



Environmental  
Management  
Group (Pty) Ltd.

**IMPACT ASSESSMENT  
FOR:  
PROPOSED CONSTRUCTION  
OF A LOW-LEVEL CULVERT  
BRIDGE BETWEEN  
KOKFONTEIN AND  
ELLENDALE IN THE  
NORTHERN CAPE  
PROVINCE.**

**JOE MOROLONG LOCAL  
MUNICIPALITY**



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## 1. Introduction:

The social and environmental impacts assessment generated by the proposed **construction of a low-level culvert bridge between Kokfontein and Ellendale in the Northern Cape Province** is presented as the risk assessment methodology and associated results. This process aims to identify possible impacts associated with the proposed development and evaluate their significance to ensure appropriate mitigation is applied. The recommendations of suitable mitigation measures that should be implemented to reduce the consequences of likely 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. For the purpose of determining 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 development and the recommendation of appropriate mitigation measures.

**Table 5:** Environmental significance evaluation score sheet.

| Aspect                             | Specific                                      | Low | Low-Medium | Medium | Medium-High | High  |
|------------------------------------|---|-----|------------|--------|-------------|-------|
| Overall Environmental significance | 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 development. 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 for the preferred alternative:

#### 3.1. Ecological impacts:

The ecological impact assessment 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. The fauna impact assessment refers to the animal component and focuses on the available habitats, resources and protected species.

| Habitat loss                                    |  |          |          |          |              |              |              |
|---|--|----------|----------|----------|--------------|--------------|--------------|
| Impact  | Loss of habitat and species diversity as a result of construction and the removal natural elements.  |          |          |          |              |              |              |
| Activities<br>( <i>Not all-inclusive list</i> ) | <ul style="list-style-type: none"> <li>• Physical clearance.</li> <li>• Trampling</li> <li>• Off roading</li> <li>• Habitat fragmentation leading to edge effects.</li> <li>• Illegal harvesting of plant material.</li> <li>• Habitat degradation.</li> </ul>   |          |          |          |              |              |              |
| Construction Phase                              |  |          |          |          |              |              |              |
| Before Mitigation                               | Status   | Severity | Duration | Extent   | Consequences | Likelihood   | Significance |
|   | Negative   | 2        | 3        | 2        | 2            | 2            | 4            |
| Mitigation                                      | <ul style="list-style-type: none"> <li>• Removal of indigenous vegetation should be kept to a minimum.</li> <li>• Disturbance related activities must be restricted to the authorised development area.</li> <li>• Prioritise the use of existing service or single track roads.</li> <li>• No new temporary roads may be constructed or utilised outside the development area.</li> <li>• No off-roading or reckless driving should be allowed.</li> <li>• Post-construction open areas should be rehabilitated and revegetated with indigenous vegetation.</li> <li>• No harvesting of plant material should be allowed.</li> <li>• No illicit fires may be allowed during construction.</li> <li>• A fire management plan should be drafted and kept on site for all phases of the development.</li> <li>• Littering should be prohibited.</li> <li>• No burning of any materials is allowed on site.</li> <li>• All rubble and litter (if applicable) must be collected and removed from the site to a suitable registered waste disposal site.</li> <li>• Implement a comprehensive grazing management plan and practices for local livestock to prevent ongoing significant overgrazing of the watercourse habitat and surrounding landscape. This effort aims to improve and restore the ecological condition over time.</li> <li>• A suitably qualified Environmental Control Officer (ECO) must be appointed to monitor the construction phase in terms of the EMP and the specialist studies recommendations.</li> </ul> |          |          |          |              |              |              |
|   | After Mitigation   | Status   | Severity | Duration | Extent       | Consequences | Likelihood   |
| Negative  |  | 1        | 3        | 1        | 2            | 1            | 2            |
| Operational Phase                               |  |          |          |          |              |              |              |
| Before Mitigation                               | Status   | Severity | Duration | Extent   | Consequences | Likelihood   | Significance |
|   | Negative   | 1        | 5        | 1        | 2            | 1            | 2            |

|                    |  |          |          |        |              |            |              |
|--------------------|--|----------|----------|--------|--------------|------------|--------------|
| Mitigation         | <ul style="list-style-type: none"> <li>• The operational phase of the access road and low-level culvert bridge is anticipated to generate low impacts which may lead to minimal habitat loss due to the operational activities being limited to the development boundaries (refer to Appendix G for ecological report).</li> <li>• Rehabilitation of disturbed areas should be implemented, where possible.</li> </ul> |          |          |        |              |            |              |
| After Mitigation   | Status   | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|                    | Negative   | 1        | 5        | 1      | 2            | 1          | 2            |
| Cumulative Impacts | Loss of plant and animal species due to construction vehicles, removal of topsoil and trampling.   |          |          |        |              |            |              |
| Additional Notes:  | Construction footprint to be demarcated as per the construction phase conditions.  |          |          |        |              |            |              |

The terrestrial ecologist has indicated that the environmental impact on habitat loss during both the construction and operational phases will be **low**, both before and after mitigation measures. However, it remains essential to implement monitoring and evaluation procedures to effectively oversee and manage any potential increase in risk. The applicant must remain mindful of activities that could cause damage to the natural environment beyond the designated development area. These activities may include, but are not limited to, veld fires, water pollution, and plastic pollution. The applicant is required to take proactive steps to significantly minimise the likelihood of such adverse impacts occurring. It is imperative to establish monitoring and evaluation protocols to assess the potential for increased risk throughout all stages of this development.

| Invasive plant species                 |   |          |          |        |              |            |              |
|--|---|----------|----------|--------|--------------|------------|--------------|
| Impact                                 | Proliferation of exotic plant species due to environmental disturbance.   |          |          |        |              |            |              |
| Activities<br>(Not all-inclusive list) | <ul style="list-style-type: none"> <li>• Improper eradication methods on existing exotics.</li> <li>• Physical clearance providing opportunity for opportunistic exotics to proliferate.</li> <li>• Accidental spread.</li> <li>• Disruption of ecological balance due to habitat disturbance.</li> <li>• Slow response to infestation eradication.</li> </ul>  |          |          |        |              |            |              |
| Construction Phase                     |   |          |          |        |              |            |              |
| Before Mitigation                      | Status  | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|  | Negative  | 2        | 3        | 2      | 2            | 3          | 6            |
| Mitigation                             | <ul style="list-style-type: none"> <li>• The vegetation on stockpiles needs to be eradicated from all stockpiles on a quarterly basis.</li> <li>• Disturbance related activities may not exceed the authorised development boundary.</li> <li>• Implement an adequate Alien Invasive Species Management and Prevention Plan during the construction- and subsequent operational phases of the proposed development.</li> <li>• Exotics may not be allowed to proliferate within the development area.</li> <li>• Construction equipment and machinery must be cleaned promptly before construction starts and routinely during construction.</li> </ul> |          |          |        |              |            |              |
| After Mitigation                       | Status  | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|  | Negative  | 1        | 3        | 1      | 2            | 2          | 4            |
| Operational Phase                      |   |          |          |        |              |            |              |
|  | Status  | Severity | Duration | Extent | Consequences | Likelihood | Significance |

|                    |   |          |          |        |              |            |              |
|--------------------|---|----------|----------|--------|--------------|------------|--------------|
| Before Mitigation  | Negative  | 1        | 5        | 2      | 3            | 1          | 3            |
| Mitigation         | • All open spaces post-construction needs to be rehabilitated with indigenous species.    |          |          |        |              |            |              |
| After Mitigation   | Status  | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|                    | Negative  | 1        | 5        | 1      | 2            | 1          | 2            |
| Cumulative Impacts | Transportation of alien/invasive plant species  |          |          |        |              |            |              |
| Additional Notes:  | Contain the natural environment and ensure the Environment Management Plan is adhered to. |          |          |        |              |            |              |

The impact that invasive plant species will have during construction phase is estimated to be **Low-medium** without mitigation and **Low** when mitigation measures are implemented. This risk assessment for the operational phase is estimated to be **Low** overall prior and after mitigation measures are implemented.

| Loss of ecological support areas (ESA) |  |          |          |        |              |            |              |
|--|--|----------|----------|--------|--------------|------------|--------------|
| Impact                                 | Uncontrolled veld fire and destruction of natural veld conditions.   |          |          |        |              |            |              |
| Activities (Not all-inclusive list)    | Clearing vegetation, grading land, and disturbance of soil structure.  |          |          |        |              |            |              |
| Construction Phase                     |  |          |          |        |              |            |              |
| Before Mitigation                      | Status   | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|  | Negative   | 3        | 3        | 2      | 3            | 3          | 9            |
| Mitigation                             | <ul style="list-style-type: none"> <li>• Construction workers will not be permitted to start veld fires, firefighting equipment must be on site and activities generating heat, or an open flame must be monitored.</li> <li>• Construction should be limited to the development boundary.</li> <li>• No wood may be collected for personal use.</li> <li>• Ensure continuous flow of the Manyeding River around the construction area during winter to maintain local ecological connectivity and habitat integrity, without significant obstruction.</li> <li>• Implement effective stormwater and erosion management measures during construction and operation phases to prevent soil erosion and maintain ecological functionality of the water catchment areas.</li> <li>• Mulching of the embankments where vegetation clearance will occur.</li> </ul> |          |          |        |              |            |              |
| After Mitigation                       | Status   | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|  | Negative   | 2        | 3        | 1      | 2            | 2          | 4            |
| Operational Phase                      |  |          |          |        |              |            |              |
| Before Mitigation                      | Status   | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|  | Negative   | 3        | 5        | 2      | 3            | 2          | 6            |
| Mitigation                             | • Rehabilitation of disturbed soil should be implemented to prevent veld fires and ensure the re-establishment of the natural vegetation.  |          |          |        |              |            |              |
| After Mitigation                       | Status   | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|  | Negative   | 3        | 5        | 1      | 3            | 1          | 3            |
| Cumulative Impacts                     | The degradation of ecological support zones throughout construction and ongoing operation results in the depletion and fragmentation of habitats, disrupting ecosystems and  |          |          |        |              |            |              |

diminishing available living spaces for wildlife. Fragmentation may isolate populations, impede migratory patterns, and heighten the risk of extinction. The destruction of these ecological support areas entails a loss of biodiversity, encompassing flora and fauna uniquely suited to their respective habitats. These zones play a crucial role in providing vital ecosystem functions, leading to compromised water and soil quality, increased erosion, reduced carbon retention, and decreased agricultural productivity.

**Additional Notes:** The proposed project traverses over portions of a category 1 Ecological Support Area, with the communities making use of the Manyeding River for water use as well.

The proposed project crosses through sections of an Ecological Support Area (ESA) 1. While the overall impact of the proposed development is assessed as **Low** during the operational phase, it is deemed to be **Low-Medium** prior to mitigations during the construction phase. However, the impact is expected to decrease to a **Low** significance after the implementation of mitigation measures.

| Protected species                      |   |          |          |        |              |            |              |
|--|---|----------|----------|--------|--------------|------------|--------------|
| Impact                                 | The loss of protected species as a result of the proposed development.  |          |          |        |              |            |              |
| Activities<br>(Not all-inclusive list) | Clearance of protected species within the development footprint.  |          |          |        |              |            |              |
| Construction Phase                     |   |          |          |        |              |            |              |
| Before Mitigation                      | Status  | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|  | Negative  | 1        | 3        | 1      | 2            | 2          | 4            |
| Mitigation                             | <ul style="list-style-type: none"> <li>Protected species to be demarcated to prevent accidental removal or damage.</li> <li>Deviation of proposed road construction to limit unnecessary removal of protected species.</li> <li>Permit applications should be done as required by DFFE for the removal of <i>Olea europaea</i> subsp. <i>cuspidata</i> (African wild olive).</li> </ul> |          |          |        |              |            |              |
| After Mitigation                       | Status  | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|  | Negative  | 1        | 3        | 1      | 2            | 1          | 2            |
| Operational Phase                      |   |          |          |        |              |            |              |
| Before Mitigation                      | Status  | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|  | Negative  | 1        | 5        | 1      | 2            | 1          | 2            |
| Mitigation                             | Routine maintenance associated with the access road and culvert bridge should be restricted to the proposed area.   |          |          |        |              |            |              |
| After Mitigation                       | Status  | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|  | Negative  | 1        | 5        | 1      | 2            | 1          | 2            |
| Cumulative Impacts                     |   |          |          |        |              |            |              |
| Additional Notes:                      | Removal of protected species should be avoided as far as possible.  |          |          |        |              |            |              |

The terrestrial ecologist has assessed that the impact on protected tree species during construction and operation will be **low**, both before and after mitigation measures. Nevertheless, it is crucial to protect these species and implement effective monitoring and management procedures to mitigate any potential risks. The applicant must be vigilant about activities that could harm protected species outside the development area, such as veld fires, water pollution, and damage from construction. They must take proactive measures to greatly reduce the chances of such adverse impacts or where such impacts can not be avoided apply for the relevant permits / licences for the removal of these protected species.

### 3.2. Heritage:

The heritage theme involves culturally significant finds including, but not limited to fossils, artefacts and certain culturally relevant infrastructure. Details concerning the heritage theme is discussed in detail within the Phase 1 Heritage Impact Assessment.

| Artefacts and Fossils                  |  |          |          |        |              |            |              |
|--|--|----------|----------|--------|--------------|------------|--------------|
| Impact                                 | Destruction of any archaeological artefacts or fossils   |          |          |        |              |            |              |
| Activities<br>(Not all-inclusive list) | <ul style="list-style-type: none"> <li>Excavation within lower geological strata.</li> <li>Illegal collecting of loose chance finds (e.g. Stone age artefacts).</li> </ul>   |          |          |        |              |            |              |
| Construction Phase                     |  |          |          |        |              |            |              |
| Before Mitigation                      | Status   | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|  | Negative   | 2        | 3        | 1      | 2            | 1          | 2            |
| Mitigation                             | <ul style="list-style-type: none"> <li>SAHRA and a qualified archaeologist be consulted immediately in the event of accidental archaeological exposure.</li> <li>In the unlikely event of a accidental archaeological exposure, all excavations should stop immediately.</li> <li>No loose chance finds such as stone age artefacts (arrow heads, stone flake blades, etc.) may be collected.</li> <li>The on site environmental representative should consult the appointed ECO regarding any such discoveries.</li> <li>All construction debris / waste should be removed from site and may not be deposited in on site excavated waste pits.</li> </ul> |          |          |        |              |            |              |
| After Mitigation                       | Status   | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|  | Negative   | 1        | 3        | 1      | 2            | 1          | 2            |
| Operational Phase                      |  |          |          |        |              |            |              |
| Before Mitigation                      | Status   | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|  | Negative   | 1        | 5        | 1      | 1            | 1          | 1            |
| Mitigation                             | <ul style="list-style-type: none"> <li>No loose chance finds such as stone age artefacts (arrow heads, stone flake blades, etc.) may be collected.</li> <li>The on site environmental representative should consult the appointed ECO regarding any such discoveries.</li> <li>No unauthorised excavations, post construction may be allowed.</li> </ul>   |          |          |        |              |            |              |
| After Mitigation                       | Status   | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|  | Negative   | 1        | 5        | 1      | 1            | 1          | 1            |

|                    |  |
|--------------------|--|
| Cumulative Impacts | The uncovering, disturbance or damaging of archaeological artefacts or fossils   |
| Additional Notes:  | According to the Phase 1 HIA report. The applicant and contractor should remain conscious of this statement. Responsible excavation and other construction related activities which reduces the likelihood of impacting heritage resources should always be implemented. |

The Paleoanthropological specialist indicated that the potential of finding any paleoanthropological resources of significant concern (Fossils and associated artefacts) is very low. The specialist further requested exemption from further investigation relating to this aspect. The overall impact on these historical resources is considered **Very Low**.

The odd chance of finding loose surface scatters such as stone age arrow heads and stone flake knives were regarded by the HIA specialist as being of **Low significance**. Nonetheless, a conservative approach needs to be retained as this prevents heritage resources from being viewed in a casual light.

The overall impacts on archaeological components will be of **Low** order prior to any mitigation and **Low** after mitigation. These low scores are attributed to the low likelihood of finding fossils and artefacts of historical significance and the absence of above ground evidence of historically significant structures. Mitigation measures as indicated should be implemented.

| Heritage cumulative impacts  |
|--|
| The overall cumulative impact associated with the archaeological aspect of the proposed development are negative due to the anthropogenic disturbances during mostly the construction phase. The proposed development will not generate any positive impacts towards the heritage aspect. The significance impact score was overall <b>Low</b> which can be attributed towards the location of the development which is not near any areas of archaeological importance. |

### 3.3. Water resources:

The water resource theme includes all aspects of freshwater including surface and groundwater resources. Water quality and quantity are two crucial components that are evaluated.

| Surface and Ground Water Quality                |   |          |          |        |              |            |              |
|---|---|----------|----------|--------|--------------|------------|--------------|
| Impact  | Sewage and effluent has the potential to adversely affect the quality of any receiving water body.  |          |          |        |              |            |              |
| Activities<br>( <i>Not all-inclusive list</i> ) | Construction activities can potentially disturb or damage the Manyeding watercourse and adjacent natural depression wetlands in proximity to the construction boundary.   |          |          |        |              |            |              |
| Construction Phase                              |   |          |          |        |              |            |              |
| Before Mitigation                               | Status  | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|   | Negative  | 4        | 3        | 3      | 3            | 2          | 6            |
| Mitigation                                      | <ul style="list-style-type: none"> <li>• During construction, chemical toilets must be provided, and any containers containing oil, grease, or other industrial substances must be treated and disposed of at a recognised facility, while also being stored as far as practically possible from the Manyeding River and depression pans.</li> <li>• It's crucial to minimise both the footprint and duration of construction activities along depression wetlands and Manyeding watercourse.</li> <li>• All activities should be confined within the construction boundary.</li> <li>• Excess material should not be dumped on site and must be removed from site.</li> <li>• No development activity may take place within a 100 metre boundary of the watercourse culvert bridge crossing until environmental authorisation has been granted from the department of environmental affairs.</li> <li>• Ensure the proposed Manyeding River culvert bridge crossing driving surface is elevated above the highwater mark or 1:100-year floodline to maintain traffic flow during heavy rainfall.</li> <li>• It is recommended that the construction of the proposed Manyeding River crossing be conducted during the winter season if practicably possible/feasible. The flow of the river will be significantly reduced during this time, which should ease the excavation activities and result in reduced impeding of- and impact on flow.</li> <li>• This lower flow during the winter season must however still be adequately diverted/channelled around the construction area of the Manyeding River crossing, in order to ensure continued flow through the area during the construction period. Under no circumstances may the flow of the Manyeding River be significantly impeded/blocked for any period of time, during construction. This must be done to maintain the local ecological connectivity, -functionality and subsequent -integrity of the semi-aquatic/riparian habitat.</li> <li>• Implement an adequate stormwater and erosion management measures during the construction- and subsequent operational phases of the proposed development. This must be done to sufficiently manage storm water runoff and clean/dirty water separation, in order to prevent any significant soil erosion from occurring within and around the assessment area and to attempt to maintain the ecological functionality and -integrity of the local and broader quaternary surface water catchment- and drainage area.</li> </ul> |          |          |        |              |            |              |
| After Mitigation                                | Status  | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|   | Negative  | 3        | 3        | 2      | 3            | 1          | 3            |
| Operational Phase                               |   |          |          |        |              |            |              |
| Before Mitigation                               | Status  | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|   | Negative  | 1        | 5        | 1      | 2            | 1          | 2            |



|                    |  |          |          |        |              |            |              |
|--------------------|--|----------|----------|--------|--------------|------------|--------------|
| Mitigation         | <ul style="list-style-type: none"> <li>• The construction area must undergo rehabilitation, which involves removing all construction materials.</li> <li>• Excavated rock should not be left in heaps but must be transported and disposed of at a registered facility.</li> <li>• Additionally, compacted areas should be loosened through ripping and the embankments of the Manyeding river should be rehabilitated to prevent possible erosion.</li> <li>• Construction roads that are no longer in use must be rehabilitated as well.</li> <li>• Implement a comprehensive grazing management plan and practices for local livestock to prevent ongoing significant overgrazing of the watercourse habitat and surrounding landscape. This effort aims to improve and restore the ecological condition over time.</li> <li>• Establish and enforce an effective Alien Invasive Species Management and Prevention Plan.</li> </ul> |          |          |        |              |            |              |
| After Mitigation   | Status   | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|                    | Negative   | 1        | 5        | 1      | 2            | 1          | 2            |
| Cumulative Impacts | The disturbance and destruction of natural wetlands result in adverse effects. This includes the introduction of pollutants such as nutrients, pathogens, heavy metals, and organic compounds into the water bodies they feed into.  |          |          |        |              |            |              |
| Additional Notes:  | To mitigate the risk of contamination or disturbance, it is essential to implement the measures outlined above. For detailed recommendations and mitigation measures specific to aquatic impacts, please refer to the aquatic impact assessment provided within the BAR (Basic Assessment Report).   |          |          |        |              |            |              |

During the construction phase of the development, it is estimated that the impact on surface and groundwater quality is of **Low-Medium** prior to mitigation and will be reduced to **Low** if mitigation measures are adhered to. During the operational phase of the development the overall significance is **Low** on account of the proposed project being a low level culvert bridge. The mitigation measures included in this impact assessment, EMP and those identified in the BAR should be adhered to.

| Water resources cumulative impacts   |
|--|
| The overall cumulative impact generated by the proposed development on water resources prior to implementing mitigation measures during the operational phase is calculated to be of <b>Low-Medium to Low</b> order significance. Adequate mitigation measures are crucial to be implemented to keep the significance score at a <b>Low-Medium</b> impact significance. The overall impact of the proposed development is negative in nature, with the project also occurring within an environmentally high-risk distance from a watercourse. Strict mitigation measures should be implemented to prevent the contamination of water resources. |



### 3.4. Aesthetics:

The aesthetic theme is focused on the alteration of the visual characteristics of the area and overall impact on landscape appreciation. Landscape appreciation is inherently subjective with few metrics allowing for an objective impact assessment. However, several aspects concerning visual impacts associated with culvert bridge and access road developments may be objectively assessed. These include development size, aesthetic deterioration due to construction, and line of sight distance.

| Construction of Infrastructure         |   |          |          |        |              |            |              |
|--|---|----------|----------|--------|--------------|------------|--------------|
| Impact                                 | The alteration of landscape appreciation, visual deterioration, and visual impacts from the culvert bridge and access road development.   |          |          |        |              |            |              |
| Activities<br>(Not all-inclusive list) | <ul style="list-style-type: none"> <li>• Construction</li> <li>• Generation of construction debris / waste</li> <li>• Temporary waste storage areas and construction signage</li> <li>• Removal of vegetation and stockpiles</li> <li>• Alteration of the overall landscape perspective</li> </ul>  |          |          |        |              |            |              |
| Construction Phase                     |   |          |          |        |              |            |              |
| Before Mitigation                      | Status  | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|  | Negative  | 2        | 3        | 2      | 2            | 4          | 8            |
| Mitigation                             | <ul style="list-style-type: none"> <li>• Construction debris should be removed regularly and not allowed to pile up.</li> <li>• A designated construction waste area should be placed. All general waste and construction debris should be removed to a registered waste landfill site.</li> <li>• A complaints register needs to remain on site in which all complaints raised by the general public is to be filed.</li> <li>• Construction should finish as quickly as possible. All open spaces after construction need to be revegetated.</li> </ul> |          |          |        |              |            |              |
| After Mitigation                       | Status  | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|  | Negative  | 1        | 3        | 1      | 2            | 3          | 6            |
| Operational Phase                      |   |          |          |        |              |            |              |
| Before Mitigation                      | Status  | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|  | Negative  | 1        | 5        | 1      | 2            | 2          | 4            |
| Mitigation                             | <ul style="list-style-type: none"> <li>• All operational activities, such as routine maintenance and repairs, should strictly be concentrated on the proposed site.</li> <li>• Rehabilitation of all open spaces after construction e.g. mulching of the excavated embankments of the watercourse crossing.</li> </ul>  |          |          |        |              |            |              |
| After Mitigation                       | Status  | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|  | Negative  | 1        | 5        | 1      | 2            | 1          | 2            |
| Cumulative Impacts                     | Construction sites disrupts the natural landscape and rural environments. The visual character of the landscape can be altered, and its aesthetic appeal can be mitigated.  |          |          |        |              |            |              |
| Additional Notes:                      | The culvert bridge is situated within the outskirts of the residential areas and as such the visual impact will be minimal.   |          |          |        |              |            |              |

The risk to the aesthetic value of the surrounding environment during the construction phase of the development is assessed to be **Low-Medium** both before and after

mitigation measures are applied. This rating is attributed to the presence of construction vehicles and machinery. During the operational phase the impact on the surrounding aesthetic value of the area is considered **Low** before and after mitigation.

| <b>Aesthetics cumulative impacts</b>  |
|---|
| A negative impact arises from the overall significant impact due to the proposed development altering the natural landscape features of the area. The significance impact ranges from <b>Low-Medium to Low</b> providing that the correct mitigation measures be implemented. There will be no positive impacts generated for the aesthetic aspect due to the alteration of the natural features of the area. |

### 3.5. Air quality and noise:

Noise and air quality assessments are based upon the type of equipment being used during a specific activity and the degree of disturbance that will occur. Air quality is further impacted by emissions emanating from the proposed development.

| <b>Air Quality</b>                              |  |          |          |        |              |            |              |
|---|--|----------|----------|--------|--------------|------------|--------------|
| Impact  | Mobilisation of equipment, land clearing and earthworks.   |          |          |        |              |            |              |
| Activities<br>( <i>Not all-inclusive list</i> ) | <ul style="list-style-type: none"> <li>Elevated dust emissions due to increased vehicle movement.</li> <li>Vegetation clearance and the construction of an access block paved road.</li> </ul>   |          |          |        |              |            |              |
| Construction Phase                              |  |          |          |        |              |            |              |
| Before Mitigation                               | Status   | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|   | Negative   | 2        | 3        | 2      | 2            | 3          | 6            |
| Mitigation                                      | <ul style="list-style-type: none"> <li>Watering bare surfaces and excavations to promote dust suppression.</li> <li>The contractor must take all reasonable measures to minimise dust generation as a result of construction activities resulting from along construction route activities such as wetting down topsoil stockpiles (but must also take into account possible water constrictions of the area).</li> <li>Enforce speed limit of 30km/h and optimisation of working schedule to reduce vehicle mobilisation.</li> <li>Limit the amount of vegetation clearance.</li> <li>The construction of new dirt roads should be restricted by prioritising existing roads. Development should remain within the authorised area.</li> <li>Construction should be completed as soon as possible.</li> </ul> |          |          |        |              |            |              |
| After Mitigation                                | Status   | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|   | Negative   | 2        | 3        | 1      | 2            | 2          | 4            |
| Operational Phase                               |  |          |          |        |              |            |              |
| Before Mitigation                               | Status   | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|   | Negative   | 1        | 5        | 1      | 2            | 1          | 2            |
| Mitigation                                      | <ul style="list-style-type: none"> <li>Regular maintenance of the access road should be completed to prevent increased dust emissions from vehicles.</li> </ul>  |          |          |        |              |            |              |
| After Mitigation                                | Status   | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|   | Negative   | 1        | 5        | 1      | 2            | 1          | 2            |

|                    |   |
|--------------------|---|
| Cumulative Impacts | The disruption of natural habitats and ecosystems leads to several significant consequences. These include habitat loss, soil disturbances, which heightens the risk of erosion and sedimentation in nearby water bodies, alteration of natural drainage patterns, and emission of dust and airborne pollutants, which pose health risks. |
| Additional Notes:  |   |

Air quality will be affected by the movement and operations of construction vehicles, but it is anticipated that these impacts will not significantly exceed the existing impact on the environment's air quality. Consequently, air quality and associated risks are expected to have an insignificant effect on the environment. The impacts during the construction phase of the proposed development are assessed as **Low-Medium** before mitigation and **Low** after mitigation measures have been put in place. Similarly, impacts during the operational phase are rated as **Low** overall. It's crucial to ensure that all necessary mitigation measures are implemented, particularly during the construction phase. The applicant bears the responsibility of regularly assessing and implementing industry best practices to mitigate the overall impact on air quality.

| Noise and Vibrations                            |  |          |          |        |              |            |              |
|---|--|----------|----------|--------|--------------|------------|--------------|
| Impact  | Vehicles and equipment utilised  |          |          |        |              |            |              |
| Activities<br>( <i>Not all-inclusive list</i> ) | <ul style="list-style-type: none"> <li>Noise generated through construction related activities.</li> <li>Vibrations generated due to the utilisation of construction equipment.</li> </ul>   |          |          |        |              |            |              |
| Construction Phase                              |  |          |          |        |              |            |              |
| Before Mitigation                               | Status   | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|   | Negative   | 2        | 3        | 2      | 2            | 3          | 6            |
| Mitigation                                      | <ul style="list-style-type: none"> <li>No loud music allowed.</li> <li>Vehicles must be maintained in such a manner as to not cause excessive noise when operating them.</li> <li>Select 'quiet' construction equipment and working methods by avoiding unnecessary revving and hooting.</li> <li>Working schedule for activities with high noise levels will be limited to 8:00 AM to 17:00 PM, machinery should be serviced regularly during the construction stage.</li> <li>Equipment should be regularly serviced in order to prevent unnecessary loud noises.</li> </ul> |          |          |        |              |            |              |
| After Mitigation                                | Status   | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|   | Negative   | 1        | 3        | 1      | 2            | 2          | 4            |
| Operational Phase                               |  |          |          |        |              |            |              |
| Before Mitigation                               | Status   | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|   | Negative   | 1        | 5        | 1      | 2            | 2          | 4            |
| Mitigation                                      | <ul style="list-style-type: none"> <li>Routine maintenance should be limited to the identified area which requires maintenance.</li> </ul>   |          |          |        |              |            |              |
| After Mitigation                                | Status   | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|   | Negative   | 1        | 5        | 1      | 2            | 2          | 4            |
| Cumulative Impacts                              | The disturbance of soil surfaces, along with the disruption of local communities, wildlife habitats, and animal behaviour, can result in several adverse effects.  |          |          |        |              |            |              |

|                   |  |
|-------------------|--|
| Additional Notes: | The noise generated by construction is unavoidable, but the impacts can be mitigated by implementing the strategies mentioned above. Operational phase may also generate unavoidable noise, however routine maintenance will mitigate noise generated. |
|-------------------|--|

During the operational phase of the proposed culvert bridge project, no significant impacts have been identified. However, during the construction phase, the environmental impact on ambient noise is assessed as **Low-Medium** before mitigation measures and **Low** after mitigation. Similarly, the environmental impact on ambient noise during the operational phase is estimated to be of overall **Low** significance.

Moreover, the anticipated impact on local noise and air quality is calculated to be of **Low-Medium** significance without mitigation measures, but this decreases to **Low** after the implementation of mitigation measures.

| <b>Air quality and noise cumulative impacts</b>  |
|--|
| Overall, the cumulative impact generated from the proposed development is of negative nature as a result of anthropogenic activities causing disturbance and pollution of the natural environment. No positive impacts are expected to arise from the proposed development. The significance impact is considered to be <b>Low</b> if the proper mitigation measures are adhered to during the construction and operational phase. |

### 3.6. Waste:

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

| <b>General Solid Waste</b>                      |   |          |          |        |              |            |              |
|---|---|----------|----------|--------|--------------|------------|--------------|
| Impact  | General solid waste pollution   |          |          |        |              |            |              |
| Activities<br>( <i>Not all-inclusive list</i> ) | <ul style="list-style-type: none"> <li>• General construction waste such as plastic items, cement bags, construction scrap etc.</li> <li>• Designated temporary construction waste dump area.</li> <li>• General operational waste (plastic items, paper, broken panels / equipment etc.)</li> <li>• Waste removal management.</li> </ul> |          |          |        |              |            |              |
| Construction Phase                              |   |          |          |        |              |            |              |
| Before Mitigation                               | Status  | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|   | Negative  | 2        | 3        | 2      | 2            | 3          | 6            |
| Mitigation                                      | <ul style="list-style-type: none"> <li>• Reduce, reuse and recycle strategy needs to be implemented.</li> <li>• Waste receptacles must be made available, and all waste should comply with environmental / waste management legislation.</li> </ul>   |          |          |        |              |            |              |
| After Mitigation                                | Status  | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|   | Negative  | 1        | 3        | 1      | 2            | 2          | 4            |
| Operational Phase                               |   |          |          |        |              |            |              |
|   | Status  | Severity | Duration | Extent | Consequences | Likelihood | Significance |

|                    |   |          |          |        |              |            |              |
|--------------------|---|----------|----------|--------|--------------|------------|--------------|
| Before Mitigation  | Negative  | 1        | 5        | 1      | 2            | 2          | 4            |
| Mitigation         | <ul style="list-style-type: none"> <li>• General waste generated during routine maintenance should be transported to a designated waste storage area and may not be burned.</li> <li>• Waste should be transported to a registered landfill site.</li> <li>• General waste should also be removed from the site and not pile up.</li> </ul>   |          |          |        |              |            |              |
| After Mitigation   | Status  | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|                    | Negative  | 1        | 5        | 1      | 2            | 1          | 2            |
| Cumulative Impacts | Solid waste contamination has the potential to draw pests, vectors, and disease-causing organisms, heightening the likelihood of vector-borne illnesses, food contamination, and public health concerns among residents residing close to the access road development area. This form of pollution may endure in the environment for extended periods, exacerbating habitat deterioration, disrupting ecosystems, and polluting soil and water resources. |          |          |        |              |            |              |
| Additional Notes:  |   |          |          |        |              |            |              |

The impact that general waste production will have during construction is estimated to be **Low-Medium** before mitigation and **Low** when mitigation measures are implemented. The impact general waste production will have during the operational phase is considered **Low-Medium** before mitigation and **Low** after mitigation measures have been implemented. It is necessary to implement monitoring and evaluation procedures to determine the potential of increase in risk over the duration of the facilities operation.

| Waste cumulative impacts   |
|--|
| Overall, the cumulative impact generated by the proposed project on the waste aspect of the environment is negative in nature. The main cause of this is rooted in the anthropogenic activity during the construction phase resulting in the increase of waste generated on-site. The overall significance of this development ranges from <b>Medium-Low</b> to <b>Low</b> which generates a slightly negative impact associated with this development. Most of these impacts may be easily mitigated resulting in a <b>Low</b> impact significance. |

### 3.7. Socio-economic:

Socio-economic impacts focus on the effects the development will have on the economic drivers in the surrounding area as well as emphasising the integration of economic development concerning the needs of the people.

| Job creation and the influx of job seekers |   |          |          |        |              |            |              |
|--|---|----------|----------|--------|--------------|------------|--------------|
| Impact                                     | Impacts associated with the need for locality appointed construction/ operation workers   |          |          |        |              |            |              |
| Activities<br>(Not all-inclusive list)     | Construction of road and culvert bridge.  |          |          |        |              |            |              |
| Construction Phase                         |   |          |          |        |              |            |              |
| Before Mitigation                          | Status  | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|  | Positive  | 4        | 3        | 2      | 3            | 4          | 12           |
| Mitigation                                 | <ul style="list-style-type: none"> <li>• Transparent fair recruitment and procurement practices.</li> <li>• The contractor chosen should maximise the involvement of local communities in construction and support activities, to the extent possible, based on available skill levels.</li> <li>• Whenever possible, training programmes that will benefit both construction stage skills requirements and long-term employment demand should be developed.</li> </ul>   |          |          |        |              |            |              |
| After Mitigation                           | Status  | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|  | N/A   |          |          |        |              |            |              |
| Operational Phase                          |   |          |          |        |              |            |              |
| Before Mitigation                          | Status  | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|  | Positive  | 3        | 5        | 2      | 3            | 3          | 9            |
| Mitigation                                 | <ul style="list-style-type: none"> <li>• Each worker should be required to abide by a Code of Conduct which will limit unsavoury activities in local towns and communities and restrict certain behaviours in the work sites and accommodation.</li> <li>• Routine maintenance of access road and culvert bridge creates job opportunities for the local businesses and community members.</li> </ul>   |          |          |        |              |            |              |
| After Mitigation                           | Status  | Severity | Duration | Extent | Consequences | Likelihood | Significance |
|  | N/A   |          |          |        |              |            |              |
| Cumulative Impacts                         | The engagement of locally hired construction and operational personnel during road access development presents both prospects and hurdles for local communities. Through adept management of these effects and optimal utilisation of advantages, developers and stakeholders can foster sustainable progress, economic advancement, and communal welfare in regions where the access road project is executed. The collective impact arising from the proposed development is predominantly positive, owing to potential employment opportunities, training initiatives, economic expansion, and the provision of a secure, sustainable water supply for the expanding populace. |          |          |        |              |            |              |
| Additional Notes:                          |   |          |          |        |              |            |              |








The proposed access road and associated infrastructure construction and operation provides for several socio-economic benefits such as local job creation, skills training, and addresses the need for formalised road infrastructure for the rural areas of South Africa. It is therefore considered that the construction phase of this project will have a

**Medium** positive impact on the local socio-economic sphere and the operational phase whereas the operational phase of the development will have a **Low-Medium** positive impact.





| Socio-economic aspect cumulative impacts  |
|---|
| The overall cumulative impact generated from the proposed project is of <b>positive</b> nature due to the ongoing job opportunities, increasing local spending, training, economic growth, and addressing food security for the growing local population. |

### 3.8. 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. This alternative would result in no environmental impacts on the site or surrounding local area. 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, and local economic growth will be lost.
-  There will be no benefits from introducing additional land use such as improvement in the flow restriction of the natural flow of the Manyeding River.
-  The stormwater culvert bridge and access road will restrict travel between the two towns.
-  Alternate routes may necessitate longer travel times and increased costs.
-  Alternative routes may involve navigating narrow or poorly maintained roads, elevating the risk of accidents.
-  Emergency responders, such as fire departments, police, and medical services might face delays due to limited access.
-  No economic revenue will be generated from material procurement or associated purchases.

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

-  No vegetation will be removed and or disturbed.
-  No change/ alteration to the existing landscape.
-  No additional waste will end up in landfill sites.
-  No additional traffic will be in the area and no additional noise and air pollution will occur (during construction phase)

While the no go alternative will not generate any negative environmental impacts, it will surely remove any socio-economic benefit the local community will receive. The no go alternative will also not aid the government in addressing the national food security matter and job creation. Therefore, the **no go alternative is not considered the preferred alternative.**

### **3.9. Conclusion**

The overall aspects associated with the proposed development is considered to be of negative nature although implementing adequate mitigation measures generates a lower significance impact on the various aspects. The overall benefits arising from the proposed development include food security, job creation and economic revenue.