpiling area and demarcated.					
	 All domestic waste and construction debris should be removed to a designated waste landfill site.					
	 A complaints register needs to remain on-site in which all complaints raised by the public are to be filed.					
	 Limit construction activities to the upgrade footprint.					
	 Implement house-keeping practices in which attention is given to neat storage of materials.					
	 Do not grub or clear beyond the operational area.					
	 Implement rehabilitation methods where possible during construction activities.					
After Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	1	3	1	2	2	4
Operational Phase						
	Severity	Duration	Extent	Consequences	Likelihood	Significance

Before Mitigation	1	5	1	2	2	4
Mitigation	 Institute a maintenance plan for the upkeep of the road to prevent commuters from creating by-passes, thus increasing the surface area the road.					
After Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	1	5	1	2	1	2
Cumulative Impacts	The aesthetic quality of the area would be reduced leading to a decrease in quality of living for the local residents and commuters.					

The potential risk to the visual appeal of the surrounding environment during the construction phase of the road is initially assessed as **Low-Medium** but is reduced to a **Low** level after mitigation measures are put in place. The operational phase of the proposed road is expected to have a **Low** visual impact before and after mitigation.

3.1.6 Noise and air quality

Noise and air quality relate to the generation of unwanted sound and atmospheric emissions that may affect human health, surrounding communities, and the environment. The proposed upgrade has the potential to generate noise, dust, and other emissions during both the construction phase. The assessment considers the potential for these activities to impact nearby sensitive receptors and the surrounding ambient environment.

Air quality						
Impact	The degradation of air quality on account of gases from construction vehicles and aerosolized particulate matter.					
Activities (not an all-inclusive list)	 Dust generation associated with construction activities  Exhaust fume generation associated with construction vehicle activity  Vegetation clearance and the construction of internal dirt roads					
Status	Negative					
Constructional Phase						
Before Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	3	3	2	3	2	6
Mitigation	 Areas cleared of vegetation must be wet down to prevent excessive dust during construction; suppression measures must be implemented, including periodic wetting of exposed soils.					

	 Enforce a speed limit of 20 km/h and optimise the working schedule to reduce vehicle mobilisation.  Limit the clearance of vegetation to only necessary areas.  The construction of new dirt roads should be restricted by prioritising existing roads.  The upgrade should remain within the authorised area.  Cleared vegetation and open areas susceptible to wind-blown dust must be rehabilitated and stabilised as soon as possible.  Stockpiled material must either be covered or wet down to prevent dust particulates from entering the atmosphere.  Construction vehicles must be maintained to prevent excessive release of emissions.  No burning of waste shall be allowed on site.  Implement a curfew of only operating between the hours of 7:00 and 17:00.  Active revegetation of cleared areas immediately after construction.					
After Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	1	3	1	2	2	4
Operational Phase						
Before Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	1	5	1	2	1	2
Mitigation	 Maintain the road surface in good condition to reduce the generation of dust from vehicle movement.  Where practicable, maintain vegetation along the road reserve to assist with the interception of airborne pollutants.					
After Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	1	5	1	2	1	2
Cumulative Impacts	The reduction in air quality could lead to respiratory ailments of people and fauna, as well as a decline in vegetation (in the incidence of excessive particulate matter).					

The movement and activities of construction vehicles will affect the air quality. However, these impacts are not expected to be significantly higher than the existing impact on the environment's air quality. The impacts during the construction phase of the proposed upgrade are considered **Low-Medium** before mitigations are applied, and **Low** after mitigation measures. During the operational phase, impacts are expected to remain **Low** before and after mitigation measures have been applied. The applicant is responsible for consistently assessing and implementing industry best practice mitigation measures to minimise the overall impact on air quality.

Noise and vibrations						
Impact	Vehicles, machinery and equipment movement causing a disturbance to local residents resulting in reduced standards of living.					
Activities (not an all-inclusive list)	 Noise generated through construction-related activities  Vibrations generated due to the utilisation of construction equipment					
Status	Negative					
Constructional Phase						
Before Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	3	3	2	3	3	9
Mitigation	 No loud music allowed on-site.  Vehicles must be maintained in such a manner as not to cause excessive noise when operating them.  Select 'quiet' construction equipment and working methods to avoid unnecessary revving and hooting.  Adequate speed signs should be distributed throughout the site.  Working schedule for activities with high noise levels will be limited to 07:00 AM to 17:00 PM.  Machinery should be serviced regularly during the construction stage. Equipment should be regularly serviced.					
After Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	2	3	2	2	2	4
Operational Phase						
Before Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	1	5	2	3	1	3
Mitigation	 Implement speed limit signage to control the acceleration and speed of commuters which will reduce noise associated with the utilisation of the road by commuters.					
After Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	1	5	1	2	1	2
Cumulative Impacts	The degradation of standard of living associated experienced by local residents on account of excessive noise.					

The construction phase falls within **Low-Medium** before any mitigation, and **Low** after mitigation is in place. During operational phase, the impacts are expected to be **Low** before and after mitigation. The noise and vibration levels in the area are primarily due to the regular ploughing and harvesting of cultivated fields using tractors. These activities contribute significantly to the overall environmental noise and vibration. As a result, the impact of the operations on the surrounding area is expected to be minimal in comparison.

3.1.7 Waste

Waste management refers to the types of waste being generated by the proposed upgrade. This theme also investigates environmental impacts generated by the upgrade concerning specific waste management strategies employed throughout all phases of the project.

General Solid, Liquid and Hazardous Waste						
Impact	 Litter generated by construction workers strewn in the area, which gets dispersed further by wind and stormwater resulting in the degradation of the aesthetic quality of the area.  Osmotically active chemicals in construction materials leaching into soil and watercourses leading to the deterioration of soil and river health.					
Activities (not an all-inclusive list)	 Litter production.  Solid construction waste material production.  Liquid waste produced.  Inadequate storage and disposal of construction material.					
Status	Negative					
Construction Phase						
Before Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	4	3	2	3	4	12
Mitigation	 Receptacles should be made available for the construction workers to dispose of litter into the receptacles.					
	 Waste should be disposed of at a licenced landfill on a frequent basis.					
	 Secure waste receptacle bins with lids to prevent wind-blown litter.					
	 Any hazardous waste must be stored separately out of direct sunlight and out of rain in the incidence of precipitation.					
	 Any liquid waste generated must be stored in watertight containers.					
	 Any construction material with leachable material must be covered and secured with impermeable tarp in the incidence of rain.					
After Mitigation	 Any left over construction material after the construction phase has terminated must be disposed of at a licenced landfill facility.					
	Severity	Duration	Extent	Consequences	Likelihood	Significance
	1	3	1	2	2	4
Operational Phase						
Before Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance

	N/A					
Mitigation	No waste is anticipated to be produced during the operational phase.					
After Mitigation	Severity	Duration	Extent	Consequences	Likelihood	Significance
	N/A					
Cumulative Impacts	The accumulation of solid waste, as well as the chemicals that leach into the soil and water courses from construction material will result in the aesthetic degradation of the area, death and deformation of vegetation and fauna who ingest the toxins either directly (water borne) or indirectly (bioaccumulation).					

The expected impact associated with general waste generation during the construction phase is rated as Medium before mitigation measures and is expected to decrease to Low following the implementation of appropriate waste management measures. The operational phase is considered not applicable, as no significant waste-generating activities associated with the road operation are anticipated.

3.1.8 Socio-economic

Socio-economic impacts focus on the effects the upgrade will have on the economic drivers in the surrounding area and emphasise the integration of economic development with the people's needs.

Socio-economic impacts	
Impact	 Impacts associated with the need for the appointment of construction workers  Positive socio-economic benefit through increased household income, improved livelihoods and opportunities for local skills development  Improvement of accessibility and mobility for surrounding communities by providing improved connectivity, safer travel conditions and more efficient access to employment opportunities, services and economic activities
Activities (not an all-inclusive list)	 Road construction and surfacing activities.  Transportation and delivery of construction materials.  Operation of construction camps and associated facilities.  Procurement of construction materials, equipment and services.
Status	Positive
Construction Phase	

Positive consequences	Severity	Duration	Extent	Consequences	Likelihood	Significance	Adjusted
	4	3	2	4	4	12	16
Conditions	Although the calculated significance score for the positive socio-economic impact during construction is 12, the score was adjusted to 16 to reflect the broader socio-economic benefits associated with the proposed development, including temporary employment opportunities, the use of local labour and suppliers, and increased economic activity within the surrounding area. The adjustment recognises the potential for these benefits to extend beyond the immediate construction activities, given the following conditions:  Ensure transparent, fair recruitment and procurement practices.  The contractor chosen should maximise the involvement of local communities in construction and support activities, to the extent possible, based on available skill levels.  Priority should be given to the local suppliers of goods and services, which meet requirements of project procurement as far as is possible.  Training programmes that will benefit both construction stage skills requirements and long-term employment demand should be developed whenever possible.						
Operational Phase							
Positive Consequences	Severity	Duration	Extent	Consequences	Likelihood	Significance	
	4	5	2	4	4	16	
Conditions	 The proponent should maximise the involvement of local communities in maintenance activities  Priority should be given to the local suppliers of goods and services, which meet requirements of project procurement as far as is possible.						
Cumulative Impacts	The proposed project will have an overall positive impact on the socio-economic aspect by creating job opportunities, increasing local spending, providing training, and fostering economic growth.						

The proposed project offers numerous socio-economic benefits, including the creation of local jobs, increased local spending, skills training opportunities, and a contribution to food security. Consequently, it is assessed that the construction and operational phase of this project will have a **Medium-High** positive impact on the local socio-economic landscape.

3.2 Summary of the positive impacts of the proposed road upgrade

The road upgrade is anticipated to contribute positively to the broader socio-economic well-being of the surrounding area by improving the functionality and reliability of existing transport infrastructure. The improved road will support more efficient movement of people and goods, strengthen links between neighbouring communities and facilitate greater participation in local economic and social activities. The project will also provide temporary employment and procurement opportunities during construction, with potential longer-term benefits associated with improved access to markets and services. Overall, the upgrade is expected to contribute to improved living conditions and local economic resilience, while supporting the infrastructure development objectives of the North West Provincial Development Plan (2030).

3.3 No go alternative

The no-go alternative assumes that the proposed project will not go ahead i.e. it is the option of not constructing the proposed development. The no-go alternative would result in no additional environmental impacts associated with the proposed development. However, existing environmental conditions and impacts, including dust generation, erosion and drainage-related problems, would likely persist. It provides the baseline against which other alternatives were compared. The following implications will occur if the “no go” alternative is implemented:

-  Socio-economic benefits such as job creation, skills development, social cohesion and local economic growth will be lost.
-  Lack of accessibility and road safety will reduce the quality of life for local residences.
-  No socio-economic benefits associated with the increased accessibility to the area would be conferred to the local communities. This would entail that the increased delivery times of goods and services as well as increased response times by emergency personnel such as police officers, firefighting vehicles, ambulances etc would continue.
-  Without a safe and reliable transport, the local economy will remain inactive.
-  No subsequent potential economic benefits associated with the continual maintenance of the road would take place either.
-  Increased unemployment: Without the construction of the road, jobs in the building, construction and engineering industry will not be created, leading to further unemployment in an already struggling economy.
-  There would be detrimental environmental impacts in the form of dust creation both by regular commuters as well as during grading activities associated with road maintenance. The increased dust generation and erosion would also continue the current trajectory of sedimentation in the nearby watercourses.
-  The current culverts which are inadequate to accommodate the flow regimes of the nearby watercourses would result in constriction, sedimentation, scouring of the outflow and impaired drainage of the headwaters. This detrimentally impacts the river health of the perennial and non-perennial watercourses which the D1954 currently crosses. These detrimental impacts would continue if not replaced by culverts with superior capacity to accommodate the watercourse throughput volumes.

Besides the above mentioned, the following benefits might occur if the no go alternative is implemented:

-  No indigenous vegetation will be removed and or disturbed.
-  No change/ alteration to the existing landscape will occur.
-  No disturbances of the watercourses will occur.

4. Conclusion

The impact assessment has evaluated the potential environmental impacts associated with the proposed project across the construction and operational phases. Prior to the implementation of mitigation measures, the identified impacts were assessed as ranging from **Medium** to **Low** significance, primarily related to destruction of flora and fauna, soil erosion, groundwater protection, noise and dust generation, waste management, and other operational related disturbances.

With the implementation of the recommended mitigation and management measures, the significance of these impacts is reduced to **Low-Medium** and **Low**. The likelihood of adverse impacts occurring is correspondingly reduced, and residual impacts are considered manageable and acceptable within the receiving environment.

All specialist studies, including ecological, heritage and aquatic assessments, conclude that the proposed road upgrade will not cause long-term degradation of the receiving environment.

In conclusion, it is the finding of this impact assessment that the road upgrade will not result in significant adverse environmental impacts, provided that all recommended mitigation measures and conditions of authorisation are implemented and adhered to. The proposed project is therefore considered environmentally acceptable and suitable for authorisation from an environmental impact perspective.