

Consultation Basic Assessment Report: Development of a low-level crossing on the Mokolo River in Kaingo Private Nature Reserve, Lephalale Local Municipality, Waterberg District, Limpopo (2022)

environmental attributes associated with the site alternatives

Apart from higher construction costs for Alternative Site No. 2 associated with the topography on both banks causing the length of the crossing structure to be undesirably long, and a more complex design in terms of slope stability measures, all other environmental attributes are identical (**Table 1**). Screening Assessments were performed on both sites, as well as a Site Sensitivity Verification, with the same results.

Table 1. Sensitivity of the environmental attributes associated with the alternative sites.

Aspect→ Alternative↓	geographical	physical	biological	social	economic	Heritage and cultural
Alternative Site No. 1 (preferred)	Very High	Very High	High	Low	Medium	Low
Alternative Site No. 2 and No-go	Very High	Very High	High	Low	High	Low

Legend	Very High	High	Medium	Low
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References (Source of information) used to designate levels of sensitivity in **Table 1**

Geographical aspect (Table 2):

- CBA1 in the Waterberg Bioregional Plan (January 2016) and CBA1 in the Limpopo C-Plan v2 (2018)
- Private Nature Reserve in the Protected Area Register (PAR) and the Kaingo PNR Management Plan (2018 – 2023) developed with support from Envirodel Ecological and Wildlife Services.
- Core area of the Waterberg Biosphere Reserve in the Protected Area Register (PAR)
- Sensitive area in the Waterberg District EMF (adopted in 2010 and reviewed in May 2021)
- The “Limpopo Central Bushveld” Focus Area in the National Protected Area Expansion Strategy (2016)
- Terrestrial Biodiversity theme is **High** in both Screening Assessments because of the presence of a “CBA1, Focus Areas for land-based protected areas expansion and South African Protected Areas.” Verified as **Low** in the Site Sensitivity Verification Report, but the Terrestrial Assessment for the Kaingo Low Level Bridge, Vaalwater, Limpopo Province (November 2021) prepared by The Biodiversity Company, confirmed the **High** sensitivity of certain habitats that overlap the study area.

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Table 2. Applicable biodiversity features or other sensitivity categories with definitions and desired management objectives.

Biodiversity Feature	Definition	Desired management objectives
Critical Biodiversity Area 1 (Waterberg Bioregional Plan)	<p>Irreplaceable Sites:</p> <p>Areas with high irreplaceability e.g., areas essential for meeting biodiversity targets.</p> <p>Critical Linkages in CBA1 Biodiversity Corridors</p> <p>Critical linkages in the provincial biodiversity corridor network where existing conversion of natural landscapes to other uses has severely restricted options for maintaining connectivity in the natural landscape.</p>	<p>Areas that are maintained in a natural or near-natural state that maximises the retention of biodiversity pattern and ecological process:</p> <ul style="list-style-type: none"> • Ecosystems and species fully or largely intact and undisturbed • Areas with high irreplaceability or low flexibility in terms of meeting biodiversity targets. • Areas that are biodiversity features or parts of landscapes that are at or past their limits of acceptable ecological change.
Protected Areas	<p>Those protected areas contemplated in section 9 of the NEMPAA and the core area of a biosphere reserve and shall include their buffers.</p>	<p>Areas that are meeting biodiversity targets and therefore must be kept in a natural state, with a management plan focused on maintaining or improving the state of biodiversity. The objectives of the Kaingo PNR Management Plan (2018 – 2023) developed with support from Envirodel Ecological and Wildlife Services, are <i>inter alia</i>:</p> <ul style="list-style-type: none"> • To recover/conservate/re-instate the diversity of landscape units, natural processes, bio-communities and species characteristic of the area. • The conservation of a representative example of the ecosystem of which Ka'Ingo is part (Savannah biome, Waterberg, veld types) and its associated animal and plant life. • To ensure the survival of those endemic rare faunal and floral species which naturally occur/should occur on Ka'Ingo.

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		<ul style="list-style-type: none"> • To manage the ecosystem and wildlife populations so that a meaningful contribution will be made towards the conservation of threatened and endangered species. • To provide facilities and opportunities for nature-based tourism activities in order for the general public to come into contact with nature. • To generate income on a sustainable base to finance the maintenance and management of the resources and infrastructure.
Core Area of Waterberg Biosphere Reserve	Core areas are determined by currently conserved (private and public) land	The aim of these sites is to conserve biodiversity. Non-destructive research and other low impact land uses are recommended.
Sensitive Areas (Waterberg District EMF)	The core areas of the Waterberg Biosphere Reserve fall within Zone 1 of the Environmental Management Zones (point 6.2, pg. 89). Zones 1 and 2 are regarded as being “sensitive areas” as identified in Listing Notice 3 (pg. 87).	<p>This zone represents areas with a generally high natural, visual and cultural quality that provides the core natural and cultural resource base for the establishment of the Waterberg as a conservation (even wilderness) destination. It is large and unique in form and character. The protection of the area as a whole is important.</p> <p>Conservation is the priority land-use in this zone and should be promoted as the core activity in every instance.</p> <p>No additional damming of rivers or stream should be allowed in this zone.</p> <p>Limited, low impact tourism facilities.</p>
Focus Area (National Protected Area Expansion Strategy Focus Areas)	An area is considered important for the expansion of the land based protected area network if it contributes to meeting biodiversity thresholds for terrestrial or freshwater ecosystems, maintaining ecological processes or climate change resilience.	To achieve cost-effective protected area expansion for ecological sustainability and increased resilience to climate change.

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Physical aspect (Table 3):

- Both alternative sites fall within the same quaternary catchment A42F of the Limpopo Water Management Area. The study area falls within a sub-catchment associated with the Mokolo River, and spans over several quaternary catchments (namely A42A, A42B, A42C, A42D, A42E and partially A42F). The Mokolo River has its origin in the headwaters of A42A, and composes the combined inflow of the Sandspruit, Grootspuit, Sand, Klein-Sand, Dwars, Sondagsloop, Sterkstroom and Taaibokspruit Rivers (Hydrology Assessment).
- The Mokolo River is situated in the Matlabas/Mokolo Sub-Water Management Area, which forms part of the Limpopo drainage system, and the project area is situated in the Waterberg (6.02) Ecoregion according to the Water Resource Classification System (DWS, 2005). According to the Classification System for Wetlands and other aquatic Ecosystems in South Africa (Ollis *et. al.*, 2013), the riverine environment of the Mokolo River can be classified as a “lower footslope river type with a channelled valley bottom and associated riparian zone” (Aquatic Assessment).
- The project area has a mean annual precipitation (MAP) in the order of 530 mm/yr, and a mean annual evaporation (MAE) > 1700 mm/yr. The estimated runoff volume for quaternary catchment A42F is in the order of 28.23 Mm³/yr. The average monthly rainfall distribution is lowest in May (16.2mm), June (1.1mm), July (4.1mm), August (7.9mm) and September (8.2mm). Similarly, the average monthly run-off for catchment A42F is lowest in May (0.9mm), June (0.6mm), July (0.6mm), August (0.5mm), September (0.4mm), October (0.6mm) and November (0.8mm) (Hydrology Assessment).
- The water quality of the Mokolo River is considered good, and, except for dissolved iron (Fe), which is slightly high, all other analysed constituents fell well within DWAF (1996) ideal target ranges for domestic water use (Hydrology Assessment).
- Not a RAMSAR site, and the study area is located 23km north of the Waterberg Strategic Water Source Area. However, the Mokolo River and associated wetland are recognised as “unclassified” National Freshwater Ecosystem Priority Areas. In terms of the South African Inventory of Inland Aquatic Ecosystem, the Mokolo River is an Endangered NBA River and the associated wetland is an “unclassified” NBA wetland.
- Aquatic Biodiversity theme is **Very High** in both Screening Assessments because of the presence of “Wetlands and Estuaries.”
- The Integrated Habitat Assessment System (IHAS) and Habitat Quality Index (HQI) scores at the preferred site were mostly “Fair” due to the scarcity of fast flowing habitats (riffles and rapids). The lack of fast flowing habitats is also reflected in the moderate number of macro-invertebrate families and “Fair” SASS scores. Most of the recorded taxa had low to moderate sensitivity scores, with the highest scores of 10 allocated to two taxa, *Heptageniidae* and *Philopotamidae*. Consequently, the relative Macro-invertebrate Response Assessment Index (MIRAI) score (77.9%) of the Mokolo River was placed within the limits of a (Macro-invertebrate) Ecological Category C/B, meaning this reach is “Moderately modified”, mainly due to upstream impacts, including abstraction and the presence of the DWS Weir. The relative Fish Response Assessment Index (FRAI) score (86.3%) for this stretch of the Mokolo River falls within the limits of a (Fish) Ecological Category B or “Largely natural with few modifications”, meaning, a change in community characteristics may have taken place but species richness and presence of intolerant species indicate little modification. A total of 16 indigenous plant species were recorded within the riverine habitat (no alien species were recorded), including three riparian indicator species (Buffalo-thorn (*Ziziphus mucronata*), River bushwillow (*Combretum erythrophyllum*) and Water elder (*Nuxia oppositifolia*). The final score (88.5%) of the VEGRAI assessment regarding the riparian and marginal zone integrity puts the project area in the (Riparian Vegetation) Ecological Category A/B or “Largely natural with few modifications”, meaning a small change in natural

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habitats and biota may have taken place but the ecosystem functions are essentially unchanged. Consequently, the overall Ecstatus of the Mokolo River falls within a Category B (84.8%) or “Largely natural with few modifications”, meaning a small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged. The Category B Ecstatus can be ascribed to the presence of the weirs in the system. Weirs constitute obstacles for longitudinal exchanges along fluvial systems and so result in discontinuities in the river continuum. However, according to the Intermediate Reserve Determination Study (DWA, 2010), the PES is rated B/C due to largely flow and non-flow related impacts such as abstraction, irrigation weirs, farming and catchment activities, whereas the Ecological Importance and Sensitivity (EIS) is rated “High” due to the diversity and sensitivity of habitat types, species taxon richness and presence of unique species and the importance of conservation areas through which it flows. Since the EIS at the site is “High”, the Recommended Ecological Category (REC) is suggested as a Class B which is an improvement to the PES. (An Aquatic Biodiversity Specialist Assessment for the development of a low water crossings over the Mokolo River within the Kaingo Private Nature Reserve (PNR), in the Vaalwater area, Limpopo Province, South Africa (November 2021), prepared by Dr Andrew Deacon).

- Air Quality Waterberg Bojanala Priority Area

Table 3. Applicable biodiversity features or other sensitivity categories with definitions and desired management objectives.

Biodiversity Feature	Definition	Desired management objectives
NFEPA Rivers and Wetlands	<p>NFEPA River - achieve biodiversity targets for river ecosystems and threatened/near-threatened fish species, and were identified in rivers that are currently in a good condition</p> <p>NFEPA Wetland - important or sensitive wetlands and wetland clusters that are required to achieve biodiversity targets</p>	<p>Their FEPA status indicates that they should remain in a good condition to contribute to national biodiversity goals and support sustainable use of water resources.</p> <p>Wetland FEPAs currently in a good ecological condition should be managed to maintain this condition. Those currently not in a good condition should be rehabilitated to the best attainable ecological condition.</p>
Priority Area (Air Quality Waterberg Bojanala Priority Area – WBPA)	Section 18(1) of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NEM: AQA) provides for the declaration of a Priority Area. The Minister of Water and Environmental Affairs may declare a Priority Area if she reasonably believes that ambient air quality standards are being, or may be, exceeded in the area, or a situation exists which is causing, or may cause, a significant impact on air quality in the	Developments with potential to cause air pollution must have strict monitoring compliance with emission standards, with directives for atmospheric impact reports or pollution prevention plans, conditions, or requirements for an AEL.

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	<p>area; and specific air quality management (AQM) is required to address the situation.</p> <p>The WBPA is in the northwest of South Africa, bordering with Botswana, and covers an area of 67 837 km². It includes the Waterberg District Municipality (WDM) in Limpopo Province and parts of the Bojanala Platinum District Municipality (BPDM) in the Northwest Province.</p>	
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Biological aspect (Table 4):

- Not a critically endangered or endangered ecosystem in terms of SANBI's latest NBA (2018). The ecosystem threat status as per the NBA 2018 data provides a holistic view of the vegetation type, the threatened species associated with the ecosystem and the overall land use currently in the area. National vegetation type is Central Sandy Bushveld, which is an area of Least Concern in the National List of Threatened Ecosystems (NBA, 2018), yet the conservation status of this vegetation community is VU according to Mucina and Rutherford (2006). However, the Ecosystem Protection Level for Central Sandy Bushveld is categorised as Poorly Protected Ecosystem (NBA, 2018). This is confirmed by Mucina and Rutherford (2006); the area that is statutorily conserved is less than 3%, compared with the national conservation target of 19%.
- The Waterberg System according to BirdLife International (2021) Important Bird Areas factsheet: Waterberg System. Downloaded from <http://www.birdlife.org> on 30/11/2021, and <https://www.birdlife.org.za/iba-directory/waterberg-system/> (page last updated Monday 16th February 2015).
- Animal Species theme is **High** in both Screening Assessments because of the presence of "Sensitive Species 1, Mammalia-*Acinonyx jubatus*, Mammalia-*Dasymys robertsii*, Mammalia-*Lycaon pictus*, and Sensitive Species 12." According to the Terrestrial Assessment for the Kaingo Low Level Bridge, Vaalwater, Limpopo Province (November 2021) prepared by The Biodiversity Company, only 19 of the 98 Red Listed mammals are regarded as threatened including *inter alia*, the Cape Clawless Otter (NT), the South African Hedgehog (NT), which is threatened by road collisions, and the Swamp Musk Shrew (NT), which has a distinct preference for marshy ponds, riverine and semi-aquatic vegetation, such as reed beds. However, only 6 mammal SCC were observed during the assessment, including *inter alia* lion, elephant, hippo and hyaena. Four of the 91 reptiles that are expected to occur within the area are regarded as threatened, including the Nile Crocodile (VU), the Waterberg Dwarf Gecko (NT), which inhabits rocky areas of the grassland and savannas, the Northern Craig Lizard (NT) which inhabits rocky habitat and a savanna species, the Lobatse hinged-back tortoise (VU). However, only the Nile Crocodile was observed during the assessment. None of the 31 amphibian species expected to occur within the area are SCC. Only the Common River Frog was observed during the assessment. Six of the expected 257 Avifauna species are threatened, including *inter alia*, the Black Stork (VU), which forage in riverine and wetland areas, a

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migratory species that generally occurs near water, the Black-winged Pratincole (NT), the African Finfoot (VU), which is found along shoreline vegetation, and the Greater Painted-snipe (NT) which occurs in freshwater habitats. None of the 65 species that were observed during the assessment are regarded as SCC.

- Plant Species theme is **Low** in both Screening Assessments. No threatened plants are expected in the study area. Although two nationally protected trees and seven provincially protected plants are expected, only two nationally protected trees, namely *Boscia albitrunca* and *Vachellia erioloba*, were observed in the study area (the Terrestrial Assessment for the Kaingo Low Level Bridge, Vaalwater, Limpopo Province (November 2021) prepared by The Biodiversity Company).

Table 4. Applicable biodiversity features or other sensitivity categories with definitions and desired management objectives.

Biodiversity Feature	Definition	Desired management objectives
Important Bird Area	IBAs are sites of global significance for bird conservation, identified nationally through multi-stakeholder processes using globally standardised, quantitative, and scientifically agreed criteria. Essentially, these are the most important sites for conserving.	IBAs are sites for conservation action and obtaining formal protection. Activities in IBA should be aligned to conservation outcomes of the protected area and should include developments such as low-impact eco-tourism.
Sensitive Species 1, Mammalia- <i>Acinonyx jubatus</i> (cheetah), Mammalia- <i>Dasymys robertsii</i> (African marsh rat), Mammalia- <i>Lycaon pictus</i> (wild dog), and Sensitive Species 12	Areas important for threatened species were identified and included in the Bioregional Plan. Threatened species were defined as Critically Endangered, Endangered and Vulnerable species in terms of the Conservation of Nature (IUCN) Red List of Threatened Species.	Each species identified will have specific management objectives to ensure biodiversity targets are met. To promote development of sustainable wildlife-based tourism that leverages the unique behaviours and spectacular attributes of these identified species. Promote wildlife-based land uses and community based natural resource management in areas with potential for these species to occur.

Social aspect:

- The low-level crossing will be confined to a single, consolidate game reserve for the benefit of the Management Authority during its day-to-day operations or management of the Nature Reserve. As such the activity does not affect or impact any broader societal needs, communities, or economies.

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- Civil Aviation theme is **High** in both Screening Assessments because within 8km of other civil aviation aerodrome. Verified as **Low** in Site Sensitivity Verification Report.
- Defence theme is **Low** in both Screening Assessments

Economic aspect:

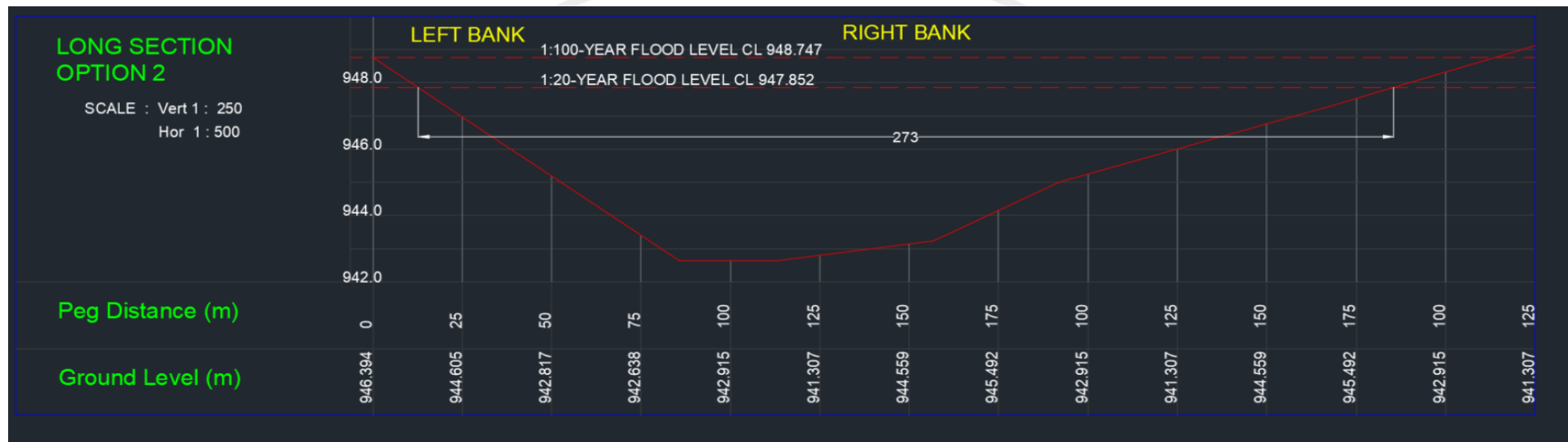
- Site Alternative No. 1 (preferred) was found to be the most favourable in terms of construction costs (**Figure 1**) in the Concept Design Report for the proposed low-level crossing at Kaingo Reserve across the Mokolo River prepared by PG Consulting Engineers dated October 2021 (Final Report).



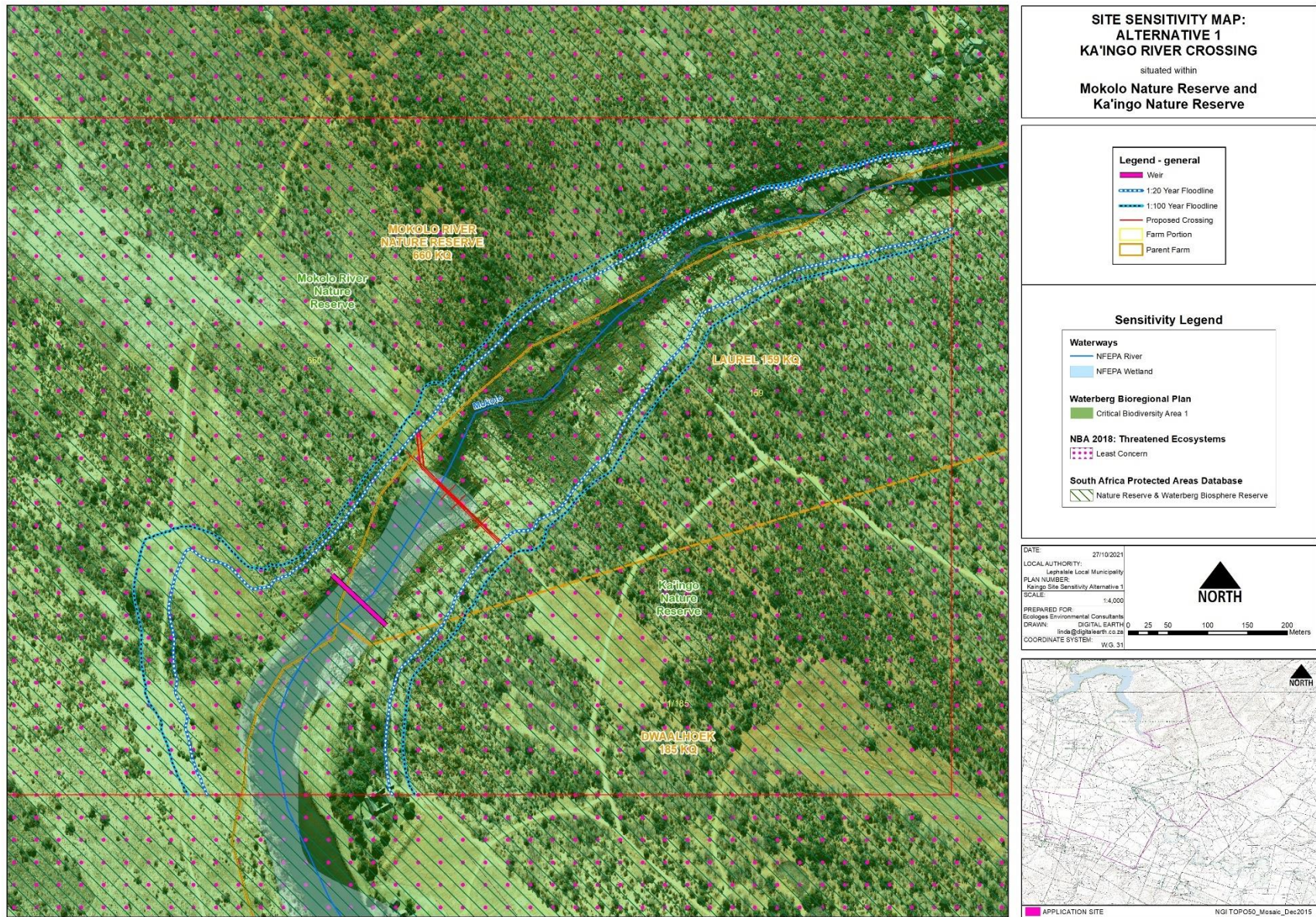
Figure 1. Long section showing the required length (183m) for the crossing structure at Site Alternative No. 1 (preferred) up to the 1:20 year flood level.

- The higher construction costs for Site Alternative No. 2 are a result of the topography on the left bank, which forms a relatively large floodplain causing the length of the crossing structure to be undesirably long (273m) (**Figure 2**), and the approach on the right bank is relatively steep, making the approach design more complex in terms of additional slope stability measures.

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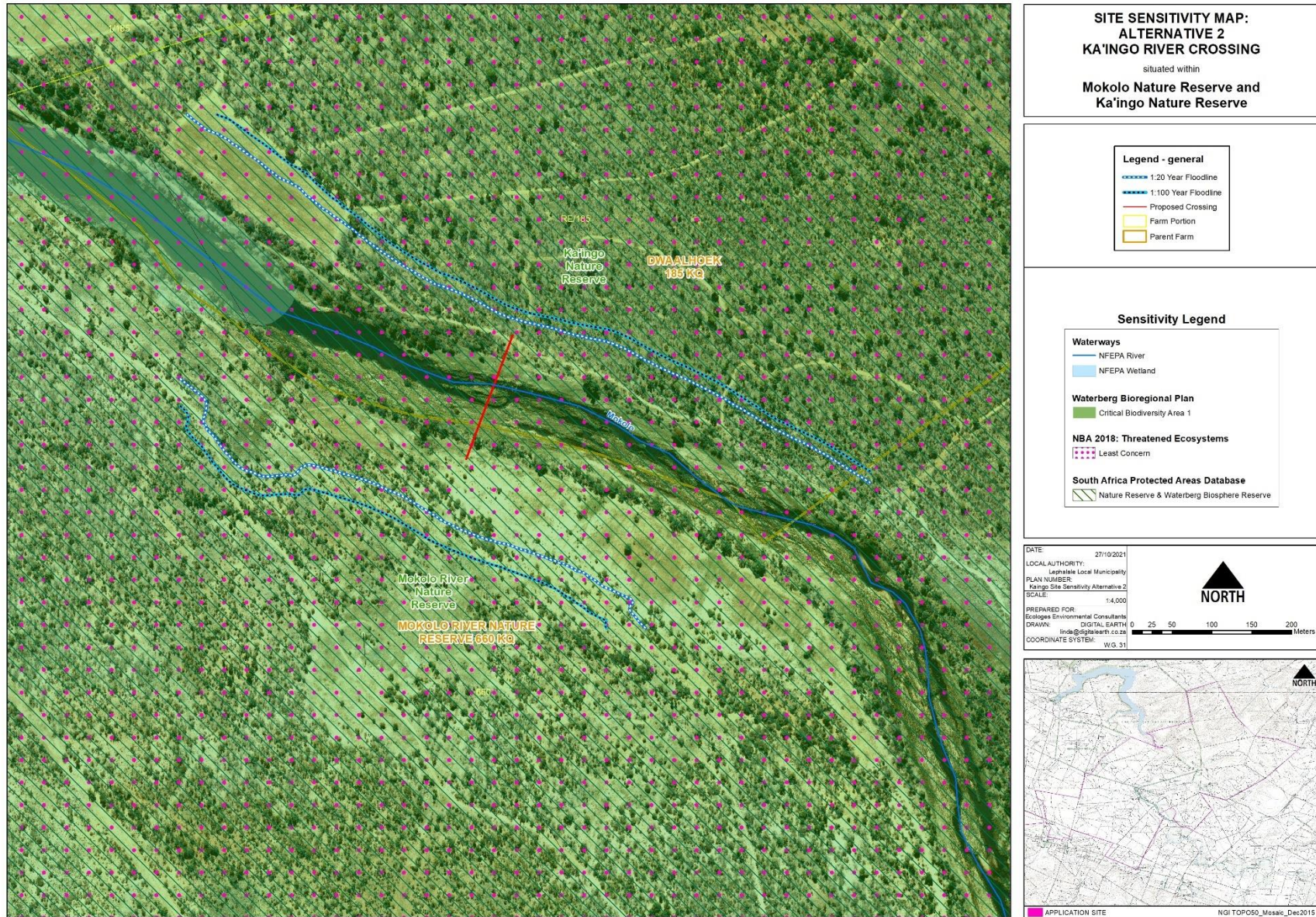
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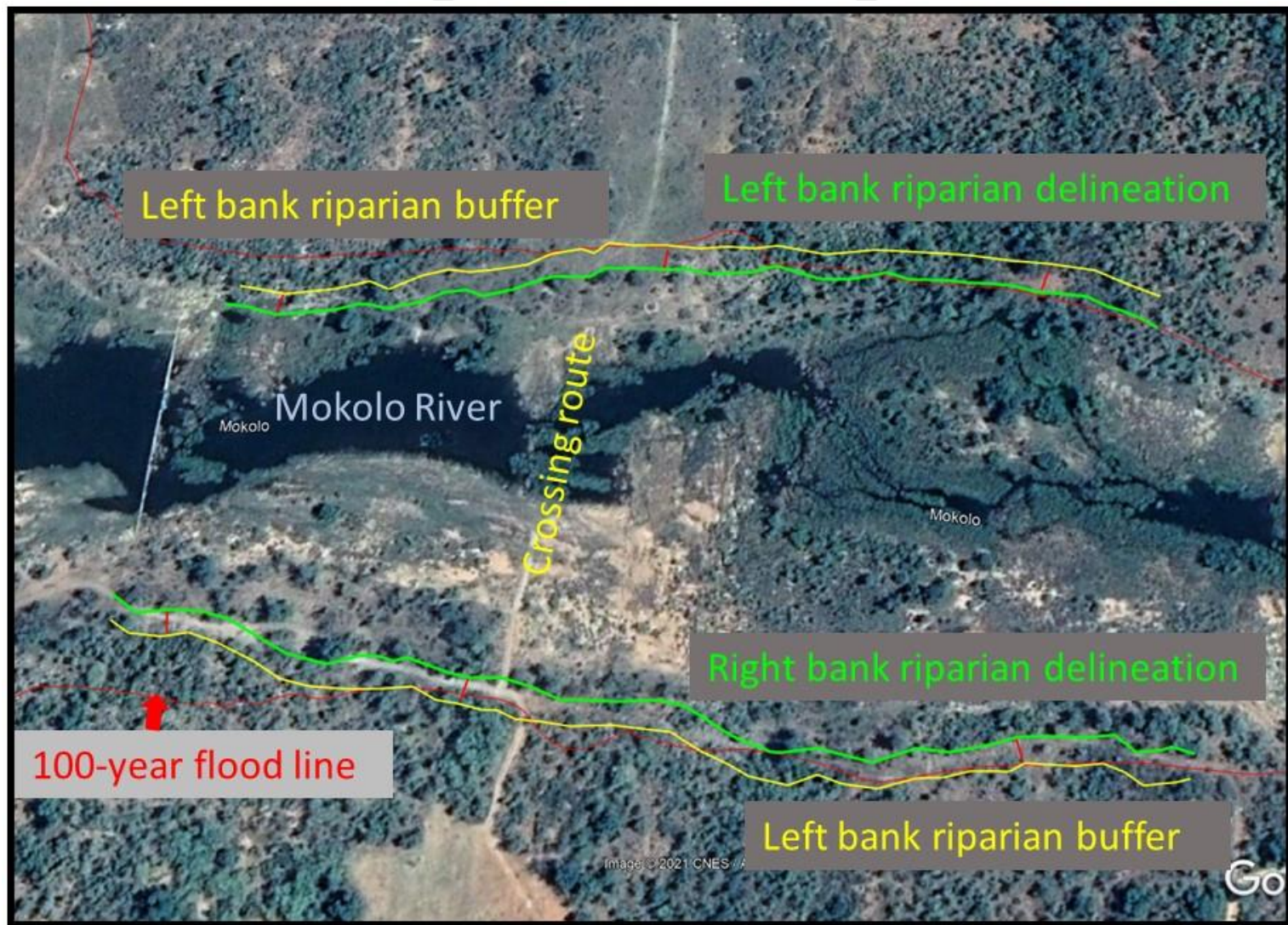
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Identification (and assessment) of impacts and risks for each alternative

3(1) A basic assessment report... must include –

(h) a full description of the process followed to reach the proposed preferred alternative within the site, including – (v) **the impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts - (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated;** (vii) **positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;** (viii) **the possible mitigation measures that could be applied and level of residual risk.**

Appendix 1 (Basic Assessment Report) of the EIA Regulations, 2014 as amended

Assessment of Site Alternatives

Receiving Environment: Legal System

Description of potential impacts:

Impact-Consequence	Change	Source*	Impact No.
Non-compliance. The development of a low-level crossing within the regulated area of a watercourse without a water use license constitutes an offence: - Any person who is guilty of an offence is liable, on the first conviction, to a fine or imprisonment for a period not exceeding five years, or to both a fine and such imprisonment and, in the case of a second or subsequent conviction, to a fine or imprisonment for a period not exceeding ten years or to both a fine and such imprisonment (S151 of NWA, 1998 as amended).	NA	Matrix	1
Non-compliance. Taking of water without a license for purposes other than reasonable domestic use and livestock watering, and which exceed the limits provided in a General Authorisation, constitutes an offence: - same as above.	NA	Matrix	
Non-compliance. Picking a protected plant without a permit constitutes an offence: - A person who is guilty of an offence is liable to a fine or imprisonment or to both such fine and imprisonment (S112 of LEMA, 2003).	NA	Matrix	

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- A person who is guilty of a first category offence (such as contravening the prohibition on picking any protected tree except under a license) may be sentenced to a fine or imprisonment for a period of up to 3 years, or to a fine and such imprisonment (S58(1) of NFA, 1998): - A person convicted of an offence is liable to a fine not exceeding R10 million, or an imprisonment for a period not exceeding ten years, or to both such a fine and such imprisonment (S102 read with 101 of NEMBA, 2004).			
Non-compliance. Building plans for the low-level water crossing must be submitted to the Lephalale Local Municipality for approval (Mr. Mateu Masoga, Executive Manager Infrastructural Services) in terms of Section 4(1) of National Building Regulations and Building Standards, 1977 (Act No. 103 of 1977) as amended: Any person erecting any building in contravention of the provisions of subsection (1) shall be guilty of an offence and liable on conviction to a fine not exceeding R100 for each day on which he was engaged in so erecting such building (Section 4 (4) of NBR and BSA, 1977).	NA	I&AP	
Non-compliance. Borrow pit licensing is classified as small-scale mining under the Mineral and Petroleum Resources Development Act, 28 of 2002 (Act No. 28 of 2002) and is administered by the Department of Minerals and Energy, through whom any permit applications must be lodged: Any person convicted of a offence in terms of this Act is liable - (a) in the case of an offence referred to in section 98 (a) (i), to a fine not exceeding R100 000 or to imprisonment for a period not exceeding two years or to both such fine and such imprisonment (Section 99 (1) of MPRDA, 2002).	NA	Matrix	
Non-compliance. A person who contravenes or fails to comply with a provision of Section 73(2) of NEMBA, 2004 is not guilty of an offence under Section 101 of the Act.	NA	Specialist	

*The source of information used in identifying the impact is either the Leipold Matrix (Matrix), Interested and Affected Parties (I&APs) and/or Specialist studies (Specialist)

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

- A mining permit is not required for mining sand from the riverbed or collecting rocks from the reserve in terms of Section 106(3) of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).
- The construction of a low-level crossing within a watercourse shall not impound water, and as such, constitutes Section 21(c) and (i) water uses only.
- A protected species (*Acacia erioloba*) was identified outside the development footprint of both alternative sites during the Site Sensitivity Verification. *Acacia erioloba* (Camel thorn) is published in the List of All Protected Tree Species Under Section 12 of the NFA, 1998 (Notice 635 of 6 December 2019, Gazette No. 42887).

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- The Applicant can abstract water for use during construction (mixing concrete) in terms of the GA for Section 21(a) and without having to register with the regional office of the DWS. The estimated water requirements during construction fall below the limits provided in the GA. The total expected volume of water required for mixing concrete, including the RMC mortar mix, is 66m³ (pers. comm. Martin Mulder, PG Consulting Engineers). The upper limit volume of concrete that can be practically mixed and placed per day, using labour and a mixer, is approximately 4 m³, which translates to a maximum water demand of roughly 1.0 m³/day (pers. comm. Martin Mulder, PG Consulting Engineers). Kaingo Game Reserve falls within Quaternary Catchment A42F (Concept Design Report). As such, the maximum volume of surface water that may be abstracted on each property along the river is 2000m³ yr⁻¹, at a maximum rate of 1l s⁻¹ and during the whole year. The maximum volume of ground water that may be abstracted on each property = size of the property (ha) x 75 m³/ha/year but may not exceed 40 000m³ per year on a property. Kaingo Game Reserve is made up of 14 properties covering 14 600ha (pers. comm. Jurie Willemse, Applicant). A person needs to register if >50m³ of surface water or >10m³ of ground water is taken per day (on average over a year on a property).
- The Terrestrial Assessment identified three alien and invasive plants within the study area, namely *Opuntia ficus-indica* (NEMBA Category 1b), *Myriophyllum aquaticum* (NEMBA Category 1b), and *Verbena bonariensis* (NEMBA Category 1b).

Assessment without mitigation:

Legend					
Criteria		Reversibility, Irreplaceability, & Mitigatory Potential		Significance (Impact Magnitude & Impact Importance)	
Abbreviation	Description	Abbreviation	Description	Abbreviation	Description
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
1	NA	NA	NA	-I	NA	NA	NA	H	H	1
Reversibility		NA		Irreplaceability		NA		Mitigatory Potential		H

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Alternative Site No. 2

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
1	NA	NA	NA	-I	NA	NA	NA	H	H	1
Reversibility		NA		Irreplaceability		NA		Mitigatory Potential		H

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- Construction may not commence without a water use license from the regional office of the Department of Water and Sanitation.
- The validity period of the environmental authorisation shall be until **31st December 2024**.
 - The authorization shall be required for a period of two years (as of 31st December 2022).
 - The date on which the activity will be concluded: 31st December 2023.
 - The post-construction monitoring requirements should be finalized by: 31st December 2024.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- General Authorisation for the taking and storing of water published in Government Notice 538 of 02nd September 2016 in Government Gazette No. 40243
 - No surface or ground water that is taken in terms of this authorisation may be taken within a 500m radius from the boundary (delineated edge) of a wetland, pan or estuary, and no ground water may be taken within a 100m radius from the delineated riparian edge of a water course.
- Limpopo Environmental Management Act, 2003 (Act No. 7 of 2003): Chapter 8 Indigenous Plants
 - No person may without a permit pick, be in possession of (a specially protected plant), sell, purchase, donate, receive as a gift, import into, export or remove from the Province, or convey a specially protected plant or a protected plant (S64(1)(a) and (b)).
 - No person may without a permit pick any indigenous plant within an area bordering any natural water course, whether wet or dry, up to and within a distance of 50 meters from the high watermark on either side of the natural water course; or in a Provincial Nature Reserve, a Site of Ecological Importance, a Protected Environment or a Private Nature Reserve (S64(1)(c)).
- National Environmental Management: Biodiversity Act (Act No. 10 of 2004): Chapter 4 Threatened or Protected Ecosystems and Species
 - A person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7 (S57(1)).
- National Forest Act, 1998 (Act No. 84 of 1998): Part 3 Protection of Trees

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- No person may cut, disturb, damage or destroy any protected tree except under a license granted by the Minister (S15(1)(a)).
- National Water Act, 1998 (Act No 36 of 1998) published in Government Notice No. 1091 of Gazette No. 19182 as amended: Chapter 4: Use of water.
- National Building Regulations and Building Standards, 1977 (Act No. 103 of 1977) as amended
 - **4 Approval by Local Authorities of Applications in Respect of Erection of Buildings** (1) No person shall without the prior approval in writing of the local authority in question, erect any building in respect of which plans and specifications are to be drawn and submitted in terms of this Act.
- Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
 - **106. Exemptions from certain provisions of Act** - (3) Any landowner or lawful occupier of land who lawfully, takes sand, stone, rock, gravel or clay for farming or for effecting improvements in connection with such land or community development purposes, is exempted from the provisions of in subsection (1) as long as the sand, stone, rock, gravel or clay is not sold or disposed of.
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) – Section 73(2) “A person who is the owner of land on which a listed invasive species occurs must- (a) notify any relevant competent authority, in writing, of the listed invasive species occurring on that land; (b) take steps to control and eradicate the listed invasive species and to prevent it from spreading; and (c) take all the required steps to prevent or minimise harm to biodiversity.”

Mitigations:

Impact Management Outcome(s):

- Lawful commencement of section 21 (c) and (i) water uses in terms of the NWA, 1998.
- Lawful activities involving any threatened or protected flora.
- Lawful abstraction of water in terms of the General Authorisation.
- Lawful commencement of land development in terms of the Lephalale Municipal Spatial Planning and Land-Use By-law.
- Duty of Care relating to Listed Invasive Species.

Targets:

- A water use license for Section 21(c) and (i) water uses.
- A license under the NFA, 1998, a permit under LEMA, 2003 and/or a permit under NEMBA, 2004.
- No evidence of taking water from excluded geographical areas.
- Approved building plans

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- A written notification sent to the relevant Competent Authority.

Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
1	A1	Unlawful commencement of section 21 (c) and (i) water uses in terms of the NWA, 1998.	Lawful commencement of section 21 (c) and (i) water uses in terms of the NWA, 1998.	A water use license for Section 21(c) and (i) water uses.	Obtain a water use license for Section 21(c) and (i) water uses from the regional office of the Department of Water and Sanitation.	Applicant	Prior to commencement of construction.	Compliance to be verified by ECO and IEA.
1	A1	Unlawful activities involving any threatened or protected flora.	Lawful activities involving any threatened or protected flora.	A license under the NFA, 1998, a permit under LEMA, 2003 and/or a permit under NEMBA, 2004.	Obtain the applicable permit(s) and/or license prior to carrying out a restricted activity involving, or picking, or cutting, disturbing, damaging or destroying any threatened or protected flora.	Applicant ECO	Prior to commencement of clearing and grubbing.	Compliance to be verified by ECO and IEA.
1	A1	Unlawful picking of any indigenous plant ("pick" includes to gather, cut off, chop off, uproot, damage	Lawful clearing of any indigenous plants.	A permit under LEMA, 2003.	Obtain a permit prior to picking any indigenous plant.	Applicant ECO	Prior to commencement of clearing and grubbing.	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		or to destroy wholly or partially, or any similar action).						
1	1 and A1	Unlawful abstraction of water for use during construction, e.g., mixing concrete.	Lawful abstraction of water for use during construction, e.g., mixing concrete.	No signs of water abstraction from the excluded geographical areas.	Ground water shall be taken from existing boreholes that are further than 500m from the boundary (delineated edge) of a wetland or pan and further than 100m from the delineated riparian edge of a water course.	Applicant and Contractor	During construction, e.g., when mixing concrete.	Compliance to be verified by ECO and IEA.
1	1 and A1	Unlawful abstraction of water for use during construction, e.g., mixing concrete.	Lawful abstraction of water for use during construction, e.g., mixing concrete.	No signs of water abstraction from the excluded geographical areas.	If surface water must be taken from the Mokolo River, then it shall be further than 500m from the boundary (delineated edge) of a wetland or pan, including the identified NFEPA wetland.	Applicant and Contractor	During construction, e.g., when mixing concrete.	Compliance to be verified by ECO and IEA.
1	A1	Unlawful commencement of land development	Lawful commencement of land development.	Building plans approved by the	Obtain building plan approval from the Lephalale Local Municipality.	Applicant	Prior to commencement of construction.	Compliance to be verified by

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		without approved building plans,		Lephalale Local Municipality.				ECO and IEA.
1	A1	Failure to comply with Duty of Care relating to Listed Invasive Species	Duty of Care relating to Listed Invasive Species	Written Notification	The Management Authority must notify the Minister (DFFE) and/or MEC (LEDET), in writing, of the listed invasive species occurring in the study area, namely <i>Opuntia ficus-indica</i> (NEMBA Category 1b), <i>Myriophyllum aquaticum</i> (NEMBA Category 1b), and <i>Verbena bonariensis</i> (NEMBA Category 1b).	Management Authority	Continuous	Compliance to be verified by ECO and IEA.

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Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
1	NA	NA	NA	+I	NA	NA	NA	L	L	0

Alternative Site No. 2

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
1	NA	NA	NA	+I	NA	NA	NA	L	L	0

Alternative No. 3 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
1	NA	NA	NA	+I	NA	NA	NA	L	L	0

Residual Risk (feeds back into “Mitigations”):

- A person may feel compelled to commence with construction without a water use license if an environmental authorisation has been granted by the competent authority and the validity period requires the applicant to conclude the authorised activity within a restrictive timeframe that is limited to one dry season.
- Although the abstraction of water for construction does not need to be registered in terms of the General Authorisation (GA), the applicant or contractor might not take the water within the specific conditions prescribed in the GA.

Receiving Environment: Terrestrial fauna

Description of potential impacts:

Impact-Consequence	Change	Source*	Impact No.
Loss of fauna. Direct loss of local sedentary or burrowing fauna, including <i>inter alia</i> Mammalia - <i>Dasymys robertsii</i> , and Aves through construction activities: - the loss of threatened (Red Data) species may result in a loss of biodiversity and ecosystem resilience to climate change (direct). - the loss of threatened keystone species may alter the functioning of an ecosystem (direct).	quantity	Matrix	2
Loss of fauna. Active mammals may emigrate from the area during construction: - Forced redistribution out of home ranges or territories can cause stress and conflict. Conflict can lead to injury or death of individuals (indirect).	quantity	Matrix	
Loss of fauna. Rock will be collected from the farm resulting in its removal from the landscape: - Persons tasked with collecting rocks may harm or kill arachnids, reptiles, and other fauna (direct).	quantity	Matrix	

*The source of information used in identifying the impact is either the Leopold Matrix (Matrix), Interested and Affected Parties (I&APs) and/or Specialist studies (Specialist)

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

- Sedentary animals pose a higher risk of harm than active animals.
- There have been no recorded observations of the African Marsh Rat at both alternative sites (pers. comm. Jurie Willemse). No visible signs, including holes along the banks of the Mokolo River, as well as sub- and above-surface runways extending from potential nest cavities (Pillay *et al.* 2016), were observed during the Site Sensitivity Verification. African Marsh Rats have not been found in artificial or degraded wetlands (Pillay *et al.* 2016). Furthermore, the low-level crossing is not identified as one of the major threats to this species (Pillay *et al.* 2016).
- Only 19 of the 98 Red Listed mammals are regarded as threatened including *inter alia*, the Cape Clawless Otter (NT), the South African Hedgehog (NT), which is threatened by road collisions, and the Swamp Musk Shrew (NT), which has a distinct preference for marshy ponds, riverine and semi-aquatic vegetation, such as reed beds. However, only 6 mammal SCC were observed during the assessment, including *inter alia* lion, elephant, hippo and hyaena. Four of the 91 reptiles that are expected to occur within the area are regarded as threatened, including the Nile Crocodile (VU), the Waterberg Dwarf Gecko (NT), which inhabits rocky areas of the grassland and savannas, the Northern Craig Lizard (NT) which inhabits rocky habitat and a savanna species, the Lobatse hinged-back tortoise (VU). However, only the Nile Crocodile was observed during the assessment. None of the 31 amphibian species expected to occur within the area are SCC. Only the Common River Frog was observed during the assessment. Six of the expected 257 Avifauna species are threatened, including *inter alia*, the Black Stork (VU), which

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forage in riverine and wetland areas, a migratory species that generally occurs near water, the Black-winged Pratincole (NT), the African Finfoot (VU), which is found along shoreline vegetation, and the Greater Painted-snipe (NT) which occurs in freshwater habitats. None of the 65 species that were observed during the assessment are regarded as SCC (The Terrestrial Assessment).

- The Management Authority shall collect the surface rock as contractors are not allowed to work in open reserve areas (pers. comm. Jurie Willemse, Applicant).

Assessment without mitigation:

Legend					
Criteria		Reversibility, Irreplaceability, & Mitigatory Potential		Significance (Impact Magnitude & Impact Importance)	
Abbreviation	Description	Abbreviation	Description	Abbreviation	Description
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
2	L	M	M	-I	M	M	1	L	M	0
Reversibility		H		Irreplaceability		H		Mitigatory Potential		H

Alternative Site No. 2

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
2	L	M	M	-I	M	M	1	L	M	0
Reversibility		H		Irreplaceability		H		Mitigatory Potential		H

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Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- The Waterberg System according to BirdLife International (2021) Important Bird Areas factsheet: Waterberg System. Downloaded from <http://www.birdlife.org> on 30/11/2021, and <https://www.birdlife.org.za/iba-directory/waterberg-system/> (page last updated Monday 16th February 2015).
- Kaingo PNR Management Plan (2018 – 2023) developed with support from Envirodel Ecological and Wildlife Services.
- Pillay N, Taylor P, Baxter R, Jewitt D, Pence G, Child MF. 2016. A conservation assessment of *Dasymys* spp. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.
- Site Sensitivity Verification Report.
- Animal Species theme is **High** in both Screening Assessments because of the presence of “Sensitive Species 1, Mammalia-*Acinonyx jubatus*, Mammalia-*Dasymys robertsii*, Mammalia-*Lycaon pictus*, and Sensitive Species 12.”
- The Terrestrial Assessment for the Kaingo Low Level Bridge, Vaalwater, Limpopo Province (November 2021) prepared by The Biodiversity Company.
- Private Nature Reserve in the Protected Area Register (PAR) and the Kaingo PNR Management Plan (2018 – 2023) developed with support from Envirodel Ecological and Wildlife Services.

Mitigations:

Impact Management Outcome(s):

- Ensure the protection of sedentary or active fauna, including mammals, aves, reptiles and arachnids.
- Ensure least impact on animal behaviour.

Targets:

- No unnecessary physical harm to wildlife.
- No poaching (e.g., snares)

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- Environmental Awareness relating to the protection of fauna
- No unnecessarily loud noise that is a nuisance to wildlife.
- All staff tasked with collecting rocks are 'trained' to do so.
- No incidents of intentionally killing animals out of fear or speeding.

Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
2	3 and A3	Loss of sedentary fauna and aves when clearing site.	Ensure the protection of sedentary fauna and aves.	No unnecessary physical harm to wildlife.	Undertake a search within the development and construction camp footprints for local sedentary or burrowing fauna, such as the the South African Hedgehog (NT), Lobatse hinged-back tortoise (VU), the Swamp Musk Shrew (NT), the nest holes and surface runways of the African Marsh Rat, and ground nesting birds, such as the African Finfoot (VU) and the Greater Painted-snipe, which are found along shoreline vegetation	Reserve Manager or ECO	After marking the boundaries of the construction camp and working servitude.	Compliance to be verified by ECO and IEA.
2	3 and A3	Loss of sedentary fauna and aves when clearing site.	Ensure the protection of sedentary fauna, and aves.	Photographic evidence of relocation operation.	If any sedentary animals or ground nesting birds are found, then these are to be relocated to a suitable distance and	Reserve Manager or ECO, Engineer, Contractor.	After marking the boundaries of the construction camp and	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
					habitat by the Reserve Manager or ECO, and only if it is not possible to relocate the footprint.		working servitude.	
2	A2, 4 and 18	Loss of sedentary or active fauna and aves when driving.	Ensure the protection of active fauna, and aves.	Content of induction. No signs of speeding.	Drivers must adhere to the reserve's speed limit (35km/hr) and slow down when approaching game. This is to be included in the induction.	Contractor, Reserve Manager or ECO.	Continuous	Compliance to be verified by ECO and IEA.
2	A2, 4 and 18	Loss of sedentary or active fauna and aves when driving.	Ensure the protection of sedentary fauna.	Content of Induction. Drivers have a knowledge of which animals to be vigilant for.	Drivers must be vigilant and on the lookout for such sedentary animals as the South African Hedgehog (NT) and Lobatse hinged-back tortoise (VU) when driving. This is to be included in the induction.	Contractor, Reserve Manager or ECO.	Continuous	Compliance to be verified by ECO and IEA.
2	4	Illegal harvesting of animals.	Ensure the protection of sedentary fauna, and aves.	No poaching (e.g., snares)	Poaching of any animal or bird is prohibited.	Contractor	Continuous	Compliance to be verified by ECO and IEA.
2	2 and A2	Illegal harvesting of animals.	Ensure the protection of sedentary fauna, and aves.	Signed register of attendance, and content of induction.	The contractor's staff must be made aware of the prohibition on poaching in an induction.	Contractor, Reserve Manager or ECO.	Prior to site establishment.	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
2	4	Forced redistribution of fauna out of territories or home ranges.	Ensure least impact on animal behaviour.	No unnecessarily loud noise that is a nuisance to wildlife.	Keep noise levels as low as practically possible when working.	Contractor	Continuous	Compliance to be monitored by SEO and verified by ECO and IEA.
2	A2	Human-caused harm to arachnids, reptiles and other fauna living under rocks.	Ensure the protection of sedentary fauna, including reptiles, arachnids, and other fauna.	An attendance register signed by all applicable staff.	Staff responsible for collecting rocks are to be given an induction or toolbox talk on the best way to collect rocks without causing harm to the animals living under the rocks, such as the Waterberg Dwarf Gecko (NT) and the Northern Craig Lizard (NT), and specifically told not to harm any animal.	Management Authority and Reserve Manager.	Before collecting rocks.	Compliance to be verified by ECO and IEA.

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Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
2	L	M	M	neutral	M	L	0	L	L	0

Alternative Site No. 2

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
2	L	M	M	neutral	M	L	0	L	L	0

Alternative No. 3 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
2	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

- Sedentary or burrowing fauna, as well as ground nesting birds, may occupy the development site after their observed absence during the basic assessment process.
- Although the development footprint is small relative to animal home ranges and territories, sound can travel further, beyond the boundaries of the footprint.
- Poaching by the contractor’s staff.
- Although sedentary animals pose a higher risk of harm than active animals, both types of animals are susceptible to harm when construction vehicles are driven at speed.

Receiving Environment: Terrestrial flora

Description of potential impacts:

Impact-Consequence	Change	Source*	Impact No.
Loss of flora. Direct loss of terrestrial plants from construction activities. Consequence: - the loss of threatened (Red Data) species may result in a loss of biodiversity and ecosystem resilience to climate change (direct). - the loss of threatened keystone species may alter the functioning of an ecosystem (direct).	quantity	Matrix	3

*The source of information used in identifying the impact is either the Leipold Matrix (Matrix), Interested and Affected Parties (I&APs) and/or Specialist studies (Specialist)

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

- Plant species theme is **Low** (in both Screening Assessments).
- No threatened plants are expected in the study area, and none were observed at both alternative sites during the Site Sensitivity Verification, as well as the terrestrial assessment.
- Although two nationally protected trees and seven provincially protected plants are expected to occur, only two nationally protected trees, namely *Boscia albitrunca* and *Vachellia erioloba*, were observed in the study area during the Site Sensitivity Verification and terrestrial assessment.
- Not a critically endangered or endangered ecosystem in terms of SANBI's latest NBA (2018). The ecosystem threat status as per the NBA 2018 data provides a holistic view of the vegetation type, the threatened species associated with the ecosystem and the overall land use currently in the area. National vegetation type is Central Sandy Bushveld, which is an area of Least Concern in the National List of Threatened Ecosystems (NBA, 2018), yet the conservation status of this vegetation community is VU according to Mucina and Rutherford (2006). However, the Ecosystem Protection Level for Central Sandy Bushveld is categorised as Poorly Protected Ecosystem (NBA, 2018). This is confirmed by Mucina and Rutherford (2006); the area that is statutorily conserved is less than 3%, compared with the national conservation target of 19%.

Assessment without mitigation:

Legend					
Criteria		Reversibility, Irreplaceability, & Mitigatory Potential		Significance (Impact Magnitude & Impact Importance)	
Abbreviation	Description	Abbreviation	Description	Abbreviation	Description

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H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
3	L	L	M	-I	M	M	1	M	M	1
Reversibility		H		Irreplaceability		H		Mitigatory Potential		H

Alternative Site No. 2

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
3	L	L	M	-I	M	M	1	M	M	1
Reversibility		H		Irreplaceability		H		Mitigatory Potential		H

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- NBA (2018)
- Mucina, L. & Rutherford, M.C. (Eds.). 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelizia 19. South African National Biodiversity Institute, Pretoria, South African.
- Screening Assessments.
- The Terrestrial Assessment for the Kaingo Low Level Bridge, Vaalwater, Limpopo Province (November 2021) prepared by The Biodiversity Company.

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- Site Sensitivity Verification Report.
- Private Nature Reserve in the Protected Area Register (PAR) and the Kaingo PNR Management Plan (2018 – 2023) developed with support from Envirodel Ecological and Wildlife Services.

Mitigations:

Impact Management Outcome(s):

- Avoid the unnecessary loss of or harm to terrestrial plants, particularly protected or threatened plants.

Targets:

- No unnecessary loss of or harm to terrestrial plants, particularly protected or threatened plants.
- No illegal harvesting of terrestrial plants or plant parts (e.g., debarking).
- Environmental Awareness relating to the protection of flora.

Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
3	3 and A3	Loss of local terrestrial plants.	Avoid the unnecessary loss of terrestrial plants.	No disturbance to protected or threatened plants, unless necessary.	Perform a search for any threatened or protected flora in those areas that will be disturbed by construction activities, including the working servitude and construction camp.	ECO	After marking the boundaries of the construction camp and working servitude.	Compliance to be verified by ECO and IEA.
3	3	Loss of local terrestrial plants.	Avoid the unnecessary loss of	No signs of disturbance to either of the trees.	High visibility flags must be placed near protected plants, including the Camel	Contractor	Ongoing	Compliance to be verified by

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
			terrestrial plants.		Thorn (<i>Vachellia erioloba</i>) and the Shepherds Tree (<i>Boscia albitrunca</i>) (see Figure 2) to avoid any damage or destruction of these species.			ECO and IEA.
3	3 and A3	Loss of local terrestrial plants.	Avoid the unnecessary loss of terrestrial plants.	No disturbance to protected or threatened plants, unless necessary.	Only apply for permit(s) and/or a license to “pick” a threatened or protected plant if it is not possible to relocate the footprint.	Applicant Engineer Contractor	Prior to commencement of clearing and grubbing.	Compliance to be verified by ECO and IEA.
3	4	Illegal harvesting of terrestrial plants.	Avoid the unnecessary loss of or harm to terrestrial plants.	No illegal harvesting of plants or plant parts, e.g., debarked trees or dug-up tubers, used for muthi.	Harvesting of any plant or plant part is prohibited.	Contractor	Continuous	Compliance to be verified by ECO and IEA.
3	2 and A2	Illegal harvesting of terrestrial plants.	Avoid the unnecessary loss of or harm to terrestrial plants.	Signed register of attendance, and content of induction.	The contractor's staff must be made aware of the prohibition on harvesting any plant or plant part in an induction.	Contractor, Reserve Manager or ECO.	Prior to site establishment.	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

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Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
3	L	L	M	neutral	M	L	0	L	L	0

Alternative Site No. 2

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
3	L	L	M	neutral	M	L	0	L	L	0

Alternative No. 3 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
3	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

- Protected or threatened plant species may have been missed during the Site Sensitivity Verification.
- Plants or plant parts, such as tree bark or tubers, may be illegally harvested for muthi.

Receiving Environment: Aquatic fauna

Description of potential impacts:

Impact-Consequence	Change	Source*	Impact No.
Loss of fauna. A direct loss of aquatic macro and microfauna by construction activities. Consequence: - The loss of threatened (Red Data) species may result in a loss of biodiversity and ecosystem resilience to climate change (direct). - The loss of a threatened keystone species may alter the functioning of the aquatic ecosystem (direct).	quantity	Matrix	4
Loss of fauna. Sand will be removed from the river. -Deep excavations in the river or floodplain can alter channel hydraulics during high flows by causing a high potential for diversion of flow through the sand removal site. - ponded water isolated from the main channel may strand entrapped fish carried there during high water events. Fish in these ponded areas could experience higher temperatures, lower dissolved oxygen, increased predation compared to fish in the main channel, and desiccation as the area dries out (indirect).	quantity	Matrix	

*The source of information used in identifying the impact is either the Leipold Matrix (Matrix), Interested and Affected Parties (I&APs) and/or Specialist studies (Specialist)

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

- The Integrated Habitat Assessment System (IHAS) and Habitat Quality Index (HQI) scores at the preferred site were mostly “Fair” due to the scarcity of fast flowing habitats (riffles and rapids). The lack of fast flowing habitats is also reflected in the moderate number of macro-invertebrate families and “Fair” SASS scores. Most of the recorded taxa had low to moderate sensitivity scores, with the highest scores of 10 allocated to two taxa, *Heptageniidae* and *Philopotamidae*. Consequently, the relative Macro-invertebrate Response Assessment Index (MIRAI) score (77.9%) of the Mokolo River was placed within the limits of a (Macro-invertebrate) Ecological Category C/B, meaning this reach is “Moderately modified”, mainly due to upstream impacts, including abstraction and the presence of the DWS Weir. The relative Fish Response Assessment Index (FRAI) score (86.3%) for this stretch of the Mokolo River falls within the limits of a (Fish) Ecological Category B or “Largely natural with few modifications”, meaning, a change in community characteristics may have taken place but species richness and presence of intolerant species indicate little modification (Aquatic Assessment).
- Except for localised benthic organisms, aquatic fauna is capable of emigrating from an area upon being disturbed.
- However, most of the development footprint within the watercourse is either exposed bedrock or coarse sand shoals.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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- Impact No. 4 is non-significant and does not require further investigation or mitigation.

Assessment without mitigation:

Legend					
Criteria		Reversibility, Irreplaceability, & Mitigatory Potential		Significance (Impact Magnitude & Impact Importance)	
Abbreviation	Description	Abbreviation	Description	Abbreviation	Description
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
4	L	L	L	neutral	L	L	0	L	L	0
Reversibility		H		Irreplaceability		H		Mitigatory Potential		H

Alternative Site No. 2

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
4	L	L	L	neutral	L	L	0	L	L	0
Reversibility		H		Irreplaceability		H		Mitigatory Potential		H

Alternative No. 3 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
4	L	L	L	neutral	L	L	0	L	L	0

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

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Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Not a RAMSAR site, and the study area is located 23km north of the Waterberg Strategic Water Source Area. However, the Mokolo River and associated wetland are recognised as “unclassified” National Freshwater Ecosystem Priority Areas. In terms of the South African Inventory of Inland Aquatic Ecosystem, the Mokolo River is an Endangered NBA River, and the associated wetland is an “unclassified” NBA wetland.
- Aquatic Biodiversity theme is **Very High** in both Screening Assessments because of the presence of “Wetlands and Estuaries.”
- An Aquatic Biodiversity Specialist Assessment for the development of a low water crossings over the Mokolo River within the Kaingo Private Nature Reserve (PNR), in the Vaalwater area, Limpopo Province, South Africa (November 2021), prepared by Dr Andrew Deacon

Mitigations:

Impact Management Outcome(s):

- Ensure the protection of aquatic macro- and microfauna.

Targets:

- No fishing and netting.
- Environmental Awareness relating to the protection of aquatic fauna.
- No deep excavations that could entrap fish in isolated ponds.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
4	4	Illegal harvesting of fish.	Ensure the protection of aquatic macro- and microfauna.	No fishing and netting in the Mokolo River.	Fishing and netting of any fish are prohibited.	Contractor	Continuous	Compliance to be verified by ECO and IEA.
4	2 and A2	Illegal harvesting of fish.	Ensure the protection of aquatic macro- and microfauna.	Signed register of attendance, and content of induction.	The contractor's staff must be made aware of the prohibition on fishing and netting in an induction.	Contractor, Reserve Manager or ECO.	Prior to site establishment.	Compliance to be verified by ECO and IEA.
4	12	Ponded water isolated from the main channel may strand entrapped fish carried there during high water events.	Ensure the protection of aquatic macro- and microfauna.	No large, random, and deep excavations in the riverbed.	Sand shall be mined using the Dry Pit Mining method, which requires scraping off the top layer from within dry ephemeral streambeds and/or from exposed sand bars without excavating below the low-flow water level, e.g., conventional sand bar skimming, or scalping.	Engineer, Contractor.	Continuous	Compliance to verified by ECO and IEA.
4	12	Ponded water isolated from the main channel may strand entrapped fish carried there	Ensure the protection of aquatic macro- and microfauna.	No large, random, and deep excavations in the riverbed.	Skim as little sand as possible (300-600mm) from different sand banks/ bars outside the active channel to	Engineer, Contractor.	Continuous	Compliance to verified by ECO and IEA.

Consultation Basic Assessment Report: Development of a low-level crossing on the Mokolo River in Kaingo Private Nature Reserve, Lephalale Local Municipality, Waterberg District, Limpopo (2022)

Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		during high water events.			minimise impacts at one area.			
4	12 and 19	Ponded water isolated from the main channel may strand entrapped fish carried there during high water events.	Ensure the protection of aquatic macro- and microfauna.	Shaped to natural forms during operations.	Re-instatement of the original landscape levels must be done concurrent with mining operations.	Engineer, Contractor.	Continuous	Compliance to verified by ECO and IEA.

Residual Risk (feeds back into “Mitigations”):

- Aquatic fauna, specifically fish, may be caught by staff.

Receiving Environment: Aquatic flora

Description of potential impacts:

Impact-Consequence	Change	Source*	Impact No.
Loss of flora. A direct loss of local aquatic plants by construction activities. Consequences: - The loss of threatened (Red Data) species may result in a loss of biodiversity and ecosystem resilience to climate change (direct). - The loss of a threatened keystone species may alter the functioning of the aquatic ecosystem (direct).	quantity	Matrix	5

*The source of information used in identifying the impact is either the Leipold Matrix (Matrix), Interested and Affected Parties (I&APs) and/or Specialist studies (Specialist)

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

- No threatened plants were observed at both alternative sites during the Site Sensitivity Verification.
- Most of the development footprint within the watercourse is either exposed bedrock or coarse sand shoals.
- Alternative Site No. 1 (preferred site) consists mostly of extensive bedrock and large sandy patches, as well as an extensive grassy lawn area (*Cynodon*) on the right bank of the river, whereas Alternative Site No. 2 is dominated by reedbeds (*Phragmites*) (Aquatic Assessment).
- A total of 16 indigenous plant species were recorded within the riverine habitat (no alien species were recorded), including three riparian indicator species (Buffalo-thorn (*Ziziphus mucronata*), River bushwillow (*Combretum erythrophyllum*) and Water elder (*Nuxia oppositifolia*). The final score (88.5%) of the VEGRAI assessment regarding the riparian and marginal zone integrity puts the project area in the (Riparian Vegetation) Ecological Category A/B or “Largely natural with few modifications”, meaning a small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged. (Aquatic Assessment).
- Impact No. 5 is non-significant and does not require further investigation or mitigation.

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Assessment without mitigation:

Legend					
Criteria		Reversibility, Irreplaceability, & Mitigatory Potential		Significance (Impact Magnitude & Impact Importance)	
Abbreviation	Description	Abbreviation	Description	Abbreviation	Description
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
5	L	L	L	-I	L	L	0	L	L	0
Reversibility		H		Irreplaceability		H		Mitigatory Potential		H

Alternative Site No. 2

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
5	L	L	L	-I	L	L	0	L	L	0
Reversibility		H		Irreplaceability		H		Mitigatory Potential		H

Alternative No. 3 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
5	L	L	L	neutral	L	L	0	L	L	0

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

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Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Site Sensitivity Verification Report.
- Not a RAMSAR site, and the study area is located 23km north of the Waterberg Strategic Water Source Area. However, the Mokolo River and associated wetland are recognised as “unclassified” National Freshwater Ecosystem Priority Areas. In terms of the South African Inventory of Inland Aquatic Ecosystem, the Mokolo River is an Endangered NBA River, and the associated wetland is an “unclassified” NBA wetland.
- Aquatic Biodiversity theme is **Very High** in both Screening Assessments because of the presence of “Wetlands and Estuaries.”
- An Aquatic Biodiversity Specialist Assessment for the development of a low water crossings over the Mokolo River within the Kaingo Private Nature Reserve (PNR), in the Vaalwater area, Limpopo Province, South Africa (November 2021), prepared by Dr Andrew Deacon

Mitigations:

Impact Management Outcome(s):

- Avoid the unnecessary loss of or harm to aquatic plants.

Targets:

- No illegal harvesting of aquatic plants or plant parts (e.g., reeds or grasses).
- Environmental Awareness relating to the protection of aquatic flora.

Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
5	4	Loss of aquatic plants directly or indirectly through pollution,	Avoid the unnecessary loss of or harm to aquatic plants.	No bundles of illegally harvested plants or plant parts,	Harvesting of any plant or plant part is prohibited.	Contractor	Continuous	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		including suspended sediment and spills.		e.g., reeds and grasses used for crafts or mats.				
5	2 and A2	Loss of aquatic plants directly or indirectly through pollution, including suspended sediment and spills.	Avoid the unnecessary loss of or harm to aquatic plants.	Signed register of attendance, and content of induction.	The contractor's staff must be made aware of the prohibition on harvesting any plant or plant part in an induction.	Contractor, Reserve Manager or ECO.	Prior to site establishment.	Compliance to be verified by ECO and IEA.

Residual Risk (feeds back into "Mitigations"):

- Aquatic flora, such as reeds or grasses, may be harvested by staff.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

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Receiving Environment: Soil and Rock

Description of potential impacts:

Impact-Consequence	Change	Source*	Impact No.
Natural resource depletion. Sourcing of rock from the farm and sand from the river, may result in the removal or use and reduction of natural resources (direct).	quantity	Matrix	6

*The source of information used in identifying the impact is either the Leipold Matrix (Matrix), Interested and Affected Parties (I&APs) and/or Specialist studies (Specialist)

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

- Being rocky terrain there is about 6,000 hectares of rock-strewn landscape (pers. comm. Jurie Willemse, Applicant)
- Despite water storage infrastructure, such as weirs interrupting the longitudinal continuity of sediment transport, the presence of sand shoals at both alternative sites does indicate that sediment is replenished during strong flow events.
- Impact No. 6 is non-significant and does not require further investigation or mitigation.

Assessment without mitigation:

Legend					
Criteria		Reversibility, Irreplaceability, & Mitigatory Potential		Significance (Impact Magnitude & Impact Importance)	
Abbreviation	Description	Abbreviation	Description	Abbreviation	Description
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
6	L	M	L	neutral	M	L	0	L	L	0

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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Reversibility	NA	Irreplaceability	NA	Mitigatory Potential	NA
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Alternative Site No. 2

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
6	L	M	L	neutral	M	L	0	L	L	0
Reversibility	NA			Irreplaceability	NA			Mitigatory Potential	NA	

Alternative No. 3 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
6	L	L	L	neutral	L	L	0	L	L	0

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- None.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Receiving Environment: Ground and Surface Water

Description of potential impacts:

Impact-Consequence	Change	Source*	Impact No.
Natural resource depletion. Construction at both sites will require the abstraction of water from boreholes for mixing concrete: - Less water in an underground aquifer means less water for other water users, including for reasonable domestic use and livestock watering (direct).	quantity	Matrix	7
Natural resource depletion. Disturbance of aquatic or terrestrial habitat at both sites can favour the recruitment of alien invasive plants: - threat to local and national water security (indirect)**	quantity	Matrix	
Altered hydrology. Construction at both sites will involve temporary diversion works, changing the surface water hydrology or flow patterns: - Altered flow patterns can slow down the stream flow, causing deposition of sediment or increase the velocity and turbulence of the water, causing erosion (direct).	behaviour	Matrix	8
Altered hydrology. Sand will be removed from the river. - Deep excavations in the river or floodplain can alter channel hydraulics during high flows by causing a high potential for diversion of flow through the sand removal site. - riverbank erosion (indirect).	behaviour	Matrix	

*The source of information used in identifying the impact is either the Leipold Matrix (Matrix), Interested and Affected Parties (I&APs) and/or Specialist studies (Specialist)

**The impact of alien plant recruitment on water security is adequately mitigated elsewhere (under “Terrestrial Ecosystems”).

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

- **Impact 7:** The total expected volume of water required for mixing concrete, including the RMC mortar mix, is 66m³ (pers. comm. Martin Mulder, PG Consulting Engineers). The upper limit volume of concrete that can be practically mixed and placed per day, using labour and a mixer, is approximately 4 m³, which translates to a maximum water demand of roughly 1.0 m³/day (pers. comm. Martin Mulder, PG Consulting Engineers). Kaingo Game Reserve is made up of 14 properties covering 14 600ha. Each accommodation unit has its own borehole and so do the workshop areas. All boreholes deliver multiples of what the engineer’s estimated need will be per day (pers. comm. Jurie Willemse, Applicant). There is ample water available, particularly if considered within the permissible rates of abstraction prescribed in the General Authorisation for Quaternary Catchment A42F (the maximum volume of surface water that may be abstracted on each property along the river is 2000m³ yr⁻¹, at a maximum

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rate of 1 l s^{-1} and during the whole year, and the maximum volume of ground water that may be abstracted on each property = size of the property (ha) x $75\text{ m}^3/\text{ha}/\text{year}$ but may not exceed $40\,000\text{ m}^3$ per year on a property).

- **Impact No. 7** is non-significant and does not require further investigation or mitigation.
- **Impact 8:** The intensity of Impact No. 8 is predicted to be greater at Alternative Site No. 2 (before mitigation) because of the NFEPA wetland located downstream of this site.
- **Impact 8:** The site falls within a sub-catchment associated with the Mokolo River, and spans over several quaternary catchments (namely A42A, A42B, A42C, A42D, A42E and partially A42F). The Mokolo River has its origin in the headwaters of A42A, and composes the combined inflow of the Sandspruit, Grootspuit, Sand, Klein-Sand, Dwars, Sondagsloop, Sterkstroom and Taaibokspruit Rivers. The mean annual precipitation (MAP) is in the order of $530\text{ mm}/\text{yr}$, and the mean annual evaporation (MAE) is $> 1700\text{ mm}/\text{yr}$. The estimated runoff volume for quaternary catchment A42F is in the order of $28.23\text{ Mm}^3/\text{yr}$. The average monthly rainfall distribution is lowest in May (16.2 mm), June (1.1 mm), July (4.1 mm), August (7.9 mm) and September (8.2 mm). Similarly, the average monthly run-off for catchment A42F is lowest in May (0.9 mm), June (0.6 mm), July (0.6 mm), August (0.5 mm), September (0.4 mm), October (0.6 mm) and November (0.8 mm). (Hydrology Assessment).
- **Impact 8:** No stormwater management plan will be required if construction takes place in dry months (Hydrology Assessment).

Assessment without mitigation:

Legend					
Criteria		Reversibility, Irreplaceability, & Mitigatory Potential		Significance (Impact Magnitude & Impact Importance)	
Abbreviation	Description	Abbreviation	Description	Abbreviation	Description
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
7	L	M	L	neutral	M	L	0	L	L	0
Reversibility		NA		Irreplaceability		NA		Mitigatory Potential		NA

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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Alternative Site No. 2

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
7	L	M	L	neutral	M	L	0	L	L	0
Reversibility		NA		Irreplaceability		NA		Mitigatory Potential		NA

Alternative No. 3 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
7	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
8	M	M	H	-I	H	H	1	H	H	1
Reversibility		H		Irreplaceability		H		Mitigatory Potential		H

Alternative Site No. 2

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
8	H	M	H	-I	H	H	1	H	H	1
Reversibility		H		Irreplaceability		H		Mitigatory Potential		H

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- Development may only take place during the low flow period of the Mokolo River, preferably from May to September, but as late as November if needed.

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References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Hydrology Assessment for the Proposed Mokolo River Bridge Crossing, Report Final 2, 08 December 2021, prepared by GCS Water and Environment (Pty) Ltd, GCS Project Number: 21-1007.
- Sand Mine Guideline for South Africa for water use authorisation of sand mining/ gravel extraction in terms of impacts on characteristics of watercourses. Department of Water and Sanitation, South Africa, September 2014.
- Not a RAMSAR site, and the study area is located 23km north of the Waterberg Strategic Water Source Area. However, the Mokolo River and associated wetland are recognised as “unclassified” National Freshwater Ecosystem Priority Areas. In terms of the South African Inventory of Inland Aquatic Ecosystem, the Mokolo River is an Endangered NBA River, and the associated wetland is an “unclassified” NBA wetland.
- Aquatic Biodiversity theme is **Very High** in both Screening Assessments because of the presence of “Wetlands and Estuaries.”

Mitigations:

Impact Management Outcome(s):

- Preserve river channel hydrological pattern

Targets:

- Avoid and remediate any erosion of banks and bars.

Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
8	8 and A3	Altered surface water flow pattern causing sedimentation and/or erosion.	Preserve in-stream hydrological pattern	In-stream diversion.	River diversion works must remain inside the active channel, e.g., the works may not extend into the active channel bank. The location of the active channel bank must be verified by the ECO.	Engineer, Contractor, ECO	Before clearing and grubbing operations	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
8	8	Altered surface water flow pattern causing sedimentation and/or erosion.	Preserve in-stream hydrological pattern	No erosion of banks or bars.	Any river diversion works, and their outlets must be designed in such a way so as not to cause scouring of any bank or mid-channel bar.	Engineer, Contractor, SEO	Before clearing and grubbing operations	Compliance to be verified by ECO and IEA.
8	22	Altered surface water flow pattern causing sedimentation and/or erosion.	Preserve in-stream hydrological pattern	SEO's site diary – findings relating to monitoring river diversion works.	The river diversion works must be monitored daily by the SEO for signs of scouring.	Contractor, SEO	Daily	Compliance to be monitored by SEO and verified by ECO and IEA.
8	22	Altered surface water flow pattern causing sedimentation and/or erosion.	Preserve in-stream hydrological pattern.	Appropriate remediation measures.	Any signs of scouring caused by the river diversion works must be immediately rectified and remediated.	Engineer, Contractor.	When required.	Compliance to verified by ECO and IEA.
8	12	Altered surface water flow pattern causing sedimentation and/or erosion.	Preserve river channel hydrological pattern.	No large, random, and deep excavations in the riverbed.	Sand mining must as far as possible be confined to the physical footprint of the Rubble Masonry Concrete (RMC) Culvert Structure and concrete causeway approaches.	Engineer, Contractor.	Continuous	Compliance to verified by ECO and IEA.
8	12	Altered surface water flow pattern causing	Preserve river channel hydrological pattern.	No large, random, and deep excavations	When sand mining cannot be confined to the development footprint then it shall	Engineer, Contractor.	Continuous	Compliance to verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		sedimentation and/or erosion.		in the riverbed.	be taken from the areas of sediment accumulation or sand shoal towards the right side of the river.			
8	12	Altered surface water flow pattern causing sedimentation and/or erosion.	Preserve river channel hydrological pattern.	No sand mining in the active channel.	Wet Pit Mining for construction activities in the active flow channel is prohibited because ecological risks are too high.	Engineer, Contractor.	Continuous	Compliance to verified by ECO and IEA.
8	12	Altered surface water flow pattern causing sedimentation and/or erosion.	Preserve river channel hydrological pattern.	No large, random, and deep excavations in the riverbed.	Sand shall be mined using the Dry Pit Mining method, which requires scraping off the top layer from within dry ephemeral streambeds and/or from exposed sand bars without excavating below the low-flow water level, e.g., conventional sand bar skimming, or scalping.	Engineer, Contractor.	Continuous	Compliance to verified by ECO and IEA.
8	12	Altered surface water flow pattern causing sedimentation and/or erosion.	Preserve river channel hydrological pattern.	No large, random, and deep excavations	Skim as little sand as possible (300-600mm) from different sand banks/ bars outside	Engineer, Contractor.	Continuous	Compliance to verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
				in the riverbed.	the active channel to minimise impacts at one area.			
8	12 and 19	Altered surface water flow pattern causing sedimentation and/or erosion.	Preserve river channel hydrological pattern.	Shaped to natural forms during operations.	Re-instatement of the original landscape levels must be done concurrent with mining operations.	Engineer, Contractor.	Continuous	Compliance to verified by ECO and IEA.
8	19	Altered surface water flow pattern causing sedimentation and/or erosion.	Preserve river channel hydrological pattern.	Shaped to natural forms.	The final grading of the mined area should not significantly alter the flow characteristics of the river during periods of high flows, e.g., shaped to natural forms that blend in with pre-mining topography.	Engineer, Contractor.	Upon completion of mining sand.	Compliance to verified by ECO and IEA.

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Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
8	L	L	L	neutral	L	M	0	L	M	0

Alternative Site No. 2

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
8	L	L	L	neutral	L	M	0	L	M	0

Alternative No. 3 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
8	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

- None.

Receiving Environment: Terrestrial Ecosystem

Description of potential impacts:

Impact-Consequence	Change	Source*	Impact No.
Loss of habitat. Loss of local terrestrial habitat: - reduced habitat for terrestrial fauna and Aves (direct). - reduced productivity and carrying capacity (direct).	quantity	Matrix	9
Loss of habitat. Rock will be removed from the reserve resulting in its removal from the landscape: - Rock removal may reduce the habitat for arachnids, reptiles, and other fauna (direct).	quantity	Matrix	
Loss of habitat. Disturbance can favour the recruitment of pioneer species and alien invasive plants, threatening habitats and alter the composition, structure and functioning of ecosystems: - reduced productivity and carrying capacity (indirect). - reduced capacity to produce ecosystem goods and services (indirect).	transformation	Matrix	

*The source of information used in identifying the impact is either the Leopold Matrix (Matrix), Interested and Affected Parties (I&APs) and/or Specialist studies (Specialist)

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

- There are no sedentary or rooted threatened or keystone species at both alternative sites.
- The Management Authority shall collect the surface rock as contractors are not allowed to work in open reserve areas (pers. comm. Jurie Willemse, Applicant).
- Stockpiles of salvaged rock, from old camps that were broken down as reserve development took place, are already available that can provide a good percentage of material needs (pers. comm. Jurie Willemse, Applicant).
- Kaingo game reserve falls in two veld types (Mucina & Rutherford, 2006) namely the Central Sandy Bushveld and the Waterberg Mountain Bushveld. The vegetation of Kaingo is further divided into 17 more or less homogenous units, including *inter alia* 258ha of old lands (Kaingo PNR Management Plan (2018 – 2023) developed with support from Envirolod Ecological and Wildlife Services).
- The terrestrial assessment identified 6 different habitats with varying levels of Site Ecological Importance (SEI) within the study area, including “Transformed” (Low), “Modified Bushveld” (Low), “Degraded Bushveld” (Medium), “Sandy Bushveld” (High), “Rocky Ridge” (High), and “Riparian” (Very High). The Modified Bushveld is significantly more disturbed than the Degraded Bushveld, which has started to recover and exhibit intact ecological driving forces.
- There are old lands (already disturbed areas) on both sides of the river, which fall outside the 1:100-year flood line, and both are close to the bridge access. There is no need to open undisturbed areas for the construction camp (pers. comm. Jurie Willemse).

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- Imported material (aggregate) is a potential source of contaminant (seed of alien invasive plants).
- The Terrestrial Assessment identified three alien and invasive plants within the study area, namely *Opuntia ficus-indica* (NEMBA Category 1b), *Myriophyllum aquaticum* (NEMBA Category 1b), and *Verbena bonariensis* (NEMBA Category 1b).
- A surface area of approximately 2500 to 3500 m² will be required for parking machinery and site offices. An additional 1000m² will be required for laydown areas for the cement, aggregates, and culverts. So, two areas covering 50mx50m and 30mx30m will be required (pers. comm. Martin Mulder PG Consulting Engineers).

Assessment without mitigation:

Legend					
Criteria		Reversibility, Irreplaceability, & Mitigatory Potential		Significance (Impact Magnitude & Impact Importance)	
Abbreviation	Description	Abbreviation	Description	Abbreviation	Description
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
9	L	M	M	-I	M	H	1	M	H	1
Reversibility		H		Irreplaceability		H		Mitigatory Potential		H

Alternative Site No. 2

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
9	L	M	M	-I	M	H	1	M	H	1
Reversibility		H		Irreplaceability		H		Mitigatory Potential		H

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Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- CARA Regulations published in Government Notice R1048 in Government Gazette 9238, dated 25 May 1984.
 - **15A. Combating of category 1 plants** (1) Category 1 plants may not occur on any land or inland water surface other than in biological control reserves. (2) A land user shall control any category 1 plants that occur on any land or inland water surface in contravention of the provisions of sub-regulation (1) by means of the methods prescribed in regulation 15E.
 - **15B. Combating of category 2 plants** (1) Category 2 plants may not occur on any land or inland water surface other than a demarcated area or a biological control reserve. (8) A land user shall control any category 2 plants that occur on any land or inland water surface in contravention of the provisions of sub-regulation (1) by means of the methods prescribed in regulation 15E.
 - **15C. Combating of category 3 plants** (1) Category 3 plants shall not occur on any land or inland water surface other than in a biological control reserve. 3(c) A land user must take all reasonable steps to curtail the spreading of propagating material of category 3 plants.
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
 - Alien and Invasive Species Regulations published in GN No. R 1020 in GG 43735 on 25 September 2020 - Category 1b Listed Invasive Species must be controlled in compliance with sections 75(1), (2) and (3) of the Act and in accordance with any Invasive Species Management Programme that has been developed in terms of section 75(4) of the Act. The Minister may require any person to develop a Category 1b Control Plan for one or more Category 1b species.
 - Alien and Invasive Species Lists published in GN No.599, amended in GN No. 1003 of GG No. 43726 on 18 September 2020
- Kaingo PNR Management Plan (2018 – 2023) developed with support from Envirodel Ecological and Wildlife Services.
- CBA1 in the Waterberg Bioregional Plan (January 2016) and CBA1 in the Limpopo C-Plan v2 (2018)
- Private Nature Reserve in the Protected Area Register (PAR) and the Kaingo PNR Management Plan (2018 – 2023) developed with support from Envirodel Ecological and Wildlife Services.
- Core area of the Waterberg Biosphere Reserve in the Protected Area Register (PAR)
- Sensitive area in the Waterberg District EMF (adopted in 2010 and reviewed in May 2021)
- The “Limpopo Central Bushveld” Focus Area in the National Protected Area Expansion Strategy (2016)
- Terrestrial Biodiversity theme is **High** in both Screening Assessments because of the presence of a “CBA1, Focus Areas for land-based protected areas expansion and South African Protected Areas.” Verified as **Low** in the Site Sensitivity Verification Report, but the Terrestrial

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Assessment for the Kaingo Low Level Bridge, Vaalwater, Limpopo Province (November 2021) prepared by The Biodiversity Company, confirmed the **High** sensitivity of certain habitats that overlap the study area.

- Not a critically endangered or endangered ecosystem in terms of SANBI's latest NBA (2018). The ecosystem threat status as per the NBA 2018 data provides a holistic view of the vegetation type, the threatened species associated with the ecosystem and the overall land use currently in the area. National vegetation type is Central Sandy Bushveld, which is an area of Least Concern in the National List of Threatened Ecosystems (NBA, 2018), yet the conservation status of this vegetation community is VU according to Mucina and Rutherford (2006). However, the Ecosystem Protection Level for Central Sandy Bushveld is categorised as Poorly Protected Ecosystem (NBA, 2018). This is confirmed by Mucina and Rutherford (2006); the area that is statutorily conserved is less than 3%, compared with the national conservation target of 19%.

Mitigations:

Impact Management Outcome(s):

- Ensure protection of undisturbed or sensitive vegetation units.
- Avoid mass habitat loss (relating to rocks) in localised areas.
- Reduce potential for the recruitment of alien invasive plants.

Targets:

- No construction creep.
- Sensitive vegetation units remain intact.
- Recycle salvaged rock.
- No distinctly visible bare patches void of rocks.
- No adult or reproductively mature alien invasive plants observed on site.

Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
9	2, A2, 3 and 22	Loss of terrestrial habitat cleared for the development footprint and	Ensure the protection of undisturbed or sensitive vegetation units.	No construction creep beyond demarcated boundaries.	Construction creep, particularly into the adjacent "Riparian habitat" (Figure 3), shall be avoided by (a) reinforcing this in an	Contractor SEO, Reserve Manager or ECO	Continuous	Compliance to be monitored by SEO and verified by

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		construction camp.			induction and/or toolbox talk, (b) clearly demarcating the working servitude (up to 3m on either side of the development footprint) and construction camp boundaries, as well as (c) regular supervision by the SEO.			ECO and IEA.
9	2, 3, 4 and 18	Loss of terrestrial habitat cleared for the development footprint and construction camp.	Ensure the protection of undisturbed or sensitive vegetation units.	No construction-related activities within these three habitat types/zones.	All construction personnel and construction-related activities shall remain outside No-Go Areas, including the adjacent "Rocky Ridge" and "Sandy Bushveld" habitat types (Figure 3) and the 10m ecological buffer zone (Figure 4).	Contractor SEO	Continuous	Compliance to be monitored by SEO and verified by ECO and IEA.
9	3	Loss of terrestrial habitat cleared for the development footprint and construction camp.	Ensure the protection of undisturbed or sensitive vegetation units.	No disturbance of undisturbed or sensitive vegetation units.	The construction camp shall be located in the "Modified Bushveld" habitat type (Figure 3), outside the 10m ecological buffer zone (Figure 4), including the 1:100-year flood line and delineated riparian habitat	Contractor	Before clearing topsoil.	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
9	3, 5, 13, 15 and 19	Loss of terrestrial habitat cleared for the development footprint and construction camp.	Ensure the protection of undisturbed or sensitive vegetation units.	No disturbance of undisturbed or sensitive vegetation units.	The site office, portable ablutions, overnight parking of machinery, waste storage area, concrete mixing area (batching site), cement, topsoil and aggregate stockpiles, and culvert laydown area shall be confined to the construction camp.	Contractor	Ongoing	Compliance to be verified by ECO and IEA.
9	A12	Reduced habitat for arachnids, reptiles, and other fauna.	Avoid mass habitat loss in localised areas.	Recycle salvaged rock.	As far as possible, use existing stockpiles of salvaged rock from demolished camps.	Management Authority	Continuous	Compliance to be verified by ECO and IEA.
9	A12	Reduced habitat for arachnids, reptiles, and other fauna.	Ensure the protection of sensitive vegetation units.	No collection of rocks from sensitive vegetation units.	Once the stockpile of suitable salvaged material has been exhausted, collect rocks from among the least sensitive vegetation units in Kaingo Game Reserve.	Management Authority	Continuous	Compliance to be verified by ECO and IEA.
9	A12	Reduced habitat for arachnids, reptiles, and other fauna	Avoid mass habitat loss in localised areas.	No visibly distinct patches of bare ground within the landscape.	Collect every other rock, e.g., not rocks immediately adjacent to another, and without focusing on single sites, e.g., from many areas, and at a	Management Authority	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
					rate that is relative to the density of rocks on each site.			
9	12 and A12	Recruitment of alien invasive plants.	Reduce the potential for the recruitment of alien invasive plants.	No adult or reproductively mature alien invasive plants observed on site.	Use local (from within the same property/reserve) materials (aggregate) as far as is practical.	Applicant, Engineer, Contractor.	When sourcing materials.	Compliance to be verified by ECO and IEA.
9	A5	Recruitment of alien invasive plants.	Reduce the potential for the recruitment of alien invasive plants.	No adult or reproductively mature alien invasive plants observed on site.	The Reserve Manager or ECO must, upon identifying an alien invasive plant on site, such as <i>Opuntia ficus-indica</i> , <i>Myriophyllum aquaticum</i> , and <i>Verbena bonariensis</i> , report it to the Contractor or SEO.	Reserve Manager or ECO	Continuous	Compliance to be verified by ECO and IEA.
9	5	Recruitment of alien invasive plants.	Reduce the potential for the recruitment of alien invasive plants.	No adult or reproductively mature alien invasive plants observed on site.	Immediately uproot and destroy any alien invasive plant in its entirety (including propagating material) upon being identified on site.	Contractor or SEO	Continuous	Compliance to be verified by ECO and IEA.
9	5	Recruitment of alien invasive plants.	Reduce the potential for the recruitment of alien invasive plants.	No adult or reproductively mature alien invasive plants observed on site.	Commence with rehabilitation immediately upon the cessation of construction in disturbed areas.	Contractor	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
9	A20	Recruitment of alien invasive plants.	Reduce the potential for the recruitment of alien invasive plants.	No adult or reproductively mature alien invasive plants observed on site.	Monitor for the recruitment of alien invasive plants on rehabilitated sites, and immediately remove any identified plants.	Management Authority, Reserve Manager.	Every two weeks, during the growing season for 2 successive growing seasons after rehabilitation.	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
9	L	M	M	neutral	M	L	0	L	L	0

Alternative Site No. 2

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
9	L	M	M	neutral	M	L	0	L	L	0

Alternative No. 3 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
9	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

- Habitat may be disturbed by construction creep beyond the footprint.
- Alien invasive plant recruitment may take place on rehabilitated sites after the contractor has left site.

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Receiving Environment: Aquatic Ecosystem

Description of potential impacts:

Impact-Consequence	Change	Source*	Impact No.
Loss of aquatic (and riparian) habitat. The crossing alignment and sand mining at both sites will result in the loss of aquatic or river habitat equivalent to the size of the development footprint and sand mining area: - reduced habitat for aquatic fauna and aves (direct) - reduced productivity and carrying capacity (direct)	quantity	Matrix	10
Turbidity. Turbid waters reduce light penetration, decreasing photosynthesis and primary production, reducing food availability for aquatic organisms higher up the food chain. Suspended solids may interfere with the feeding mechanisms of filter-feeding organisms such as certain macroinvertebrates, and the gill functioning, foraging efficiency (due to visual disturbances) and growth of fish, leading to changes in invertebrate and fish assemblages. Suspended solids that settle out may cover spawning grounds (places to lay eggs), smother or abrade benthic plants and animals, resulting in changes to the nature of the substratum where invertebrates live, causing either change in the structure of the biotic community by the replacement of these organisms with organisms that burrow in soft sediments, or massive declines in fish populations. Sensitive species may be permanently eliminated if the source of the suspended solids is not removed. The recovery of a stream from sediment deposition is dependent on the elimination of the sediment source and the potential for the deposited material to be flushed out by stream flow (indirect).	transformation	Matrix	
Spills. Hydrocarbon spills, during construction in the river at both sites may temporarily reduce the quality of the water: - Alter feeding and breeding behaviour (lowering vigour and reproductivity), species composition and aquatic ecosystem functioning (indirect)	transformation	Matrix	

*The source of information used in identifying the impact is either the Leipold Matrix (Matrix), Interested and Affected Parties (I&APs) and/or Specialist studies (Specialist)

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

- There are no threatened or keystone species at both alternative sites.
- Both alternative sites are in an area of aquatic ecological importance and sensitivity, including a catchment that falls within a Private Nature Reserve, within a river and near to a wetland that are listed as National Freshwater Ecosystem Priority Areas (NFEPA), and a limited development area in terms of the Waterberg District EMF (Environmental Management Zone 1) (Sand Mine Guideline for South Africa).

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- Both alternative sites are in an NFEPA river. However, Alternative Site No. 1 (preferred) is located downstream of an NFEPA wetland retained by the DWS measuring weir, whereas Alternative Site No. 2 is located upstream of the same wetland.
- The NFEPA wetland is likely to be the result of the impoundment caused by the DWS measuring weir upstream of the Alternative Site No. 1 (preferred). However, weirs raise water levels and generally create wetland systems upstream. Furthermore, the amount of scouring and exposed bedrock below the weir is indicative of an anthropogenic disturbance resulting from the man-made impoundment. Suspended sediment is deposited and accumulates in low-energy areas where the water flow is slower, such as in the backwater above a weir. The lower sediment load that is transported below the weir, combined with the increased energy created by the vertical drop, is the probable cause for a larger area of exposed bedrock at Alternative Site No. 1 (preferred) compared with Alternative Site No. 2 that is above the NFEPA Wetland.
- The expansive bedrock flanked by alluvial riverbeds covered with couch grass or being bare sand, makes Alternative Site No. 1 (preferred) the least aquatic biodiversity sensitivity compared with Alternative Site No. 2 (Aquatic Assessment).
- The sparse and scattered bedrock at Alternative Site No. 2 is not suitable for founding conditions and will require the removal of more sand from the riverbed to reach the bedrock (Concept Design Report) thereby increasing the intensity of the activity and impact relating to LA 19 of Listing Notice 1. The moving of more material within a watercourse will increase the risk of turbidity caused by suspended sediment and deposited sediment in the wetland exacerbated by the low-energy backwater (NFEPA wetland) created by the DWS measuring weir. Consequently, any impacts on wetland flora resulting from moving sand, including suspended and deposited sediment, will have a greater intensity or severity at Alternative Site No. 2 than Alternative Site No. 1 (preferred).
- The significance to aquatic biota of changes in the TSS depends on the extent, duration, frequency, and timing of these changes. If increases in TSS from anthropogenic sources result in the same amplitude as that of natural flooding, then these increases may well be tolerated by aquatic ecosystems. Continuous high-level inputs may however have serious consequences. The norms for assessing the effects of the TSS concentration on aquatic ecosystems are changes from "natural" site-specific TSS levels that cause changes to ecosystem structure and functioning. Any increase in TSS concentrations in aquatic ecosystems must be limited to < 10 % of the background TSS concentrations at a specific site and time. Background TSS concentrations in all aquatic ecosystems should be below 100mg/litre (DWA, 1996).
- The overall Ecstatus of the assessed river reach (project area) falls within a Category B (84.8%) or "Largely natural with few modifications", meaning a small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged. The Category B Ecstatus can be ascribed to the presence of the weirs in the system. Weirs constitute obstacles for longitudinal exchanges along fluvial systems and so result in discontinuities in the river continuum. However, according to the Intermediate Reserve Determination Study (DWA, 2010), the PES is rated B/C due to largely flow and non-flow related impacts such as abstraction, irrigation weirs, farming and catchment activities, and the Ecological Importance and Sensitivity (EIS) is rated "High" due to the diversity and sensitivity of habitat types, species taxon richness and presence of unique species and the importance of conservation areas through which it flows. Since the EIS at the site is "High", the Recommended Ecological Category (REC) is suggested as a Class B, which is an improvement to the PES. However, the design and development, particularly after mitigation, of the proposed low-level crossing will not change the Present Ecological Status (PES), Ecological Importance and Sensitivity (EIS) and Recommended Ecological Class (REC) of the target aquatic ecosystem to a lower ecological category or compromise defined Resource Quality Objectives (RQOs) for this river reach in terms of water quality, quantity, habitat and biota (Aquatic Assessment).

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- The water quality of the Mokolo River is considered good, and, except for dissolved iron (Fe), which is slightly high, all other analysed constituents fell well within DWAF (1996) ideal target ranges for domestic water use. The baseline water quality of the project area, established during the hydrology assessment is, in the absence of Resource Water Quality Objectives (RWQO) for the Mokolo River, to be taken as the resource water quality objectives (RWQO) pre-and post-development (Hydrology Assessment).
- It is especially imperative that the construction take place in the winter months to ensure the water borne SCCs are not directly impacted and have temporarily moved out of the area to the upstream weir. (The Terrestrial Assessment).
- It is possible for the contractor to access the site without having to cross the Mokolo River by using the main road system on both Mokolo River Private Nature Reserve and Kaingo Game Reserve (pers. comm. Jurie Willemse, Applicant).
- Kaingo's main workshop can cater for all vehicle and equipment maintenance. It contains full automotive, mechanical, joinery and electrical workshops, as well as related service areas, such as wash bay and refuelling station with an 11 300-litre diesel bowser. All service areas meet specified requirements with catch pits (e.g., sump with oil separator), etc. to meet standards for insurance and other purposes (pers. comm. Jurie Willemse, Applicant).

Assessment without mitigation:

Legend					
Criteria		Reversibility, Irreplaceability, & Mitigatory Potential		Significance (Impact Magnitude & Impact Importance)	
Abbreviation	Description	Abbreviation	Description	Abbreviation	Description
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
10	M	M	M	-I	M	M	1	H	M	1
Reversibility		H		Irreplaceability		H		Mitigatory Potential		H

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Alternative Site No. 2

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
10	H	M	M	-I	H	M	1	H	M	1
Reversibility		H		Irreplaceability		H		Mitigatory Potential		H

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- Development may only take place during the low flow period of the Mokolo River, preferably from May to September, but as late as November if needed.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- An Aquatic Biodiversity Specialist Assessment for the development of a low water crossings over the Mokolo River within the Kaingo Private Nature Reserve (PNR), in the Vaalwater area, Limpopo Province, South Africa (November 2021), prepared by Dr Andrew Deacon
- The National Water Act, 1998 (Act No. 36 of 1998) requirements with regards to *inter alia* classification of water resources and Resource Quality Objectives (RQO's) must be adhered to.
- The White Paper on a National Water Policy for South Africa (1997), states that effective resource protection requires two separate sets of measures. The first are resource-directed measures, which set clear objectives for the desired level of protection for each resource. The second are source-directed controls which aim to control what is done to the water resource by way of registration of sources of impact, standards for waste discharges, best management practices, permits, Water Use Authorisations, impact assessments and environmental management plans - so that the resource protection objectives are achieved.
- The Terrestrial Assessment for the Kaingo Low Level Bridge, Vaalwater, Limpopo Province (November 2021) prepared by The Biodiversity Company
- Hydrology Assessment for the Proposed Mokolo River Bridge Crossing, Report Final 2, 08 December 2021, prepared by GCS Water and Environment (Pty) Ltd, GCS Project Number: 21-1007
- Sand Mine Guideline for South Africa for water use authorisation of sand mining/ gravel extraction in terms of impacts on characteristics of watercourses. Department of Water and Sanitation, South Africa, September 2014.
- Concept Design Report for the proposed low-level crossing at Kaingo Reserve across the Mokolo River prepared by PG Consulting Engineers dated October 2021 (Final Report).
- Department of Water Affairs and Forestry, 1996. South African Water Quality Guidelines. Volume 7: Aquatic Ecosystems

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- Not a RAMSAR site, and the study area is located 23km north of the Waterberg Strategic Water Source Area. However, the Mokolo River and associated wetland are recognised as “unclassified” National Freshwater Ecosystem Priority Areas. In terms of the South African Inventory of Inland Aquatic Ecosystem, the Mokolo River is an Endangered NBA River, and the associated wetland is an “unclassified” NBA wetland.
- Aquatic Biodiversity theme is **Very High** in both Screening Assessments because of the presence of “Wetlands and Estuaries.”

Mitigations:

Impact Management Outcome(s):

- Preserve aquatic ecosystem structure and function as well as riparian habitat.

Targets:

- No construction creep.
- Sensitive areas (riparian habitat, riverbanks, and active channel) are intact.
- No construction activities are to be in direct contact with flowing water in the Mokolo River.
- No new access roads through riparian habitat or on the riverbank.
- Construction is carried out during low flows in the dry season.
- Any increase in TSS concentrations in aquatic ecosystems must be limited to < 10 % of the background TSS concentrations at a specific site and time.

Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
10	A3	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	Water Quality Sampling Results.	Establish background TSS and Turbidity levels as per the Surface water Monitoring Plan in Appendix B , shortly before the contractor arrives on site.	Applicant, Water Quality Monitor or ECO or Reserve Manager.	Before construction commences within the watercourse.	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
10	6	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	No construction creep.	Restrict clearing of the in-situ material from the bedrock to the physical footprint of the Rubble Masonry Concrete structure and where necessary up to the edge of the working servitude, that is 3m on either side of the development footprint.	Engineer, Contractor	Prior clearing and grubbing operations	Compliance to be verified by ECO and IEA.
10	6 and 8	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	No turbid, cloudy, or milky plumes of suspended sediment in the river.	If it is practical to do so, construct river diversion works within the perimeter of the working servitude (up to 3m on either side of the development footprint) before clearing the in-situ material from the bedrock.	Engineer, Contractor	Prior clearing and grubbing operations	Compliance to be verified by ECO and IEA.
10	8	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	No driving or working in flowing water within the working servitude.	Any working servitude alongside the Rubble Masonry Concrete structure and within the river shall be kept as dry as possible, that is free of flowing water,	Engineer, Contractor	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
					using river diversion works.			
10	8	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	No turbid, cloudy, or milky plumes of suspended sediment in the river.	Aggregate used in the construction of river diversion works shall not be in direct contact with flowing water, by using for example, plastic sheets, sandbags, culverts, or pipes.	Engineer, Contractor	Continuous	Compliance to be verified by ECO and IEA.
10	8	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	No turbid, cloudy, or milky plumes of suspended sediment in the river.	Aggregate used in the construction of river diversion works shall not include dispersive soils.	Engineer, Contractor	Continuous	Compliance to be verified by ECO and IEA.
10	4,18 and A18	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	No driving through flowing water, unless at a designated crossing.	Construction vehicles shall so far as is reasonably practical reach the site without having to cross the Mokolo River. In instances where it is impractical to do so, then only existing river crossings designated by the Management Authority may be used.	Management Authority, Contractor	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
10	4 and 18	Degradation of riparian habitat.	Preserve riparian habitat.	No new access roads through riparian habitat or on the riverbank.	Access to the low-level crossing and sand mining site is to be at the existing approach.	Contractor	Continuous	Compliance to be verified by ECO and IEA.
10	8	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	Access over river diversion is either rock protection, a low-level bridge, or a culvert bridge.	Access to work areas whilst on site and through flowing water is only to be via rock protection, a low-level bridge, or a culvert bridge.	Engineer, Contractor	Continuous	Compliance to be verified by ECO and IEA.
10	4,18, and A18	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	No washing of vehicles and other equipment in or within proximity to the river.	Construction vehicles and other equipment shall be washed only at the designated service area in Kaingo's main workshop.	Management Authority, Contractor	Continuous	Compliance to be verified by ECO and IEA.
10	2 and A2	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	Low flow in the river.	Construction may only be carried out during low flows in the dry season, preferably from May to September, but as late as November if needed.	Applicant, Engineer, Contractor	Continuous during the dry season	Compliance to be verified by ECO and IEA.
10	A22	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	SEO's site diary – findings relating to weekly field measurements.	The ECO and/or Reserve Manager shall implement the Surface Water Monitoring Plan as per Appendix B .	ECO and/or Reserve Manager	Weekly	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
10	22	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	SEO's site diary – findings relating to visual inspections of turbidity.	The SEO is to monitor TSS and turbidity daily, by visibly inspecting the surface water downstream of the site compared with the clarity of the water upstream of the site.	Contractor, SEO	Daily	Compliance to be monitored by the SEO and verified by ECO and IEA.
10	22	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	Appropriate corrective measures being implemented. TWQR: Any increase in TSS concentrations must be < 10 % of the background TSS concentrations.	Immediately upon seeing an increase in TSS or turbidity downstream of the site compared with the clarity of the water upstream of the site, identify the source of the problem and implement corrective measures until the Target Water Quality Range (TWQR) has been achieved.	Contractor, SEO	When required.	Compliance to be monitored by the SEO and a Water Quality Monitor and verified by ECO and IEA.
10	22	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	Written report, e.g., email, WhatsApp text, etc.	If the water is more visibly turbid downstream of the site compared with the clarity of the water upstream of the site for more than two	Contractor, SEO	Daily	Compliance to be monitored by the SEO and verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
					successive days, then report it in writing to the ECO and Reserve Manager.			
10	22 and A22	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	Results from a SANS-accredited laboratory. TWQR: Any increase in TSS concentrations must be < 10 % of the background TSS concentrations.	Upon being notified by the SEO of a persistent increase in turbidity, the ECO and/or Reserve Manager shall take water samples for laboratory analysis (as per the Surface Water Monitoring Plan in Appendix B) until the contractor has succeeded in achieving the Target Water Quality Range (TWQR). The laboratory analyses shall be at the Contractor's expense.	Contractor, SEO, and Water Quality Monitor, ECO and/or Reserve Manager	When required.	Compliance to be verified by ECO and IEA.
10	12	Degradation of riparian habitat.	Preserve riparian habitat.	No sand mining in riparian habitat and active channel.	Riparian habitat and riverbanks are excluded from sand mining.	Contractor	Continuous	Compliance to be verified by ECO and IEA.
10	12 and A12	Altered aquatic ecosystem	Preserve aquatic ecosystem	Demarcated buffers.	Buffers must be demarcated by the	Engineer, Contractor, SEO,	Continuous	Compliance to be monitored

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		structure and function.	structure and function, as well as riparian habitat.		ECO and maintained between the active water channel, riparian habitat, and the mining area.	ECO		by the SEO and verified by ECO and IEA.
10	7, 12 and 13	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	Stockpiled (river channel) topsoil.	Topsoil from vegetated sand bars must be skimmed, and stored separately of the terrestrial topsoil, in the construction camp and outside the 10m ecological buffer zone (Figure 4), including the 1:100-year flood line and riparian habitat, for rehabilitation purposes.	Contractor	Prior to sand mining.	Compliance to be verified by ECO and IEA.
10	12 and 13	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	No Stockpiles within the 1:100-year flood line and riparian habitat.	Aggregate (sand) stockpiles must be stored in the construction camp and outside the 10m ecological buffer zone (Figure 4), including the 1:100-	Contractor	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
					year flood line and delineated riparian habitat.			

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
10	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 2

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
10	L	L	L	neutral	L	L	0	L	L	0

Alternative No. 3 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
10	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

- Despite the mitigations to avoid significant suspended sediment in the river, strong flows or a flash flood during summer would render any river diversion works futile.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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Receiving Environment: Economical

Description of potential impacts:

Impact-Consequence	Change	Source*	Impact No.
Construction costs. The cost of constructing a crossing at a site, which depends on its geotechnical aspects and subsequent design requirements, will occur at the expense of other conservation-related projects within the game reserve: - less capital to fund other projects (direct).	NA	Matrix	11
Replacement costs. Both Low-level crossings pose a risk to property (vehicles) during floods: - Loss of property and the cost of having to replace it (Risk).	NA	Matrix	
Increased Productivity. Strong flows prevent direct access across the Mokolo River by reserve management, who are then required to drive out the reserve and use the existing crossing on a district road. Direct access across a low-level crossing to the rest of the Private Nature Reserve will save the Management Authority time: - increased productivity during the day-to-day management of the reserve (positive impact).	NA	Matrix	12
Reduced Reserve management costs. Direct access across a low-level crossing to the rest of the Private Nature Reserve will save the Management Authority money (on fuel), as well as increase opportunities for nature-based tourism activities, allowing the general public to come into contact with nature (positive impact).	NA	Matrix	13

*The source of information used in identifying the impact is either the Leipold Matrix (Matrix), Interested and Affected Parties (I&APs) and/or Specialist studies (Specialist)

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

- Impact 11:** Alternative Site No. 1 (preferred) is the most favourable in terms of construction costs related to the geotechnical and topographical aspects of the sites. Alternative Site No. 1 (preferred) is characterised by exposed solid bedrock and a shallow sand shoal towards the right bank. Conversely, the sparse and scattered bedrock at Alternative Site No. 2 is not suitable for founding conditions and will require the removal of more sand from the riverbed to reach the bedrock. The topography on the left bank of Alternative Site No. 2 forms a relatively large floodplain causing the length of the crossing structure to be undesirably long (273m), compared with 183m at Alternative Site No.1 (preferred). Furthermore, the approach on the right bank of Alternative Site No. 2 is relatively steep, making the approach design more complex in terms of additional slope stability measures (Concept Design Report).
- Impact 12:** Both alternative sites will, in most cases, provide year-round accessibility. However, the existing DWS measuring weir regulates the river's flow regime by storing floodwater and reducing the intensity of flash floods, ensuring a more stable flow regime (less turbulence) at

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Alternative Site No. 1 (preferred) (Concept Design Report) thereby improving accessibility and therefore productivity compared with Alternative Site No. 2, which is located upstream of the weir.

Assessment without mitigation:

Legend					
Criteria		Reversibility, Irreplaceability, & Mitigatory Potential		Significance (Impact Magnitude & Impact Importance)	
Abbreviation	Description	Abbreviation	Description	Abbreviation	Description
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
11	L	L	L	neutral	L	H	0	L	H	0
Reversibility		NA		Irreplaceability		NA		Mitigatory Potential		L

Alternative Site No. 2

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
11	M	L	M	-I	M	H	1	H	H	1
Reversibility		L		Irreplaceability		L		Mitigatory Potential		L

Alternative No. 3 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
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MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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11	L	L	L	neutral	L	L	0	L	L	0
Reversibility		NA		Irreplaceability		NA		Mitigatory Potential		NA

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
12	H	L	H	+I	H	M	Significant positive	L	M	0
Reversibility		NA		Irreplaceability		NA		Mitigatory Potential		L

Alternative Site No. 2

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
12	M	L	M	+I	M	M	Significant positive	L	M	0
Reversibility		L		Irreplaceability		L		Mitigatory Potential		L

Alternative No. 3 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
12	M	M	M	-I	M	M	1	M	M	1
Reversibility		NA		Irreplaceability		NA		Mitigatory Potential		NA

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
13	M	M	H	+I	H	M	Significant positive	L	M	0
Reversibility		NA		Irreplaceability		NA		Mitigatory Potential		L

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Alternative Site No. 2

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
13	M	M	H	+I	H	M	Significant positive	L	M	0
Reversibility		NA		Irreplaceability		NA		Mitigatory Potential		L

Alternative No. 3 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
13	H	M	H	-I	H	M	1	H	M	1
Reversibility		H		Irreplaceability		H		Mitigatory Potential		L

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Concept Design Report for the proposed low-level crossing at Kaingo Reserve across the Mokolo River prepared by PG Consulting Engineers dated October 2021 (Final Report).
- Private Nature Reserve in the Protected Area Register (PAR) and the Kaingo PNR Management Plan (2018 – 2023) developed with support from Envirodel Ecological and Wildlife Services.

Mitigations:

- Mitigatory potential is low.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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Receiving Environment: Health and Safety

Description of potential impacts:

Impact-Consequence	Change	Source*	Impact No.
Agriculture and domestic water use. Suspended sediment (or turbidity) during construction in the river at both sites can influence water quality: - making it unfit for agricultural use (irrigation), affecting crop yield by photosynthetic activity reducing films, reducing infiltration rate and/or seedling emergence because of a soil surface crust being deposited by suspended solids, clogging of drip irrigation systems as well as accelerated wear and tear of sprinkler irrigation nozzles (indirect). - making it unfit for domestic water use, by having aesthetics effects (appearance, taste, and odour), and affecting human health (indirect).	NA	Matrix	14
Safety risk during strong flows. Sand bed crossings pose a risk to human life (driver and passengers) during strong flows: - low-level crossings or bridges allow safe passage across rivers (positive Impact).	NA	Matrix	15
Injury to workers. Rock will be collected from the reserve resulting in its removal from the landscape: - Rock removal may result in harm or injury to labourers from stings, bites, and falls (indirect).	NA	Matrix	16
Injury to workers. Staff will be working in a Big 5 Game Reserve: - close encounters with dangerous animals may result in injury or death.	NA	Specialist	

*The source of information used in identifying the impact is either the Leipold Matrix (Matrix), Interested and Affected Parties (I&APs) and/or Specialist studies (Specialist)

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

- **Impact 14:** Alternative Site No. 1 (preferred) is the most favourable in terms of the geotechnical aspects of the sites, including exposed solid bedrock and a shallow sand shoal towards the right bank. Conversely, the sparse and scattered bedrock at Alternative Site No. 2 is not suitable for founding conditions and will require the removal of more sand from the riverbed to reach the bedrock (Concept Design Report) thereby increasing the intensity of the activity and impact relating to LA 19 of Listing Notice 1. The moving of more material within a watercourse at Alternative Site No. 2 will increase the risk of turbidity caused by suspended sediment.
- Turbidity decreases in the downstream direction if there are no additional sources of suspended sediment.
- **Impact 14:** Turbidity is visible and may be objectionable to domestic water users at levels above 5 NTU. Some chance of transmission of disease by micro-organisms associated with particulate matter, particularly for agents with a low infective dose such as viruses and protozoan parasites (DWAF, 1996 Volume 1)

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- **Impact 14:** Total Suspend Solids (TSS) concentration of 50 to 100 mg/litre can cause slight to moderate problems with the clogging of drip irrigation emitters (DWAf, 1996 Volume 4)
- **Impact 14:** The mitigations to reduce turbidity or suspended sediment are adequately addressed in Impact 10 relating to Aquatic Ecosystem.
- **Impact 15:** The wetland is likely to be an anthropogenic consequence of and retained by the DWS weir located upstream of Alternative Site No. 1 (preferred). The same weir will have a regulating effect on the river channel hydrology by serving to attenuate brief flood events (or flash floods) (Concept Design Report) and reduce turbulence at this site, making a low-level crossing at Alternative Site No. 1 (preferred) a safer and more useable option compared with a crossing located upstream of the weir.
- **Impact 15:** Flooding indicator blocks will be constructed on the bridge deck (concept Design Report).
- **Impact 16:** Six (6) mammal SCC were observed during the terrestrial assessment, including *inter alia* lion, elephant, hippo and hyaena, and one reptile SCC, specifically the Nile Crocodile (The Terrestrial Assessment).

Assessment without mitigation:

Legend					
Criteria		Reversibility, Irreplaceability, & Mitigatory Potential		Significance (Impact Magnitude & Impact Importance)	
Abbreviation	Description	Abbreviation	Description	Abbreviation	Description
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
14	L	M	M	-I	M	M	1	H	M	1
Reversibility		H		Irreplaceability		H		Mitigatory Potential		H

Alternative Site No. 2

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Consultation Basic Assessment Report: Development of a low-level crossing on the Mokolo River in Kaingo Private Nature Reserve, Lephalale Local Municipality, Waterberg District, Limpopo (2022)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
14	M	M	M	-I	M	M	1	H	M	1
Reversibility		H		Irreplaceability		H		Mitigatory Potential		H

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
15	H	L	H	+I	H	M	Significant positive	L	M	0

Alternative Site No. 2

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
15	M	L	H	+I	H	M	Significant positive	L	M	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
16	M	L	M	-I	M	M	1	H	M	1
Reversibility		H		Irreplaceability		NA		Mitigatory Potential		H

Alternative Site No. 2

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
16	M	L	M	-I	M	M	1	H	M	1
Reversibility		H		Irreplaceability		NA		Mitigatory Potential		H

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- Construct flooding indicator blocks on the bridge deck.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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Consultation Basic Assessment Report: Development of a low-level crossing on the Mokolo River in Kaingo Private Nature Reserve, Lephalale Local Municipality, Waterberg District, Limpopo (2022)

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Department of Water Affairs and Forestry, 1996. South African Water Quality Guidelines (second edition). Volume 1: Domestic Use.
- Department of Water Affairs and Forestry, 1996. South African Water Quality Guidelines (second edition). Volume 4: Agricultural Use: Irrigation.
- Concept Design Report for the proposed low-level crossing at Kaingo Reserve across the Mokolo River prepared by PG Consulting Engineers dated October 2021 (Final Report)
- The Terrestrial Assessment for the Kaingo Low Level Bridge, Vaalwater, Limpopo Province (November 2021) prepared by The Biodiversity Company.

Mitigations:

Impact Management Outcome(s):

- Ensure water quality (specifically turbidity and TSS) is fit for domestic water use and agricultural use (irrigation).
- Enhance safety when using the low-level crossings.
- Reduce injury and avoid fatality amongst staff.

Targets:

- Turbidity must not exceed 5 NTU (no turbidity visible, a slight chance of adverse aesthetic effects and infectious disease transmission exists)
- TSS must be below 50mg/litre to prevent problems with the clogging of drip irrigation emitters.
- All staff tasked with collecting rocks are 'trained' to do so.
- No Incidents involving encounters with resident wild animals.

Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
14	A22	Unfit for domestic water use and agricultural	Ensure water quality is fit for domestic water use and	SEO's site diary – findings relating to	The ECO and/or Reserve Manager shall implement the Surface Water	ECO and/or Reserve Manager	Weekly	Compliance to be verified by

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		water use (irrigation)	agricultural use (irrigation)	weekly field measurements.	Monitoring Plan as per Appendix B .			ECO and IEA.
14	22	Unfit for domestic water use and agricultural water use (irrigation)	Ensure water quality is fit for domestic water use and agricultural use (irrigation)	SEO's site diary – findings relating to visual inspections of turbidity.	The SEO is to monitor TSS and turbidity daily, by visibly inspecting the surface water downstream of the site compared with the clarity of the water upstream of the site.	Contractor, SEO	Daily	Compliance to be monitored by the SEO and verified by ECO and IEA.
14	22	Unfit for domestic water use and agricultural water use (irrigation)	Ensure water quality is fit for domestic water use and agricultural use (irrigation)	Appropriate corrective measures being implemented. TWQR: Turbidity ≤ 5NTU and TSS ≤ 50mg/l (unless exceeded by Background TSS levels).	Immediately upon seeing an increase in TSS or turbidity downstream of the site compared with the clarity of the water upstream of the site, identify the source of the problem and implement corrective measures until the Target Water Quality Range (TWQR) has been achieved.	Contractor, SEO	When required.	Compliance to be monitored by the SEO and a Water Quality Monitor and verified by ECO and IEA.
14	22	Unfit for domestic water use and agricultural water use (irrigation)	Ensure water quality is fit for domestic water use and agricultural use (irrigation)	Written report, e.g., email, WhatsApp text, etc.	If the water is more visibly turbid downstream of the site compared with the clarity of the water upstream of	Contractor, SEO	Daily	Compliance to be monitored by the SEO and verified

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
					the site for more than two successive days, then report it in writing to the ECO and Reserve Manager.			by ECO and IEA.
14	22 and A22	Unfit for domestic water use and agricultural water use (irrigation)	Ensure water quality is fit for domestic water use and agricultural use (irrigation)	Results from a SANS-accredited laboratory. TWQR: Turbidity ≤ 5NTU and TSS ≤ 50mg/l (unless exceeded by Background TSS levels).	Upon being notified by the SEO of a persistent increase in TSS or turbidity, the ECO and/or Reserve Manager shall take water samples for laboratory analysis (as per the Surface Water Monitoring Plan in Appendix B) until the contractor has succeeded in achieving the Target Water Quality Range (TWQR). The laboratory analyses shall be at the Contractor's expense.	Contractor, SEO, and Water Quality Monitor, ECO and/or Reserve Manager	When required.	Compliance to be verified by ECO and IEA.
15	1	Low-level crossings or bridges allow safe passage across rivers.	Enhance safety when using the low-level crossings.	Final Design, including flooding indicator blocks.	Provide flooding indicator blocks on the bridge deck.	Engineer	During Final Design.	Compliance to be verified by ECO and IEA.

Consultation Basic Assessment Report: Development of a low-level crossing on the Mokolo River in Kaingo Private Nature Reserve, Lephalale Local Municipality, Waterberg District, Limpopo (2022)

Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
16	A2	Injured staff from stings, bites, and falls (indirect).	Avoid injury or fatality amongst staff.	An attendance register signed by all applicable staff.	Staff responsible for collecting rocks are to be given an induction or toolbox talk on the best way to collect rocks without causing harm to themselves.	Management Authority, Reserve Manager	Before collecting rocks.	Compliance to be verified by ECO and IEA.
16	A4	Injured staff from stings, bites, and falls (indirect).	Avoid injury or fatality amongst staff.	Protective gloves worn by staff.	Equip staff responsible for collecting rocks with protective gloves.	Management Authority.	Before collecting rocks.	Compliance to be verified by ECO and IEA.
16	A2	Injured staff from chance encounters with dangerous animals (indirect).	Avoid injury or fatality amongst staff.	An attendance register signed by all applicable staff.	All staff are to be given an induction or toolbox talk on the dangers posed by chance encounters with lion, elephant, hippo, hyaena, and the Nile Crocodile, as well as the necessary precautionary and emergency procedures.	ECO or Reserve Manager	Before site establishment	Compliance to be verified by ECO and IEA.
16	2, 4 and A4	Injured staff from stings, bites, falls or chance encounters with dangerous	Remedy injury or avoid fatality amongst staff.	First Aid Certificates and an adequate First Aid Kit with each team.	At least one person within each working team must have a valid First Aid Certificate and a First Aid Kit that is adequate to deal with	Management Authority, Contractor	Ongoing	Compliance to be verified by ECO and IEA.

Consultation Basic Assessment Report: Development of a low-level crossing on the Mokolo River in Kaingo Private Nature Reserve, Lephalale Local Municipality, Waterberg District, Limpopo (2022)

Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		animals (indirect).			the range of possible life-threatening injuries.			

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
14	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 2

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
14	L	L	L	neutral	L	L	0	L	L	0

Alternative No. 3 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
14	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
15	H	L	H	+I	H	M	Significant positive	L	M	0

Alternative Site No. 2

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Consultation Basic Assessment Report: Development of a low-level crossing on the Mokolo River in Kaingo Private Nature Reserve, Lephalale Local Municipality, Waterberg District, Limpopo (2022)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
15	H	L	H	+I	H	M	Significant positive	L	M	0

Alternative No. 3 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
15	H	L	H	-R	H	M	1	H	M	1

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
16	L	L	M	neutral	M	L	0	L	L	0

Alternative Site No. 2

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
16	L	L	M	neutral	M	L	0	L	L	0

Alternative No. 3 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
16	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

- Low-level crossings still pose a risk to life during major flood events.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Receiving Environment: Public services

Description of potential impacts:

Impact-Consequence	Change	Source*	Impact No.
Water purification costs. Sedimentation (or turbidity) caused by working in the river can increase the cost of treating drinking water: - Increased cost of treating water, or if there is limited capacity to treat the water (financial, technical, etc.) then poorer quality drinking water, including appearance, odour, and taste problems (indirect).	NA	Matrix	17

*The source of information used in identifying the impact is either the Leipold Matrix (Matrix), Interested and Affected Parties (I&APs) and/or Specialist studies (Specialist)

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

- The Mokolo Dam is approximately 8.5km downstream of Alternative Site No. 1 (preferred), and Alternative Site No. 2 is approximately 2.1km upstream of Alternative Site No. 1 (preferred).
- Mokolo Dam supplies the Lephalale area, Grootgeluk coal mine, Matimba power station and part of the water requirements of Medupi power station.
- Turbidity decreases in the downstream direction if there are no additional sources of suspended sediment.
- Mitigations to avoid or reduce the impact of suspended sediment causing an increased turbidity are adequately addressed under “Aquatic Ecosystem” (relating to Impact No. 10) and need not be repeated here.

Assessment without mitigation:

Legend					
Criteria		Reversibility, Irreplaceability, & Mitigatory Potential		Significance (Impact Magnitude & Impact Importance)	
Abbreviation	Description	Abbreviation	Description	Abbreviation	Description
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				

Consultation Basic Assessment Report: Development of a low-level crossing on the Mokolo River in Kaingo Private Nature Reserve, Lephalale Local Municipality, Waterberg District, Limpopo (2022)

+I/R	Positive Impact/Risk				
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Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
17	M	M	M	-I	M	M	1	H	M	1
Reversibility		H		Irreplaceability		H		Mitigatory Potential		H

Alternative Site No. 2

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
17	M	M	M	-I	M	M	1	H	M	1
Reversibility		H		Irreplaceability		H		Mitigatory Potential		H

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- None

Mitigations:

Impact Management Outcome(s):

- Avoid the necessity for increasing the treatment of contaminated river water.

Targets:

- Water downstream of the site shall not be more visibly turbid than water upstream of the site for more than two successive days.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
17	2, 6, 8 and/or 18	Increased cost of treating turbid water.	Avoid the necessity for increasing the treatment of contaminated river water.	Water downstream of the site shall not be more visibly turbid than water upstream of the site for more than two successive days.	Mitigations to avoid or reduce the impact of suspended sediment causing an increased turbidity are adequately addressed under "Aquatic Ecosystem" (relating to Impact No. 10) and need not be repeated here.			

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
17	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 2

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
17	L	L	L	neutral	L	L	0	L	L	0

Alternative No. 3 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
17	L	L	L	neutral	L	L	0	L	L	0

Consultation Basic Assessment Report: Development of a low-level crossing on the Mokolo River in Kaingo Private Nature Reserve, Lephalale Local Municipality, Waterberg District, Limpopo (2022)

Residual Risk (feeds back into “Mitigations”):

- None



MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Receiving Environment: Visual Aesthetics

Description of potential impacts:

Impact-Consequence	Change	Source*	Impact No.
Alien plant recruitment. Disturbance of aquatic or terrestrial habitat can favour the recruitment of alien invasive plants, threatening individuals, habitats and alter the composition, structure and functioning of ecosystems: - a decrease in aesthetic, cultural and recreational values (indirect).	NA	Matrix	18
Removed rock. Rock will be collected from the reserve resulting in their removal from the landscape: - Rock removal may negatively impact on or reduce the visual aesthetic value of a rocky landscape (indirect).	NA	Matrix	19

*The source of information used in identifying the impact is either the Leipold Matrix (Matrix), Interested and Affected Parties (I&APs) and/or Specialist studies (Specialist)

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

- The restricted development footprint within the Mokolo River and low level of the proposed water crossing, will not alter the visual landscape in any way. The proposed infrastructure will be less visually intrusive than the existing weir.
- The impact of alien invasive plant recruitment on visual aesthetic values is adequately mitigated under “Terrestrial ecosystem” (relating to Impact No. 9).

Assessment without mitigation:

Legend					
Criteria		Reversibility, Irreplaceability, & Mitigatory Potential		Significance (Impact Magnitude & Impact Importance)	
Abbreviation	Description	Abbreviation	Description	Abbreviation	Description
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

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Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
18	M	L	H	-I	H	M	1	H	M	1
Reversibility		H		Irreplaceability		H		Mitigatory Potential		H

Alternative Site No. 2

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
18	M	L	H	-I	H	M	1	H	M	1
Reversibility		H		Irreplaceability		H		Mitigatory Potential		H

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
19	M	L	L	-I	M	M	1	M	M	1
Reversibility		H		Irreplaceability		H		Mitigatory Potential		H

Alternative Site No. 2

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
19	M	L	L	-I	M	M	1	M	M	1
Reversibility		H		Irreplaceability		H		Mitigatory Potential		H

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None.

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References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- None

Mitigations:

Impact Management Outcome(s):

- Preserve or improve visual aesthetic values in Kaingo Game Reserve.

Targets:

- No adult or reproductively mature alien invasive plants observed on site.
- No distinctly visible bare patches void of rocks.

Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
18	5 and A5	Alien invasive plant recruitment leading to a decrease in aesthetic, cultural and recreational values.	Preserve or improve visual aesthetic values in Kaingo Game Reserve.	No adult or reproductively mature alien invasive plants observed on site.	The impact of alien invasive plant recruitment on visual aesthetic values is adequately mitigated under "Terrestrial ecosystem" (relating to Impact No. 9)			
19	A12	Rock removal may negatively impact on or reduce the visual aesthetic value of a rocky landscape	Preserve or improve visual aesthetic values in Kaingo Game Reserve.	No distinctly visible bare patches void of rocks.	The impact of collecting rocks on visual aesthetic values is adequately mitigated under "Terrestrial ecosystem" (relating to Impact No. 9)			

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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Consultation Basic Assessment Report: Development of a low-level crossing on the Mokolo River in Kaingo Private Nature Reserve, Lephalale Local Municipality, Waterberg District, Limpopo (2022)

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
18	L	L	L	neutral	L	M	0	L	M	0

Alternative Site No. 2

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
18	L	L	L	neutral	L	M	0	L	M	0

Alternative No. 3 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
18	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
19	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 2

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
19	L	L	L	neutral	L	L	0	L	L	0

Alternative No. 3 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
19	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

- None.



MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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Consultation Basic Assessment Report: Development of a low-level crossing on the Mokolo River in Kaingo Private Nature Reserve, Lephalale Local Municipality, Waterberg District, Limpopo (2022)

Receiving Environment: Social well-being

Description of potential impacts:

Impact-Consequence	Change	Source*	Impact No.
Enhanced eco-tourism. Strong flows prevent direct access across the Mokolo River by game-drive vehicles, who are then required to drive out the reserve and use the existing crossing on a badly corrugated agricultural dirt road: Direct access across a low-level crossing to the rest of the Private Nature Reserve will improve the guest experience as well as increase opportunities for nature-based tourism activities (positive impact).	NA	Matrix	20

*The source of information used in identifying the impact is either the Leipold Matrix (Matrix), Interested and Affected Parties (I&APs) and/or Specialist studies (Specialist)

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

- The low-level crossing will be confined to a single, consolidate Private Nature Reserve for the benefit of localised eco-tourism and the Management Authority during its day-to-day operations or management of the Nature Reserve. As such the activity does not affect or impact any broader societal needs, communities, or economies.

Assessment without mitigation:

Legend					
Criteria		Reversibility, Irreplaceability, & Mitigatory Potential		Significance (Impact Magnitude & Impact Importance)	
Abbreviation	Description	Abbreviation	Description	Abbreviation	Description
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
20	M	L	H	+I	H	H	Significant positive	L	H	0
Reversibility		NA		Irreplaceability		NA		Mitigatory Potential		L

Alternative Site No. 2

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
20	M	L	H	+I	H	H	Significant positive	L	H	0
Reversibility		L		Irreplaceability		L		Mitigatory Potential		L

Alternative No. 3 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
20	M	M	H	-I	M	H	1	H	H	1
Reversibility		NA		Irreplaceability		NA		Mitigatory Potential		NA

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

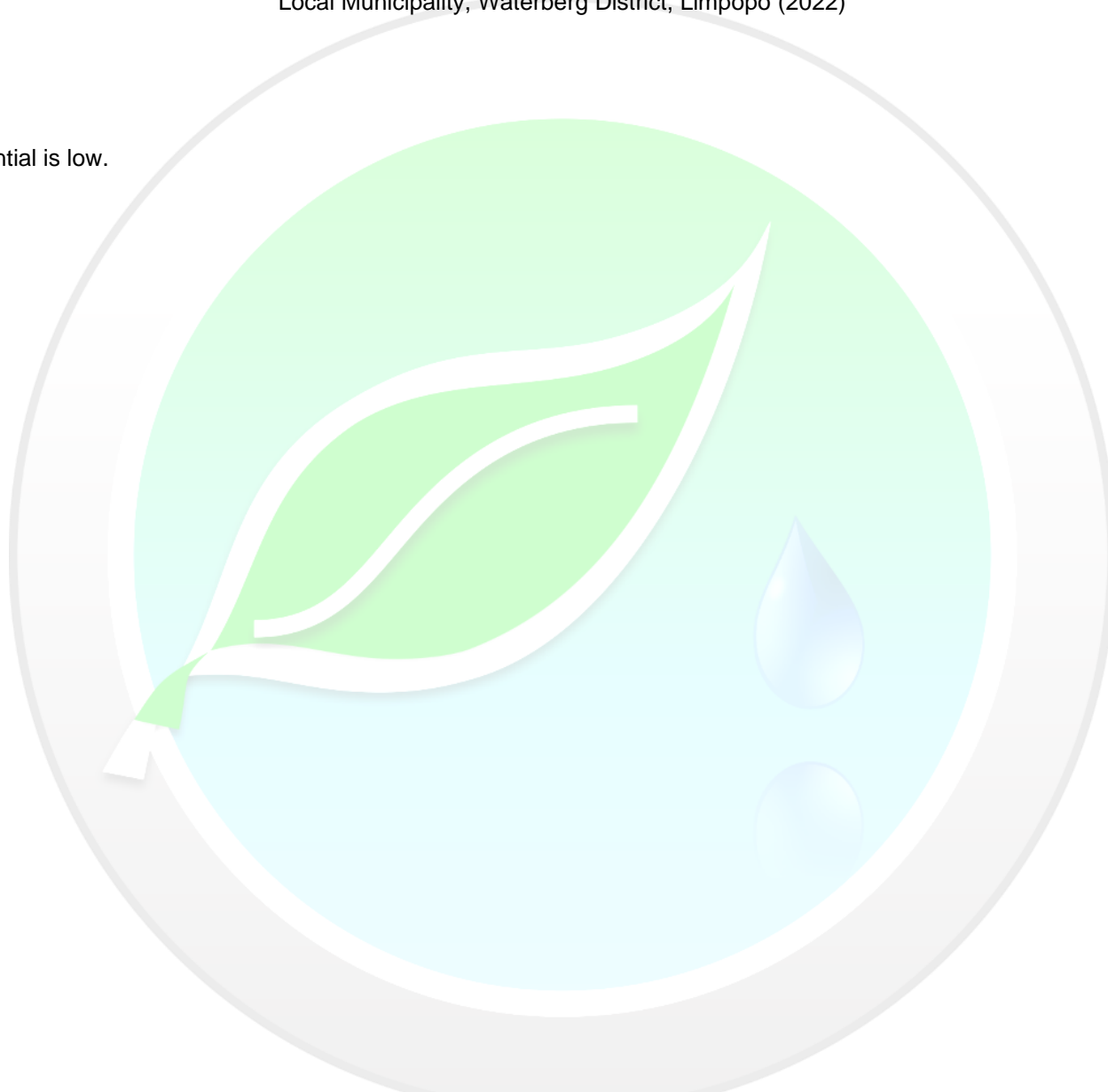
- None

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Concept Design Report for the proposed low-level crossing at Kaingo Reserve across the Mokolo River prepared by PG Consulting Engineers dated October 2021 (Final Report).
- Private Nature Reserve in the Protected Area Register (PAR) and the Kaingo PNR Management Plan (2018 – 2023) developed with support from Envirodel Ecological and Wildlife Services.

Mitigations:

- Mitigatory potential is low.



MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Receiving Environment: Heritage and Culture

Description of potential impacts:

Impact-Consequence	Change	Source*	Impact No.
Loss of heritage resources. Excavation could damage or destroy artefacts: - The loss of a heritage resources undermines the understanding of previous generations that is vital to creating a sense of unity, belonging, and even pride among South Africans (direct).	NA	Matrix	21

*The source of information used in identifying the impact is either the Leipold Matrix (Matrix), Interested and Affected Parties (I&APs) and/or Specialist studies (Specialist)

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

- The proposed low-level crossing is confined to the edge of the watercourse or macro-channel bank. The in-situ material is either solid bedrock or recent alluvial sediments deposited by flood events. Perennial watercourses, including their bed & banks, are dynamic environments under constant change and therefore unlikely to support artefacts.
- Archaeological and Cultural Heritage theme is **Low** in both Screening Assessments – Verified as **Low** in the Site Sensitivity Verification Report and in the Exemption Letter for further Heritage Impact Assessment - “Because of the small footprint and the location of the proposed crossing as well as the result of a physical inspection by an archaeologist, the proposed activities will not have an impact on any heritage resources and no remedial action or mitigation is needed.”
- The proposed low-level crossing is confined to the edge of the watercourse or macro-channel bank. The in-situ material is either solid bedrock, specifically feldspathic sandstone with lesser arkose, siltstone, and shale from the Vaalwater Formation of the Kransberg Sub-group of the Waterberg Group (Engineer Concept Design Report) or recent alluvial sediments deposited by flood events. Fossils are more common in some kinds of sedimentary rocks than others. Fossils are most common in limestones and least common in sandstones. Furthermore, the crossing structure will be secured to the bedrock by drilling into it. The bedrock will not be blasted.
- Palaeontology theme is **Medium** in both Screening Assessments – Verified as **Low** in the Site Sensitivity Verification Report and in the Request for Exemption from further Palaeontological Assessment - “The site is northwest of Vaalwater and so in the Waterberg geological system. The whole area is in the Cleremont Formation sandstones and of about 2000 million years old. These sandstones with trough cross-bedding represent a relatively high energy ancient shoreline (Barker et al., 2006). At that age, the only life forms were microscopic or small marine invertebrates and only trace fossils might occur. None has been reported from this formation. It is extremely unlikely that any fossils would be found or recognised. The moderate sensitivity indicated by the SAHRIS palaeosensitivity map (Fig 2) is inconsistent with the interpretation for this formation in the Limpopo Palaeotechnical Report (Groenewald et al., 2004). We request, therefore for exemption from any further palaeontological impact assessment, and that as far as the palaeontological heritage is concerned, that this project be authorised.”
- The construction camp shall be established on any one of the “old lands” nearby the site.

Consultation Basic Assessment Report: Development of a low-level crossing on the Mokolo River in Kaingo Private Nature Reserve, Lephalale Local Municipality, Waterberg District, Limpopo (2022)

- Impact No. 21 is non-significant and does not require further investigation or mitigation.

Assessment without mitigation:

Legend					
Criteria		Reversibility, Irreplaceability, & Mitigatory Potential		Significance (Impact Magnitude & Impact Importance)	
Abbreviation	Description	Abbreviation	Description	Abbreviation	Description
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
21	L	L	L	neutral	L	L	0	L	L	0
Reversibility		L		Irreplaceability		L		Mitigatory Potential		H

Alternative Site No. 2

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
21	L	L	L	neutral	L	L	0	L	L	0
Reversibility		L		Irreplaceability		L		Mitigatory Potential		H

Alternative No. 3 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
21	L	L	L	neutral	L	L	0	L	L	0

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Reversibility	NA	Irreplaceability	NA	Mitigatory Potential	NA
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Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- The construction camp shall be established in the “Modified” habitat type.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Not a World Heritage site in the Protected Areas Register (PAR)
- (Engineer) Concept Design Report Proposed Low-level Crossing at Kaingo Reserve Across the Mokolo River (October 2021), Final Report, prepared by PG Consulting Engineers.
- Screening Assessments
- Site Sensitivity Verification Report
- (Exemption Letter for) Low level crossing on the Mokolo River, Kaingo Private Nature Reserve (26 November 2021), prepared by Kudzala antiquity cc.
- Request for Exemption of any Palaeontological Impact Assessment for the proposed Kayingo low-water bridge, below Mokolo Dam, Farm Laurel 195, Limpopo Province (02 December 2021), prepared by Prof Marion Bamford (Palaeobotanist; PhD Wits 1990).
- National Heritage Resources Act, 1999 (Act No. 25 of 1999)
 - *Structures*
 - No person may alter or demolish any structure or part of a structure, which is older than 60 years without a permit issued by the LIHRA ² (Section 34(1) of NHRA).
 - *Archaeological Sites and Remains*
 - In terms of Section 35(3) of the NHRA, any person who discovers archaeological or palaeontological objects or material or a meteorite during development or an agricultural activity must **immediately report the find** to the LIHRA.
 - In terms of Section 35(4) of the NHRA, **no person may without a permit** issued by the LIHRA destroy, damage, excavate, alter, deface, or otherwise disturb any archaeological or palaeontological site or any meteorite, or remove from its original position any archaeological, or palaeontological material or object or any meteorite.
 - *Graves*
 - In terms of Section 36(6) any person who during development discovers the location of a grave **must immediately cease such activity and report the discovery** to the LIHRA. The LIHRA must then, in co-operation with the SAPS, carry out an investigation.

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- In terms of Section 36(3) of the NHRA, **no person may, without a permit** issued by LIHRA, destroy, damage, alter, exhume, or remove from its original position or otherwise disturb the grave of a victim of conflict, any burial ground or part thereof which contains such graves, or any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority (Section 36(3) of NHRA).

Mitigations:

Impact Management Outcome(s):

- Protection and preservation of heritage resources.

Targets:

- No unnecessary damage or destruction of heritage resources.
- Adequate supervision when clearing and grubbing, stripping topsoil, and excavating.
- Construction has ceased at the site of a discovery.
- Site of discovery has been cordoned off.
- A written response from the Limpopo Heritage Resources Agency (LIHRA) and where applicable, the local police (SAPS).
- Permits issued by LIHRA.
- Protected fossiliferous material
- A SAHRA permit (relating to removal of fossil plants or vertebrates that are of good quality or Scientific interest)
- A Final Report prepared by the palaeontologist upon project completion (in the case of fossil finds).

Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
21	6, 7 and 17	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	Supervision	The bulk of archaeological remains are normally located beneath or near the soil surface, so please be especially vigilant when clearing and	Contractor, SEO	During clearing and grubbing operations and excavations.	Compliance to be monitored by the SEO and verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
					grubbing, and excavating.			
21	10 and A10	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	Written findings or photographs of cursory inspection.	The ECO or Reserve Manager must give a cursory inspection of the bedrock after clearing and before drilling, in this case for small marine invertebrates and/or trace fossils (e.g., footprints, trails, burrows, etc.).	Contractor, SEO, ECO	After clearing and grubbing of bedrock in river.	Compliance to be verified by ECO and IEA.
21	6, 7 and 17	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	Supervision	The SEO shall supervise all clearing and grubbing, as well as excavation activities. Examples of cultural or archaeological objects include <i>inter alia</i> (a) skeletal remains (bones) in middens (refuse heaps) or graves, (b) burned hut clay or other hut debris, (c) broken pieces of ceramic pottery (potsherds), (d) large quantities of iron	Contractor, SEO	During clearing and grubbing operations and excavations.	Compliance to be monitored by the SEO and verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
					smelting slag or sub-surface charcoal and ash deposits, etc.			
21	21 and A21	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	Construction has ceased at a site of discovery.	<p>If any evidence of archaeological sites or remains (e.g., remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal, and ash concentrations), fossils or other categories of heritage resources are found or uncovered by construction staff during construction:</p> <ol style="list-style-type: none"> 1. IMMEDIATELY cease the construction activity, 2. notify the Reserve Manager or ECO, and 	Contractor, SEO, Reserve Manager or ECO.	Chance Find Protocol - artefacts	Compliance to be monitored by the SEO and verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
					3. don't tamper with the finds.			
21	21 and A21	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	Site of discovery has been cordoned off.	The site of discovery must be cordoned off and demarcated a no-go area. Access to construction staff shall be prohibited until further notice by the Reserve Manager or ECO.	Contractor, SEO, Reserve Manager or ECO.	Chance Find Protocol - artefacts	Compliance to be monitored by the SEO and verified by ECO and IEA.
21	A21	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	A written response from the LIHRA.	The Reserve Manager or ECO shall alert the Limpopo Heritage Resources Authority (LIHRA) and if necessary, arrange for a registered heritage specialist to assess the significance of the discovery and advise on further actions.	Reserve Manager or ECO, Heritage Specialist.	Chance Find Protocol - artefacts	Compliance to be verified by ECO and IEA.
21	A21	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	A written response from the SAPS.	In the case of unmarked human burials, the Reserve Manager or ECO shall also alert the local police.	Reserve Manager or ECO.	Chance Find Protocol - artefacts	Compliance to be verified by ECO and IEA.
21	A21	Damage or destruction of heritage resources.	Protection and preservation	Permits issued by LIHRA.	If the newly discovered heritage resources prove to be of archaeological or	Applicant, Heritage Specialist.	Chance Find Protocol - artefacts	Compliance to be verified by

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
			of heritage resources.		paleontological significance, a Phase 2 rescue operation may be required subject to permits issued by either the Limpopo Heritage Resources Authority (LIHRA).		Prior to a Phase 2 rescue operation.	ECO and IEA.
21	21 and A21	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	Site of discovery has been cordoned off.	Ensure the heritage site remains safeguarded until clearance is given by the Limpopo Heritage Resources Authority (LIHRA) for work to resume.	Contractor, SEO, Reserve Manager or ECO.	Chance Find Protocol - artefacts	Compliance to be verified by ECO and IEA.
21	21 and A21	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	Protected fossiliferous material, photographs, and a preliminary assessment.	If possible, any fossiliferous material should be put aside in a suitably protected place and photographs of putative fossils should be sent to a palaeontologist for a preliminary assessment.	Management Authority, Contractor, SEO	Chance Find Protocol - fossils	Compliance to be verified by ECO and IEA.
21	A21	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	Palaeontologist's findings of site visit.	If necessary, the palaeontologist should visit the site to inspect the fossiliferous material.	Management Authority, Palaeontologist	Chance Find Protocol - fossils	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
21	A21	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	SAHRA permit	Fossil plants or vertebrates that are of good quality or Scientific interest by the palaeontologist must be removed, catalogued, and housed in a suitable institution where they can be made available for further study. A SAHRA permit must be obtained first.	Management Authority, Palaeontologist	Chance Find Protocol - fossils	Compliance to be verified by ECO and IEA.
21	A21	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	A Final Report	A final report by the palaeontologist must be sent to the SAHRA once the project has been completed and only if there are fossils.	Management Authority, Palaeontologist	Chance Find Protocol - fossils	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Not necessary.

Residual Risk (feeds back into "Mitigations"):

- All be it small, there remains a risk of chance finds.

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Assessment of Design Alternatives

Receiving Environment: Economical

Description of potential impacts:

Impact-Consequence	Change	Source*	Impact No.
Construction Costs. The cost of constructing different designs, which depends on <i>inter alia</i> the materials used, will occur at the expense of other conservation-related projects within the game reserve: - less capital to fund other projects (direct).	NA	Matrix	22
Maintenance Costs. Designs with different stability and structural integrity values, will incur variable maintenance and/or replacement costs: - less capital to fund other conservation-related projects within the game reserves (direct).	NA	Matrix	
Replacement Costs. Designs with different stability and structural integrity values, will pose variable risks of failure and damage to property (vehicles) during strong flows: - Loss of property and the cost of having to replace it (Risk).	NA	Matrix	

*The source of information used in identifying the impact is either the Leipold Matrix (Matrix), Interested and Affected Parties (I&APs) and/or Specialist studies (Specialist)

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

- Alternative Design No. 1 (preferred), that is the Rubble Masonry Concrete (RMC) structure is the most practical and economical of all three designs with respect to the topography and exposed bedrock at Alternative Site No. 1 (preferred) (Concept Design Report).
- Designs requiring more gabion units and structural reinforcing steel, such as a gabion basket structures or conventional reinforced concrete deck bridge with piers, are more expensive (Concept Design Report).
- The stability and structural integrity of Alternative Design No. 2 and 3 were also evaluated and found to be less structurally sound and stable during high floods, compared with Alternative Design No. 1 (preferred), that is the Rubble Masonry Concrete (RMC) structure, inferring higher maintenance costs (Concept Design Report).

Consultation Basic Assessment Report: Development of a low-level crossing on the Mokolo River in Kaingo Private Nature Reserve, Lephalale Local Municipality, Waterberg District, Limpopo (2022)

Assessment without mitigation:

Legend					
Criteria		Reversibility, Irreplaceability, & Mitigatory Potential		Significance (Impact Magnitude & Impact Importance)	
Abbreviation	Description	Abbreviation	Description	Abbreviation	Description
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Design No. 1 (preferred) - Rubble Masonry Concrete (RMC) Culvert Structure

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
22	L	L	L	neutral	L	H	0	L	H	0
Reversibility		L		Irreplaceability		L		Mitigatory Potential		L

Alternative Design No. 2 - Gabion Basket Structure

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
22	M	L	M	-I	M	H	1	H	H	1
Reversibility		L		Irreplaceability		L		Mitigatory Potential		L

Alternative Design No. 3 - Conventional Reinforced Concrete Deck Bridge with Piers

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
22	M	L	M	-I	M	H	1	H	H	1
Reversibility		L		Irreplaceability		L		Mitigatory Potential		L

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

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Consultation Basic Assessment Report: Development of a low-level crossing on the Mokolo River in Kaingo Private Nature Reserve, Lephalale Local Municipality, Waterberg District, Limpopo (2022)

- None

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Concept Design Report for the proposed low-level crossing at Kaingo Reserve across the Mokolo River prepared by PG Consulting Engineers dated October 2021 (Final Report).

Mitigations:

Low mitigatory potential.

Residual Risk (feeds back into “Mitigations”):

- None

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Consultation Basic Assessment Report: Development of a low-level crossing on the Mokolo River in Kaingo Private Nature Reserve, Lephalale Local Municipality, Waterberg District, Limpopo (2022)

Receiving Environment: Health and Safety

Description of potential impacts:

Impact-Consequence	Change	Source*	Impact No.
Structural Integrity (Failure). Designs with different stability and structural integrity values, will pose variable risks of failure and harm to human life (driver and passengers) during strong flows: - Death and burden on families after losing their principal or only means of support, financial or otherwise (Risk).	NA	Matrix	23

*The source of information used in identifying the impact is either the Leipold Matrix (Matrix), Interested and Affected Parties (I&APs) and/or Specialist studies (Specialist)

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

- The stability and structural integrity of Alternative Design No. 2 and 3 were also evaluated and found to be less structurally sound and stable during high floods, compared with Alternative Design No. 1 (preferred), that is the Rubble Masonry Concrete (RMC) structure (Concept Design Report), inferring higher risk to the safety of people.

Assessment without mitigation:

Legend					
Criteria		Reversibility, Irreplaceability, & Mitigatory Potential		Significance (Impact Magnitude & Impact Importance)	
Abbreviation	Description	Abbreviation	Description	Abbreviation	Description
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

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Alternative Design No. 1 (preferred) - Rubble Masonry Concrete (RMC) Culvert Structure

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
23	H	L	L	-R	H	L	0	L	L	0
Reversibility		L		Irreplaceability		L		Mitigatory Potential		L

Alternative Design No. 2 - Gabion Basket Structure

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
23	H	L	L	-R	H	M	1	M	M	1
Reversibility		L		Irreplaceability		L		Mitigatory Potential		L

Alternative Design No. 3 - Conventional Reinforced Concrete Deck Bridge with Piers

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
23	H	L	L	-R	H	M	1	M	M	1
Reversibility		L		Irreplaceability		L		Mitigatory Potential		L

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Concept Design Report for the proposed low-level crossing at Kaingo Reserve across the Mokolo River prepared by PG Consulting Engineers dated October 2021 (Final Report).

Mitigations:

Low mitigatory potential.

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Residual Risk (feeds back into “Mitigations”):

- None.



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Receiving Environment: Visual Aesthetics

Description of potential impacts:

Impact-Consequence	Change	Source*	Impact No.
Sense of Place. The architectural design or appearance of a structure can enhance or detract from the 'sense of place': - an increase or decrease in aesthetic, cultural and recreational values (direct).	NA	Matrix	24
Strewn debris. Designs with different stability and structural integrity values, will pose variable risks of failure during strong flows: - Foreign structural debris strewn in the downstream stretches of the river will decrease aesthetic, cultural, and recreational values (Risk).	NA	Matrix	

*The source of information used in identifying the impact is either the Leipold Matrix (Matrix), Interested and Affected Parties (I&APs) and/or Specialist studies (Specialist)

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

- Alternative Design No. 1 (preferred), that is the Rubble Masonry Concrete (RMC) structure utilises local weathered rock on the outer surface of the sidewalls (Concept Design Report), creating a far more visually aesthetic and less obtrusive structure compared with Alternative Design No. 2 and 3, particularly within the context of a protected area.
- Well-designed structures using local materials and more natural forms can enhance the the 'sense of place' within an area.

Assessment without mitigation:

Legend					
Criteria		Reversibility, Irreplaceability, & Mitigatory Potential		Significance (Impact Magnitude & Impact Importance)	
Abbreviation	Description	Abbreviation	Description	Abbreviation	Description
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Consultation Basic Assessment Report: Development of a low-level crossing on the Mokolo River in Kaingo Private Nature Reserve, Lephalale Local Municipality, Waterberg District, Limpopo (2022)

Alternative Design No. 1 (preferred) - Rubble Masonry Concrete (RMC) Culvert Structure

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
24	M	L	H	+I	H	M	Significant positive	L	M	0
Reversibility		L		Irreplaceability		L		Mitigatory Potential		L

Alternative Design No. 2 - Gabion Basket Structure

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
24	M	L	H	-I	H	M	1	M	M	1
Reversibility		L		Irreplaceability		L		Mitigatory Potential		L

Alternative Design No. 3 - Conventional Reinforced Concrete Deck Bridge with Piers

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
24	M	L	H	-I	H	M	1	M	M	1
Reversibility		L		Irreplaceability		L		Mitigatory Potential		L

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Concept Design Report for the proposed low-level crossing at Kaingo Reserve across the Mokolo River prepared by PG Consulting Engineers dated October 2021 (Final Report).

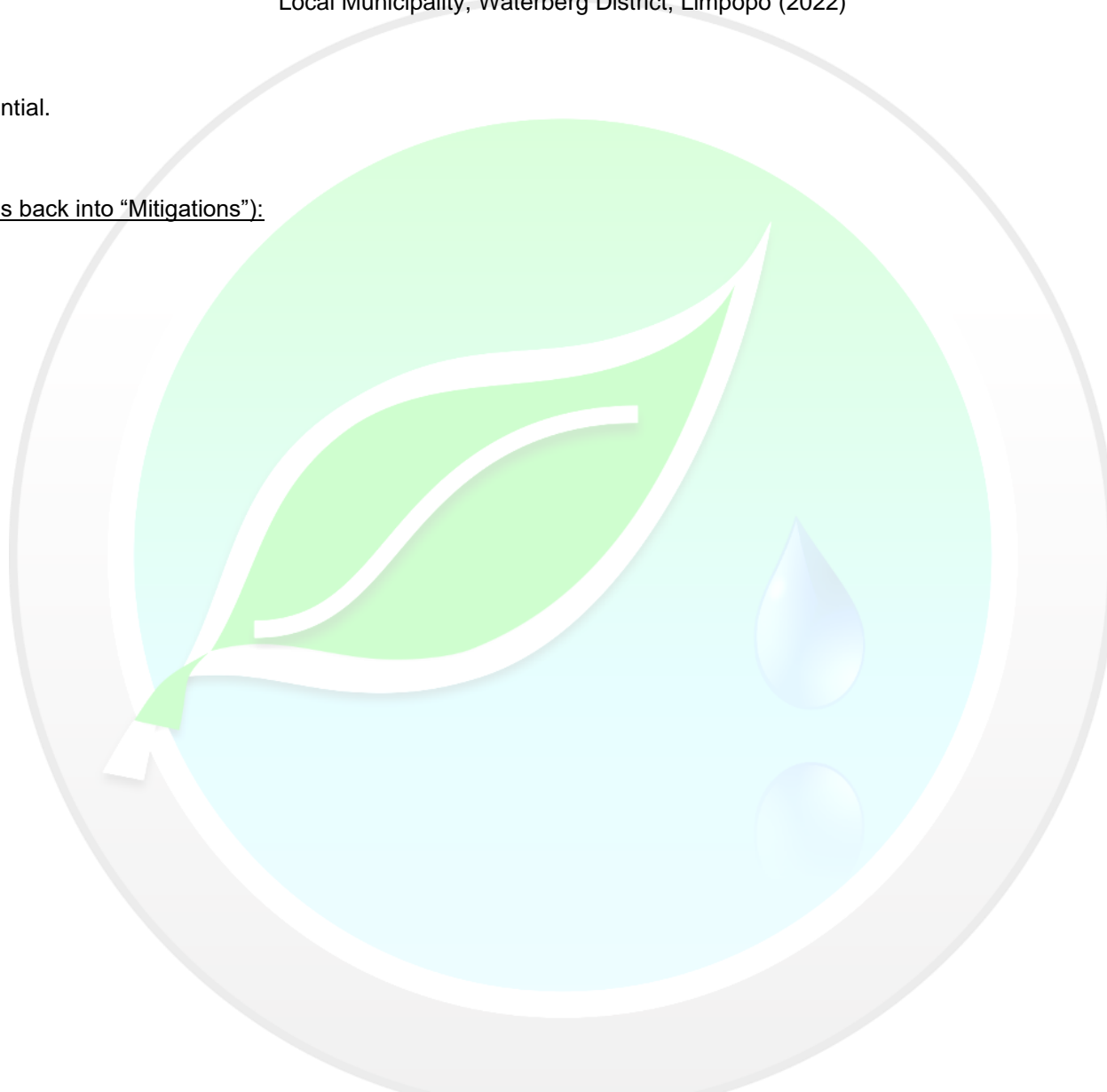
Consultation Basic Assessment Report: Development of a low-level crossing on the Mokolo River in Kaingo Private Nature Reserve, Lephalale Local Municipality, Waterberg District, Limpopo (2022)

Mitigations:

Low mitigatory potential.

Residual Risk (feeds back into “Mitigations”):

- None.



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Site Selection Matrix

3(1) A basic assessment report... must include –

(h) a full description of the process followed to reach the proposed preferred alternative within the site, including - (ix) **the outcome of the site selection matrix;**

Appendix 1 (Basic Assessment Report) of the EIA Regulations, 2014 as amended

Table 5. Site Selection Matrix before mitigation.

Aspect	Legal system	Biological				Physical			Geographic		Economical			Social						Heritage & Culture	
		Terrestrial fauna	Terrestrial flora	Aquatic fauna	Aquatic flora	Soil and Rock	G/Surface water	Bed & banks	Terrestrial Ecosystem	Aquatic Ecosystem	Building costs	Time saving	Reserve mgt costs	Health & safety			Public services	Visual aesthetics	Visual aesthetics		Well-being
Impact	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
A1																					
A2																					
No-Go																					

Legend: Aspect – aspect or attribute of the receiving environment, **Impact** – any change to the environment: **1.** non-compliance, **2.** Loss of terrestrial fauna (Animal species), **3.** loss of terrestrial flora (Plant species), **4.** Loss of aquatic fauna, **5.** Loss of aquatic flora, **6.** Natural resource depletion (soil and rock), **7.** Ground and surface water depletion, **8.** Altered hydrology, **9.** Loss of terrestrial ecosystem, **10.** Turbidity/spills in aquatic ecosystem, **11.** Construction costs, **12.** Increased Productivity, **13.** Reserve Management Costs, **14.** Agricultural and domestic water use (downstream water users), **15.** Safety risk during strong flows, **16.** Injury to workers, **17.** Water purification costs, **18.** Alien plant recruitment, **19.** Removed rock, **20.** Enhanced eco-tourism, **21.** Loss of heritage resources, **A1** – Alternative Site No. 1 (preferred), **A2** - Alternative Site No. 2, **No-Go** – No-Go option.

	Significant negative impact/risk		Non-significant impact/risk		Significant positive impact/risk
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Consultation Basic Assessment Report: Development of a low-level crossing on the Mokolo River in Kaingo Private Nature Reserve, Lephalale Local Municipality, Waterberg District, Limpopo (2022)

Table 6. Site Selection Matrix after mitigation.

Aspect	Legal system	Biological				Physical			Geographic		Economical			Social						Heritage & Culture	
		Terrestrial fauna	Terrestrial flora	Aquatic fauna	Aquatic flora	Soil and Rock	G/Surface water	Bed & banks	Terrestrial Ecosystem	Aquatic Ecosystem	Building costs	Time saving	Reserve mgt costs	Health & safety			Public services	Visual aesthetics	Visual aesthetics		Well-being
Impact	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
A1																					
A2																					
No-Go																					

Legend: Aspect – aspect or attribute of the receiving environment, **Impact** – any change to the environment: **1.** non-compliance, **2.** Loss of terrestrial fauna (Animal species), **3.** loss of terrestrial flora (Plant species), **4.** Loss of aquatic fauna, **5.** Loss of aquatic flora, **6.** Natural resource depletion (soil and rock), **7.** Ground and surface water depletion, **8.** Altered hydrology, **9.** Loss of terrestrial ecosystem, **10.** Turbidity/spills in aquatic ecosystem, **11.** Construction costs, **12.** Increased Productivity, **13.** Reserve Management Costs, **14.** Agricultural and domestic water use (downstream water users), **15.** Safety risk during strong flows, **16.** Injury to workers, **17.** Water purification costs, **18.** Alien plant recruitment, **19.** Removed rock, **20.** Enhanced eco-tourism, **21.** Loss of heritage resources, **A1** – Alternative Site No. 1 (preferred), **A2** - Alternative Site No. 2, **No-Go** – No-Go option.

	Significant negative impact/risk		Non-significant impact/risk		Significant positive impact/risk
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Outcome of Site Selection Matrix

Alternative Site No. 1 (preferred) is the most favourable in terms of construction costs related to the geotechnical and topographical aspects of the sites. Alternative Site No. 1 (preferred) is characterised by exposed solid bedrock and a shallow sand shoal towards the right bank. Conversely, the sparse and scattered bedrock at Alternative Site No. 2 is not suitable for founding conditions and will require the removal of more sand from the riverbed to reach the bedrock. The topography on the left bank of Alternative Site No. 2 forms a relatively large floodplain causing the length of the crossing structure to be undesirably long (273m), compared with 183m at Alternative Site No.1 (preferred). Furthermore, the approach on the right bank of Alternative Site No. 2 is relatively steep, making the approach design more complex in terms of additional slope stability measures (Concept Design Report).

Apart from higher construction costs for Alternative Site No. 2 associated with the topography on both banks causing the length of the crossing structure to be undesirably long, and a more complex design in terms of slope stability measures (Concept Design Report), all other environmental attributes are identical. Screening Assessments were performed on both sites, as well as a Site Sensitivity Verification, with the same results.

Consequently, except for the economical aspect or attribute, the proposed development of a low-level crossing results in the same significance ratings at both alternative sites (before and after mitigation). However, an NFEPA wetland is located between both alternative sites on the Mokolo (also NFEPA) River. The wetland is downstream of Alternative Site No. 2 and upstream of Alternative Site No. 1 (preferred). Consequently, potential impacts while working in the river during the construction phase at Alternative Site No. 1, specifically increased turbidity, and Total Suspended Solids (TSS), as well as a change in the river channel hydrology, run the risk of altering the aquatic ecosystem structure and function of that wetland. Additionally, Alternative Site No. 1 carries an increased risk of turbidity because of the greater amount of in-situ material that would need to be removed from the riverbed, impacting not only the wetland, but also potentially reducing the fitness of the water for domestic and agricultural use by downstream water users. None the less, these impacts can be adequately mitigated to generate the same insignificant outcomes that construction at Alternative Site No. 1 (preferred) will have on the Mokolo River system.

The wetland is likely to be an anthropogenic consequence of and retained by the DWS weir located upstream of Alternative Site No. 1 (preferred). The same weir will have a regulating effect on the river channel hydrology by serving to attenuate brief flood events (or flash floods) (Concept Design Report) and reduce turbulence at this site, making a low-level crossing at Alternative Site No. 1 (preferred) a safer and more useable option compared with a crossing located upstream of the weir.

Unlike both alternative sites, the No-go option poses no ecological threat before mitigation. However, a high mitigatory potential of the identified impacts at both sites means that the low-level crossing can be constructed without any significant negative impacts on the natural and socio-economical environments. In fact, after mitigation, and with ecological impacts being equally insignificant for all alternatives (including the No-go option), both alternative sites result in significantly positive socio-economic impacts when compared to the negative impacts on the same socio-economic aspects if a low-level crossing would not be developed. Positive socio-economic outcomes for developing a low-level crossing, include time savings and increased productivity, as well as lower operational costs associated with the day-to day management of the reserve, increased safety for staff and tourists when crossing the river during strong flows, and improved social well-being. Well-being specifically relates to the guest experience. Without a low-level crossing to access the full extent of the nature reserve during the rainy season when the river is flowing

strongly, game drive vehicles would have to exit the reserve and use the existing crossing on a badly corrugated agricultural dirt road. Guest experience and ratings indirectly, but unequivocally translate into much needed revenue “to finance the maintenance and management of the (reserve’s) resources and infrastructure” (Kaingo PNR EMP 2018 – 2023). Increased productivity by reserve management, facilitated by quick and direct access to the full extent of the reserve, will ensure that the income generated from eco-tourism activities will go much further.

Table 7. Design Selection Matrix.

Aspect	Economical	Social	
		Health and Safety	Visual Aesthetics
Impact	22	23	24
A1			
A2			
A3			

Legend: **Aspect** – aspect or attribute of the receiving environment, **Impact** – any change to the environment: **22.** Construction and Maintenance Costs, **23.** Structural Integrity (Failure), **24.** Sense of Place **A1** – Alternative Design No. 1 (preferred) Rubble Masonry Concrete (RMC) Culvert Structure, **A2** - Alternative Design No. 2 Gabion Basket Structure, **A3** – Alternative Design No. 3 Conventional Reinforced Concrete Deck Bridge with Piers.

	Significant negative		Non-significant		Significant positive
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Outcome of Design Selection Matrix

Alternative Design No. 1 (preferred), that is the Rubble Masonry Concrete (RMC) Culvert Structure, is the most favourable option compared with both other alternative designs because it is not only the least expensive of all three structures, but it is also the most structurally stable, increasing its reliability and safety during strong flows, and will contribute towards the ‘sense of place’ by creating a visually aesthetic crossing using local rock ‘farmed’ from the reserve.