IMPACT ASSESSMENT REPORT

THE PROPOSED NORTHERN BULK DISTRIBUTION PIPELINE, MANGAUNG METROPOLITAN MUNICIPALITY, FREE STATE PROVINCE.

Environmental Management Group (Pty) Ltd

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1. Introduction:

The social and environmental impacts assessment generated by the **proposed northern bulk distribution pipeline, Mangaung Metropolitan Municipality, Free State 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 the 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.

$$Environmental\ Significance = C \times L$$

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 the 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.

$$Overal\ Consequence = \frac{\sum(\boldsymbol{I}+\boldsymbol{D}+\boldsymbol{E})}{\boldsymbol{n}}$$

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 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 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.

<table>
<tr><th colspan="8">Habitat loss</th></tr>
<tr><td>Impact</td><td colspan="7">Loss of habitat and species diversity as a result of construction and the removal of natural elements.</td></tr>
<tr><td>Activities(Not all-inclusive list)</td><td colspan="3">Physical clearance of vegetation
Trampling
Accidental events such as fire
Reduced biodiversity</td><td colspan="4">Soil erosion
Introduction of alien and invasive species
Soil compaction reducing re-establishment success</td></tr>
<tr><td colspan="8">Construction Phase</td></tr>
<tr><td rowspan="2">Before Mitigation</td><td>Status</td><td>Severity</td><td>Duration</td><td>Extent</td><td>Consequences</td><td>Likelihood</td><td>Significance</td></tr>
<tr><td>Negative</td><td>2</td><td>3</td><td>2</td><td>2</td><td>2</td><td>4</td></tr>
<tr><td>Mitigation</td><td colspan="7">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.</td></tr>
<tr><td rowspan="2">After Mitigation</td><td>Status</td><td>Severity</td><td>Duration</td><td>Extent</td><td>Consequences</td><td>Likelihood</td><td>Significance</td></tr>
<tr><td>Negative</td><td>2</td><td>2</td><td>1</td><td>2</td><td>1</td><td>2</td></tr>
<tr><td colspan="8">Operational Phase</td></tr>
<tr><td rowspan="2">Before Mitigation</td><td>Status</td><td>Severity</td><td>Duration</td><td>Extent</td><td>Consequences</td><td>Likelihood</td><td>Significance</td></tr>
<tr><td colspan="7">N/A</td></tr>
<tr><td>Mitigation</td><td colspan="7">N/A</td></tr>
<tr><td rowspan="2">After Mitigation</td><td>Status</td><td>Severity</td><td>Duration</td><td>Extent</td><td>Consequences</td><td>Likelihood</td><td>Significance</td></tr>
<tr><td colspan="7">N/A</td></tr>
<tr><td colspan="8">Cumulative Impacts</td></tr>
<tr><td colspan="8">Habitat loss, clearance, and transformation represent localised high-risk activities during construction these effects are temporary. Given that the project footprint is small and comprises previously disturbed areas, the resulting cumulative impact is assessed as having low significance after the application of mitigation and management measures.</td></tr>
</table>

Overall, the anticipated disturbance footprint is limited, as existing roads provide access to much of the development area and the proposed pipeline requires only small, localised areas for equipment laydown and material storage. Consequently, the expected level of disturbance associated with the proposed development is low and will result in only limited vegetation clearing and habitat transformation within the terrestrial environment. While some habitat loss is unavoidable, the overall impact on the receiving environment is anticipated to be of low significance.

The affected area is not considered unique in terms of vegetation type or broad-scale vegetation structure. However, portions of the affected farm remain in a near-pristine condition and therefore possess elevated ecological sensitivity. As a result, strict adherence to the recommended mitigation measures is essential to minimise disturbance and protect the ecological integrity of these areas.

The impacts associated with habitat loss are considered to be of low significance, primarily because the proposed pipeline constitutes a linear development that is largely located within or adjacent to existing road corridors. Nevertheless, medium- to high-intensity mitigation measures are recommended and should form an integral component of the Environmental Management Programme (EMPr). Effective implementation of these measures will further reduce the significance of habitat loss impacts. In particular, habitat disturbance and vegetation clearing must be minimised through strict control of the construction footprint and adherence to designated work areas.

<table>
<tr><th colspan="8">Loss of Ecological Support Areas (ESA)</th></tr>
<tr><td>Impact</td><td colspan="7">Disturbance and loss of ecological habitat and ecological corridors.</td></tr>
<tr><td>Activities(Not all-inclusive list)</td><td colspan="3">Physical clearance of vegetation
Loss of protected species
Habitat fragmentation
Introduction of alien and invasive species
Accidental events such as fire</td><td colspan="4">Soil erosion
Thinning of local genetic diversity
Loss in ecological functionality
Soil compaction reduces re-establishment success</td></tr>
<tr><td colspan="8">Construction Phase</td></tr>
<tr><td rowspan="2">Before Mitigation</td><td>Status</td><td>Severity</td><td>Duration</td><td>Extent</td><td>Consequences</td><td>Likelihood</td><td>Significance</td></tr>
<tr><td>Negative</td><td>2</td><td>3</td><td>2</td><td>2</td><td>1</td><td>2</td></tr>
<tr><td>Mitigation</td><td colspan="7">Limit the removal of vegetation in these 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 pipe, 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 watercourse or within 100 m of a watercourse.
A comprehensive fire management plan and an alien invasive management plan need to be drafted prior to construction.
Removal of indigenous flora should be kept to 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.</td></tr>
<tr><td rowspan="2">After Mitigation</td><td>Status</td><td>Severity</td><td>Duration</td><td>Extent</td><td>Consequences</td><td>Likelihood</td><td>Significance</td></tr>
<tr><td>Negative</td><td>2</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td colspan="8">Operational Phase</td></tr>
<tr><td rowspan="2">Before Mitigation</td><td>Status</td><td>Severity</td><td>Duration</td><td>Extent</td><td>Consequences</td><td>Likelihood</td><td>Significance</td></tr>
<tr><td colspan="7">N/A</td></tr>
<tr><td>Mitigation</td><td colspan="7">N/A</td></tr>
<tr><td></td><td>Status</td><td>Severity</td><td>Duration</td><td>Extent</td><td>Consequences</td><td>Likelihood</td><td>Significance</td></tr>
</table>

After Mitigation	N/A
Cumulative Impacts	
The cumulative impacts associated with the loss or modification of ESA are assessed as being of Low significance for the overall project, both before and after mitigation. Following the implementation of the recommended mitigation measures, including strict demarcation, limited vegetation clearance, proper topsoil handling, and the avoidance of unnecessary disturbance, the cumulative impact score is Low.	

According to the Technical Guidelines for Critical Biodiversity Area (CBA) Maps, CBAs are areas that must remain largely in a natural ecological condition, whereas Ecological Support Areas (ESAs) are required to maintain at least a semi-natural ecological condition (SANBI, 2017). Protected areas, such as Woodland Hills Golf and Wildlife Estate, and potential protected areas identified through the National Protected Area Expansion Strategy (NPAES, 2018), comprise areas that are either formally protected or earmarked for future conservation initiatives. The intersection of the study area with ESA-designated and protected areas (including NPAES, SACAS, and SAPAD categories) is limited and highly localised.

The loss of ESA areas associated with the proposed development is primarily related to the presence of watercourses. Given that the proposed pipeline is located adjacent to existing developments, roads, and other transformed areas, portions of the affected environment have already experienced disturbance. Furthermore, the extent of ESA habitat affected by the development is negligible relative to the overall extent of ESA areas within the surrounding landscape. Consequently, the proposed development is expected to result in only minor impacts on ESA functionality and ecological processes.

The affected SAPAD areas are largely associated with the proximity of the proposed pipeline to the Woodland Hills Golf and Wildlife Estate and the Dawn Valley Private Nature Reserve. However, as the proposed pipeline represents a temporary construction activity with a relatively small disturbance footprint, impacts on these protected and conservation-priority areas are expected to be minimal.

Accordingly, the anticipated impact on biodiversity priority and protected areas is considered very low prior to mitigation. The recommended mitigation measures are practical and readily implementable, and their effective application will ensure that impacts on ESA areas remain very low. Given the temporary nature of the construction phase and the limited extent of disturbance, residual impacts on SAPAD and other protected-area designations are also expected to remain low.

Loss of indigenous floral and faunal diversity							
Impact	Habitat loss due to vegetation clearance and construction activities						
Activities(*Not all-inclusive list*)	• Physical clearance of vegetation • Loss of biodiversity • Trampling • Habitat fragmentation • Accidental events such as fire, oil spills etc • Accidental entrapment • Accidental injury				• Unlawful harvesting of plants • Unlawful hunting/ poaching of animals • Road mortalities • Introduction of unnatural competitors, i.e. alien and invasive species • Noise pollution (construction phase) • Disrupted general animal behaviour		
Construction Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	2	3	2	2	2	4
Mitigation	• Development may only occur within the clearly demarcated 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 AMP 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	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
	N/A						
Mitigation	N/A						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	N/A						
Cumulative Impacts							
To ensure the cumulative impact remains Low, the specialists mandate the mitigation hierarchy, prioritising the avoidance of sensitive natural habitats. The preferred alternative adheres to this by using the smallest possible working corridor.							

A limited number of alien and invasive plant species were recorded within the study area, with occurrences being sparse and localised. Despite the presence of existing road infrastructure and varying levels of disturbance, the receiving environment remains predominantly natural in terms of vegetation structure and species composition. Consequently, construction activities associated with the proposed development will result in the localised removal of predominantly indigenous vegetation and a minor reduction in floral diversity within the construction footprint.

During the construction phase, mobile faunal species are expected to temporarily relocate to adjacent, less disturbed habitats, which are readily available throughout the surrounding landscape. As a result, impacts on faunal diversity are anticipated to be temporary and localised, with no significant long-term effects on local populations.

Given the limited extent of disturbance and the availability of suitable surrounding habitat, the anticipated impact on indigenous floral and faunal diversity is considered to be of very low significance prior to mitigation. The recommended mitigation measures are practical and readily achievable and should be implemented to minimise unnecessary vegetation clearing, habitat disturbance, and the spread of alien invasive species.

Following the implementation of mitigation measures, the residual impact on indigenous floral and faunal diversity is expected to remain very low. Furthermore, due to the temporary nature of the construction activities and the limited operational footprint of the pipeline, impacts on floral and faunal diversity during both the construction and operational phases are anticipated to remain of very low significance. Notwithstanding the low significance rating, the implementation of mitigation measures remains necessary to ensure that impacts are minimised and environmental best-practice principles are maintained.

<table>
<tr><th colspan="8">Loss of floral and faunal species of conservation concern</th></tr>
<tr><td>Impact</td><td colspan="7">Loss of species diversity as a result of construction and the removal of natural elements.</td></tr>
<tr><td>Activities(Not all-inclusive list)</td><td colspan="7">Physical clearance of vegetation
Loss of biodiversity
Trampling
Accidental events such as fire, oil spills etc
Accidental entrapment
Accidental injury
Unlawful harvesting of plants
Unlawful hunting/ poaching of animals
Road mortalities
Introduction of unnatural competitors, i.e. alien and invasive species
Noise pollution (construction phase)
Disrupted general animal behaviour</td></tr>
<tr><td colspan="8">Prior to construction and during the construction Phase</td></tr>
<tr><td rowspan="2">Before Mitigation</td><td>Status</td><td>Severity</td><td>Duration</td><td>Extent</td><td>Consequences</td><td>Likelihood</td><td>Significance</td></tr>
<tr><td>Negative</td><td>2</td><td>3</td><td>2</td><td>2</td><td>2</td><td>4</td></tr>
<tr><td>Mitigation</td><td colspan="7">Protected plant species should be located and demarcated prior to development by way of walkthrough by a qualified botanist.
DARDEA should be consulted with regard to the feasibility of transplanting or removing provincially protected species.
Removal or transplant permits from DARDEA must be obtained for all provincially protected fauna/flora.
Removal or relocation of the SCC/protected species are prohibited without the appropriate permits.
If DARDEA indicates transplant or relocation of some of the provincially protected flora, a formal relocation management plan should be drafted and implemented.
A thorough walk-through of the study area by a qualified zoologist/ avifaunal specialist should occur to locate any potential SCC/protected species.
On-site environmental and health and safety officers must report any observations of SCC/protected species to a qualified botanist/ zoologist/ avifaunal specialist and apply the recommended buffer area for that SCC/protected species
All construction staff should be informed about SCC and protected species or species of special conservation concern.
A relevant specialist should be notified when any SCC and protected flora are observed during construction.
All disturbance-related activities must be restricted to the authorised development boundary.
No illegal harvesting of plant material is allowed.
Any other relevant recommendations listed in this report should be implemented.</td></tr>
<tr><td rowspan="2">After Mitigation</td><td>Status</td><td>Severity</td><td>Duration</td><td>Extent</td><td>Consequences</td><td>Likelihood</td><td>Significance</td></tr>
<tr><td>Negative</td><td>1</td><td>3</td><td>1</td><td>2</td><td>1</td><td>2</td></tr>
<tr><td colspan="8">Operational Phase</td></tr>
<tr><td rowspan="2">Before Mitigation</td><td>Status</td><td>Severity</td><td>Duration</td><td>Extent</td><td>Consequences</td><td>Likelihood</td><td>Significance</td></tr>
<tr><td colspan="7">N/A</td></tr>
<tr><td>Mitigation</td><td colspan="7">N/A</td></tr>
<tr><td rowspan="2">After Mitigation</td><td>Status</td><td>Severity</td><td>Duration</td><td>Extent</td><td>Consequences</td><td>Likelihood</td><td>Significance</td></tr>
<tr><td colspan="7">N/A</td></tr>
<tr><td colspan="8">Cumulative Impacts</td></tr>
<tr><td colspan="8">To ensure the cumulative impact remains Low, the specialists mandate the mitigation hierarchy, prioritising the avoidance of sensitive natural habitats. The preferred alternative adheres to this by using the smallest possible working corridor.</td></tr>
</table>

The proposed development is not expected to impact any provincially or nationally protected faunal species, including *Pyxicephalus adspersus* (Giant Bullfrog). The DFFE Screening Tool identified two faunal Species of Conservation Concern (SCC) that may potentially occur within the broader study area, namely *Hydrictis maculicollis* (Spotted-necked Otter) and *Mystromys albicaudatus* (White-tailed Mouse). However, no individuals or evidence of these species were recorded during the site assessment.

Considering the limited disturbance footprint of the proposed pipeline, its predominantly linear nature, and the absence of confirmed SCC occurrences within the development footprint, impacts on faunal Species of Conservation Concern during both the construction and operational phases are anticipated to be of very low significance.

With regard to flora, the proposed development is not expected to result in significant impacts on protected plant species or floral Species of Conservation Concern. Nevertheless, it is recommended that a detailed pre-construction walk-through be undertaken by a suitably qualified botanist to identify any provincially or nationally protected plant species within the final development footprint. During the site assessment, individuals belonging to the *Aloe* and *Euphorbia* genera (both provincially protected), as well as *Olea europaea* subsp. *africana* (African Wild Olive; provincially protected), were recorded. Should any protected plant species be unavoidably affected by the proposed development, the relevant permitting authority must be consulted regarding the feasibility of obtaining the required removal or translocation permits. All necessary permits must be obtained prior to the commencement of construction.

The implementation of the recommended mitigation measures, particularly those aimed at minimising vegetation clearing, restricting construction activities to the approved development footprint, and avoiding unnecessary disturbance to natural habitat, will further reduce the potential for impacts on both faunal and floral Species of Conservation Concern. Following the effective implementation of these measures, the residual impact on protected and conservation-important fauna and flora is expected to remain of very low significance.

3.2. Heritage:

The phase 1 Heritage Impact Assessment (HIA) and Palaeontological Impacts Assessment (PIA) takes into consideration archaeological/cultural as well as palaeontological artefacts and sensitivities in assessing the potential impact the development may have on the collective heritage of South Africa.

Archaeological and Heritage Resources							
Impact	Destruction of archaeological and heritage resources such as remains and graves.						
Activities(*Not all-inclusive list*)	• Grubbing • Trenching						
Construction Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	2	3	1	2	1	2
Mitigation	• The identified historical features and stone-built gateway pillars are protected by a minimum 30 m no-go buffer and a 10 m no-go buffer, respectively • Construction remains confined to approved corridors. • A Chance Find Protocol (CFP) is implemented during all ground disturbances. • SAHRA and a qualified archaeologist are to be consulted immediately in the event of accidental archaeological exposure. • In the unlikely event of an accidental archaeological exposure, all excavations should stop immediately. • No loose chance finds, such as Stone Age artefacts (arrowheads, stone flake blades, etc.), may be collected. • Regular site inspections and toolbox talks should be conducted to raise awareness among construction personnel about the potential for heritage finds and the importance of reporting them. • The on-site environmental representative should consult the appointed ECO regarding any such discoveries.						
	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance

After Mitigation	Negative	1	3	1	2	1	2
Operational Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	N/A						
Mitigation	N/A						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	N/A						
Cumulative Impacts							
The gradual loss or destruction of artefacts, cryptic graves, and heritage structures that contribute to the cultural and historical heritage of local and national communities.							

The proposed pipeline traverses a landscape that has been variably modified by agriculture, road infrastructure, fluvial processes, grazing, and peri-urban expansion, resulting in generally low archaeological visibility and preservation potential within the development corridor. No in situ heritage resources, including Stone Age artefact scatters, graves, or structures older than 60 years, were identified within 5 m of the pipeline footprint during the field assessment.

A localised cluster of probable historical graves and associated stone-built features, dating to the late 19th to early 20th century, was recorded on a dolerite koppie near the N1/R700 junction on Farm Olrig 1710. This heritage cluster is situated approximately 50–400 m from the pipeline footprint. In addition, two stone-built gateway pillars were recorded adjacent to an unpaved access track linking a modern homestead to the R700 and may pre-date the current peri-urban landscape. These features are located approximately 16 m east of the pipeline footprint.

The historical grave cluster and stone-built gateway pillars are respectively assessed as being of Local Significance (Grade 3A) and Generally Protected (GPA) status and are located outside the direct development footprint. Accordingly, the potential impact on archaeological and heritage resources is assessed as being of low significance, both before and after mitigation, provided that the recommended mitigation measures are implemented.

Palaeontological Resources							
Impact	Destruction of undiscovered artefacts of palaeontological significance.						
Activities(*Not all-inclusive list*)	• Grubbing • Trenching						
Construction Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	2	3	1	2	1	2
Mitigation	• A Chance Find Protocol must be implemented during construction to safeguard against unexpected discoveries. • Notification of a qualified palaeontologist for routine palaeontological monitoring if excavations extend into unweathered sedimentary (Adelaide Subgroup) bedrock below the soil mantle. • Developers must follow a strict protocol if anomalous or irregular shapes are identified in the rock or sediments • If a find is made, the material must not be washed or cleaned • The find must be protected by a rigid object (like a box or bucket) and a no-go buffer zone implemented until a professional palaeontologist can confirm the discovery • Pending professional verification, all potential fossil exposures must be demarcated and protected by a no-go buffer zone to prevent disturbance. • If the uncovered material is deemed to hold palaeontological significance, a Phase 2 mitigation or rescue excavation may be required, subject to the issuance of						

	appropriate permits by SAHRA in accordance with Section 35 of the National Heritage Resources Act (Act 25 of 1999). Regular site inspections and toolbox talks should be conducted to raise awareness among construction personnel about the potential for heritage finds and the importance of reporting them. The on-site environmental representative should consult the appointed ECO regarding any such discoveries.						
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
	N/A						
Mitigation	N/A						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	N/A						
Cumulative Impacts							
The destruction or loss of palaeontological resources and fossil material of scientific significance, leading to the loss of heritage resources that contribute to an understanding of the country's natural history and sense of national identity.							

The proposed pipeline is underlain by sedimentary strata of the Late Permian Adelaide Subgroup of the Beaufort Group (Karoo Supergroup), which are regionally classified as having high palaeontological sensitivity. However, field verification confirmed that the fossil-bearing bedrock along the pipeline alignment is variably overlain by eluvium, Late Quaternary aeolian-derived topsoils, and residual dolerite weathering material, resulting in a low effective palaeontological sensitivity at the surface. No fossil material was identified during the field assessment, and the likelihood of encountering in situ fossiliferous material during construction is low. Consequently, the potential impact on palaeontological resources is assessed as being of low significance, both before and after mitigation, provided that the recommended mitigation measures are implemented.

3.3. Water resources:

A specialist conducted an Aquatic Biodiversity Ecological Assessment of the proposed development area to confirm, identify, and delineate the watercourses that might be impacted by the proposed development. The specialist determined the current ecological state, overall watercourse importance, significance, risk rating, and confidence intervals for activities associated with identified watercourses using a combination of desktop study, literature review, and visual observation during the site visit. The specialist recommended mitigation measures to reduce the risk to watercourses associated with the development's construction and operational phases.

Surface Water Qualities	
Impact	Water and/or soil pollution causes negative changes in the physical, chemical and biological characteristics of water resources (i.e., water quality). This can result in possible deterioration in aquatic ecosystem integrity and a reduction in, or loss of, species of conservation concern (i.e., rare, threatened/endangered species).
Activities(*Not all-inclusive list*)	Incorrect disposal of hydrocarbons Storage of materials (Building materials, hydrocarbons, or other chemicals) Operational procedures for machinery Construction activities leading to runoff of pollutants into watercourses. Excavation in proximity and within watercourses eventually causing increased sedimentation and turbidity in the water. Erosion due to slow re-establishment of plants.
Constructional Phase	

Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	3	3	2	3	2	6
Mitigation	• No littering may be allowed. All litter must be removed from the site • The timeframe for construction through the watercourses should be kept to a minimum. • If hydrocarbons or other chemicals are stored on site, storage areas must be situated a minimum distance of 40 m away from any watercourses and wetlands. • Storage areas must be adequately bunded to contain a minimum of 150% of the capacity of storage tanks/units. • Adequate hydrocarbon and other chemical storage, handling, usage and spillage clean-up procedures must be developed, and employees must be sufficiently trained and apply these procedures. • Spill kits must be readily available at the construction site, and all relevant employees must be adequately trained on their correct use • Implement suitable dust management and prevention measures during construction and operation. • Construction areas and roads must be sufficiently wetted down during construction, if necessary, to prevent significant fugitive dust generation. • Construction within any of the watercourses should preferably be undertaken during the winter months (June to September) when flooding will be unlikely. • A construction method statement must be compiled and available on site. It must consider any no-go areas and include methods to avoid unnecessary disturbance and prevent material from being washed downslope into the river. • 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 Environmental Control Officer with an appropriately timed audit report. • All stockpiles must be protected and located in flat areas where run-off will be minimised and sediment recoverable. • Disturbed areas must be adequately rehabilitated concurrently with, or as soon as practicably possible after, construction. • Implement 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 surface water contamination of the local and broader surrounding landscape. • Immediate steps must be taken by the Mangaung Metropolitan Municipality to identify and alleviate the sources of the continued unlawful raw/untreated sewage discharges which feed into the identified watercourses						
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
	N/A						
Mitigation	N/A						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	N/A						
Cumulative Impacts							
The deterioration of water quality by introduction of pollutants associated with construction and sedimentation associated with alteration of bed and banks of watercourses will lead to the decline of aquatic organisms as well as organisms which depend on them (food sources, pollination etc.). Impaired aquatic community structures will reduce the watercourses capacity to buffer disturbances and provide ecosystem functions.							

The proposed pipeline has the potential to result in temporary and localised impacts on surface water quality during the construction phase through sediment mobilisation, accidental hydrocarbon spills, and the inappropriate stockpiling of excavated material near watercourses. However, the development footprint is narrow and linear in nature, and the pipeline will be

installed underground with no permanent infrastructure within watercourses. Provided that recommended mitigation measures are implemented, including appropriate management of excavated material, erosion control measures, and the prevention of contamination from construction activities, impacts on surface water quality are expected to be of low significance. No significant long-term deterioration of water quality is anticipated during the operational phase, and the proposed development is not expected to compromise the ecological functioning of the affected watercourses or the broader catchment.

<table>
<tr><th colspan="8">Alteration of Hydrology and Flow Regimes</th></tr>
<tr><td>Impact</td><td colspan="7">Alteration/Impeding of the flow regimes (volumes and peak flow), which directly impacts the ecological functionality and integrity of the local watershed and broader quaternary surface water catchment and drainage area.</td></tr>
<tr><td>Activities(Not all-inclusive list)</td><td colspan="7">Mechanical clearance,
Trench excavation,
Subsequent trench backfilling</td></tr>
<tr><td colspan="8">Constructional Phase</td></tr>
<tr><td rowspan="2">Before Mitigation</td><td>Status</td><td>Severity</td><td>Duration</td><td>Extent</td><td>Consequences</td><td>Likelihood</td><td>Significance</td></tr>
<tr><td>Negative</td><td>2</td><td>3</td><td>2</td><td>2</td><td>2</td><td>4</td></tr>
<tr><td>Mitigation</td><td colspan="7">Trench excavation, pipeline placement and subsequent trench backfilling at the proposed watercourse crossings must be conducted concurrently, in order to ensure continued flow through the area during the construction period. Under no circumstances may the flow of the watercourses be significantly impeded/blocked for any period of time, during construction
Access to and from the development area should be either via existing roads or within the construction zone.
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 Environmental Control Officer with an appropriately timed audit report.
It is recommended that the pipeline be buried at a minimum depth of 1.5 m at the proposed watercourse crossings in order to allow for continued surface- and subsurface interflow of the watercourses over the pipeline
It is recommended that adequate hydraulic designs such as siphons or culverts be incorporated underneath the pipeline at the proposed watercourse crossings if required, in order to allow for continued surface- and interflow of the watercourses underneath the pipeline
Trench excavation, pipeline placement and subsequent trench backfilling at the proposed watercourse crossings must be conducted manually underneath the riparian woodland- and woody thicket canopies and no trees may be removed, as far as practicably possible/feasible.
Materials excavated from the proposed pipeline trench at the proposed watercourse crossings must be adequately placed/stockpiled outside the watercourse extents on the upstream side of the trench, before being backfilled into the trench after pipeline placement.
Construction within any of the watercourses should preferably be undertaken during the winter months (June to September) when flooding will be unlikely.
Lower flow during the winter season must, however, still be adequately diverted/channelled around the construction area of the proposed watercourse crossings
If winter construction is not feasible, then construction of the proposed watercourse crossings must be completed within a maximum 10-day period, during which the weather forecast predicts no possibility of rainfall
If required, sufficient culvert designs be installed underneath the proposed service road at the proposed watercourse crossings
Construction must have contingency plans for high rainfall events during construction. Even in the operational phase, measures to contain impacts caused during high rainfall events must be planned for and available for use.</td></tr>
</table>

	• The contractor or ECO must educate all staff undertaking the work on the best practice methods and environmentally sensitive areas (general dos and don'ts).						
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
	N/A						
Mitigation	N/A						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	N/A						
Cumulative Impacts							
The cumulative impact associated with Hydrological Alteration 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 development will involve several watercourse crossings, including seasonal streams of moderate to moderately high ecological importance. Temporary disturbances to flow regimes may occur during trench excavation and pipeline installation. However, as the pipeline will be buried and construction activities at watercourse crossings will be undertaken concurrently, no permanent alteration of channel morphology, flow characteristics, or hydrological connectivity is anticipated. The proposed development is therefore not expected to significantly affect the natural flow regimes, ecological functionality, or integrity of the affected watercourses and associated Freshwater Ecosystem Priority Areas (FEPAs). Following rehabilitation and implementation of mitigation measures, impacts on hydrology and flow regimes are expected to be of low significance.

Erosion & Sedimentation							
Impact	Sedimentation and erosion refer to the alteration in the physical characteristics of rivers/wetlands because of increased turbidity and sediment deposition, caused by soil erosion and earthworks that are associated with construction activities, as well as instability and collapse of unstable soils during project operation.						
Activities(*Not all-inclusive list*)	• Mechanical clearance, • Trench excavation, • Subsequent trench backfilling • Erosion • Sediment transport to downstream systems						
Constructional Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	2	3	2	2	2	4
Mitigation	• Implement adequate stormwater and erosion management measures during the construction- and subsequent operational phases of the proposed development. This must be done to sufficiently manage stormwater runoff and clean/dirty water separation. • A construction method statement must be compiled and available on site. It must consider any no-go areas and include methods to avoid unnecessary disturbance and prevent material being washed downslope into the river. • All stockpiles must be protected and located in flat areas where run-off will be minimised and sediment recoverable. • The contractor or ECO must educate all staff undertaking the work on the best practice methods and environmentally sensitive areas (general dos and don'ts). • Stormwater from the construction footprint must be managed so that flow is dispersed and slowed before re-entering the broader system, using measures such as level spreaders, temporary check structures or roughened surfaces. • All stockpiles should be positioned on elevated, stable ground (ideally outside of the wet areas and not near the river) within the transformed footprint and surrounded by berms or silt barriers to prevent sediment release.						

	▲ Regular inspection of the footprint and access routes is required to identify erosion, sediment build-up, or preferential flow pathways; corrective actions should be implemented immediately to maintain surface stability.						
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
	N/A						
Mitigation	N/A						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	N/A						
Cumulative Impacts							
The cumulative impact associated with erosion and sedimentation 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. If the identified long-term aquatic ecological receptor impacts were to proceed without mitigation.							

Construction activities associated with trench excavation, stockpiling of excavated material, and vegetation clearing may result in localised erosion and sedimentation, particularly at watercourse crossings and on exposed soils. If unmanaged, these impacts could temporarily affect aquatic habitats and downstream water quality. However, the disturbance footprint is limited and temporary in nature, and the implementation of appropriate erosion and sediment control measures will substantially reduce the risk of soil loss and sediment transport. Following rehabilitation of disturbed areas and successful implementation of mitigation measures, erosion and sedimentation impacts are expected to be short-term, localised, and of low significance.

Aquatic and Riparian Ecosystems							
Impact	The deterioration of biodiversity through the direct removal of species and the accidental introduction of alien and invasive species which outcompete indigenous fauna.						
Activities(*Not all-inclusive list*)	▲ Mechanical clearance, ▲ Trench excavation, ▲ Subsequent trench backfilling ▲ Levelling ▲ Compacting soils ▲ Movement of construction workers and vehicles.						
Constructional Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	2	3	2	2	3	6
Mitigation	▲ Implement adequate alien invasive species management and prevention measures during the construction- and subsequent operational phases of the proposed development. ▲ Problematic weeds must be eradicated where these establish on the proposed pipeline development section. ▲ If winter construction is not feasible, then construction of the proposed watercourse crossings must be completed within a maximum 10-day period, during which the weather forecast predicts no possibility of rainfall ▲ Immediate steps must be taken by the Mangaung Metropolitan Municipality to identify and alleviate the sources of the continued unlawful raw/untreated sewage discharges which feed into the identified watercourses ▲ Any disturbance and removal of vegetation within these watercourses should be kept to a minimum. ▲ Vegetation clearance must be restricted to the narrow linear route of the proposed pipeline, as far as practicably possible/feasible ▲ The linear development footprint of the proposed pipeline at the proposed watercourse crossings must be kept as narrow as practicably possible/feasible						

	▲ Adequate operational procedures must be developed and implemented to ensure that the movement of machinery and equipment is strictly confined to the approved development footprint. ▲ No bright light from any spotlights or perimeter lights or loud/excessive noise should be emitted into the surrounding landscape, during the nighttime. ▲ Environmentally responsible water-use practices and activities must be adopted ▲ Existing roads and farm tracks in close proximity to the proposed development construction footprint, must be used during the construction phase. No new temporary roads or tracks may be constructed or implemented through any aquatic features within the surrounding undeveloped landscape outside the proposed development footprint ▲ Disturbed areas within and immediately surrounding the proposed development construction footprints associated with the proposed watercourse crossings must be adequately rehabilitated concurrently with- or as soon as practicably possible after the construction processes.						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	1	2	1	1	2	2
Operational Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	N/A						
Mitigation	N/A						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	N/A						
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 functioning. This will make the aquatic ecosystems less capable of absorbing disturbances and less capable of supporting ecosystem functions.							

The proposed pipeline traverses several aquatic features, including seasonal streams that provide ecological connectivity and support local aquatic and riparian biodiversity. While temporary disturbances to aquatic and riparian habitats may occur during construction, the narrow linear footprint of the development and the underground placement of the pipeline will minimise habitat loss and fragmentation. No significant impacts on aquatic fauna, flora, ecological connectivity, or the long-term integrity of watercourses are anticipated. Furthermore, the specialist assessment concluded that the disturbed areas can be restored to their current condition within a relatively short period following construction. With the implementation of the recommended mitigation measures, including protection of riparian vegetation and minimisation of disturbance within watercourses, residual impacts on aquatic and riparian ecosystems are expected to be of low significance and will not compromise regional aquatic conservation objectives.

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 the proposed developments may be objectively assessed. These include development size, aesthetic deterioration due to construction, and line of sight distance.

<table>
<tr><th colspan="8">Construction of Infrastructure</th></tr>
<tr><td>Impact</td><td colspan="7">Negative overall aesthetic value due to construction</td></tr>
<tr><td>Activities(Not all-inclusive list)</td><td colspan="7">Mechanical clearance of vegetation
Trench excavation
Stockpiling of excavated material
Rehabilitation works
Temporary storage of construction materials, pipes etc.
Movement and operation of construction vehicles and machinery</td></tr>
<tr><td colspan="8">Constructional Phase</td></tr>
<tr><td rowspan="2">Before Mitigation</td><td>Status</td><td>Severity</td><td>Duration</td><td>Extent</td><td>Consequences</td><td>Likelihood</td><td>Significance</td></tr>
<tr><td>Negative</td><td>2</td><td>3</td><td>2</td><td>2</td><td>3</td><td>6</td></tr>
<tr><td>Mitigation</td><td colspan="7">Construction debris should be removed regularly and not allowed to pile up.
A designated construction waste area should be demarcated and marked. All general waste and construction debris should be removed to a registered landfill.
Complaints register needs to remain on site, where all complaints raised by the public are to be filed.
Construction should finish as quickly as possible. All open spaces after construction need to be revegetated.
Limit construction activities to the development footprint.
Implement housekeeping practices in which attention is given to the neat storage of materials.
Do not grub or clear beyond the operational area.
Implement rehabilitation methods where possible during construction activities.
Store stockpiles in demarcated areas.
Only utilise existing roads as far as possible.</td></tr>
<tr><td rowspan="2">After Mitigation</td><td>Status</td><td>Severity</td><td>Duration</td><td>Extent</td><td>Consequences</td><td>Likelihood</td><td>Significance</td></tr>
<tr><td>Negative</td><td>1</td><td>3</td><td>1</td><td>2</td><td>2</td><td>4</td></tr>
<tr><td colspan="8">Operational Phase</td></tr>
<tr><td rowspan="2">Before Mitigation</td><td>Status</td><td>Severity</td><td>Duration</td><td>Extent</td><td>Consequences</td><td>Likelihood</td><td>Significance</td></tr>
<tr><td colspan="7">N/A</td></tr>
<tr><td>Mitigation</td><td colspan="7">N/A</td></tr>
<tr><td rowspan="2">After Mitigation</td><td>Status</td><td>Severity</td><td>Duration</td><td>Extent</td><td>Consequences</td><td>Likelihood</td><td>Significance</td></tr>
<tr><td colspan="7">N/A</td></tr>
<tr><td colspan="8">Cumulative Impacts</td></tr>
<tr><td colspan="8">The aesthetic quality of the area would be reduced, leading to a decrease in quality of living for the local residents and commuters.</td></tr>
</table>

The aesthetic impact associated with the proposed pipeline is assessed as Low to Medium prior to mitigation during the construction phase, primarily due to temporary visual disturbance resulting from construction activities, the presence of construction vehicles and equipment, stockpiled materials, and disturbed ground surfaces. These impacts will be localised and short-term in nature and confined to the duration of the construction period.

Following the implementation of mitigation measures, including the proper management of construction areas, removal of waste and excess material, and rehabilitation of disturbed areas, the residual construction-phase aesthetic impact is expected to be Low.

During the operational phase, the pipeline will be located underground and will not introduce any permanent visually intrusive structures into the landscape. Following rehabilitation, the affected areas are expected to blend with the surrounding environment, resulting in a negligible to Low operational aesthetic impact. Consequently, the proposed development is not anticipated to result in any significant long-term alteration of the visual character or sense of place of the surrounding area.

3.5. Air Quality, Noise and Vibrations:

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. This will have repercussions for the surrounding vegetation, wildlife, domestic animals and people.

Noise and Vibrations							
Impact	Vehicles, machinery and equipment used during construction activities cause an increase in noise and vibrations						
Activities (*Not all-inclusive list*)	Noise associated with construction vehicles. Noise associated with construction activities. Noise associated with construction workers.						
Construction Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	2	3	2	2	3	6
Mitigation	No loud music allowed. Vehicles must be maintained in such a manner as not to cause excessive noise when operating them. Avoid unnecessary simultaneous noisy activities. Slowing down the vehicles by enforcing a speed limit of 20 km/h and carrying the construction materials to reduce dust generation. Select 'quiet' construction equipment and working methods by avoiding unnecessary revving and hooting. Working schedule for activities with high noise levels will be limited to 07:00 AM to 17:00 PM. Equipment should be regularly serviced. All activities must strictly conform to the Mangaung Metropolitan Municipality (MMM) Noise Control By-law of 2016, which regulates nuisance noise and sets standards for the jurisdiction						
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
	N/A						
Mitigation	N/A						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	N/A						
Cumulative Impacts							
The degradation of the standard of living experienced by local residents on account of excessive noise.							

The construction phase of the proposed pipeline will result in temporary increases in ambient noise and vibration levels due to the operation of construction vehicles, earthmoving equipment, trench excavation activities, and material transportation. These impacts will be localised, intermittent, and limited to the construction period. Given the linear nature of the development and the temporary duration of construction activities, significant impacts on surrounding land uses are not anticipated.

Prior to mitigation, the noise and vibration impact is assessed as being of Low to Medium significance. The implementation of mitigation measures, including restricting construction activities to daylight hours, ensuring equipment is properly maintained, and limiting unnecessary vehicle idling, will reduce the impact to Low significance. No significant noise or vibration impacts are anticipated during the operational phase, as the pipeline will be located underground and will not generate ongoing noise or vibration.

<table>
<tr><th colspan="8">Air quality</th></tr>
<tr><td>Impact</td><td colspan="7">Mobilisation of equipment, land clearing, earthworks, and general construction activities leading to dust generation, emissions, and fallout along the route.</td></tr>
<tr><td>Activities(Not all-inclusive list)</td><td colspan="7">Construction materials such as cement, truck fumes, etc.
Dust accumulation due to construction and the movement of construction vehicles.</td></tr>
<tr><td colspan="8">Constructional Phase</td></tr>
<tr><td rowspan="2">Before Mitigation</td><td>Status</td><td>Severity</td><td>Duration</td><td>Extent</td><td>Consequences</td><td>Likelihood</td><td>Significance</td></tr>
<tr><td>Negative</td><td>2</td><td>3</td><td>2</td><td>2</td><td>3</td><td>6</td></tr>
<tr><td>Mitigation</td><td colspan="7">Wetting down topsoil stockpiles, haul roads, and other areas where dust will likely arise. Dust screens or barriers should be installed around sensitive areas, especially near the watercourses.
Enforce a strict speed limit of 20 km/h for all vehicles along the construction route to reduce dust and vehicle emissions.
Optimise the construction schedule to minimise the number of vehicles mobilised at any given time, further reducing airborne pollutants.
Limit the amount of vegetation clearance.
The construction of new dirt roads should be restricted by prioritising existing roads.
Topsoil stockpile height should be restricted to 2 m in height. Lower stockpiles are less susceptible to wind erosion, reducing the risk of dust generation.
Ensure that all construction personnel are trained in dust mitigation practices and the importance of maintaining air quality.
Implement a curfew of only operating between the hours of 7:00 and 17:00.
Regular maintenance of construction vehicles to ensure minimal exhaust emissions.
Fuels stored on site in dedicated, demarcated and bunded areas. Fuel spill containment procedures and equipment are to be in place.</td></tr>
<tr><td rowspan="2">After Mitigation</td><td>Status</td><td>Severity</td><td>Duration</td><td>Extent</td><td>Consequences</td><td>Likelihood</td><td>Significance</td></tr>
<tr><td>Negative</td><td>1</td><td>3</td><td>1</td><td>2</td><td>2</td><td>4</td></tr>
<tr><td colspan="8">Operational Phase</td></tr>
<tr><td rowspan="2">Before Mitigation</td><td>Status</td><td>Severity</td><td>Duration</td><td>Extent</td><td>Consequences</td><td>Likelihood</td><td>Significance</td></tr>
<tr><td colspan="7">N/A</td></tr>
<tr><td>Mitigation</td><td colspan="7">N/A</td></tr>
<tr><td rowspan="2">After Mitigation</td><td>Status</td><td>Severity</td><td>Duration</td><td>Extent</td><td>Consequences</td><td>Likelihood</td><td>Significance</td></tr>
<tr><td colspan="7">N/A</td></tr>
<tr><td colspan="8">Cumulative Impacts</td></tr>
<tr><td colspan="8">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).</td></tr>
</table>

The primary air quality impacts associated with the proposed pipeline will arise during the construction phase and are expected to include temporary dust generation from vegetation clearing, trench excavation, soil stockpiling, and vehicle movement along access routes. Minor emissions from construction vehicles and machinery will also contribute to a temporary reduction in local air quality.

Due to the limited extent and temporary nature of the construction activities, these impacts are expected to be localised and short-term. Prior to mitigation, the air quality impact is assessed as being of Low to Medium significance. The implementation of mitigation measures, including dust suppression, appropriate management of stockpiles, speed restrictions on unpaved surfaces, and the maintenance of construction equipment, will reduce the residual impact to Low significance. No significant air quality impacts are anticipated during the operational phase, as the pipeline will be installed underground and will not generate ongoing emissions.

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.

<table>
<tr><th colspan="8">General Solid and Hazardous Waste</th></tr>
<tr><td>Impact</td><td colspan="7">Improper handling, storage, or disposal of general and hazardous waste, together with accidental spills of fuels, oils, lubricants, and other hazardous substances, may result in soil and groundwater contamination, degradation of water quality, and pollution of the surrounding environment.</td></tr>
<tr><td>Activities (Not all-inclusive list)</td><td colspan="7">Handling and storage of fuels, oils, lubricants, and other hazardous substances.
Refuelling of construction vehicles and equipment.
Maintenance and servicing of construction vehicles, machinery, and equipment.
Temporary storage and handling of construction waste.
Handling, storage, and disposal of general and hazardous waste materials.
Operation of construction vehicles, machinery, and equipment.</td></tr>
<tr><td colspan="8">Constructional Phase</td></tr>
<tr><td rowspan="2">Before Mitigation</td><td>Status</td><td>Severity</td><td>Duration</td><td>Extent</td><td>Consequences</td><td>Likelihood</td><td>Significance</td></tr>
<tr><td>Negative</td><td>2</td><td>3</td><td>2</td><td>2</td><td>3</td><td>6</td></tr>
<tr><td>Mitigation</td><td colspan="7">Reduce, reuse, and recycle strategy needs to be implemented.
Provide clearly marked waste bins or receptacles on-site for different waste streams (general waste, hazardous waste, and recyclable materials)
Designate specific areas for waste storage away from watercourses and drainage systems to prevent contamination. The designated waste storage area should be approved by the ECO.
Train workers on proper waste segregation practices to ensure compliance.
Keep records of all waste disposed, reused, or recycled and ensure proper documentation for regulatory reporting.
Waste may not be burned or buried.
Normal construction site practices for preventing and containing fuels/oil, etc., spills.
Spill clean-up procedures to be in place before commencing construction.
The long-term risk rating for contamination due to spills of hazardous materials on aquatic features
○ If hydrocarbons or other chemicals are stored on site, storage areas must be situated a minimum distance of 100 m away from any watercourses and wetlands. These areas must be adequately bunded to contain at least 150% of the capacity of the storage tanks/units.
○ Adequate hydrocarbon and other chemical storage, handling, usage and spillage clean-up procedures must be developed and applied by sufficiently trained employees during the construction phase.
○ Spill kits must be readily available at the construction site, and all relevant employees must be adequately trained on their correct procedure and use.
All construction-related waste and surplus materials must be regularly removed and disposed of at authorised waste disposal facilities. All remaining waste must be removed from the site upon completion of construction.</td></tr>
<tr><td rowspan="2">After Mitigation</td><td>Status</td><td>Severity</td><td>Duration</td><td>Extent</td><td>Consequences</td><td>Likelihood</td><td>Significance</td></tr>
<tr><td>Negative</td><td>1</td><td>3</td><td>1</td><td>2</td><td>2</td><td>4</td></tr>
<tr><td colspan="8">Operational Phase</td></tr>
<tr><td rowspan="2">Before Mitigation</td><td>Status</td><td>Severity</td><td>Duration</td><td>Extent</td><td>Consequences</td><td>Likelihood</td><td>Significance</td></tr>
<tr><td colspan="7">N/A</td></tr>
<tr><td>Mitigation</td><td colspan="7">N/A</td></tr>
<tr><td rowspan="2">After Mitigation</td><td>Status</td><td>Severity</td><td>Duration</td><td>Extent</td><td>Consequences</td><td>Likelihood</td><td>Significance</td></tr>
<tr><td colspan="7">N/A</td></tr>
<tr><td colspan="8">Cumulative Impacts</td></tr>
</table>

The accumulation of solid waste, as well as the chemicals that leach into the soil and water courses from construction materials, will result in the aesthetic degradation of the area, death and deformation of vegetation and fauna who ingest the toxins either directly (waterborne) or indirectly (bioaccumulation), leading to loss of biodiversity and degeneration of ecosystems.

The proposed development will generate limited quantities of general and hazardous waste during the construction phase, primarily associated with construction activities, packaging materials, domestic waste generated by construction personnel, and small quantities of hazardous substances such as hydrocarbons, oils, and contaminated materials. If not properly managed, these waste streams could result in localised soil and water contamination and negatively affect the surrounding environment.

Prior to mitigation, the impact associated with the generation and management of general and hazardous waste is assessed as being of Low to Medium significance. The implementation of appropriate waste management measures, including the application of the reduce–reuse–recycle principle, waste segregation, the provision of suitable waste storage facilities, regular waste collection, and disposal at licensed waste disposal facilities, will substantially reduce potential environmental risks. Hazardous waste must be stored, transported, and disposed of in accordance with relevant legislative requirements.

Following the implementation of the recommended mitigation measures, the residual impact is expected to be of Low significance. Given the temporary nature of the construction activities, the limited volumes of waste anticipated, and the absence of significant waste generation during the operational phase, no significant long-term or cumulative impacts associated with general and hazardous waste management are anticipated.

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 locally appointed construction/ operation workers						
Activities (*Not all-inclusive list*)	Job creation Economic growth Reliable potable water usage			Increased local spending Creation of additional services			
Construction Phase							
	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Positive	4	3	2	3	4	12
Conditions	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. Whenever possible, training programmes that will benefit both construction stage skills requirements and long-term employment demand should be developed.						
Operational Phase							
	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Positive	3	5	1	3	4	12
Conditions	Routine maintenance, as required, will provide job creation for locals.						
Cumulative Impacts							
The proposed development is expected to result in positive cumulative socio-economic impacts through the creation of temporary employment opportunities, increased local spending, and support for local							

businesses and service providers during the construction phase. In the long term, the provision of a reliable potable water supply will improve service delivery, support future residential and economic development, and contribute to improved living conditions within the surrounding communities. Collectively, these benefits are expected to enhance local economic growth, stimulate the expansion of supporting services, and contribute positively to sustainable community development.

The proposed development will provide temporary employment opportunities during the construction phase and may create indirect economic benefits through the procurement of goods and services from local businesses and service providers. Although the number of jobs generated is expected to be limited and short-term in nature, the development has the potential to contribute positively to local livelihoods and economic activity within the surrounding area.

The significance of this positive impact will depend largely on the extent to which local labour and service providers are utilised. Prioritising local employment and procurement opportunities, where reasonably practicable, will maximise the socio-economic benefits associated with the project and promote community support for the development.

Failure to implement transparent and equitable recruitment procedures may result in perceptions of unfairness, potentially leading to community dissatisfaction or resistance to the project. However, this risk can be effectively minimised through clear communication of recruitment processes and the prioritisation of suitably qualified local workers and service providers.

Overall, the impact associated with job creation and local economic stimulation is assessed as a positive impact of Low to Medium significance, increasing where local employment and procurement are maximised. With the implementation of fair and transparent recruitment practices, the socio-economic benefits of the proposed development are expected to outweigh any potential adverse effects associated with an influx of job seekers.

4. No-go alternative

The “no-go” alternative assumes that the proposed development does not proceed, and therefore no pipeline or associated infrastructure is constructed. Under this scenario, the site would remain in its current condition, and no direct environmental disturbance from construction activities would occur. This option serves as the baseline against which the proposed development and other alternatives are assessed.

In the short term, the no-go alternative would present certain advantages:

- Avoidance of capital expenditure associated with bulk earthworks, deep excavations, pipeline installation, and associated civil structures such as valve chambers and tie-ins.
- It would eliminate construction-phase disturbances such as vegetation clearing, soil excavation, temporary access roads, construction traffic, noise, dust generation, and waste production.
- No disturbance would occur within or adjacent to watercourses, thereby avoiding potential short-term risks such as sediment mobilisation, erosion, or accidental contamination from construction-related activities (e.g., fuels and oils).
- Prevent direct physical disturbance to indigenous vegetation.
- Not proceeding would avoid development within sensitive biodiversity and conservation planning areas, including portions of the footprint within watercourses

and regulated areas, within an NPEAS Priority Focus Area, and within ESA 1 and ESA 2.
- It would avoid placing new infrastructure near the Woodland Hills Golf and Wildlife Estate and the Dwaal Valley Private Nature Reserve, thereby reducing exposure to ecological sensitivity and the complexity of mitigation and rehabilitation requirements.

Despite these short-term environmental and financial advantages, the benefits of the no-go alternative are largely temporary and must be weighed against longer-term operational and service delivery considerations. Not implementing the pipeline carries several significant operational, water-quality, environmental, and socio-economic implications:

- Continued reliance on the current water distribution system, which may be constrained in terms of capacity and operational performance.
- Reduced ability to support planned urban expansion and future development within the service area.
- Loss of opportunity to enhance long-term water security and service delivery efficiency.
- No creation of direct employment opportunities during the construction phase (e.g., local labour, contractors, and service providers).
- No indirect economic benefits associated with the procurement of materials, equipment, and services.
- No stimulation of local economic activity linked to infrastructure development and maintenance.
- Potential continued inefficiencies in water distribution that may result in higher operational stress on existing infrastructure over time.

Overall, while the no-go alternative avoids immediate construction-related environmental disturbances and capital costs, it does not contribute to long-term infrastructure development, service reliability, or socio-economic uplift associated with the proposed pipeline.

5. Conclusion

The combined impact assessment for the proposed pipeline development indicates that the project's environmental and socio-economic risks are manageable and remain within acceptable levels, provided the prescribed mitigation measures are effectively implemented. The pre-mitigation construction activities place the overall impact within the Low significance range (Refer to Table 7), primarily driven by temporary construction-related disturbances such as noise, air quality emissions, aesthetic alteration, and short-term effects on fauna, flora, and water resources. Table 7 Summary of Combined Impacts

Environmental Aspect	Potential Anticipated Impact	Phase	Status	Significance *pre-mitigation*	Significance *post-mitigation*
Ecological impacts					
Habitat loss	*Loss of habitat and species diversity as a result of construction and the removal of natural elements.*	Planning	N/A	N/A	N/A
		Construction	Negative	Low	Low
		Operation	N/A	N/A	N/A
Loss of ESA	Disturbance and loss of ecological habitat and ecological corridors.	Planning	N/A	N/A	N/A
		Construction	Negative	Low	Low

		Operation	N/A	N/A	N/A
Loss of indigenous floral and faunal diversity	*Habitat loss and fragmentation due to vegetation clearance and construction activities*	Planning	N/A	N/A	N/A
		Construction	Negative	Low	Low
		Operation	N/A	N/A	N/A
Loss of floral species of special conservation concern	*Loss of species diversity as a result of construction and the removal of natural elements.*	Planning	N/A	N/A	N/A
		Construction	Negative	Low	Low
		Operation	N/A	N/A	N/A
Heritage impacts					
Archaeological and Heritage Resources	Destruction of archaeological and heritage resources such as remains and graves.	Planning	N/A	N/A	N/A
		Construction	Negative	Low	Low
		Operation	N/A	N/A	N/A
Palaeontological Resources	Destruction of undiscovered artefacts of palaeontological significance.	Planning	N/A	N/A	N/A
		Construction	Negative	Low	Low
		Operation	N/A	N/A	N/A
Watercourse impacts					
Surface and Ground Water Contamination	*Water and/or soil pollution cause negative changes in the physical, chemical and biological characteristics of water resources (i.e. water quality). This can result in possible deterioration in aquatic ecosystem integrity and a reduction in, or loss of, species of conservation concern (i.e. rare, threatened/endangered species).*	Planning	N/A	N/A	N/A
		Construction	Negative	Low-Medium	Low
		Operation	N/A	N/A	N/A
Alteration of Hydrology and Flow Regimes	*Alteration or impeding of flow regimes (volumes and peak flows), which directly impacts the ecological functionality and integrity of the local watershed and the broader quaternary surface water catchment and drainage area.*	Planning	N/A	N/A	N/A
		Construction	Negative	Low	Low
		Operation	N/A	N/A	N/A
Erosion & Sedimentation	*Sedimentation and erosion refer to the alteration in the physical characteristics of rivers/wetlands because of*	Planning	N/A	N/A	N/A

	increased turbidity and sediment deposition, caused by soil erosion and earthworks that are associated with construction activities, as well as instability and collapse of unstable soils during project operation	Construction	Negative	Low	Low
		Operation	N/A	N/A	N/A
Aquatic and Riparian Ecosystems	*The deterioration of biodiversity through the direct removal of species and the accidental introduction of alien and invasive species which outcompete indigenous fauna.*	Planning	N/A	N/A	N/A
		Construction	Negative	Low-Medium	Low
		Operation	N/A	N/A	N/A
Aesthetics					
Construction of Infrastructure	*Negative overall aesthetic value due to construction*	Planning	N/A	N/A	N/A
		Construction	Negative	Low-Medium	Low
		Operation	N/A	N/A	N/A
Air Quality, Noise and Vibrations:					
Noise and Vibrations	*Vehicles, machinery, and equipment used during construction activities increase noise and vibrations.*	Planning	N/A	N/A	N/A
		Construction	Negative	Low-Medium	Low
		Operation	N/A	N/A	N/A
Air quality	*Mobilisation of equipment, land clearing, earthworks, and general construction activities that generate dust, emissions, and fallout occur along the route.*	Planning	N/A	N/A	N/A
		Construction	Negative	Low-Medium	Low
		Operation	N/A	N/A	N/A
Waste Impact					
General Solid and Hazardous Waste	Improper handling, storage, or disposal of general and hazardous waste, together with accidental spills of fuels, oils, lubricants, and other hazardous substances, may result in soil and groundwater contamination, degradation of water quality, and pollution of the surrounding environment.	Planning	N/A	N/A	N/A
		Construction	Negative	Low-Medium	Low
		Operation	N/A	N/A	N/A
Socio-economic impacts					
Job creation and the influx of job seekers	*Impacts associated with the need for locally appointed construction/ operation workers.*	Planning	N/A	N/A	
		Construction	Positive	Medium	
		Operation	Positive	Medium	

Based on the findings of the ecological, aquatic, and heritage specialist assessments, the proposed pipeline development is not anticipated to result in significant long-term environmental impacts, provided that the recommended mitigation measures are effectively implemented. The development comprises a temporary, narrow linear disturbance associated with the installation of an underground pipeline, with no significant residual impacts anticipated on ecological processes, aquatic systems, heritage resources, or the broader receiving environment. The overall impact of the proposed development is therefore considered to be of Low significance. Furthermore, specialist investigations indicate that disturbed areas can be successfully rehabilitated and restored to a condition comparable to the current baseline within approximately two years following completion of the construction phase.

In summary, with full adherence to the EMPr and ongoing compliance monitoring, the proposed development is considered environmentally acceptable and socio-economically beneficial. The project's implementation is therefore supported from an environmental and regulatory perspective, subject to the continued application of all mitigation, monitoring, and management measures outlined in this assessment.