Report

Consultation Basic Assessment Report for the Proposed White Mfolozi River Bridge and the L2598 Link Road within the Ulundi Municipality, KwaZulu-Natal

Client:	KwaZulu-Natal Department of Transport
Reference:	MD2485_R01_D04_White Umf & L2598 Link Rd
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Executive Summary

Royal HaskoningDHV were appointed by the Province of KwaZulu-Natal: Department of Transport (hereafter referred to as KZN DoT) to undertake the engineering studies, preliminary design, environmental studies, detailed design and the construction supervision of a new river crossing over the White Mfolozi River and linking up to an existing road, namely the L2598.

The proposed bridge crossing is located approximately 12 km west of the town of Ulundi within the Ulundi Local Municipality, KwaZulu-Natal. The proposed bridge and link road infrastructure will serve to link the KwaMphothi and Mabedlana communities situated east of the White Mfolozi River to the KwaMbambo community situated west of the White Mfolozi River.

The study area can be accessed off the Main Road P734 from Ngoma on the eastern side of District Road D2047 via the P47-3 from Melmoth on the western side.

The first 3.6 km of L2598 is an existing gravel road that starts on Main Road P734 between the Mabedlana Mountains on the Ulundi side near the Mphothi Primary School. Thereafter the route is made up of tracks that traverse through the KwaMphothi area up until the proposed site for the new river crossing (White Mfolozi River Bridge). The route then continues in a north western direction where it intersects with District Road D2047. The link road has a total length of approximately 6.956 km.

Three link road alternatives were investigated. The existing portion (first 3.6 km) of all 3 options is similar as this is an existing road and the proposed upgrades are restricted by the residential properties along the road. The remaining greenfield section of the link road was split into three alternatives:

- Option 1 (Preferred) – deviates from the existing track on the eastern approach.
- Option 2 – similar to Option 1 on the eastern approach, however, the link road has to traverse through a hilltop on the western approach resulting in large cut operations.
- Option 3 – follows an existing track.

The proposed link road will be a Class 4 District Road with a 20 m road reserve. The cross section for this class of road according to KZN DoT standards (as per SD210 type 6) is a 6 m road carriageway on a 7 m wide pavement, comprising two 3 m lanes and two 0.45 m shoulders on either side.

The proposed bridge must have a carriageway width commensurate with the approach road, two 3 m wide lanes with 0.5 m wide shoulders on either side (the edge details for the kerb and channel at the bridge are in accordance with the new (2016) KZN DoT design standard details. This configuration results in a total of 7 m carriageway. For a design speed of 60 km per hour (over a 180 m long bridge), a 1.5 m wide raised pedestrian sidewalk is required on the upstream side. This provides an overall road width of 8.5 m inclusive of the 1.5 m sidewalk. The bridge design is a proposed Class 4 bridge.

Three (3) bridge crossing options were considered during the Basic Assessment (BA) study i.e.:

- Option 1 (Preferred) - This crossing alignment has fairly well defined banks. The channel shows evidence of visible rock with rock foundations at deeper levels on the D2047 side. On the P734 side there are Eskom power lines which have been avoided by moving the structure upstream. The altered alignment also avoids the game fence on this bank. On the D2047 side, the alignment needs to negotiate the presence of dwellings, and in some cases encroaching onto dwellings fences. The steep slopes on either bank results in big cuts and a bridge height determined by road vertical alignment not by hydrological requirements. The bridge length at this alignment is 180 m. This is the preferred crossing point; the bridge on this alignment is perpendicular to the river.

- Option 2 – This option is aligned along a rocky ridge in the river and runs directly under Eskom power lines. This ridge would impede water flow and therefore this site is not considered a viable option. On the P734 side, the abutment would be in the exact position of the Eskom power line. On the D2047 side, the road will be at the tip of a very steep hill and would require expropriation of dwellings on either side of the hill.
- Option 3 - The Main Road P734 banks on Option 3 are well defined but are erodible as seen on Google imagery. The D2047 side banks are not so well defined. The waterway has an overgrown island which would impede flow and possibly trap debris under the bridge. To get the abutments out of the main channel, the bridge structure for this alignment is 240 m in length.

The bridge design team received a request by the community to upgrade one (1) culvert at the Mooti River crossing on an existing gravel road linking onto the existing L2598 (the proposed link road) for to the following reasons:

- This road is overtopped during heavy rain and the community cannot cross over the Mooti River, in these weather conditions.
- During overtopping the proposed link road and bridge structure will be inaccessible to the community.
- The community want the existing pipe to be replaced by a larger pipe as part of the White Mfolozi and Link Road contract.
- There will be no temporary deviation of the road to allow for the construction works.
- The construction work will be less than 30 days.

The existing one (1) pipe culvert will be replaced with a three (3) pipe culvert.

Royal HaskoningDHV has been appointed by the KwaZulu-Natal Department of Transport to provide independent Environmental Consulting Services for the proposed project, by conducting a Basic Assessment (BA) Study in terms of the Environmental Impact Assessment (EIA) Regulations of 2014 (GNR 982 of December 2014 as amended in 2017), as promulgated under the National Environmental Management Act (NEMA) (Act No. 107 of 1998).

One (1) perennial river (White Mfolozi River), one (1) seasonal river (Mooti River), eight (8) ephemeral streams and one (1) seep wetland were assessed as being at a high 'likelihood of impact'.

A total of nine (9) protected plant species were identified including seven (7) species of specially protected forbs under Schedule 12 of the Natal Nature Conservation Ordinance, No. 15 of 1974 and two (2) nationally protected trees under Section 15(1) of the National Forest Act. Specially protected forbs include *Aloe marlothii, A. parvibracteata, Ceropegia racemosa* subsp. *setifera, Dietes irioides, Gladiolus* cf. *crassifolius, Ledebouria asperifolia* and *L. zebrina*. In accordance with Section 200, sub-section 5(1) of the Natal Nature Conservation Ordinance, No. 15 of 1974, an Ordinary Permit is required from ***eZemvelo*** KZN Wildlife if provincially protected species listed are to be handled in any manner during construction of the proposed road.

Nationally protected trees include *Sclerocarya birrea subsp. caffra* and *Sideroxylon inerme* and these require a licence from the Department of Agriculture, Forestry and Fisheries (DAFF) if these trees need to be removed during construction.

The link road (Option 1) routing design reveals that a single home will be impacted (28°17'57.55" S; 31°20'44.80" E) to the extent that it will need to be expropriated and re-constructed. The traditional leader will advise the owner of a new location (within the community) where the residence can be rebuilt. Additionally, the KZN Department of Transport has its own protocols that are utilised for physical

displacement scenarios (and economic, in the case of loss of assets / land only). The relocation and compensation method must be applied, ensuring full engagement with the owner and the traditional leader throughout the process. Relocation must take place in the pre-construction phase.

Eight (8) grave sites have been identified within 50 m from the proposed White Mfolozi Bridge and associated link road (L2598) (Option 1). These sites have all been rated as locally significant. They are all protected by provincial heritage legislation and may not be removed or altered. In terms of mitigation the following is suggested:

- It is also important to note that Grave Sites 6, 7 and 8 are situated within the construction servitude of Option 3 and will require a Phase 2 HIA and permitting if this option is pursued.
- Grave Site 1 should have a buffer zone of at least 2 m due to its close proximity to the proposed link road (and existing road trajectory).
- A 10 m buffer must be maintained to remaining graves.
- There is no need for mitigation for the identified Shembe Site of Worship as this site is situated outside of the footprint near Option 3. The site is not threatened by the proposed development. However, it is strongly advised that the developer maintain a buffer zone of 20 m around this locally important site.
- The Early Stone Age Site is rated as having a low significance. However, it is situated on the L2598 approximately 150 m – 200 m from the preferred bridge crossing over the White Mfolozi River. It is strongly advised that a surface collection of all the stone artefacts be made by a heritage consultant or AMAFA prior to any construction activities.
- These artefacts are out of context and of little research value, however, the collection can be used for teaching purposes.
- Interviews with local community members supported the independent point of view of the consultant that the proposed development will not have any major effect on the known heritage resources of the project area. These included, archaeological and historical sites, living heritage sites (including the Shembe Site of Worship), sources of clay for pottery and medicinal purposes, areas used by traditional healers for the harvesting of medicinal herbs, and cultural landscape values. These views were also reflected by two (2) Public Meetings held by the EAP on 5th September 2017.

The desktop Palaeontological investigation confirms that the study area is underlain by relatively deep (>2 m) clay soil associated with the ancient granites and metamorphic rocks of the Natal Metamorphic Belt and the Karoo Supergroup.

The excavations for the construction of the infrastructure cutting into the Swazian aged Stromatolitic dolomite of the Chobeni Formation will undoubtedly expose significant ancient stromatolites that are very important indicators of palaeo-environments. Swazian aged sediments of the Thembeni and Carboniferous to Permian aged rocks of the Dwyka Group will have a moderate likelihood of exposing significant fossils.

Due to the deep weathering it is highly unlikely that any trace and other fossils will be exposed before deep (>1.5 m) excavations into the Chobeni and Thembeni Formations and the Dwyka Group are undertaken.

This BA follows the legislative process prescribed in the Environmental Impact Assessment (EIA) Regulations (2014 as amended in 2017). This report constitutes the draft Consultation Basic Assessment Report (cBAR) which details the environmental outcomes, impacts and residual risks of the proposed activity. The report aims to assess the key environmental issues and impacts associated with the development, and to document Interested and Affected Parties' (I&APs) issues and concerns.

Furthermore, it provides background information of the proposed project, a motivation and details of the proposed project, and describes the public participation undertaken to date.
The objective of this report is to provide the project's I&APs, stakeholders, commenting authorities, and the competent authority (CA), with a thorough project description and BA process description. The outcome being to engender productive comment / input, based on all information generated to date and presented herein.

In order to protect the environment and ensure that the development is undertaken in an environmentally responsible manner, there are a number of significant portions of environmental legislation that were taken into consideration during this study and are elaborated on in this report.

The KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs (KZN EDTEA) is the lead / Competent Authority for this BA process and the development needs to be authorised by this Department.

This draft cBAR provides an assessment of both the benefits and potential negative impacts anticipated as a result of the proposed project. Having duly considered the project, in the Environmental Assessment Practitioner's (EAP's) opinion, the project does not pose a detrimental impact on the receiving environment and it inhabitants and can be mitigated significantly. The Applicant should be bound to stringent conditions to maintain compliance and a responsible execution of the project.

The impacts identified and assessed by way of risk ratings, have been extensively reported herein. The report at hand (i.e. draft cBAR) will now be made available for comment and amended post comment period to form the final Consultation BAR (i.e. final cBAR). The final cBAR report will, together with a comprehensive issues trail, the final draft of the EMPr, and all addenda as referred to, will be submitted to the KZN EDTEA, for decision making. The final BAR report will be a culmination of all the scientific specialist studies' findings, public contribution via formal comment, and the drawing of conclusions by the EAP as the environmental specialist.

The findings conclude that there are potential negative impacts highlighted in the draft cBAR that can be mitigated, provided that the recommended mitigation and management measures contained within the EMPr are implemented. Furthermore, the proposed bridge and link road will serve to benefit the local community who have unanimously expressed support for the project at both Public Meetings and have further expressed concerns at the delays in implementing the proposed bridge.

The project, in the EAP's opinion, does not pose a detrimental impact on the receiving environment and it inhabitants and can be mitigated significantly. Therefore, the EAP recommends the construction of the White Mfolozi Bridge (Option 1 – preferred alternative) and link road (Option 1 – preferred alternative) as well as the replacement of the culvert.

The following recommendations are elaborated on:

- Bridge Crossing Option 1 is recommended as it is the shortest river bridge crossing, avoids Eskom Power Lines, crosses the river at right angles and does not result in large cuts and blasting operations.
- Link Road Option 1 is recommended as this line involves the least impact on Eskom Power lines, does not require any grave relocations and is the safest as it meets the geometric design standards. Whilst Option 1 requires the most clearance of indigenous vegetation, the need to relocate Eskom Power lines and graves for the other options are not favoured and the geometric safety standards are not met for both Option 2 and 3 when the intersect with the existing D2047.

- The replacement of the one (1) culvert on the existing informal road is recommended to a three (3) pipe culvert.

AcronymsAcronyms

ASPT	Average Score Per Taxa
BA	Basic Assessment
BAR	Basic Assessment Report
BGIS	Biodiversity Geographic Information Systems
BID	Background Information Document
BRG	BioResource Group
BSIA	Basic Social Impact Assessment
CA	Competent Authority
CBA	Critical Biodiversity Area
CBAR	Consultation Basic Assessment Report
CCA	Community Conservation Area
CV	Curriculum Vitae
DAFF	Department of Agriculture, Fisheries and Forestry
DoT	Department of Transport
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EDTEA	KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs
EIA	Environmental Impact Assessment
EKZNW	*eZemvelo* KZN Wildlife
EIS	Ecological Importance and Sensitivity
EMPr	Environmental Management Programme
ESA	Ecological Support Area
GA	General Authorisation
GIS	Geographic Information System
GNR	Government Notice Regulation
GVA	Gross Value Added
HGM	Hydrogeomorphic Unit
HIA	Heritage Impact Assessment
HiP	Hluluwe iMfolozi Park
I&AP	Interested and Affected Party
IAP	Alien Invasive Plant
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
ITB	Ingonyama Trust Board
KZN	KwaZulu-Natal
LM	Local Municipality
MSL	Mean Sea Level
MTBE	Methyl Tert-butyl Ether
NDP	National Development Programme
NEMA	National Environmental Management Act (Act No. 107 of 1998)
NEM:AQA	National Environmental Management Air Quality Act (Act No. 39 of 2004)
NEM:BA	National Environmental Management Biodiversity Act (Act No. 10 of 2004)
NEM:PAA	National Environmental Management Protected Areas Act (Act No. 57 of 2003)

NEM:WA	National Environmental Management – Waste Act (Act No. 59 of 2008)
NFA	National Forests Act (Act No. 84 of 1998)
NGO	Non-Governmental Organisation
NHRA	National Heritage Resources Act (Act No. 25 of 1999)
NWA	National Water Act (Act No. 36 of 1998)
OHSA	Occupational Health and Safety Act (Act No 85 of 1993)
PES	Present Ecological State
PIA	Palaeontological Impact Assessment
PPE	Personnel Protective Equipment
PPP	Public Participation Process
PSDF	Provincial Spatial Development Framework
QDGS	Quarter Degree Grid Square
REC	Recommended Ecological Category
RMO	Resource Management Objective
SACNASP	South African Council of Natural Science Professionals
SAHRA	South African Heritage Resource Agency
SANBI	South African National Biodiversity Institute
SASS	South African Scoring System
SCA	Systemic Conservation Assessments
SCP	Systematic Conservation Plan
SWMP	Stormwater Management Plan
ULM	Ulundi Local Municipality
VOC	Volatile Organic Compounds
WUA	Water Use Authorisation
ZDM	Zululand District Municipality

Glossary

Activity (Development)	An action either planned or existing that may result in environmental impacts through pollution or resource use. For the purpose of this report, the terms 'activity' and 'development' are freely interchanged.
Alternatives	Different means of meeting the general purpose and requirements of the activity, which may include site or location alternatives; alternatives to the type of activity being undertaken; the design or layout of the activity; the technology to be used in the activity and the operational aspects of the activity.
Applicant	The project proponent or developer responsible for submitting an environmental application to the relevant environmental authority for environmental authorisation.
Biodiversity	The diversity of animals, plants and other organisms found within and between ecosystems, habitats, and the ecological complexes.
Buffer	A buffer is seen as an area that protects adjacent communities from unfavourable conditions. A buffer is usually an artificially imposed zone included in a management plan.
Construction	The building, erection or establishment of a facility, structure or infrastructure that is necessary for the undertaking of a listed or specified activity but excludes any modification, alteration or expansion of such a facility, structure or infrastructure and excluding the reconstruction of the same facility in the same location, with the same capacity and footprint.
Cumulative Impact	The impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.
Decommissioning	The demolition of a building, facility, structure or infrastructure.
Direct Impact	Impacts that are caused directly by the activity and generally occur at the same time and at the same place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally quantifiable.
Ecological Reserve	The water that is necessary to protect the water ecosystems of the water resource. It must be safeguarded and not used for other purposes. The Ecological Reserve specifies both the quantity and quality of water that must be left in the national water resource. The Ecological Reserve is determined for all major water resources in the different water management areas to ensure sustainable development.
Ecosystem	A dynamic system of plant, animal (including humans) and micro-organism communities and their non-living physical environment interacting as a functional unit. The basic structural unit of the biosphere, ecosystems are characterised by interdependent interaction between the component species and their physical surroundings. Each ecosystem occupies a space in which macro-scale conditions and interactions are relatively homogenous.
Environment	In terms of the National Environmental Management Act (NEMA) (Act No 107 of 1998) (as amended), "Environment" means the surroundings within which humans exist and that are made up of: i. the land, water and atmosphere of the earth; ii. micro-organisms, plants and animal life; iii. any part or combination of (i) and (ii), and the interrelationships among and between them; and iv. the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing.
Environmental Assessment	The generic term for all forms of environmental assessment for projects, plans, programmes or policies and includes methodologies or tools such as environmental impact assessments, strategic environmental assessments and risk assessments.
Environmental	An authorisation issued by the competent authority in respect of a listed activity,

Authorisation	or an activity which takes place within a sensitive environment.
Environmental Assessment Practitioner (EAP)	The individual responsible for planning, management and coordination of environmental impact assessments, strategic environmental assessments, environmental management programmes or any other appropriate environmental instrument introduced through the EIA Regulations.
Environmental Control Officer (ECO)	An individual nominated through the Client to be present on site to act on behalf of the Client in matters concerning the implementation and day to day monitoring of the EMPr and conditions stipulated by the authorities.
Environmental Impact	Change to the environment (biophysical, social and/ or economic), whether adverse or beneficial, wholly or partially, resulting from an organisation's activities, products or services.
Environmental Impact Assessment (EIA)	In relation to an application to which scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application as defined in NEMA.
Environmental Issue	A concern raised by a stakeholder, interested or affected parties about an existing or perceived environmental impact of an activity.
Environmental Management	Ensuring that environmental concerns are included in all stages of development, so that development is sustainable and does not exceed the carrying capacity of the environment.
Environmental Management Programme (EMPr)	A detailed plan of action prepared to ensure that recommendations for enhancing or ensuring positive impacts and limiting or preventing negative environmental impacts are implemented during the life cycle of a project. This EMPr focuses on the construction phase, operation (maintenance) phase and decommissioning phase of the proposed project.
Fatal Flaw	An event or condition that could cause an unanticipated problem and/or conflict which will could result in a development being rejected or stopped.
Groundwater	Water in the ground that is in the zone of saturation from which wells, springs, and groundwater runoff are supplied.
Hazardous Waste	Any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment and includes hazardous substances, materials or objects within business waste, residue deposits and residue stockpiles as outlined in the National Environmental Management: Waste Amendment Act (No 26 of 2014).Schedule 3: Category A – Hazardous Waste.
Hydrology	The science encompassing the behaviour of water as it occurs in the atmosphere, on the surface of the ground, and underground.
Indirect Impacts	Indirect or induced changes that may occur as a result of the activity. These types if impacts include all of the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity
Integrated Environmental Management	A philosophy that prescribes a code of practice for ensuring that environmental considerations are fully integrated into all stages of the development and decision-making process. The IEM philosophy (and principles) is interpreted as applying to the planning, assessment, implementation and management of any proposal (project, plan, programme or policy) or activity - at local, national and international level – that has a potentially significant effect on the environment. Implementation of this philosophy relies on the selection and application of appropriate tools for a particular proposal or activity. These may include environmental assessment tools (such as strategic environmental assessment and risk assessment), environmental management tools (such as monitoring, auditing and reporting) and decision-making tools (such as multi-criteria decision support systems or advisory councils).
Interested and Affected Party (I&AP)	Any person, group of persons or organisation interested in or affected by an activity; and any organ of state that may have jurisdiction over any aspect of the activity.
Method Statement	A method statement is a written submission by the Contractor to the Engineer in

	response to the specification or a request by the Engineer, setting out the plant, materials, labour and method the Contractor proposes using to carry out an activity, identified by the relevant specification or the Engineer when requesting a Method Statement. It contains sufficient detail to enable the Engineer to assess whether the Contractor's proposal is in accordance with the Specifications and/or will produce results in accordance with the Specifications.
Mitigate	The implementation of practical measures designed to avoid, reduce or remedy adverse impacts or enhance beneficial impacts of an action.
No-Go Option	In this instance the proposed activity would not take place, and the resulting environmental effects from taking no action are compared with the effects of permitting the proposed activity to go forward.
Pollution	The National Environmental Management Act, No. 107 of 1998 defines pollution to mean any change in the environment caused by – substances; radioactive or other waves; or noise, odours, dust or heat emitted from any activity, including the storage or treatment of waste or substances, construction and the provision of services, whether engaged in by any person or an organ of state, where that change has an adverse effect on human health or well-being or on the composition, resilience and productivity of natural or managed ecosystems, or on materials useful to people, or will have such an effect in the future.
Public Participation Process	A process in which potential interested and affected parties are given an opportunity to comment on, or raise issues relevant to, specific matters.
Re-use	To utilise articles from the waste stream again for a similar or a different purpose without changing the form of properties of the articles.
Rehabilitation	A measure aimed at reinstating an ecosystem to its original function and state (or as close as possible to its original function and state) following activities that have disrupted those functions.
Sensitive Environments	Any environment identified as being sensitive to the impacts of the development.
Significance	Significance can be differentiated into impact magnitude and impact significance. Impact magnitude is the measurable change (i.e. magnitude, intensity, duration and likelihood). Impact significance is the value placed on the change by different affected parties (i.e. level of significance and acceptability). It is an anthropocentric concept, which makes use of value judgements and science-based criteria (i.e. biophysical, social and economic).
Stakeholder Engagement	The process of engagement between stakeholders (the proponent, authorities and I&APs) during the planning, assessment, implementation and/or management of proposals or activities.
Sustainable Development	Development which meets the needs of current generations without hindering future generations from meeting their own needs.
Visual Contrast	The degree to which the development would be congruent with the surrounding environment. It is based on whether or not the development would conform with the land use, settlement density, forms and patterns of elements that define the structure of the surrounding landscape.
Watercourse	Defined as: i. a river or spring; ii. a natural channel or depression in which water flows regularly or intermittently; iii. a wetland, lake or dam into which, or from which, water flows; and iv. any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse as defined in the National Water Act, 1998 (Act No. 36 of 1998) and a reference to a watercourse includes, where relevant, its bed and banks.
Water Pollution	The National Water Act, 36 of 1998 defined water pollution to be the direct or indirect alteration of the physical, chemical or biological properties of a water resource so as to make it – less fit for any beneficial purpose for which it may reasonably be expected to be used; or harmful or potentially harmful (aa) to the

	welfare, health or safety of human beings; (bb) to any aquatic or non-aquatic organisms; (cc) to the resource quality; or (dd) to property".
Wetland	Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.

1 INTRODUCTION

Royal HaskoningDHV was appointed by the Province of KwaZulu-Natal: Department of Transport (hereafter referred to as KZN DoT) to undertake the following;

- engineering studies;
- preliminary design;
- environmental studies[1];
- detailed design, and;
- construction supervision.

of a new river crossing over the White Mfolozi River and linking up to an existing road i.e. the L2598.

The proposed bridge crossing is located approximately 12 km west of the town of Ulundi within the Ulundi Local Municipality, KwaZulu-Natal (**Figure 1**). The proposed bridge and link road infrastructure will serve to link the KwaMphothi and Mabedlana communities situated east of the White Mfolozi River to the KwaMbambo community situated west of the White Mfolozi River (**Figure 2**). The study area can be accessed off the Main Road P734 from Ngoma on the eastern side of District Road D2047 via the P47-3 from Melmoth on the western side.

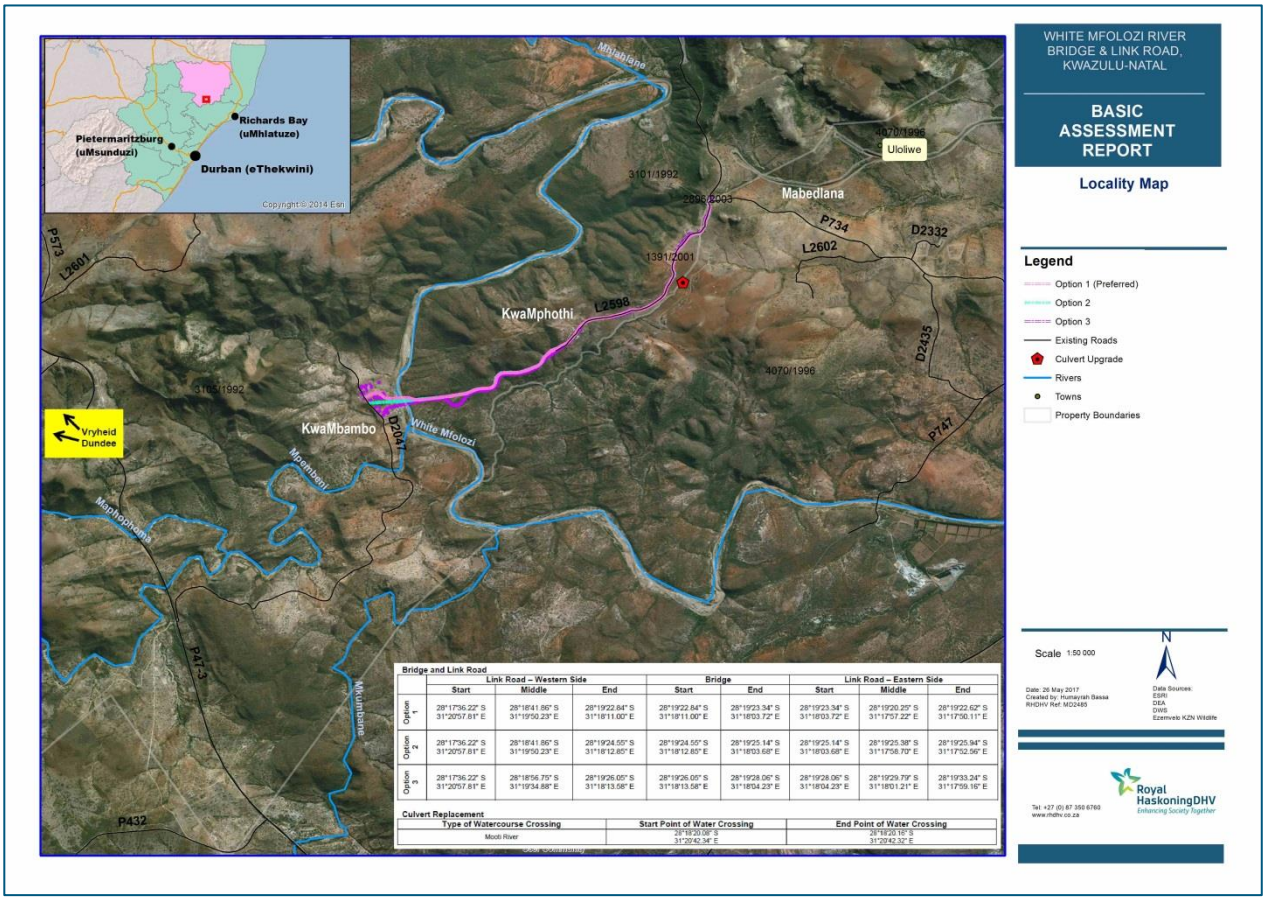

Figure 1: Locality map

[1] *As the Environmental Assessment Practitioner (EAP) is from the same company as the Engineering Team, an independent peer review has been undertaken by Dr R Kinvig for this project.*

Figure 2: Locality map of affected areas and Traditional Authorities

The affected communities and the Traditional Authorities that have jurisdiction over the area are illustrated in **Figure 2** and summarised as follows:

- Mbatha and Mpungose Traditional Authority which has jurisdiction of the KwaMphothi and Mabedlana areas east of the White Mfolozi River; and
- Nombamba / Usuthu Traditional Authority which has jurisdiction of the KwaMbambo (Sgodiphola) area west of the White Mfolozi River.

1.1 Project Details

1.1.1 Bridge and Link Road

Originally the site had been earmarked for a pedestrian bridge; however, the KZN DoT Bridge Office and the district engineer, Ingerop, in liaison with representatives of the local community requested that the proposal is upgraded to a vehicular bridge to fully address the community's mobility requirements. Currently the local residents in the KwaMbambo and Sgodiphola area along the White Mfolozi River utilise the D2047 which links to the P47-3 then P52 in order to travel to Ulundi which is a travel distance of more than 40 km. The proposed construction of the new river bridge and the upgrading of the L2598 link road will reduce their travelling distance by more than half, to approximately 15 km. Presently at the site there is a disused track only trafficable by 4x4 vehicles and there is no crossing structure over the White Mfolozi River at this site.

The proposed link road is currently a Class 4 Gravel Rural Collector Road with a 20 m road reserve. It is proposed to re-declare the whole route from P47-3 through to P734 as District Road D2047. This will include the existing L2598 in the re-declaration. The cross section for this class of road according to KZN DoT standards (as per SD210 Type 6) is a 6 m road carriageway on a 7 m wide pavement, comprising two 3 m lanes and two 0.45 m shoulders.

The proposed bridge must have a carriageway width commensurate with the approach road i.e. two 3 m wide lanes with 0.5 m wide shoulders on either side (these edge details for the kerb and channel at the bridge are in accordance with the KZN DoT design standard (2016) details. This configuration results in a total of 7 m carriageway. For a design speed of 60 km/hr (over a 180 m long bridge), a 1.5 m wide raised pedestrian sidewalk is required on the upstream side. This provides an overall surfaced road width of 8.5 m inclusive of the 1.5 m sidewalk at the bridge and is a proposed Class 4 bridge cross-section.

1.1.2 Culvert Upgrading

The bridge design team received a request by the community to upgrade one (1) culvert at the Mooti River crossing on an existing gravel road linking onto the existing L2598 (the proposed link road) due to the following reasons:

- This road overtops during heavy rain and the community cannot utilise this access.
- The over-topping will make the proposed link road and bridge structure inaccessible to the community during heavy rains.
- The community want the existing pipe to be replaced by a larger pipe as part of the White Mfolozi and Link Road contract.
- There will be no temporary deviation of the road to allow for the construction works.
- The construction work will be less than 30 days.

It is proposed that this culvert replacement be included as part of this Basic Assessment study for the White Mfolozi Bridge and L2598 link road. The location of the culvert in relation to the proposed bridge and link road is illustrated in **Figure 3**. It is evident from the image in Figure 3, that the Culvert is being

scoured away, which poses a threat to road users and is having a detrimental effect on the ater resources as it is contributing sediment into the system.

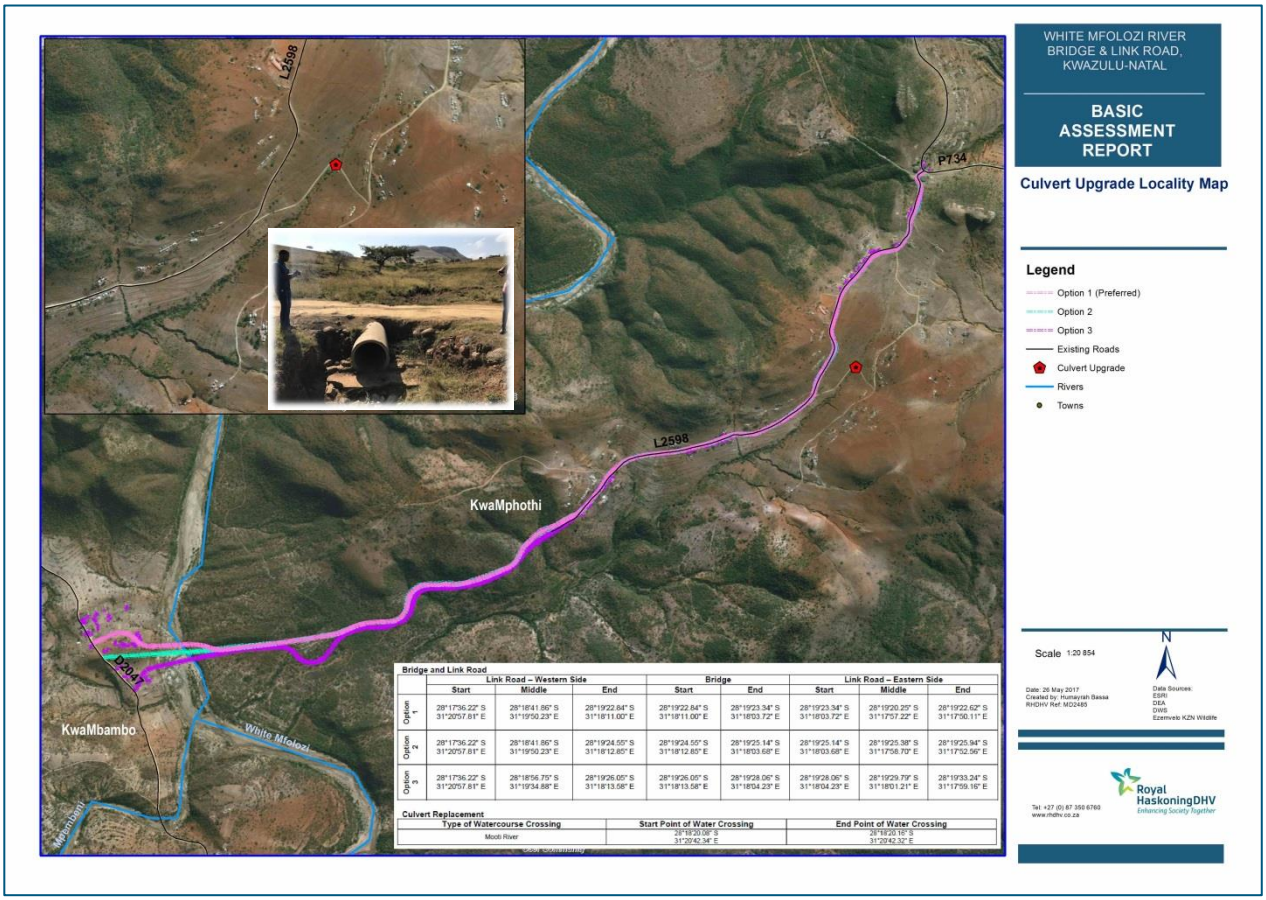

Figure 3: Culvert location in relation to the proposed bridge and link road

1.2 Approach to the Study

1.2.1 Pre-application Consultation

A pre-application meeting and site visit was held with the Competent Authority (CA), the KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs (KZN EDTEA) on the 8th June 2017. Minutes of the meeting as well as confirmation to upgrade one (1) culvert on an existing gravel road linking onto the existing L2598 (the proposed link road) can be subject to one (1) combined application for Environmental Authorisation (EA) is included at ***Appendix A***.

1.2.2 Basic Assessment Study

A Basic Assessment (BA) is the level of environmental assessment applied to activities listed in Listing Notices 1 and 3. A BA is applied to activities that are considered less likely to have significant environmental impacts and, therefore, unlikely to require a detailed Environmental Impact Assessment (EIA). The Consultation BA Report (cBAR) is a more concise analysis of the environmental impacts of the proposed activity / development than a Scoping and EIA Report.

The BA aims to achieve the following:

- Determine the policy and legislative context within which the proposed activity is undertaken and how the activity complies with and responds to the policy and legislative context;
- Describe the need and desirability of the proposed project;
- Identify the alternatives considered, including the activity, location, and technology alternatives;
- Undertake an impact and risk assessment process inclusive of reasonably foreseeable cumulative impacts (where applicable). The focus being; determining the geographical, physical, biological, social, economic, heritage and cultural sensitivity of the project and the risk of impact of the proposed activity on the these aspects to determine the nature, significance, consequence, extent, duration, and probability of the impacts occurring to; and the degree to which these impacts:
  - can be reversed;
  - may cause irreplaceable loss of resources; and
  - can be avoided, managed or mitigated.

This cBAR has been compiled in accordance with the stipulated requirements in **GNR 982 Appendix 1** of the EIA Regulations (2014 as amended in 2017), which outlines the legislative BA process and requirements for assessment of outcomes, impacts and residual risks of the proposed development. The cBAR further incorporates the findings and recommendations of the specialist studies conducted for the project.

An Environmental Management Programme (EMPr) (***Appendix B***) has been compiled according to **Appendix 4 of GNR 982** of the EIA Regulations (2014 as amended in 2017) for the construction and rehabilitation phases of the project. The EMPr has been compiled as a stand-alone document from the cBAR and will be submitted to the KZN EDTEA along with the cBAR. The EMPr provides the actions for the management of identified environmental impacts emanating from the project and a detailed outline of the implementation programme to minimise and / or eliminate any anticipated negative environmental impacts and to enhance positive impacts. The EMPr provides strategies to be used to address the roles and responsibilities of environmental management personnel on site, and a framework for environmental compliance and monitoring.

1.3 Structure of the Consultation Basic Assessment Report (cBAR)

The cBAR is structured as follows (**Table 1**):

Table 1: Structure of the BA report

Chapter	Description
1	**Introduction** – Provides the background to the project as well as details of the specialist studies conducted and contact details for the project proponent and EAP
2	**Environmental Legislative Context** – Details the pertinent environmental legislation and the applicability to the project
3	**Project Description** – Provides the site locality, property details and project description
4	**Project Need and Desirability** – Provides a motivation for the project and the associated need and desirability
5	**Project Alternatives** – Describes the alternatives considered, including the 'no-go' option
6	**Description of the Baseline Environment** – Describes the pre-development context of the site

Chapter	Description
7	**Public Participation Process** – Explains the public consultation undertaken
8	**Specialist Assessments** – Describes the impact assessment and findings of the specialist studies
9	**Impact Assessment** – Details the impact assessment methodology and quantifies the impacts anticipated
10	**Environmental Impact Statement** – Provides the EAP opinion and summarises the impact assessment and outlines conclusions and recommendations

1.4 Specialist Assessment

To ensure the scientific rigour of the BA study, as well as a robust assessment of impacts, Royal HaskoningDHV commissioned a suite of specialist studies in order to comprehensively identify both potentially positive and negative environmental impacts (social and biophysical), associated with the project, and where possible to provide mitigation measures to reduce the potentially negative impacts and enhance the positive impacts (**Table 2**). The specialist studies can be found in ***Appendix C***.

Table 2: Specialist assessments conducted for the project

Specialist Study	Organisation	Appendix
Geotechnical Investigation	Davies Lynn and Partners	***Appendix C6***
Agricultural Potential Assessment (Baseline)	Msanzi Agriculture	***Appendix C5***
Freshwater Habitat Impact Assessment	Eco-Pulse Environmental Consulting Services	***Appendix C1***
Terrestrial Habitat Impact Assessment	Eco-Pulse Environmental Consulting Services	***Appendix C2***
Social Baseline Assessment	Royal HaskoningDHV (Peer Review – Hilda Bezuidenhout)	***Appendix C4***
Heritage Impact Assessment	Active Heritage cc	***Appendix C3***
Desktop Palaeontology Assessment	Dr Gideon Groenewald	***Appendix C3***

1.4.1 Peer Review

In addition to the above, the EIA Regulations (2014 as amended in 2017) requires the Environmental Assessment Practitioner (EAP) to be independent, objective and have expertise in conducting EIA's. Such expertise should include knowledge of all relevant legislation and of any guidelines that have relevance to the proposed activity. To ensure a lack of bias and to ensure transparency an external technical peer review has been undertaken prior to the public review during the formal BA process. This peer review has been conducted by Dr. Richard Kinvig (*Pr.Sci.Nat.)* of Kinvig & Associates Environmental Consultants.

1.5 Details of the Project Developer

The Developer is the KZN DoT and the details of the responsible person are listed in

Table 3 below.

Table 3: Applicant details

Applicant	KwaZulu-Natal Department of Transport
Representative	Ms Khumbu Sibiya
Physical Address	172 Burger Street, Pietermaritzburg, 3200
Postal Address	Private Bag X9043, Pietermaritzburg, 3200
Telephone	033 355 0594
Facsimile	033 345 7537
E-mail	Khumbu.Sibiya@kzntransport.gov.za

1.6 Details of the Environmental Assessment Practitioner

The environmental team of Royal HaskoningDHV have been appointed as an independent Environmental Assessment Practitioner (EAP) by the KZN DoT to undertake the appropriate environmental studies for this proposed project (**Table 4**).

The professional team of Royal HaskoningDHV has considerable experience in the environmental management field. Royal HaskoningDHV been involved in and / or managed several of the largest EIAs undertaken in South Africa to date. A specialist area of focus is on the assessment of multi-faceted projects, including the establishment of linear developments (national and provincial roads, and power lines), mixed-use developments, bulk infrastructure and supply (e.g. wastewater treatment works, pipelines, landfills), electricity generation and transmission, urban, rural and township developments, environmental aspects of Local Integrated Development Plans, as well as general environmental planning, development and management.

Table 4: EAP details

Consultant	Royal HaskoningDHV	Royal HaskoningDHV	Royal HaskoningDHV
Contact Persons	Humayrah Bassa (EAP)	Prashika Reddy	Clive Zwane (PPP Consultant)
Postal Address	PO Box 1243 Umhlanga Rocks 4320	PO Box 25302 Monument Park 0105	PO Box 1243 Umhlanga Rocks 4320
Telephone	087 350 6760	012 367 5973	087 350 6783
E-mail	humayrah.bassa@rhdhv.com	prashika.reddy@rhdhv.com	clive.zwane@rhdhv.co
Qualification	MSc Environmental Science	BSc (Hons) Geography	BA (Hons) Geography and Environmental Management
Expertise	Humayrah Bassa is an Associate with 7 years' experience in various facets of environmental management. These include	Prashika Reddy is a Principal Associate with 15 years' experience in various environmental fields including: EIAs, EMPrs,	Clive is an Environmental Consultant at Royal HaskoningDHV with 4 years' experience as an ECO and Public

Consultant	Royal HaskoningDHV	Royal HaskoningDHV	Royal HaskoningDHV
	conducting environmental impact assessments and the public participation process (PPP); compiling environmental impact reports; developing environmental management programmes; compiling water use licence applications; conducting environmental control officer duties; and conducting legal compliance audits. She is a Professional Natural Scientist (400032/15) with the South African Council for Natural Scientific Professions.	PPP and environmental monitoring and audits. She is/has been part of numerous multi-faceted large-scale projects, including the establishment of linear developments (roads and power lines), industrial plants, electricity generation plants, mixed-use developments and mining projects. She is a Professional Natural Scientist (400133/10) with the South African Council for Natural Scientific Professions.	Participation consultant.

The Environmental Management and Planning Knowledge Group Profile for Royal HaskoningDHV and the Curriculum Vitae (CV) of the respective consultants can be found in ***Appendix D***.

2 ENVIRONMENTAL LEGISLATIVE CONTEXT

In order to protect the environment and ensure that the development is undertaken in an environmentally responsible manner, there are a number of significant pieces of environmental legislation that need to be considered during this study.

This section outlines the legislation that is applicable to the proposed project and has been considered in the preparation of this report.

Table 5: Key legislation considered

Acts	Objectives, important aspects, associated notices and regulations
National Environmental Management Act, 1998 (Act No. 107 of 1998) as amended	***Objectives:*** To provide for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by organs of state. ***Relevant Notices and Regulations:*** • Environmental Impact Assessment Regulations, 2014 (GNR 982 in GG 38282 of 4 December 2014 as amended in GNR 326 of 2017) • Listing Notice 1 (GNR 983 in GG 38282 of 4 December 2014 as amended in GNR 327 of 2017) • Listing Notice 2 (GNR 984 in GG 38282 of 4 December 2014 as amended in GNR 325 of 2017) • Listing Notice 3 (GNR 985 in GG 38282 of 4 December 2014 as amended in GNR 324 of 2017) ***Relevance to the proposed project:*** • Development must be socially, environmentally and economically sustainable. • Environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated; the social, economic and environmental impacts of activities including disadvantages and benefits, must be considered, assessed and evaluated and decisions must be appropriate in the light of such consideration. • 'Polluter Pays' principle. • Any activity that is proposed and which is listed in the NEMA EIA Regulations, requires environmental authorisation.

Acts	Objectives, important aspects, associated notices and regulations
	Listed Activity/ies & Applicability: **Listing Notice 1** **Activity 12 - The development of (ii) infrastructure or structures with a physical footprint of 100 m^2 or more where such development occurs (a) within a watercourse.** *This activity is applicable for the construction of a bridge over the White Mfolozi River as well as for the replacement of the culvert over the Mooti River on an adjacent road and the construction / replacement of culverts over wetlands and / or streams for the establishment / upgrade of the link road. These structures will be greater than 100 m^2 and will be constructed within watercourses.* **Activity 19 - The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse.** *This activity is applicable for the infilling and / or removal of more than 10 m^3 of material from watercourses for the construction of a bridge over the White Mfolozi River as well as for the replacement of the culvert over the Mooti River on an adjacent road and the construction / replacement of culverts over wetland and / or streams for the establishment / upgrade of the link road.* **Activity 24(ii) - The development of a road with a reserve wider than 13.5 m or where no road reserve exists where the road is wider than 8 m.** *This activity is applicable for the construction of the link road where no road presently exists (km 3.6 to km 6.9). The road reserve will be wider than 13.5 m (i.e. 20 m).* **Listing Notice 3** **Activity 12 - The clearance of an area of 300 m^2 or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan (d) KwaZulu-Natal in (v) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans and (viii)**

Acts	Objectives, important aspects, associated notices and regulations
	A protected area identified in terms of NEMPAA, excluding conservancies. *The bridge and link road crosses Critical Biodiversity and Ecological Support Areas. The proposed project is located:* - *approximately 2 km from the eMakhosini Heritage Park (Protected Area by EKZNW and AMAFA);* - *approximately 39 m from the Matshitsholo Community Conservation Area and* - *approximately 2 km from the Northern Interior Corridor Biodiversity Sector Plan.* *The construction of the link road and construction servitude for the bridge will involve the clearance of more than 300 m^2 of indigenous vegetation within a CBA and within 5 km to the eMakhosini Heritage Park.* **Activity 14 - The development of (ii) infrastructure or structures with a physical footprint of 10 m^2 or more; where such development occurs (a) within a watercourse; in (d) KwaZulu-Natal in (vii) Critical biodiversity areas or ecological support areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans and / or (x) Outside urban areas in (aa) Areas within 10 km from national parks or world heritage sites or 5 km from any terrestrial protected area identified in terms of NEMPAA or from the core area of a biosphere reserve.** *This activity is applicable for the construction of a bridge over the White Mfolozi River as well as for the replacement of the culvert over the Mooti River on an adjacent road and the construction of culverts over wetland and / or streams for the establishment/upgrade of the link road. These structures will be greater than 10 m^2 and will occur within watercourses which are within CBAs, ESAs and / or within 5 km to the eMakhosini Heritage Park (a protected area) in KwaZulu-Natal.* **Activity 23 - The expansion of (ii) infrastructure or structures where the physical footprint is expanded by 10 square metres or more; where such expansion occurs (a) within a watercourse; in (d) KwaZulu-Natal, (x) outside urban areas in (aa) areas within 10 km from national parks or world heritage sites of 5 km from any terrestrial protected area identified in terms of NEMPAA or from the core area of a biosphere reserve.** *This activity is applicable for the replacement of existing culverts along the existing L2598 which occurs within 5 km to the Protected Area (eMakhosini Heritage Park) in KwaZulu-Natal.*
National Water Act (Act No. 36 of 1998) (as amended)	***Objectives:*** The National Water Act (NWA) is a legal framework for the effective and sustainable management of water

Acts	Objectives, important aspects, associated notices and regulations
	resources in South Africa. Central to the NWA is recognition that water is a scarce resource in the country which belongs to all the people of South Africa and needs to be managed in a sustainable manner to benefit all members of society. The NWA places a strong emphasis on the protection of water resources in South Africa, especially against its exploitation, and the insurance that there is water for social and economic development in the country for present and future generations. ***Relevance to the proposed project:*** • Sustainable protection, use, development and conservation of water resources – including aquatic ecosystems. • Defines 11 water uses and provides licencing procedures. ***Notices and Regulations:*** • General Authorisation in terms of Section 39 of the National Water Act (Act No. 36 of 1998, Water Uses Section 21 (a) and (b) (GN in GG 40243 of 02 September 2016). • General Authorisation in terms of Section 39 of the National Water Act (Act No. 36 of 1998, Water Uses Section 21 (c) and (i) (GN in GG 40229 of 26 August 2016). ***Water uses triggered:*** **As the proposed development involves the crossing of 9 river / stream units and 1 wetland unit, a Water Use Authorisation is required in terms of Section 21 (c) and (i) of the NWA:** • **Section 21 (a) – *taking water from a water resource* (applicable for water for construction purposes);** • **Section 21 (c) - *impeding or diverting the flow of water in a watercourse* (applicable for the construction within watercourses); and** • **Section 21 (i) - *altering the bed, banks, course or characteristics of a watercourse* (applicable for the construction within watercourses).**
National Forests Act (Act No. 84 of 1998)	***Purposes:*** The purposes of this Act are to: promote the sustainable management and development of forests for the benefit of all; create the conditions necessary to restructure forestry in State forests; provide special

Acts	Objectives, important aspects, associated notices and regulations
	measures for the protection of certain forests and trees; promote the sustainable use of forests for environmental, economic, educational, recreational, cultural, health and spiritual purposes. ***Notices and Regulations:*** In terms of the NFA and Government Notice 1339 of 6 August 1976 (promulgated under the Forest Act, 1984 (Act No. 122 of 1984) for protected tree species, the removal, relocation or pruning of any protected plants will require a licence. ***Relevance to the proposed project:*** • *The Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that: 'no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister'.* ***Permitting requirements:*** • **Two protected trees: *Sclerocarya birrea subsp. caffra* and *Sideroxylon inerme* were found in the study area. A licence will have to be obtained from the Department of Agriculture, Forestry and Fisheries. (DAFF) for the rescue and relocation of species potentially impacted during construction.**

2.1 Other Relevant Acts, Guidelines, Department Policies and Environmental Management Instruments

Acts/Guideline/Policies/Environmental Management Instruments	Considerations
The Constitution (No. 108 of 1996)	Chapter 2 – Bill of Right Section 24 – Environmental Rights
KZN Nature Conservation Ordinance (Ordinance No. 15 of 1974)	Protected indigenous plants in general are controlled under the relevant provincial Ordinances or Acts dealing with nature conservation. In KwaZulu-Natal the relevant statute is the 1974 Provincial Nature Conservation Ordinance. In terms of this Ordinance, a permit must be obtained from *eZemvelo* KZN Wildlife to remove or destroy any plants listed in the Ordinance. **A permit must be obtained from *eZemvelo* KZN Wildlife for the relocation of seven (7) species of specially protected plants (protected under Schedule 12) *Aloe marlothii, A. parvibracteata, Ceropegia racemosa* subsp. *setifera, Dietes iridoides, Gladiolus* cf. *crassifolius, Ledebouria asperifolia* and *L. zebrina*.**
National Environmental Management Biodiversity Act (Act No. 10 of 2004) and Regulations: • Threatened or protected species (GN 388) • Lists of species that are threatened or protected (GN 389) • Alien and invasive species regulations (GNR 506) • Publication of exempted alien species (GNR 509) • Publication of National list of invasive species (GNR 507) • Publication of prohibited alien species (GNR 508)	Provide for the protection of species and ecosystems that warrant national protection and the sustainable use of indigenous biological resources.
National Environmental Management: Protected Areas Act (Act No. 57 of 2003) - NEMPAA	Creates a legal framework and management system for all protected areas in South Africa as well as establishing the South African National Parks (SANParks) as a statutory board. Each conservation area will have its own set of land use restrictions or regulations that stem either from generic restrictions under NEM:PAA, or customized regulations for individual protected areas.
National Environmental Management: Waste Act (Act No. 59 of 2008)	Section 17 - Every attempt must be made to reduce, recycle or re-use all waste before it is disposed.

Acts/Guideline/Policies/Environmental Management Instruments	Considerations
	Section 25 - All waste (general and hazardous) generated during construction may only be disposed of at appropriately licenced waste disposal sites.
National Environmental Management: Air Quality Act (Act No 39 of 2004)	Section 32 - Control of dust. Section 34 - Control of noise. Section 35 - Control of offensive odours.
Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)	Section 22 - Application for a mining permit / right. Section 39 - Environmental management programme and environmental management plan.
National Heritage Resources Act (Act No. 25 of 1999)	Section 34 – 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 relevant provincial heritage resources authority. Section 35 – No person may, without a permit issued by the responsible heritage resources authority destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site. Section 36 – No person may, without a permit issued by the South African Heritage Resource Agency (SAHRA) or a provincial heritage resources authority destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority. “Grave” is widely defined in the Act to include the contents, headstone or other marker of such a place, and any other structure on or associated with such place. **Eight grave sites were located within 50 m of the link road alternative 1 (preferred option). As the area is rich in archaeological sites, construction work may expose artefacts**
Occupational Health and Safety Act (Act No. 85 of 1993)	Section 8 - General duties of employers to their employees. Section 9 - General duties of employers and self-employed persons to persons other than their employees.
Construction Regulations (2014)	Contractors must comply with the Construction Regulations which lay out the framework for construction related activities.
By-laws	
National Development Plan 2030 KwaZulu-Natal Department of Transport’s Strategic Plan 2015/2015 – 2019/2020 Zululand District Municipality IDP Review (2016 – 2017)	

Acts/Guideline/Policies/Environmental Management Instruments	Considerations
Ulundi Local Municipality Spatial Development Framework (SDF) (2016) Ulundi Local Municipality IDP - 2016 Ulundi Local Municipality, IDP Main Document - 18 April 2016-2017 Ulundi Local Municipality, Annexure 3. Provincial Service Delivery Plan, 2016- 2017 Ulundi Local Municipality, Annexure 5. Ward Based Community Needs, 2016 -2017	

2.2 Sustainable Development

The principle of Sustainable Development has been established in the Constitution of the Republic of South Africa (Act No. 108 of 1996) and given effect by NEMA. Section 1(29) of NEMA states that sustainable development means the integration of social, economic and environmental factors into the planning, implementation and decision-making process so as to ensure that development serves present and future generations.

Therefore, Sustainable Development requires that:

- The disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied;
- That pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied;
- The disturbance of landscapes and sites that constitute the nation's cultural heritage is avoided, or where it cannot be altogether avoided, is minimised and remedied;
- Waste is avoided, or where it cannot be altogether avoided, minimised and re-used or recycled where possible and otherwise disposed of in a responsible manner;
- A risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions; and
- Negative impacts on the environment and on people's environmental rights be anticipated; and, prevented and where they cannot altogether be prevented, are minimised and remedied.

2.3 Climate Change Consideration

The proposed project will take into account energy efficient technologies and consider international best practice in terms of the construction methodologies and management of finite resources.

Since climate change concerns include unpredictability and severity in weather patterns, the provision of basic human needs, such as road infrastructure, is considered critical.

3 PROJECT DESCRIPTION

3.1 Property Details

The proposed activity is situated within two (2) wards, namely, Wards 17 and 23 of the Ulundi Local Municipality, within the Zululand District Municipality. The land is owned by the Ingonyama Trust Board (ITB). The property details are provided in **Table 6** below.

Table 6: Property details

21 Digit Reference	Portion Number, Farm Number, Farm Name
N0GU00000001584000008	Portion 8 of Farm 15840, Reserve No 220
N0GU00000001584000017	Remainder of 17 of Farm 15840, Reserve No 220
N0GU00000001584000051	Portion 51 of Farm 15840, Reserve No 220
N0GU00000001584000107	Portion 107 of Farm 15840, Reserve No 220
N0GU00000001650500000	Remainder of Farm 16505, Nobamba

3.2 Co-ordinates[2]

3.2.1 Bridge and Link Road

Table 7: Co-ordinates of the proposed bridge and link road

	Link Road – Western Side			Bridge		Link Road – Eastern Side		
	Start	Middle	End	Start	End	Start	Middle	End
Option 1	28°17'36.22" S 31°20'57.81" E	28°18'41.86" S 31°19'50.23" E	28°19'22.84" S 31°18'11.00" E	28°19'22.84" S 31°18'11.00" E	28°19'23.34" S 31°18'03.72" E	28°19'23.34" S 31°18'03.72" E	28°19'20.25" S 31°17'57.22" E	28°19'22.62" S 31°17'50.11" E
Option 2	28°17'36.22" S 31°20'57.81" E	28°18'41.86" S 31°19'50.23" E	28°19'24.55" S 31°18'12.85" E	28°19'24.55" S 31°18'12.85" E	28°19'25.14" S 31°18'03.68" E	28°19'25.14" S 31°18'03.68" E	28°19'25.38" S 31°17'58.70" E	28°19'25.94" S 31°17'52.56" E
Option 3	28°17'36.22" S 31°20'57.81" E	28°18'56.75" S 31°19'34.88" E	28°19'26.05" S 31°18'13.58" E	28°19'26.05" S 31°18'13.58" E	28°19'28.06" S 31°18'04.23" E	28°19'28.06" S 31°18'04.23" E	28°19'29.79" S 31°18'01.21" E	28°19'33.24" S 31°17'59.16" E

3.2.2 Culvert

Table 8: Co-ordinates of the culvert to be replaced

Type of Watercourse Crossing	Start Point of Water Crossing	End Point of Water Crossing
Mooti River	28°18'20.08" S 31°20'42.34" E	28°18'20.16" S 31°20'42.32" E

[2] *Co-ordinates for every 250 m per alternative option proposed are included in Appendix H.*

3.3 Bridge Description

3.3.1 Hydrology

The catchment area of the White Mfolozi at the site is 3 397 km² with a river length of 183 km. Deterministic; Empirical and Statistical methods using the *Upflood Sinotech* software were used to determine the flood peaks. The statistical analysis was based on flow data at gauge station W2H005 located about 10 km downstream at Overvloed for the period 1960 to 2016.

Results for the various methods used are presented in **Table 9**.

Table 9: Hydrology summary

Flood Return Period (years)	Rational	Alternative Rational Method	Unit Hydrograph Method	Standard Design Flood method (SDF)	Empirical method developed by Midgley and Pitman	Statistical Analysis	Flood Peaks adopted for Design
1:2	546	691	220	236		390	236
1:5	791	983	361	830			830
1:10	1060	1243	526	1381	830	1053	1381
1:20	1381	1529	737	2005	1129	1443	2005
1:50	1890	1942	1120	2935	1577	2095	2935
1:100	2443	2331	1561	3718	1992	2715	3718
1:200		2651		4548		3470	4548
RMF					10806		

Based on the above evaluation, it was concluded that the flood peak estimates produced by the Statistical and the SDF methods are the most reliable for design estimates for this application. The results from the SDF, which produce higher flood peak estimates than most of the methods were ultimately adopted as they provide a more conservative design.

3.3.2 Hydraulics

- ***Hydraulic factors***

At the site of the White Mfolozi Bridge, the river has a very gentle left curve. Nine cross sections averaging 900 m long and spaced at about 50 m were used for modelling the site in HEC-RAS software (version 4.1.0). The main channel has boulders and rock outcrops and gravels, the banks have rock outcrops, bushes and weeds, and a roughness coefficient of 0.030 was used for the main channel and for the banks 0.04. The river slope used for the hydraulics was 0.0038m/m, the 10/85 slope of the river catchment.

- ***Flood lines***

Flood lines for the 1:50 and 1:100 year flood return periods were established by recording the position of the respective flood at each of the nine cross-sections and joining these points.

The flood line positions are indicated in **Figure 4**.

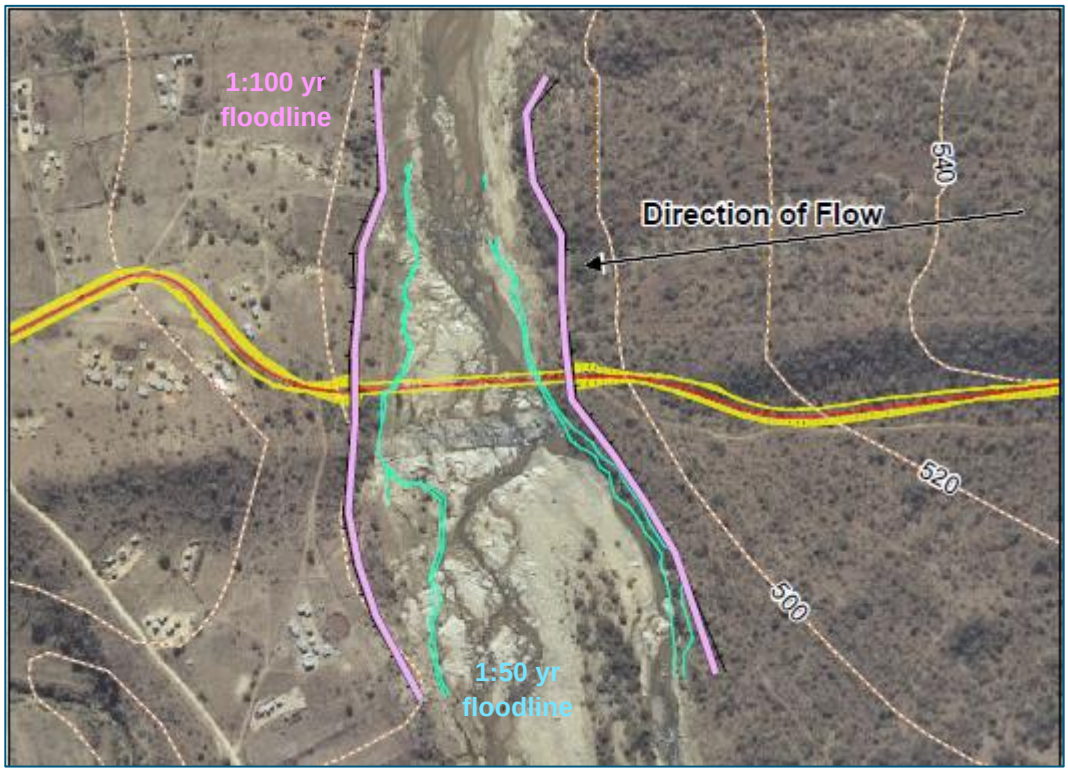

Figure 4: Flood lines

- ***Bridge hydraulics***
  The proposed bridge opening is adequate for a Class 4 road providing for a 10 year flood with a 2 m freeboard (required freeboard is 1.2 m). The bridge can also take a 100 year flood without a freeboard. The limiting criterion on this bridge is the road's vertical alignment.

3.3.3 Plan Geometry

The proposed bridge must have a carriageway width commensurate with the approach road i.e. two 3 m wide lanes with 0.45 m wide shoulders on either side (these edge details for the kerb and channel at the bridge are in accordance with the KZN DoT design standard (2016) details. This configuration results in a total of 7 m carriageway. For a design speed of 60 km / hr (over a 180 m long bridge), a 1.5 m wide raised pedestrian sidewalk is required on the up-stream side. This provides an overall road width of 8.5 m inclusive of the 1.5 m sidewalk. The proposed bridge will be a Class 4 bridge.

The road cross section was widened at the bridge to accommodate these kerb and channel shoulders and pedestrian side walk. Refer to ***Appendix C7 for Bridge Design Report and Drawings.***

The bridge will be provided with F-Type NJ parapets as per the (2016) KZN DoT standard details on the outside edge of the deck (refer to the General Arrangement Drawing in ***Appendix F***).

3.3.4 Vertical Alignment

There will be an average 2 m deep cut on the P734 bridge approaches with a grade of 9% for a length of 300 m. The 180 m long bridge is on sag followed by a 1% grade and sag at the bridge end, there is no horizontal curve on the bridge (refer to the General Arrangement Drawing in ***Appendix F***).

On the D2047 side, the road grade is 10% and the cut on this bank is about 2 m deep for about 100 m in length.

The grades on the approaches may require the provision of concrete paving.

3.3.5 Bridge Dimensions

Based on the traffic lanes, shoulders and pedestrian facilities required to be accommodated by the bridge, the following table summarises the leading dimensions of the proposed bridge.

Table 10: Bridge dimensions

Bridge components	Dimension (m)
Carriageway width (m)	7,00
Width of sidewalk (one number on upstream) (m)	1,50
Total width between parapets (m)	8,50
Total Width (m) including parapets	9,62
Total length (m)	180,00
Height from Top of deck to ground (m)	9,45
Maximum total pier height (m)	9,00

3.3.6 Services

There are no anticipated services on the bridge in the near future. However, standard provisions have been made in the design of the bridge deck for the accommodation of small diameter services beneath sidewalks. The Eskom power lines in the vicinity of the bridge site have been avoided at the preferred bridge by a parallel shift to the up-stream.

3.3.7 Drainage

Drainage of the decks will be by standard 110 mm diameter scupper pipes located at the kerb and channel and at the bridge ends by drainage shoots and catch pits which will be part of the drainage system. Provision of drainage from abutment seats is by drainage pipes into the back face of the abutments.

3.3.8 Construction Materials

Concrete is available in Ulundi. In the event the Contractor wants to mix concrete on site, aggregates will have to be imported from commercial sources, also in Ulundi or Vryheid. Steel will be sourced from Richards Bay or Durban.

3.4 Link Road Description

The first 3.6 km of the L2598 is an existing gravel road that starts on Main Road P734 between the Mabedlana Mountains on the Ulundi side near the Mphothi Primary School. Thereafter the route is made up of tracks that traverse through the KwaMphothi area up until the proposed site for the new river crossing (White Mfolozi River Bridge). The route then continues in a north western direction where it intersects with District Road D2047. The link road has a total length of approximately 6.956 km.

3.4.1 Road Functional Classification

The construction of the bridge and link road will result in a continuous route connection between the P47-3 and the P734 that will provide access to the communities living along the route. Public transport vehicles can be expected to start using the route to serve the nearby community settlements. These settlements are however small and relatively sparse and traffic volumes can be expected to be low.

Along the length of the route the topography varies between rolling and rugged, resulting in sections of road with gradients of 12% and design speeds as low as 60 km/hr. Direct access from the road is also obtained from homesteads near the road. Due to the topography and low geometric standards this route will not function as a through route and therefore cannot be considered for a 'Minor Arterial' functional classification.

The appropriate functional classification for the route is a Class 4 Gravel Rural Collector Road. It is proposed to re-declare the whole route from P47-3 through to P734 as District Road D2047, as illustrated in **Figure 5**.

The cross section of the road for this class of road according to KZN DoT standards is a 6 m road carriageway on a 6.9 m wide pavement, comprising two 3 m lanes and two 0.45 m shoulders on either side. The typical road cross-section is provided in ***Appendix F***.

3.4.2 Road Reserve

The road reserve will be formalised to a 20 m road reserve throughout the stretch of L2598, to be re-declared as the D2047.

3.4.3 Design Speed

The existing road L2598 is on a rolling natural profile. The new designed road will have a profile that adheres to standards for a design speed of 60 km/hr whilst balancing out cut and fills. The design speed of 60 km/hr will be maintained throughout the road.

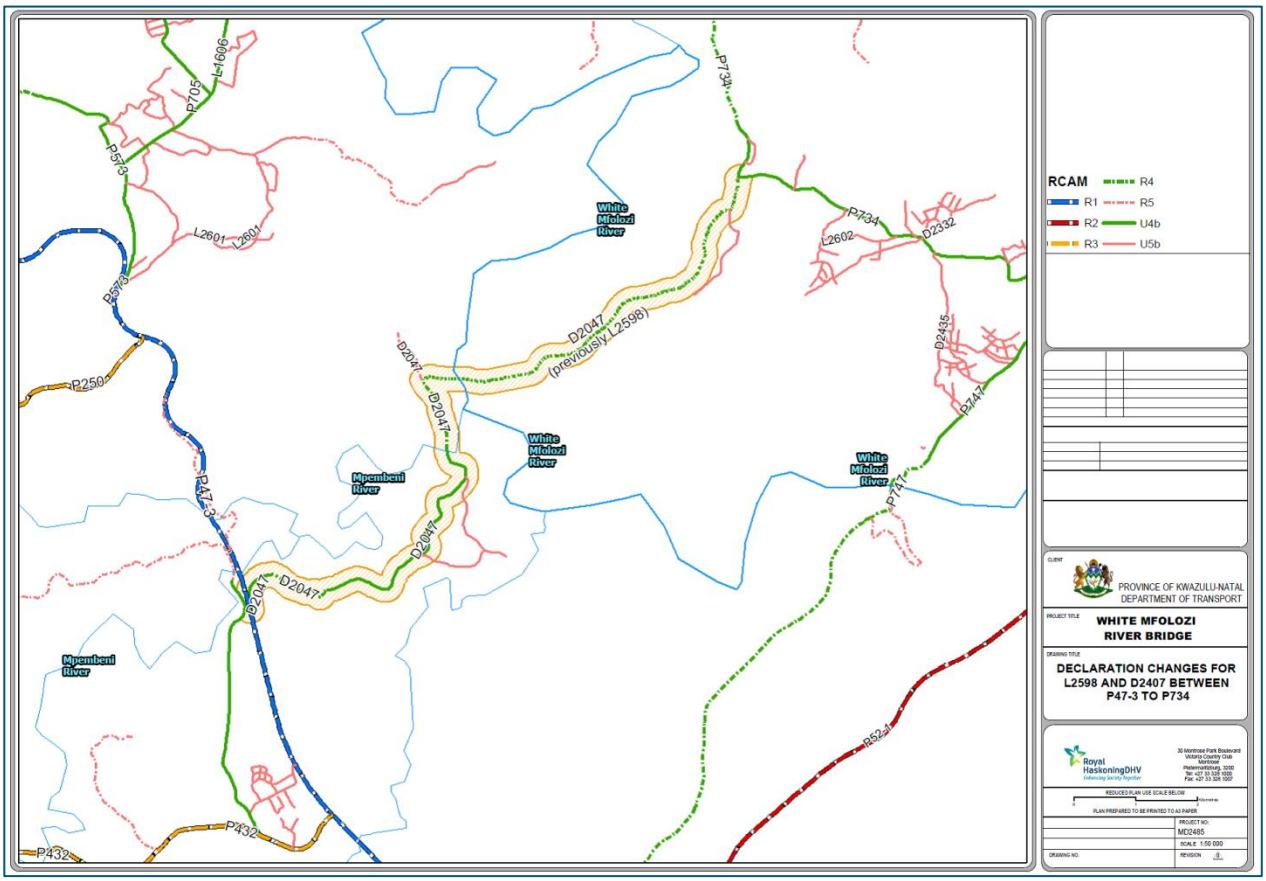

Figure 5: Declaration changes for the L2598 and D2407 between the P47-3 to P724

3.4.4 Horizontal Alignment

A horizontal alignment standard appropriate for a 60 km/hr design speed was chosen. This design speed can be achieved throughout the entire stretch of this road. An overall maximum super-elevation of 6% was adopted for the L2598. A minimum horizontal curve radius of 110 m was adopted. A normal camber of 4% on unsurfaced roads was used at locations such as long tangents and horizontal curves with large radii. The designed re-alignment of L2598 consists of linear tangents connecting circular curves.

There are 3 alternative alignment options that were considered for the L2598, which are detailed in ***Section 5***. The existing portion (the first 3.6 km) of all 3 options is the same due to the restrictions created by the presence of residential properties directly adjacent the existing road.

3.4.5 Vertical Alignment

The vertical alignment of the existing road had to be improved in most of the sections along the route to accommodate a design speed of 60 km/hr.

3.4.6 Drainage

The drainage design has been based on a distribution of flow through sets of culverts located at points along the road where free flow conditions and minimum 2% invert slopes could be achieved.

The cross drainage culverts have been designed for inlet control conditions at a maximum headwater / depth ratio of 1 and for runoff calculated using the rational method for a 1 in 10 year flood return period.

3.4.7 Pavement Structure

The existing section of road under investigation currently has a gravel wearing course. The width of the wearing course varies from 4.0 m to 6.0 m.

The proposed upgrade economical design is based on the estimated future traffic and the material test results. It is proposed that material of sufficient strength will be placed in a layered system to provide the desired functional and structural service level over the design period, subject to applicable traffic demand and the prevailing environment. The placed material must be covered and protected by means of suitable materials.

The upgrade strategy therefore constitutes the following:

- Utilisation of the existing in-situ material as the selected layer depending on the proposed vertical alignment.
- The import and construction of subgrade, wearing course and concrete surfacing (where applicable).
- The drainage improvements will form part of the upgrade of the existing road.

3.5 Culvert Upgrade

The identified crossing has been calculated as having a catchment area of approximately 48 ha and three (3) pipes of 1 200 mm diameter would suffice to allow the storm water to cross the road, without causing over-topping.

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This will alleviate the inaccessibility problem highlighted by the community as the crossing will be usable even after heavy rains.

The construction activities will be completed within 30 days and it is not expected that any temporary deviations will be required. The informal road will be closed during this time.

3.6 Access Management

There are many rural settlements as well a school along the L2598. These would require access to the L2598 through limited accesses. Attempts have been made to ensure that accesses are located at positions with adequate intersection sight distances to ensure user safety and reduce the number of direct accesses.

3.7 Traffic Accommodation

3.7.1 Bridge Site

The White Mfolozi Bridge is on a site with no existing traffic. No public vehicle traffic is expected at the bridge site during the construction phase. However, there will be a need for pedestrians to be accommodated in the vicinity of the construction site.

3.7.2 Link Road

Maintaining a safe flow of traffic during construction is to be carefully planned and executed. Due to the numerous rural settlements along the existing section of the L2598 it is strongly advised that the local community is engaged in all planning related to road use and accommodation of traffic generated from the direct local communities. It is envisaged that most of the existing section of L2598 will be constructed using half width construction methods. In essence, the road will be closed in one direction whilst it is being

constructed, with the need for traffic and safety personnel to be available to ensure road users safety and to inform them of the construction works that are taking place.

It is often a more suitable option to provide detours such that traffic is kept outside of the construction area. Where possible, detour roads will be used, though it will be very limited due to the dense settlements along the route.

The layout of construction areas and detours through the use of delineators and warning devices is to be in accordance to the latest South African Roads and Traffic Signs Manual. The establishment of areas for contractor operations is necessary to minimise the impact on the safety of motorists, pedestrians and workers.

3.8 Borrow Pits

The project will consider existing sources of material and as such this study does not entail the permitting and / or licencing of borrow pit /quarries.

3.9 Water

It is expected that 4 703 kl of water per annum will be required during the construction phase for construction activities and dust suppression. This water will be abstracted by a water tanker(s) from various points along the White Mfolozi River. Expected abstraction points are as follows:

- 28^{o} 19’ 23.72’’S and 31^{o} 18’ 10.50’’E;
- 28^{o} 19’ 24.06’’S and 31^{o} 8’ 5.69’’E.

A Water Use Authorisation will be obtained for this activity.

3.10 Construction Camp

A construction camp will need to be located at least 100 m away from the White Mfolozi River and outside of environmentally sensitive areas. The location of the construction camp will need to be approved by the Environmental Control Officer (ECO) prior to implementation.

4 PROJECT NEED AND DESIRABILITY

4.1 Development Priorities

The larger framework within which the need for the development would be motivated, is hinged on the Country's national and regional priorities. Sector–specific mandates are developed and implemented against the backdrop of such priorities. The most important mandates of relevance to this project, are discussed below.

4.1.1 National Development Programme (NDP) Strategic Priorities

In Chapter 4: Economic Infrastructure of the National Development Plan for 2030, the vision statement concerning the Transport sector states the following:

> *"Improved access to economic opportunities, social spaces and services by bridging geographic distances affordably, reliably and safely"*

The proposed project speaks directly to the vision statement in that it will provide access to social services and economic opportunities through the linking of remote areas.

4.2 The Department of Transport's (DoT's) Legal Mandate

As part of the KwaZulu-Natal Department of Transport's Strategic Plan (DoT Strategic Plan 2015/2015 – 2019/2020), it lists under Programme 2: Integrated Transport Planning and Programme 4: Road Transport, the following strategic objectives:

- Macro Planning Sector Planning - An efficient and integrated transport infrastructure network for social and economic development.
- Freight Logistics - An efficient and integrated transport infrastructure network for social and economic development.

4.3 KwaZulu-Natal Provincial Spatial Development Framework

The KwaZulu-Natal (KZN) Provincial Spatial Development Framework (PSDF) identifies rural services as a development priority, for which access is paramount. The KZN PSDF also recognises the Principle of Accessibility, which promotes the highest level of accessibility to resources, services, opportunities and other communities.

This is intrinsically linked to transportation planning and should consider localised needs for the transportation of people and goods by various modes of transport as guided by the scale and function of a region. At a provincial level there is a strong correlation between the most deprived areas and poor regional accessibility to those areas. In addressing accessibility at provincial and local level, the need for possible new linkages, the upgrade in the capacity of existing linkages and the suitable mix of modes of transport should be considered.

4.4 Direct Beneficiary Communities

A request for a new bridge over the White Mfolozi River and a link road between the L2598 and D2047 was initiated by the Mbatha and Mpungose as well as the Nobamba / Usuthu Traditional Authorities that are located on either side of the White Mfolozi River.

Visual verification of towns and communities in close proximity to the proposed bridge and link road, show that there are ten (10) communities that will directly benefit from the said infrastructure.

This assessment has been made by understanding the approximate distances of each community to the proposed development, with the consideration that a road that will be most in use, is typically indicated by its location to users (whether business or residential users). **Figure 6** below shows the existing road linkages to communities.

Figure 6: Existing road linkages

Table 11 is representative of the communities that are considered direct beneficiaries.

Table 11: Location of beneficiary communities

Distance[3] of communities from the proposed White Mfolozi Bridge (and link road)	
Western Side of the White Mfolozi River (closer to R34/ P47-3)	**Eastern Side of the White Mfolozi (closer to R66/ P52)**
KwaMbambo (1.3 km away from proposed bridge) Currently has access to the R34, then R66 towards Ulundi	***KwaMphothi*** (2.3 km away from proposed bridge)
Request and ***Dwarsrivier*** (4 and 5 km (respectively) away from proposed bridge) on the east side of the R34	***Mbedlana*** (6.4 km away from proposed bridge)
Mbuzikuzi, ***Kwe Yezulu*** and ***Makhosini*** (5.5, 7.5, and 7.7 km (respectively)) away from the proposed bridge on the west side of the R34	***Mkhazane*** (8.8 km away from proposed bridge)
	Town of ***Ulundi*** (11 km away from proposed bridge)

[3] *All km represented in above tabulation are a reflection of 'straight-line' distance.*

Figure 7 is a screen-shot of the schools that are located with an eight (8) kilometre radius of the proposed road upgrade and new bridge construction. Ten (10) schools (from within Wards 17 and 23) are found within said eight (8) kilometres.

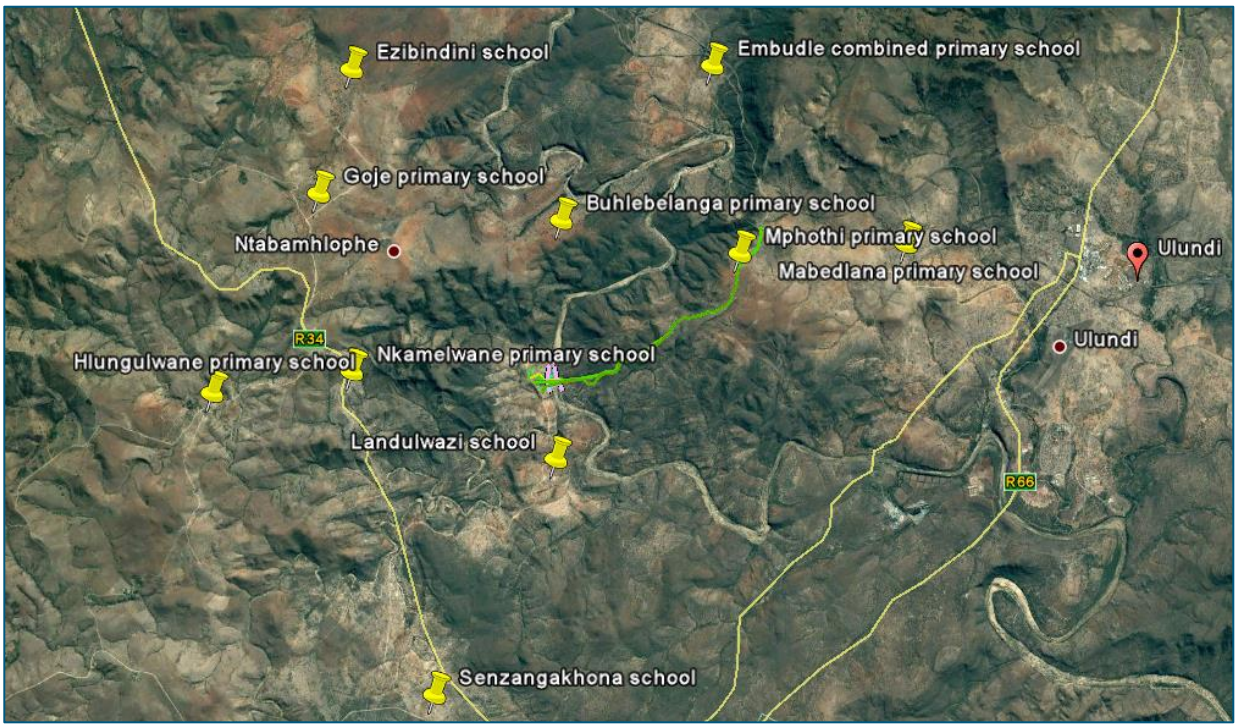


Figure 7: Schools within an 8 km range of proposed bridge and link road[4]

There are four hospitals located within the Ulundi Municipal area namely the Nkonjeni District Hospital, the Ceza District Hospital, the St Francis Psychiatric Hospital and the Thulasizwe MDR TB Hospital. Ulundi has the highest number of hospitals within its municipal area amongst the municipalities that comprise the Zululand District.

The two district hospitals have a total of nineteen (19) fixed clinics to which they provide a referral service. None of the hospitals or clinics fall within Wards 17 or 23. This is referenced in the Ulundi IDP (2016-2017).

The Ulundi Local Municipality is serviced by five police stations each with a service radius of 20 km. The police stations are situated in Babanango, Strangers Rest, Ulundi, Mahlabathini and Ceza (near the hospital). None of the police stations are located in Ward 17 or 23. This is referenced in the Ulundi IDP (2016-2017).

The Department of Sport and Recreation has funded a project in Ward 23 which consisted of the development of the King Senzangakhona Sports Field.

The fact that hospitals, clinics, police stations and recreational facilities are not located within Ward 17 and 23, signifies that the local communities within these respective Wards will have a further distance to travel to reach such facilities. The bridge and link road would serve to decrease the travel distances and increase safety, and individuals will benefit from a lowered risk due to them not being on the roads longer.

[4] *The Senzangakhona School is outside the 8 km radius.*

Further opportunity exists for a greater policing presence with improved access, and the opportunity exists for mobile clinics to potentially service these areas, once improved access is achieved.

4.5 Project Need, Desirability and Benefits

Project Need			
1.	**Was the relevant provincial planning department involved in the application?**	**YES**	
2.	**Does the proposed land use fall within the relevant provincial planning framework?** The KwaZulu-Natal Provincial Spatial Economic Development Strategy (PSDF) 2011 recognises the importance of the service sector in particular transport as a factor contributing to sustainable development. It further identifies rural services as a development priority, for which accessibility is of great value. The Principle of Accessibility as recognised by the KZN PSDF promotes the highest level of accessibility to resources, services, opportunities, urban areas and other communities. This is linked to transportation planning and should consider localised needs for the transportation of people and goods by various modes of transport as guided by the scale and function of a region. At a provincial level there is a strong correlation between the most deprived areas and poor regional accessibility. In addressing accessibility at a provincial and local level, the need for possible new linkages, the upgrade in the capacity of existing linkages and the suitable mix of modes of transport must be considered.	**YES**	
3.	**If the answer to questions 1 and / or 2 was NO, please provide further motivation / Explanation** – N/A.		
Desirability			
1.	**Does the proposed land use / development fit the surrounding area?** No it does not, however, the following benefits of the proposal can be realised - the proposed construction of the river bridge and upgrade of the L2598 is significantly beneficial to the surrounding area i.e. Ward 17 and 23. Currently the local residents in the KwaMbambo and Sgodiphola area along the White Mfolozi River utilise the D2047 which links to P47 then P52 in order to travel to Ulundi which is a travel distance of more than 40 km. The proposed construction of the new river bridge and the upgrading of the L2598 link road will reduce their travelling distance by more than half to approximately 15 km. The Communities are in support of the proposal and have specifically requested the bridge and link road.	**YES**	
2.	**Does the proposed land use / development conform to the relevant structure plans, SDF and planning visions for the area?** **Ulundi Local Municipality within Zululand District Municipality** The Ulundi Local Municipality Spatial Development Framework (SDF) 2016 identifies that the largest part of the Ulundi Local Municipality (74%) is pedestrianized of which a significant percentage of this is in rural areas. This affirms that roads infrastructure is under-developed, which makes the rural areas highly inaccessible. It is crucial that the rural areas be made more accessible through provision of transportation infrastructure. As a result, investment towards transportation infrastructure will ensure that rural areas like KwaMbambo and Sgodiphola are more accessible to economic opportunities and possible businesses	**YES**	

	that might locate to these areas. The Zululand District Municipality (ZDM) Integrated Development Plan (2016/2017) identifies that transport infrastructure in the district has an urban bias, such that the urban areas are accessible whilst the rural areas face problems of inaccessibility and poor infrastructure maintenance. The IDP further identifies that the rural access roads have the most important impact for future development of the district. As a result the ZDM has developed a Road Asset Management Systems (RRAMS) with the aim of ensuring effective and efficient investments in rural roads and bridges. The RRAMS shows a backlog of 8,367 households within Ulundi Local Municipality which requires access to road infrastructure.		
3.	**Will the benefits of the proposed land use / development outweigh the negative impacts of it?** The proposed construction of the bridge and link road will provide improved access to 10 schools identified within an 8 km range of the KwaMbambo, KwaMphothi, Mbuzikuzi, KweYezulu and Makhosini communities. In addition, the two district hospitals Nkonjeni District Hospital and Ceza District Hospital with a total of 19 fixed clinics are not located within Ward 17 and 23. Apart from the clinics, police stations and recreational services are also not located within the area which entails that the local communities within these respective Wards have a greater distance to travel to access these facilities. The proposed bridge and link road will provide shorter travelling distances and public safety.	**YES**	
4.	**If the answer to any of the questions 1-3 was NO, please provide further motivation / Explanation** – N/A.		
5.	**Will the proposed land use / development impact on the sense of place?** The proposed construction of the bridge and road link will not impact on the sense of place as the community engagement process conducted thus far has revealed that the community do not view the bridge as a visual intrusion which is usually is the main driver behind impacts associated with the sense of place. However, it must be considered that the potential exists for greater traffic utilisation, noise, road safety issues and these must be considered and mitigated through the BAR process.		**NO**
6.	**Will the proposed land use / development set a precedent?** The link road and the bridge will be a key accessibility development within the area, it is a district road and is therefore not expected to set a precedent.		**NO**
7.	**Will any person's rights be affected by the proposed land use / development?** The engagement process thus far has indicated that the community approves of the proposed development. As a result, there is one household who will suffer a contravention of their rights. Furthermore, fencelines may be affected. The land is owned by Ingonyama Trust Board in which an approved compensation process which details the values and asset relocation process must be offered for homestead(s) that will be affected by physical displacement as a result of the project.		**NO**
8.	**Will the proposed land use / development compromise the "urban edge"?** The area is completely rural in nature.		**NO**
9.	**If the answer to any of the question 5-8 was YES, please provide further motivation /**		

	explanation – N/A.		
Benefits			
1.	**Will the land use / development have any benefits for society in general?**	**YES**	
2.	The proposed construction of a bridge and road link will serve as a link to a number of schools, clinics, police stations and recreational facilities. The proposed construction of the bridge and link road will provide a link to 10 schools identified within an 8km range of the KwaMbambo, KwaMphothi, Mbuzikuzi, KweYezulu and Makhosini communities. In addition, the two district hospitals Nkonjeni District Hospital and Ceza District Hospital with a total of 19 fixed clinics to whom the district hospitals provide referral services to, are not located within Ward 17 and 23. Apart from the clinics, police stations and recreational services are also not located within the area which entails that the local communities within these respective Wards have a greater distance to travel to access these facilities. The proposed bridge and link road will provide shorter travelling distances and public safety.		
3.	**Will the land use / development have any benefits for the local communities where it will be located?**	**YES**	
4.	The proposed construction of the bridge and link road will provide a link to 10 schools identified within an 8km range of the KwaMbambo, KwaMphothi, Mbuzikuzi, KweYezulu and Makhosini communities. In addition, the two district hospitals Nkonjeni District Hospital and Ceza District Hospital with a total of 19 fixed clinics to whom the district hospitals provide referral services to are not located within Ward 17 and 23. Apart from the clinics, police stations and recreational services are also not located within the area which entails that the local communities within these respective Wards have a greater distance to travel to access these facilities. The proposed bridge and link road will provide shorter travelling distances and public safety. During construction it is anticipated that the proposed development will provide employment to local residents through engagement with the Community Liaison Officer (CLO).		

4.6 Summary

The following simplified 'needs and desirability' of the project are acknowledged as:

- Motivation Point 1: The development is proposing the establishment of a bridge and link road that will link communities on the western side of the White Mfolozi River (closer to the R34 / P47-3 routes) and the eastern side of the river (closer to R66 / P52 routes), strengthening the overall secondary road network.
- Motivation Point 2: The development will provide an alternative mobility belt for possible future expansion in the residential population in the respective Wards 17 and 23. One must also be cognisant that small businesses tend to grow in areas immediately adjacent to residential nodes, thus increasing the potential for local economic growth.
- Motivation Point 3: It represents an infrastructure project that has the ability to provide the communities an opportunity to access social facilities that can support an increasing number of the socially and economically dependent population, and which can enhance opportunities for growth within the livelihood sector, for a large proportion of the community.
- Motivation Point 4: The development has the ability to improve the regional / local road network, increase mobility, linking many communities and allowing immediate improved access to community facilities, but in the long term it may also improve the regional economy across a number of areas.
- Motivation Point 5: A recent engagement and project information disclosure process confirms that members from the communities of Sgodiphola, Mfiliji, Ngono, Mshisampisi, KwaMbambo, Mshiqo (communities along the D2047 road) and the KwaMpothi community show their support for the

project, acknowledging that apart from ensuring that people no longer have to risk their lives crossing the river on foot, all residents will have access to public spaces and facilities in a quicker and safer manner. A shorter travel distance also signifies less travel costs. The establishment of the bridge will serve to increase residents' quality of life.

The end intention of this project is three-fold:

- To work towards fulfilling the country's national strategic priorities, aligned to the KZN DoT's mandate and the local municipality's' development objectives;
- To ensure that such benefits are shared by the majority of the population irrespective of class, colour, culture and social / political affiliation; and
- To give credence to future social and economic development goals in the region.

The KZN DoT has had a number of cases where pedestrian bridges have been provided initially, only to receive demands for road bridges thereafter. These demands have resulted in road bridges having to be provided in close proximity to the original pedestrian bridges, resulting in wasted expenditure. The policy that has been adopted by the KZN DoT is that if there are roads or tracks near to the crossing point, then a road bridge should be provided in preference to a pedestrian bridge.

While the cost of this bridge is high, due to this being a large river, strategic discussions have identified the need to provide infrastructure in rural areas to support the communities living there and to encourage them to stay in the rural area. There is presently a tendency for persons living in rural areas to move to urban areas in the hope of finding improved work opportunities. However, research has shown that unemployment and poverty in urban areas is in fact higher than in rural areas. This has resulted in the large slum areas around the larger urban areas where the residents are now worse off than when they were in rural areas.

There is a distance of more than 6 km between the kwaMambo and KwaMpothi Communities. This leans itself towards vehicular travel rather than a pedestrian bridge. The vehicular bridge promotes shorter travel distances, utilising public transportation, to Ulundi, therefore, increasing access to social (e.g. high schools) and economic (e.g. jobs, markets, etc.) opportunities whilst discouraging urbanisation.

4.7 Socio-economic Value

Table 12: Socio-economic details

What is the expected capital value of the activity on completion?	R 69 million
What is the expected yearly income that will be generated by or as a result of the activity?	NA
Will the activity contribute to service infrastructure?	Yes
Is the activity a public amenity?	Yes
How many new employment opportunities will be created in the development phase of the activity?	60 - 105
What is the expected value of the employment opportunities during the development phase?	R 690 135.60
What percentage of this will accrue to previously disadvantaged individuals?	100%
How many permanent new employment opportunities will be created during the operational phase of the activity?	NA
What is the expected current value of the employment opportunities during the first 10 years?	NA
What percentage of this will accrue to previously disadvantaged individuals?	NA

5 PROJECT ALTERNATIVES

In terms of the EIA Regulations (2014 as amended in 2017) feasible alternatives are required to be considered as part of the environmental investigations. In addition, the obligation that alternatives are investigated is also a requirement of Section 24(4) of the NEMA (Act No. 107 of 1998) (as amended).

An alternative in relation to a proposed activity refers to the different means of meeting the general purpose and requirements of the activity which may include alternatives to:

- the property on which or location where it is proposed to undertake the activity;
- the type of activity to be undertaken;
- the design or layout of the activity;
- the technology to be used in the activity;
- the operational aspects of the activity; and
- the option of not implementing the activity.

5.1 Bridge Crossing Alternatives

When considering the appropriate location and design of the proposed bridge crossing, Royal HaskoningDHV followed the best practice approach for river crossings as illustrated in **Figure 8**.

Figure 8 demonstrates that when selecting an appropriate site for a river bridge crossing, several factors need to be considered. As a point of departure, the need for such a structure must be demonstrated from a socio-economic perspective. The location must ensure that the proposed structure adds value by creating key linkages for as many communities as possible, and specifically, for the target communities. Once a location is identified that is suitable to address the needs of the target communities, structural and environmental factors must be considered.

The factors include:

(i) the use of existing structures and infrastructure, where appropriate;
(ii) identifying hydrological, geological and ecological constraints and ensuring the design is according to engineering best practice guidelines and principles;
(iii) carrying out an assessment of various options to ensure a cost-effective solution is obtained; and
(iv) implementing best practice procedures during detailed design and construction.

Most engineering requirements can be addressed in a number of ways. It is a basic principle of best practice to consider a range of options to address any river engineering problem or need and to carry out an options appraisal. Without considering a range of options it is not possible to determine if the chosen approach represents the most suitable option (i.e. the option that minimises ecological harm at a cost that is not disproportionately expensive).

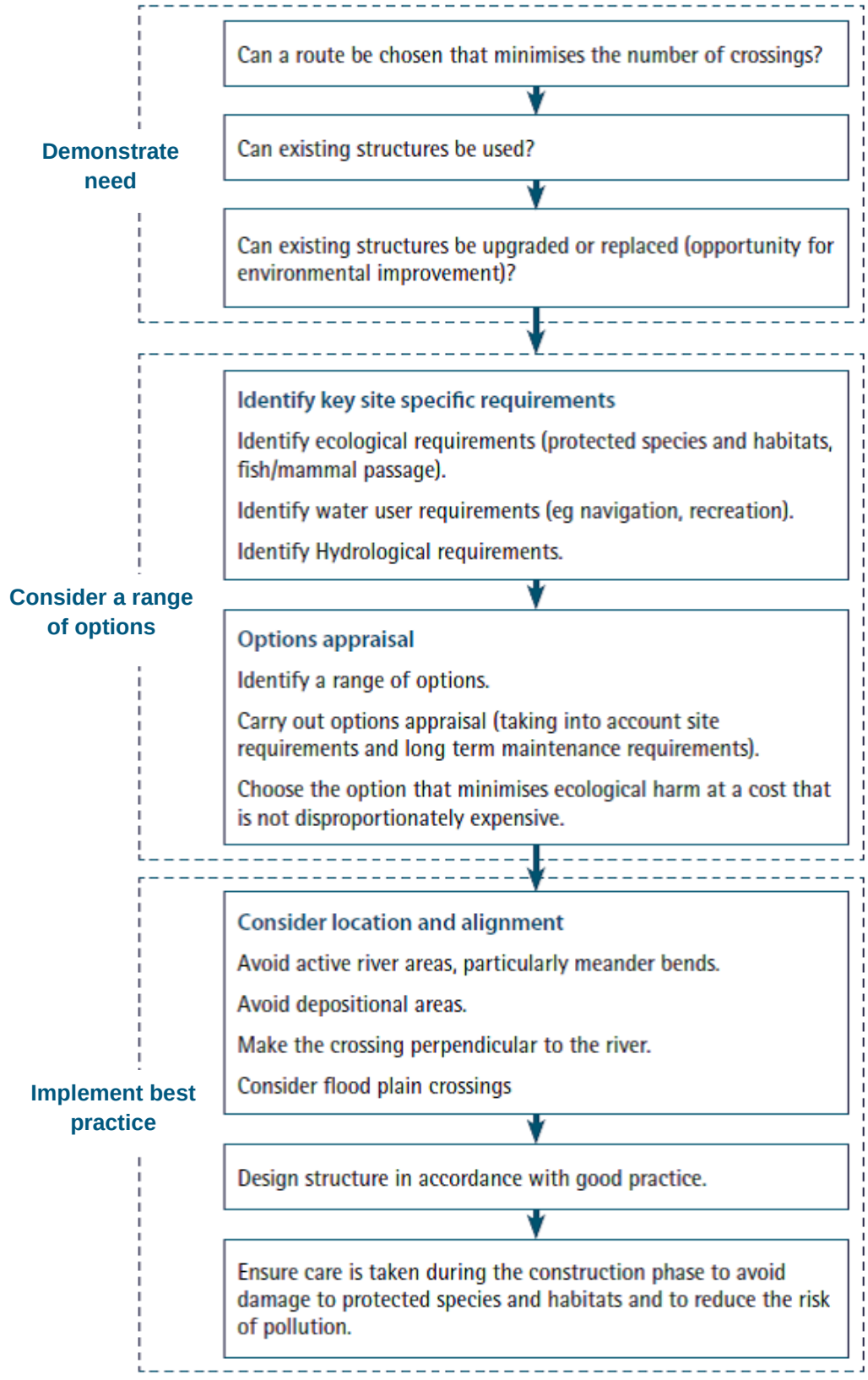


Figure 8: River crossings best practice process for site selection

5.1.1 Technical Best Practice

As demonstrated in **Figure 8**, the alignment and location must be considered from a technical perspective to ensure engineering principles of best practice are applied. In this regard, **Figure 8** suggests that active river areas, particularly meander bends should be avoided. Furthermore, the crossing should be perpendicular to the river.

Selecting an appropriate location, or taking into account the characteristics of the location, is the first step in reducing:

- The impact of the river crossing on the hydrological environment;
- The risk of damage to the crossing structure itself; and
- Future maintenance costs.

Geological and hydraulic characteristics of a river can change considerably over short distances and it is important to afford careful consideration to the choice of location. When selecting a suitable bridge crossing site over a river, there are several factors the design team must consider from a technical perspective. Some of these factors are briefly outlined below.

- Bridge length – economic and environmental considerations may dictate choice of the shortest crossing point as this not only reduces capital costs, it also reduces the number of piers required to be installed into the river bed, thereby reducing the impacts on the river.
- Channel instability – evidence of existing channel instability including degradation and aggradation, lateral movement and bank erosion and hydraulic problems at other bridges in the area need to be considered in choice of bridge crossing location.
- Meanders and bends - bridges sited on sharp bends often experience problems due to channel shift. As a rule of thumb, bridge locations on straight reaches or gentle bends are preferable because such sites reduce the possibility of an oblique approach to the river and exhibit a reasonably uniform distribution of flow across the bridge section.

5.1.2 Alternative Bridge Crossing Options

Local residents in the KwaMbambo area along the White Mfolozi River are currently using the D2047 which links to the P47 then the P52 (via Ulundi 19) to get to Ulundi. This journey is more than 40 km. These local communities lodged a request for a bridge which would reduce travel distances and create a linkage between the two communities. In response to this request, the KZN DoT began investigating the suitability of a bridge. Initially a pedestrian bridge was proposed, however, it was later discarded due to the proximity of these communities to an established road network. The construction of a vehicular bridge and the upgrading of the L2598 will reduce the travelling distance by more than half, to about 15 km.

Therefore, when investigating a suitable location to site the bridge, the design team were constricted by the following factors:

- The bridge seeks to serve and provide a linkage between the communities of KwaMbambo to the west and KwaMphothi to the east. Therefore, any location of the bridge would need to be in the vicinity of these communities;
- A location for the bridge would need to consider the existing road network and potential linkages;
- The presence of the Matshitsholo Community Conservation area to the north of the affected communities limited the potential linkages upstream of the communities;
- The presence of the eMakhosini Heritage Park (Ophathe Park) to the south of the communities limited the potential linkages downstream of the communities.

Therefore, in light of the factors presented above, a zone of investigation as illustrated in **Figure 9** was proposed as this area, located between the Matshitsholo Community Conservation Area and the eMakhosini Heritage Park presented an opportunity for a potential linkage.

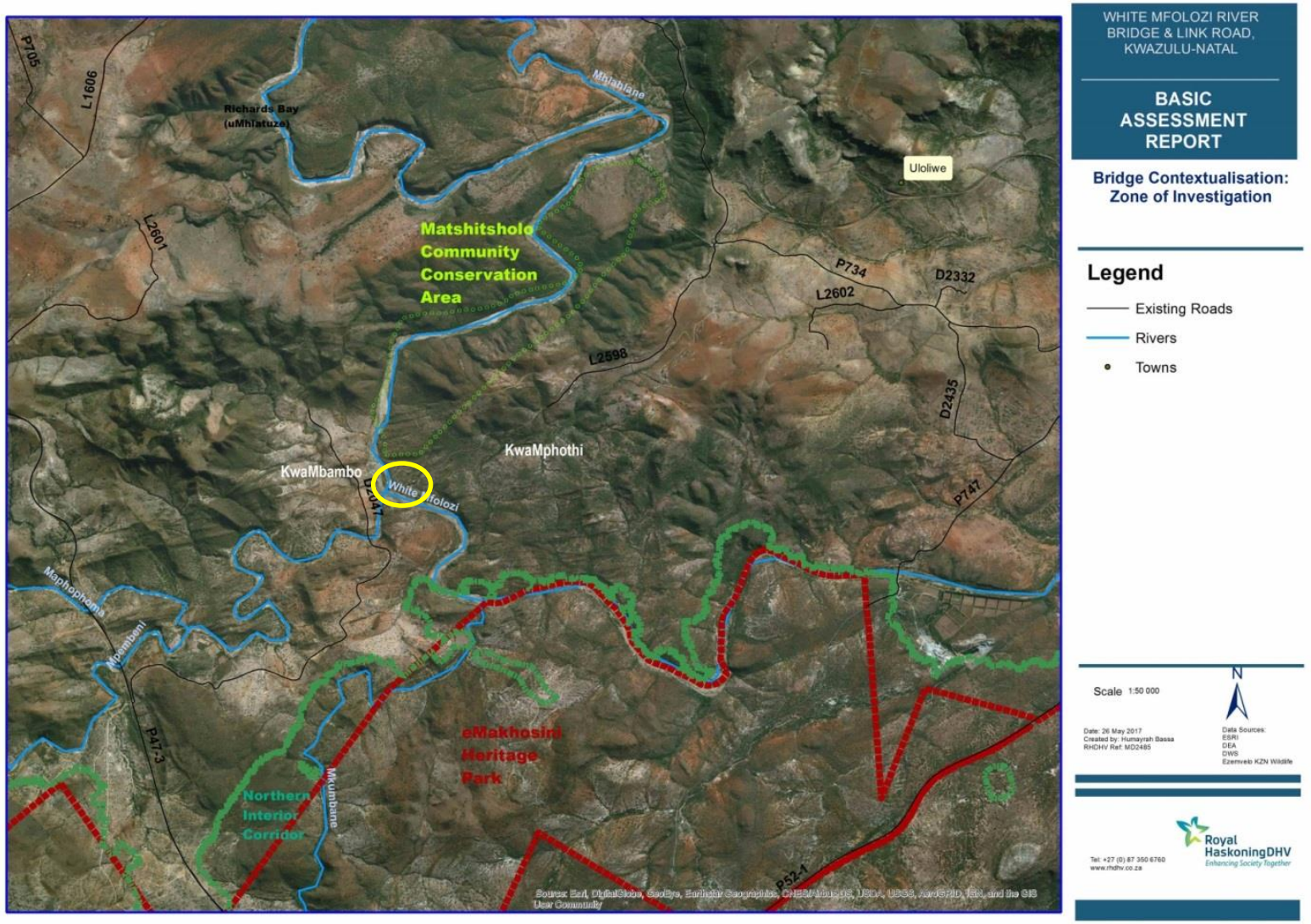


Figure 9: Bridge siting zone of investigation

Due to the proximity of the KwaMbambo and KwaMphothi communities as well as the identification of the L2598 as a potential link for the bridge to the existing road network, three (3) alternative bridge crossings were considered within the zone of investigation (**Figure 10**).

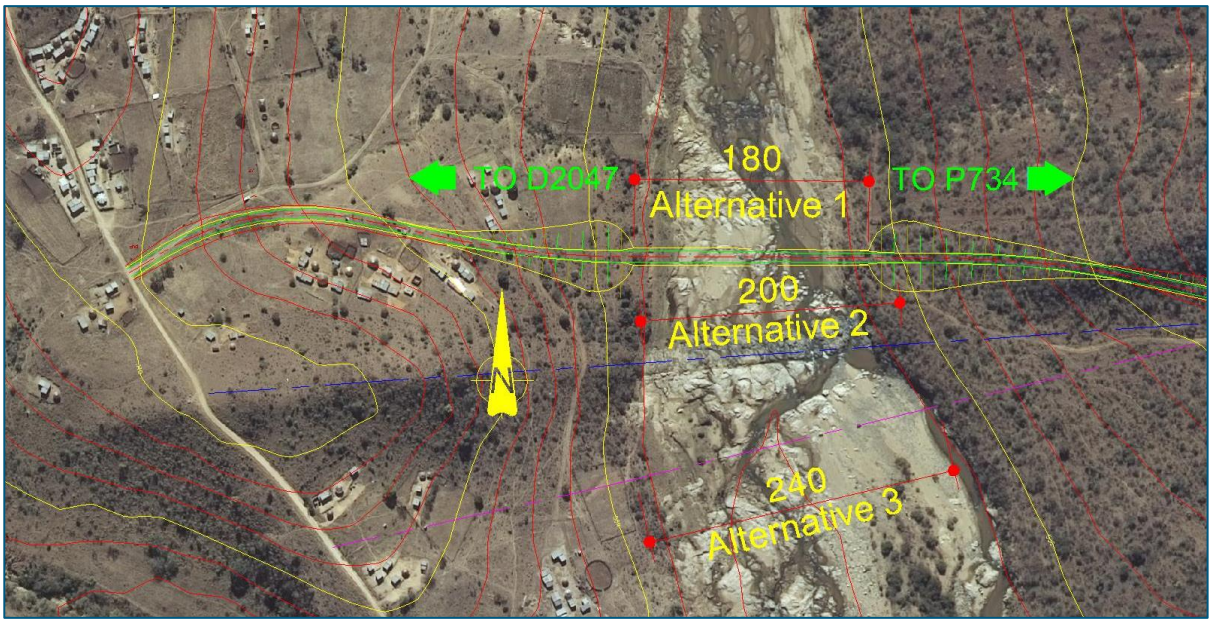


Figure 10: Three bridge crossing option investigated

- ***Option 1 (Preferred)***

This crossing alignment has fairly well defined banks. The channel depicts visible rock with rock foundations at deeper levels on the D2047 side. On the P734 side there are Eskom power lines which have been avoided by moving the structure upstream, the alignment also avoids the game fence on this bank. On the D2047 side, the alignment meanders to avoid dwellings.

The steep slopes on either banks result in big cuts and a bridge height determined by road vertical alignment not by hydrological requirements. The bridge length at this alignment is 180 m. This is the preferred crossing point; the bridge on this alignment is at right angles to the river.

Photograph 1: Option 1 view towards the D2047 (L). Alignment 1 option view towards the P734 – between the Eskom power lines and the game fence (R)

- ***Option 2***

Option 2 is along a rocky ridge in the river and runs directly under existing Eskom power lines. This ridge would impede water flow and excludes this site. On the P734 side, the abutment would be in the exact position the of Eskom power lines, pylons???. On the D2047 side, the road will be at the tip of a very steep hill and would require the expropriation of a number (provide number) dwellings on either side of the hill. The bridge length for this alignment would be approximately 200 m. This crossing point is not ideal for the following reasons:

- A link road on top of a hilltop resulting in potential visual intrusions from a distance (**Figure 11**);
- A longer bridge structure;
- Relocation of Eskom power lines; and
- Large cut operations and blasting to establish the link road.

Photograph 2: Option 2 view towards the D2047 (L). Alignment Option 2 P734 bank (R)

- ***Option 3***

The Main Road P734 banks on Option 3 are well defined but are erodible as seen on Google imagery. The D2047 side banks are not well defined. The waterway has an overgrown island which would impede flow and possibly trap debris under the bridge. To withdraw the abutments out of the main channel, the bridge span that would be required is 240 m. Google Imagery evidence shows that some of the foundations could be very deep to get to the rock stratum. This crossing alignment is not preferred for the following reasons:

- The bridge would not cross the river at a perpendicular angle (**Figure 11**);
- The bridge is a removed a distance to the downstream of the affected communities;
- This is the longest river crossing option.

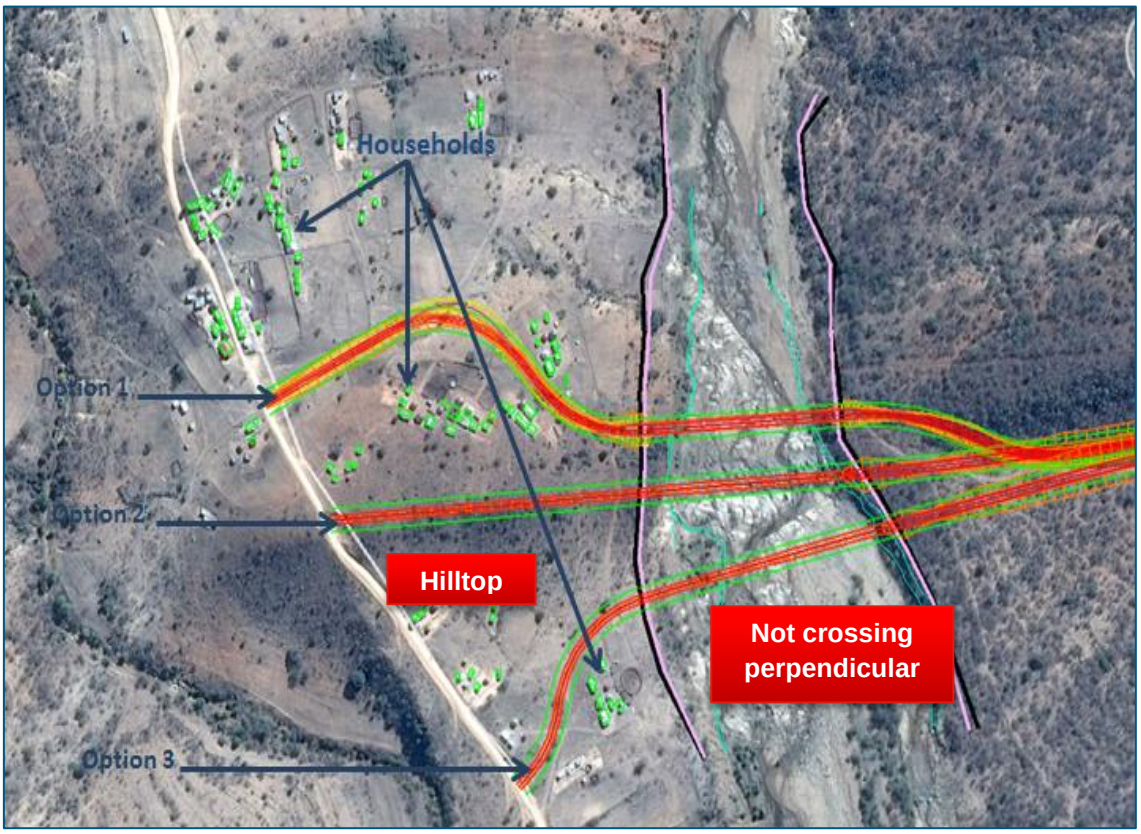


Figure 11: Bridge crossing options – constraints associated with Options 2 and 3

A right angle bridge (perpendicular bridge) (as proposed in Option 1) is preferred from a bridge design perspective to a skew bridge (as proposed in Option 3). According to the best practice engineering guidelines, river bridge crossings should be perpendicular to the river (**Figure 12**). This ensures that the crossing is as short as possible, thus reducing impacts and in some instances the cost. This also reduces the risk of localised scour at the abutment structure, therefore ensuring the structural integrity of the bridge.

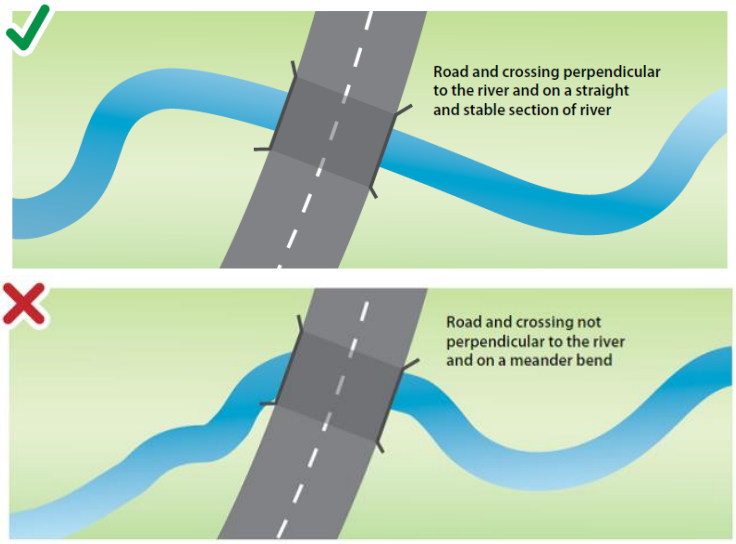


Figure 12: Guideline for the angle of bridge crossing

5.1.3 Link Road Alternatives

Linked to the three (3) bridge crossing alternatives presented above, three (3) link road alternatives were also considered for each of the crossings: The existing portion (the first 3.6 km) of all 3 options is similar as this is an existing road (the L2598) and proposed upgrades are restricted by the residential properties along the road. Therefore this report will focus on the remainder of the road which is predominately greenfields or an existing track:

- Option 1 (Preferred) – deviates from the existing track on the eastern approach;
- Option 2 – similar to Option 1 on the eastern approach, however, the link road has to traverse through a hilltop on the western approach resulting in large cut operations; and
- Option 3 – follows an existing track.

5.1.4 Consolidated Alternatives

Part 1

As indicated above, the first 3.6 km of the proposed link road follows the existing L2598 road. This road will be re-gravelled and widened. However, the road will not be widened by more than 4 m. The reason for this is the restriction created by the presence of existing homesteads established along the road. The only option proposed for this stretch of road is the upgrade of the existing alignment for all three options (**Figure 13**).

Part 2

The next section of road follows from where the existing L2598 ends. An existing track is evident and all options try to follow this track as far as possible. Options 1 and 2 follow the same alignment with Option 3 following the existing track together with the Eskom power line. It is evident from **Figure 14** that Option 3 is not feasible along this alignment as this will involve the significant relocation of Eskom pylons. Furthermore, at least three (3) clusters of graves (grave sites) will be directly affected by Option 3 which will involve the relocation of these graves. Two (2) graves sites are evident in close proximity to the alignment of Options 1 and 2, however, these options do not directly impact the graves.

Part 3

The next section of road is located on the approach to the bridge on the eastern side. Option 3 follows the existing track which involves a bend whereas the alignments of Option 1 and 2 remain largely the same and allow for a straighter approach. Options 1 and 2 result in the largest area of vegetation to be cleared at this point, however, **Figure 15** illustrates that Option 3 involves the relocation of Eskom poles and grave sites. Therefore, the proposal to follow the existing track along the bend is less desirable.

Part 4

The next section of road is located on the immediate approach to the bridge on the eastern side as well as the river bridge crossing and the approach on the western side. The following is noted per option, as illustrated in **Figure 16**:

- Option 1 – Option 1 is the closest to the Matshitsholo Community Conservation Area fence (39 m). This option involves the largest extent of vegetation to be cleared on the eastern approach. Whilst this option largely avoids the Eskom Power lines, some pylons are unavoidable and will need to be relocated. The bridge crossing over the river is at right angles to the river which is ideal from a bridge design perspective. The bridge length is the shortest. However, the approach road on the western end needs to be aligned around existing homesteads and graves. There are a

number of grave sites in the vicinity of the approach road on the western side, however, the road will avoid these and no relocations are proposed.

- Option 2 – Option 2 is in the middle of Option 1 and Option 3. The approaches on either side as well as the bridge directly follows the Eskom Power lines and a large number of Eskom pylons will need to be relocated. The bridge is slightly longer than Option 1 at 200 m. Vegetation clearance on the eastern approach is also very high for Option 2 as this option deviates from the existing track. The approach road on the western side bisects a hilltop and will involve a large cut (generating excessive spoil) as well as blasting operations. Furthermore, the road will be elevated causing potential visual intrusions for the neighbouring parks and conservation areas, impacting on the sense of place. Furthermore, the intersection of the link road with the D2047 at this option is unsafe from a geometric perspective (insufficient sight distance).
- Option 3 – Option 3 is furthest downstream along the river. The approach on the eastern side involves the least clearing of indigenous vegetation as the road follows an existing track, however, Eskom pylons will need to be relocated. Furthermore, the bridge crosses the river at a non-perpendicular alignment which is not ideal and can compromise the long-term integrity of the structure. Moreover, grave sites are affected on the western approach of the road as the road needs to meander around existing homesteads. Furthermore, the intersection of the link road with the D2047 at this option is unsafe from a geometric perspective (insufficient sight distance).

5.1.5 Combination of Alternatives

As detailed in this Section, a combination of bridge crossing Option 1 with the road approach Option 3 on the eastern side is not feasible for the following reasons:

- This combination will result in the relocation of a significantly higher number of Eskom pylons;
- This combination will result in the relocation of at least three (3) grave sites;
- This combination does not work from a geometric perspective and will be considered technically unsafe.

5.1.6 Elimination of Alternatives

Whilst each specialist assessment has investigated all three (3) options, Option 2 and 3 are not assessed in same detail in this report for the following reasons:

- **Option 3**
  - The design requires the exhumation and relocation of at least three (3) grave sites;
  - This alignment would require a relocation of Eskom pylons and the deviation of the power line for the entire greenfield section;
  - The tie-in point of the alignment (Bridge Option 3) is at a wider section of the White Mfolozi River, making the bridge longer increasing the environmental impacts associated with this length of bridge as well as increasing the cost of the bridge; and
  - There is inadequate sight distance for a 60km/hr design speed where the road intersects with the D2047.
- **Option 2**
  - The alignment is similar to Option 1 on the eastern extent, however, the tie-in point (Bridge Option 2) is at a wider section of the White Mfolozi River.
  - The design of the alignment after the bridge requires deep cuts and possibly blasting (depending on the composition of the material) because the alignment is going through a hilltop.
  - There is inadequate sight distance for a 60km/hr design speed where the road intersects with D2047.

Figure 13: Options for km 0.0 to km 3.6 (existing L2598)

Figure 14: Options for Part 2

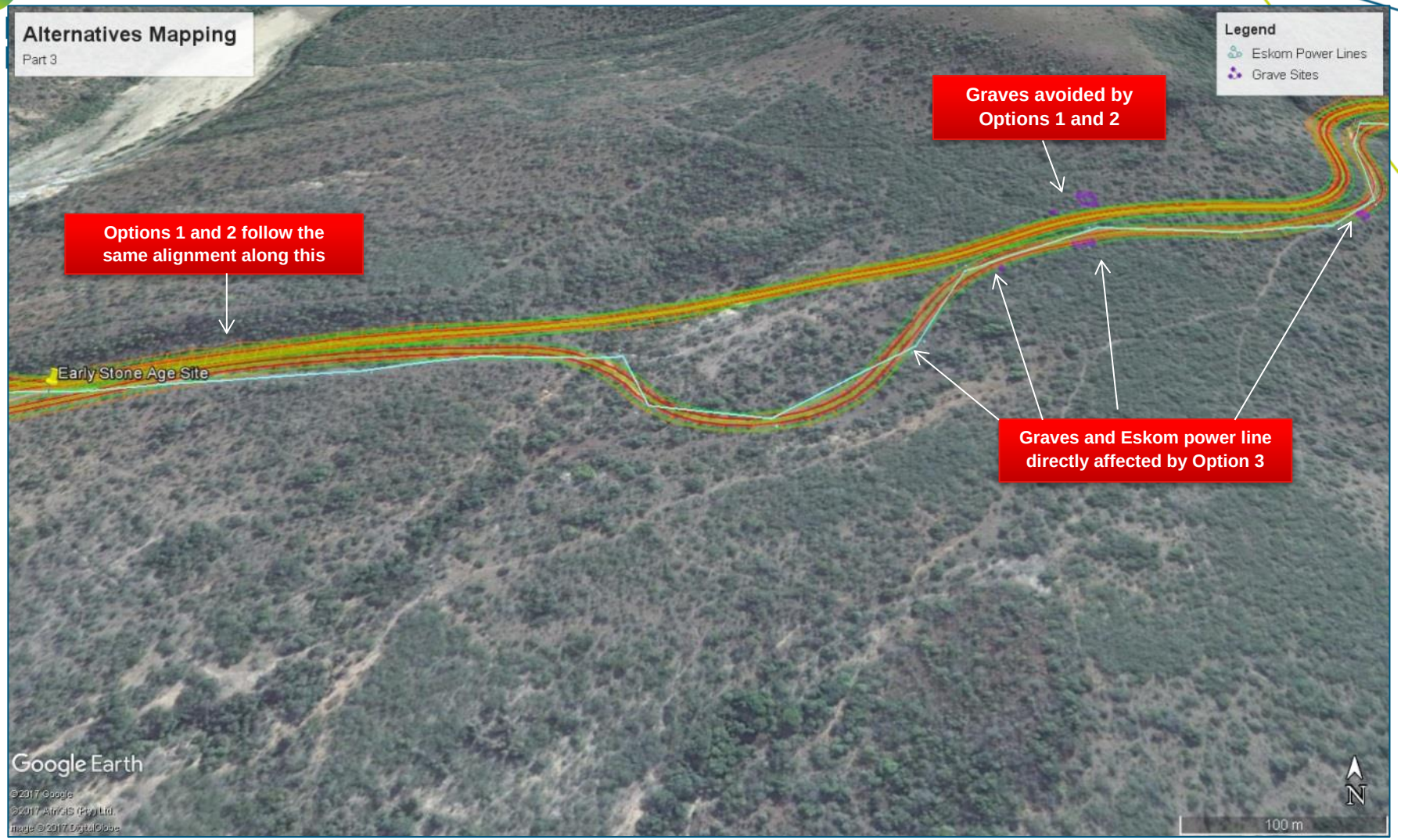


Figure 15: Options for Part 3

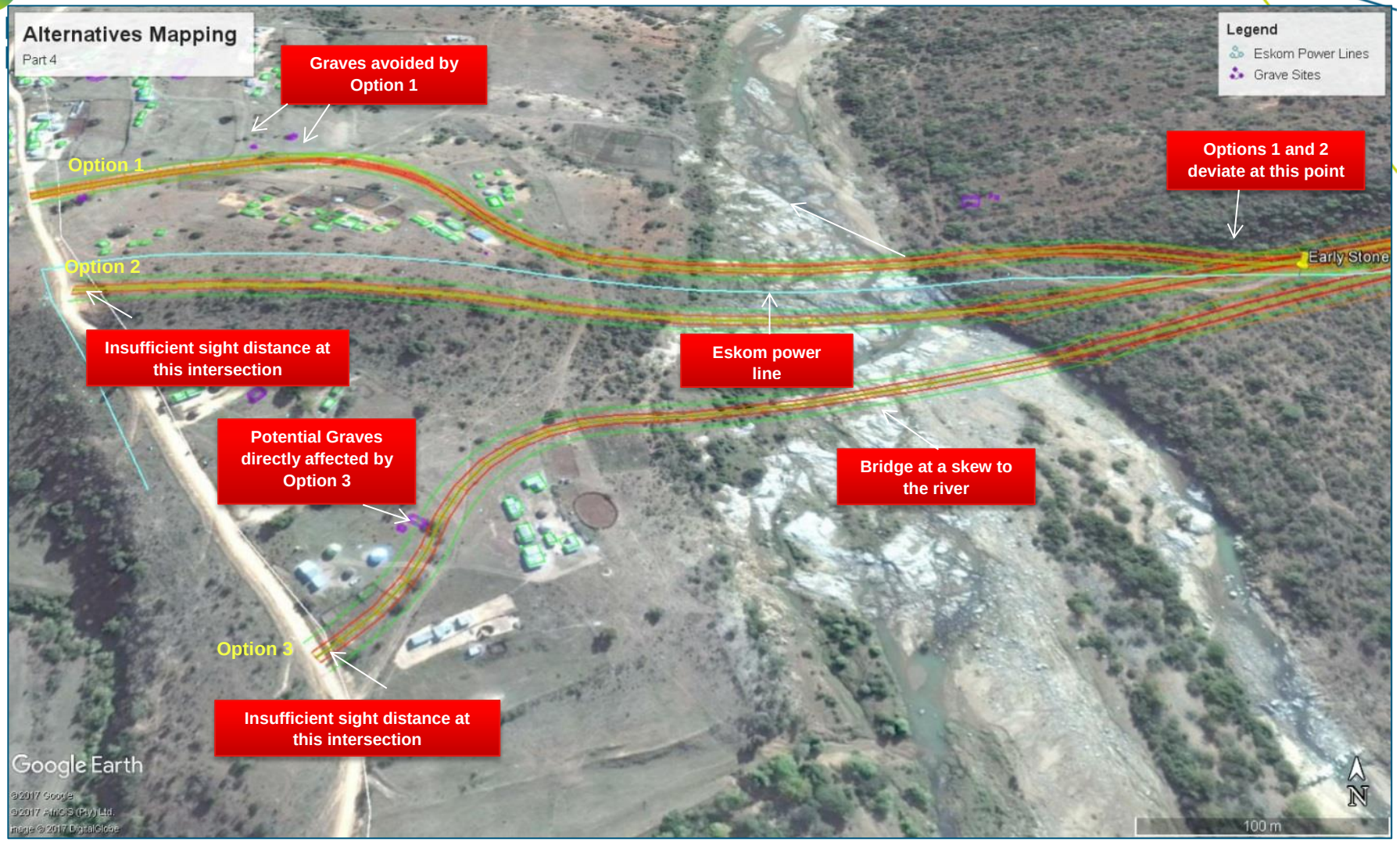


Figure 16: Options for Part 4

5.1.7 Preferred Alternative (Option 1)

The reasons why Option 1 has been selected as the preferred option are as follows:

- The alignment requires no exhumation or relocation of graves;
- The alignment largely avoids the Eskom power line and requires fewer pylons to be relocated;
- The tie-in point of the alignment (Bridge Option 1) is at a its shortest crossing of the White Mfolozi River;
- The bridge is perpendicular to the river;
- There is adequate sight distance for a 60 km/h design speed where the road intersects with D2047.

5.2 Bridge Type (Design) Alternatives

In addition to location alternatives, bridge design alternatives have also been considered.

5.2.1 Pedestrian Bridge vs Road Bridge

In considering whether a pedestrian bridge or road bridge should be provided at this crossing, consideration is given to the locality of the existing roads on either side of the river. In situations where there are roads reasonably close to the crossing point, or leading towards the crossing point on both banks of the river, then the provision of a pedestrian bridge should not be considered.

Experience has shown that where pedestrian bridges are built in such situations, requests are received later for the provision of a road bridge in close proximity to the pedestrian bridge. With the White Mfolozi crossing, the provision of a pedestrian bridge can be expected to result in a subsequent demand for a road bridge in the nearby vicinity.

5.2.2 Class of Bridge

Initially a Class 3 bridge structure was proposed by the design team, however, following pre-application consultation with *eZemvelo* KZN Wildlife, a Class 4 bridge structure was requested. The design team re-visited the design and a Class 4 bridge structure has been deemed appropriate. As detailed earlier, the L2598 link will be re-declared as the D2047. As this road can be expected to develop into a public transport access route serving the local settlements in the area, a Class 4 classification is appropriate for this function.

It is important to note that the class of the road relates directly to the functionality of the road therefore a functional classification is not related to the traffic or design standards of a road.

According to the TRH 26 South African Road Classification and Access Management Manual (2012):

> *"Roads must be classified exclusively on the basis of their function. The functional classification therefore cannot be derived from unrelated criteria such as the current type, size or condition of the road network. The fact that a road has been built or managed to a particular standard does not mean that it has a particular function".*

A distinction must be made between the Class (Functional Classification) and Type (Design Standard) of a specific road. Furthermore, the TRH 26 South African Road Classification and Access Management Manual (2012) explains that traffic volume and travel speed are not used as a criteria in the classification of a road.

In determining the functional classification of the bridge structure, a higher-order bridge structure (i.e. a Class 3 road cross-section) was initially proposed. Where roads cross major rivers, it is advisable to build bridges to the standard required for a higher class than the given road classification in instances where high flood flows are maintained for several days. A long term view should be taken with respect to the length and width of bridges and future clearances that could limit the future development potential of carriageways. However, in this instance, a Class 4 cross-section for the bridge has been deemed appropriate by the transportation planning team and a Class 4 bridge structure is proposed.

However, it is noted that the Class 4 bridge is now designed for a lower flood return period (1:10 yr flood) as opposed to the previously proposed Class 3 bridge which was designed for a higher flood return period (1:20 yr flood). This is not ideal from an ecological perspective.

5.2.3 Dual Lane vs Single Lane Bridge with Pedestrian Walkway

It is safer to cater for a Class 4 road bridge width which will allow two large vehicles to pass in opposite direction comfortably. Due to the bridge length options, the vehicles are more likely to increase speed on a straight deck; a single lane bridge will be unsafe considering sight distance and the waiting period needed for oncoming traffic to pass, this would be easily mitigated with a Class 4 road width.

5.3 Bridge Deck Structural Alternatives

The following structural forms were considered:

- Twin rib;
- Box girder bridge;
- Voided deck bridge; and
- Precast beam.

The following parameters (design goals) were considered in selecting the bridge structure form:

- Safety;
- Strength: serviceability, durability and robustness;
- Constructability;
- Economy; and
- Aesthetics.

5.3.1 Safety, Serviceability, Durability and Robustness

All four (4) structural options satisfy the four design goals. These are mandatory.

5.3.2 Constructability

All proposed structural forms require similar effort regarding the construction of the abutments and piers. The difference would be the total cost of the bridge.

With regards to constructability, about 7 m of excavation is required on the D2047 abutment which will be a challenge but this is the scenario for all options. These deep excavations will require lateral shoring designed by a Professional Engineer. The fact that this abutment is out of the main channel allows for construction of berms out of the main watercourse.

All the proposed bridge form options are constructible.

5.3.3 Economy

The bridge costs are summarized in **Table 13** below. These costs include Preliminary and General costs (P&G), accommodation of traffic and 200 m of road works on the bridge approaches.

Table 13: Estimate costs of the bridge structural options

Structural Alternative Description	Twin rib	Box girder bridge	Voided deck bridge	Precast beam
Description	Twin rib	Box girder bridge	Voided deck bridge	Precast beam
Total Volume of concrete (m^3)	2845	3110	3295	2857
Total Estimate (incl. VAT)	**68 652 063.85**	**71 196 279.37**	**73 209 123.93**	**79 334 679.18**

Of the considered alternatives, the most economic structural form is the Twin rib bridge.

5.3.4 Aesthetics

Due to the close proximity of this bridge to the national parks, it is essential for the bridge to harmoniously blend into the environment. To this end the bridge parapets shall be constructed of tinted concrete with a colour which blends with the local environment.

5.4 Need for a High-lying Structure instead of a Low-lying Structure

The road geometrics (long section) dictates that a higher bridge, spanning a total of 180 m, be provided to reduce the huge cut on either side of the bridge which would be inevitable should a low–level structure be provided. The high level structure would result in less environmental impact due to reduced cut, whereas a bridge at a lower finished road level would have resulted in much steeper and unsafe gradients and much deeper cuts. In addition, a low level structure will potentially collect debris when the river is in flood and will potentially significantly alter the flow of the river and may promote significant channel islanding on the downward side of the bridge.

5.5 No-Go Alternative

The alternative of not constructing the bridge and link road will lead to the primary goal of improving mobility and accessibility of the local residents in the KwaMbambo and Sgodiphola area along the White Mfolozi River, not being met. The local residents will have to continue utilising the D2047 which links to P47 then P52 in order to travel to Ulundi which is a travel distance of more than 40 km. The proposed construction of the new river bridge and the upgrading of the L2598 link road will reduce their travelling distance by more than half to approximately 15 km.

Furthermore, the proposed project will provide the local resident's with improved access to critical social facilities e.g. two district hospitals (Nkonjeni and Ceza) with a total of 19 fixed clinics, police stations and recreational services.

Furthermore, a pedestrian bridge is not considered as a reasonable alternative as there are existing roads close to the crossing point that can been linked to provide access to the communities on either side of the bridge. The communities consulted thus far have also expressed the need for a vehicular bridge as opposed to a pedestrian bridge.

6 DESCRIPTION OF THE BASELINE ENVIRONMENT

6.1 Climate

The town of Ulundi usually receives approximately 685 mm of rain per year which falls primarily during mid-summer. The area receives the lowest rainfall in July (7 mm) and the highest in December (105 mm). The average midday temperatures range from about 21.9°C in June to 28.9°C in January. The coldest temperatures in the Ulundi area are observed in July where nightly temperatures are, on average, 7.5°C[5].

6.2 Drainage Setting and Topography

The road traverses two DWS quaternary catchments; W21J (east) and W21H (west), both within the greater White Mfolozi River catchment. The majority of the proposed link road upgrade will occur with quaternary catchment W21J, whilst the proposed bridge crossing over the White Mfolozi River will occur within quaternary catchment W21H.

The 1: 50000 2831AD topo-cadastral map indicates that the proposed link road runs parallel to the Mooti River, a perennial left-bank tributary of the White Mfolozi River, and crosses seven (7) non-perennial tributaries of left-bank tributary. The White Mfolozi is a major perennial river that joins the Black Mfolozi 120km downstream to form the Mfolozi River that flows into the Indian Ocean.

According to the 1999 desktop PES assessment, the White Mfolozi River is in a 'Largely Natural' condition.

6.3 Geology

The site of the development falls partly on very old, Swazian aged granites, quartzite and dolomite, Randian aged Diabase of the White Mfolozi area as well as Permian aged tillites and Jurassic aged dolerite of the Karoo Supergroup (**Figure 17**).

[5] *http://saexplorer.co.za/south-africa/climate/ulundi_climate.asp*

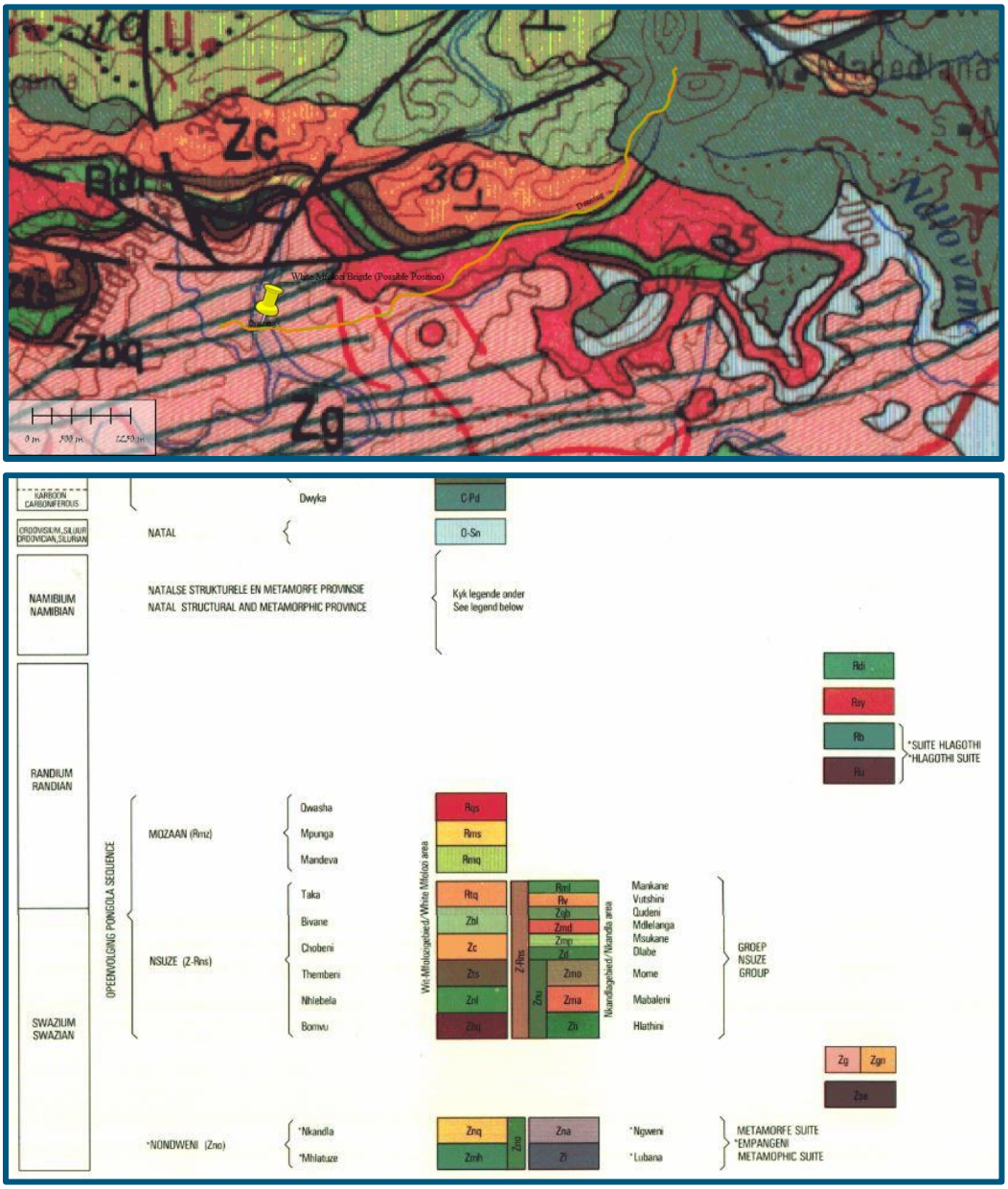


Figure 17: Geology of the study area

6.4 Soils

Table 14 below provides a summary of the main features of the soil forms encountered in the study area.

Table 14: Soil forms encountered in the study area

Soil Family	Features
Dresden	These soils are non-arable when the rooting depth is less than 400 mm. The easily dispersed topsoil is highly erodible. Poor drainage may lead to salinity problems on soil derived from Dwyka Tillite.
Glenrosa	Glenrosa soils are widespread throughout KZN. They comprise of grey loamy sand to clay that is typically 200 mm to 400 mm deep. However, tongues of soil do

Soil Family	Features
	penetrate into a substrate of weathering rock, thus permitting some root, moisture and nutrient penetration to a deeper level. They carry a high erosion hazard.
Mispah	Also highly erodible, exceptionally good surface water management required. Topsoil depth is often less than 200 mm, covering a stratum of densely bedded shale or solid rock. Often found in proximity to Glenrosa soils or merging into them, depending on highly localised weathering. Mispah soils also carry a high erosion hazard.
Willowbrook	Apart from the topsoil, the Willowbrook and Katspruit Soil Forms are very similar. The diagnostic difference is in the topsoil which is in the form of heavy clay. Hard ridges and gullies formed by tractor tyres when the gluey mud dries out. Not arable when the rooting depth is less than 400 mm.

Photograph 3: Typical Glenrosa profile (L). Typical Mispah profile (R)

6.5 Land Use

The western portion of the study area is characterised by the existence of rural smallholdings associated with the KwaMbambo community, D2047 road and the Nkamelwane Primary School. Traditional agricultural activities are evident as well as livestock grazing.

Across the White Mfolozi River, there are clustered smallholdings situated along the proposed route of the L2598. The identified small holdings are associated with traditional agricultural activities as well as livestock grazing. This land use pattern is common within the overall study area. Approximately 2.6 km south of the proposed bridge is the Ophathe Game Reserve. An Eskom powerline runs parallel to the proposed link road alignment.

The area beyond the proposed bridge has similar land uses to the sections mentioned above. The dominant land use is rural low density residential area i.e. the KwaMphothi community characterised by smallholdings clustered in a linear pattern close to the L2598. Traditional agricultural activities are noted as a source of food. The Mphothi Primary School is located in close proximity to the proposed link road whilst the Matshitsholo Community Conservation Areas is located west (39 – 90 m) of the proposed road and bridge.

6.6 Conservation Context

Understanding the conservation context and importance of the study area and surrounds is important to inform decision-making regarding the management of the resources in the area. In this regard, national, provincial and regional conservation planning information available was interrogated to obtain an overview of the study site in terms of conservation. Key findings that have a bearing on the proposed development include the following:

6.6.1 National and Provincial Vegetation Type (Mucina & Rutherford, 2006)

At a regional and local vegetation type scale, the study corridor falls within the Northern Zululand Sourveld (SVl 22) to the north and the Zululand Lowveld (SVl 23) to the south (Mucina and Rutherford, 2006 and Scott-Shaw and Escott, 2011) as shown in **Figure 18**.

The Northern Zululand Sourveld is characterised by three broad vegetation types including wooded grassland, sour grassland and dense bushveld thickets (Mucina and Rutherford, 2006).

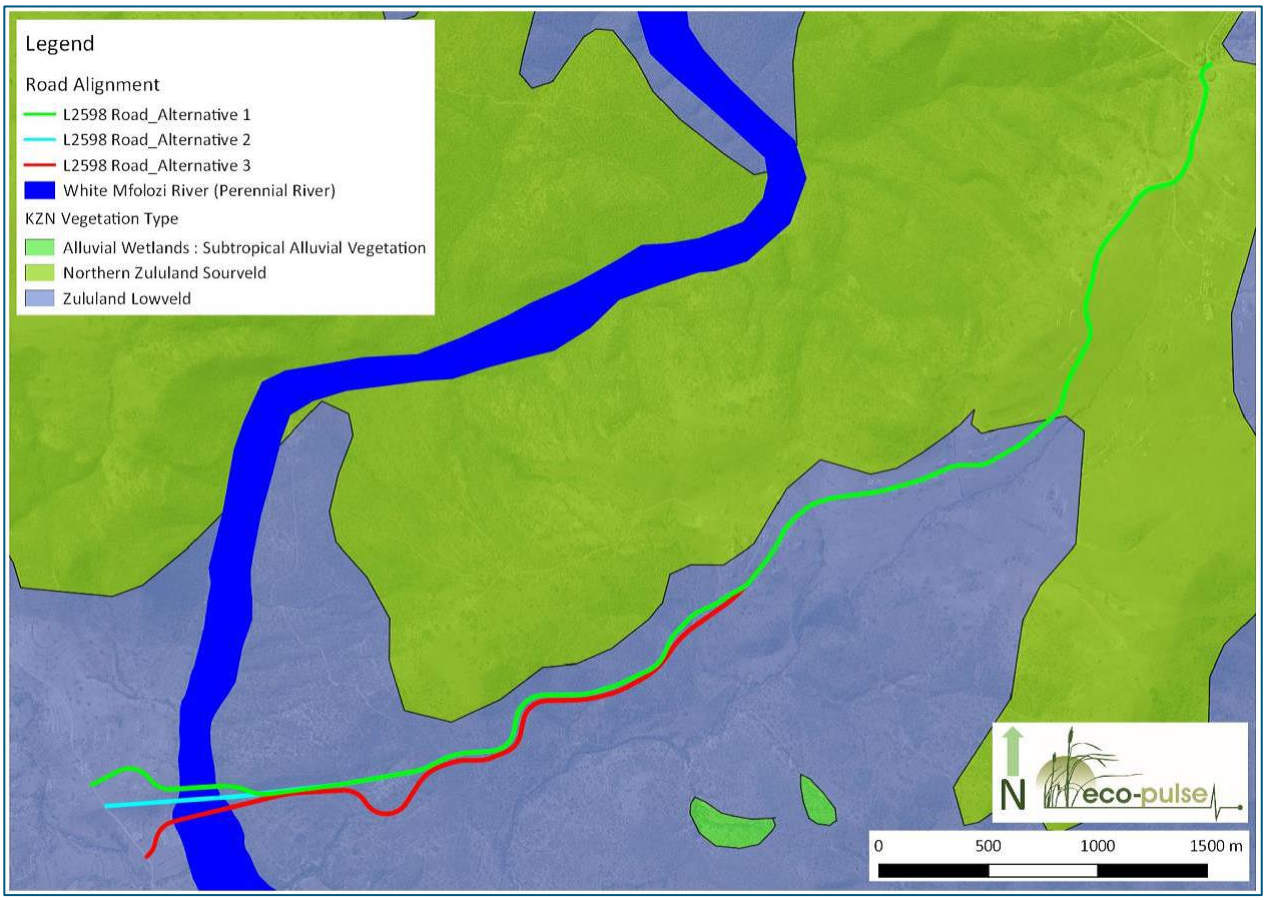


Figure 18: Map showing the distribution of Provincial vegetation types within and around the study area (Scott-Shaw & Escott, 2011)

The Northern Zululand Sourveld has a national threat status of Vulnerable (NBA, 2011) and provincial threat status of Least Threatened (Jewitt, 2014). Only 4% of the unit is statutorily conserved, mainly in the Hluhluwe-iMfolozi Park and Ithala Game Reserve and hence considered poorly protected (Mucina and Rutherford, 2006).

The Zululand Lowveld has a national and provincial threat status of Vulnerable (NBA, 2011; Jewitt, 2014). Approximately 11% of the unit is statutorily conserved, mainly in the Hluhluwe-iMfolozi Park and Pongolapoort Nature Reserve and hence considered poorly protected (Mucina and Rutherford, 2006).

6.6.2 National Freshwater Ecosystem Priority Area (NFEPA) Assessment (CSIR, 2011)

In terms of the NFEPA project, the Lowveld Group 11 wetland vegetation group is listed as **Vulnerable.**

6.6.3 KwaZulu-Natal Aquatic Systematic Conservation Plan (EKZNW, 2007)

The local wetland type, which occurs within close proximity to the study area, Alluvial Wetlands: Subtropical Alluvial Vegetation, is listed as **Endangered**.

In terms of the KZN Aquatic Systematic Conservation Plan (SCP), the planning units No. 1872, 1879 and 1895 which account for the area covered by the proposed road alignment are 'Earmarked' for conservation. This means the catchment has been identified as having a potential to conserve aquatic biodiversity.

6.6.4 KwaZulu-Natal Terrestrial Systematic Conservation Plan - TSCP (EKZNW, 2016)

Review of the 2016 Systemic Conservation Assessments (SCAs) planning datasets confirmed the presence of a Critical Biodiversity Area (CBA): Irreplaceable unit to be crossed by the proposed project that is associated with the intact Zululand Lowveld vegetation type and the Matshitsholo Community Conservation Area (CCA) located 39 – 90 m north of the proposed road servitude as shown in **Figure 19**.

Review of the KZN TSCP (*E*KZNW, 2011) indicates that the 2016 CBA: Irreplaceable unit is associated with the 2011 TSCP planning units that have flagged the presence of Black Rhino (*Diceros bicornis minor*) as a key feature, which is assumed to be the reason for the CBA category.

Furthermore, a portion of the road project in the west, adjacent to the CBA, is proposed to cross an ESA that has been defined as part of the SCA (*E*KZNW, 2016) (**Figure 19**). The identified ESA is a north-south aligned corridor that appears to link the Ophathe Game Reserve located ±2.6 km to the south of the proposed bridge site to a number of CBA: Irreplaceable areas to the north including the Matshitsholo CCA. In terms of the National Protected Areas Expansion Strategy (NPAES), the ESA corridor does not currently form part of the strategy.

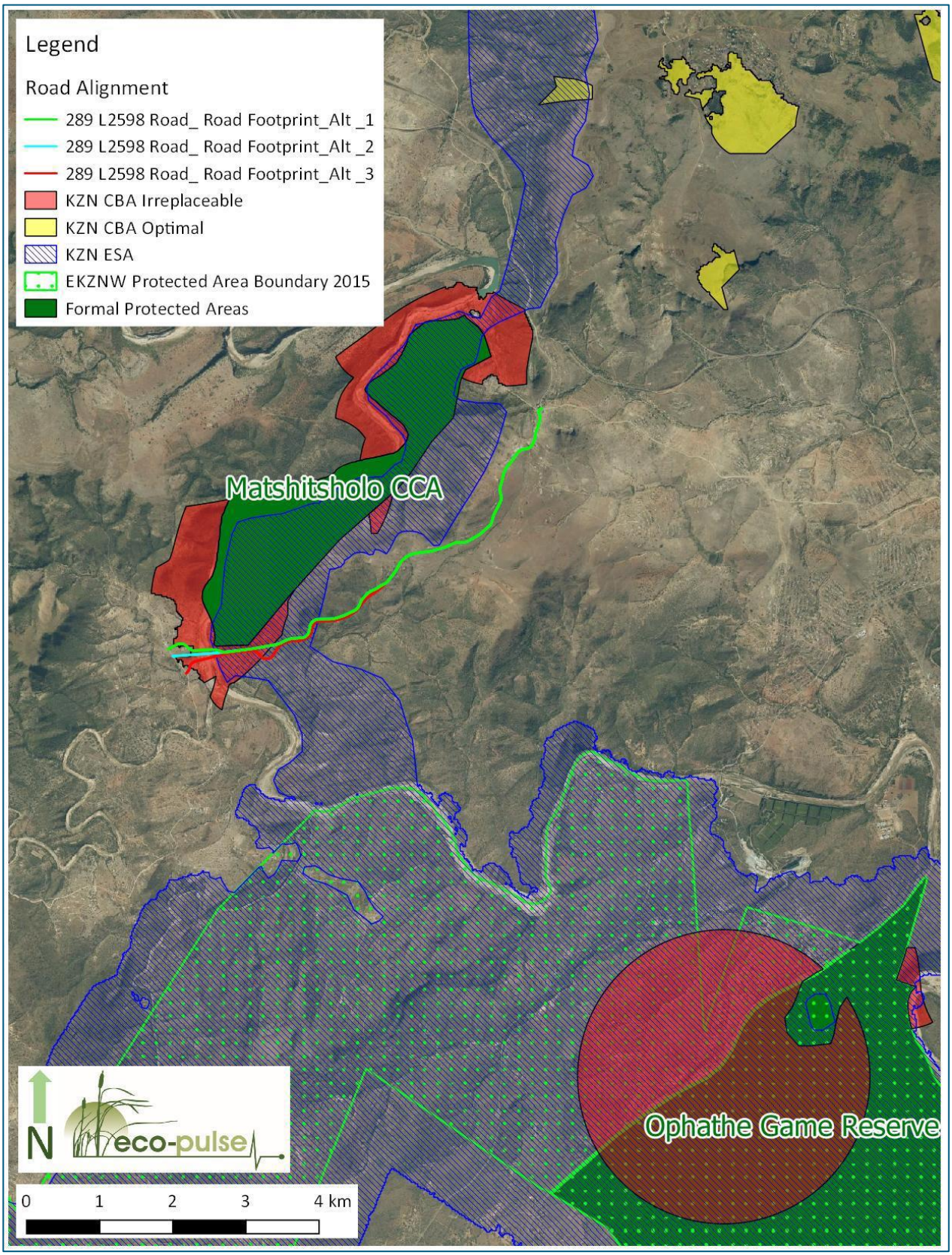


Figure 19: Map showing CBA: Irreplaceable and an ESA linking the Ophathe Game Reserve to the Matshitsholo CCA

6.7 Desktop Watercourse Delineation

The watercourse units occurring within a 500 m radius of the proposed project were mapped at a desktop level and classified in terms of their broad hydro-geomorphic (HGM) type (**Figure 20**). The majority of the watercourses currently crossed by the existing dirt road are steep, first order non-perennial streams that are tributaries to the Mooti River (left-bank tributary of the White Mfolozi River) (**Figure 20**). The Mooti River is of a higher order and is seasonal in nature. One seep wetland was identified within the valley head of the left-bank tributary in close proximity to proposed road upgrade. The proposed bridge crosses the perennial White Mfolozi River, which is a major river regionally.

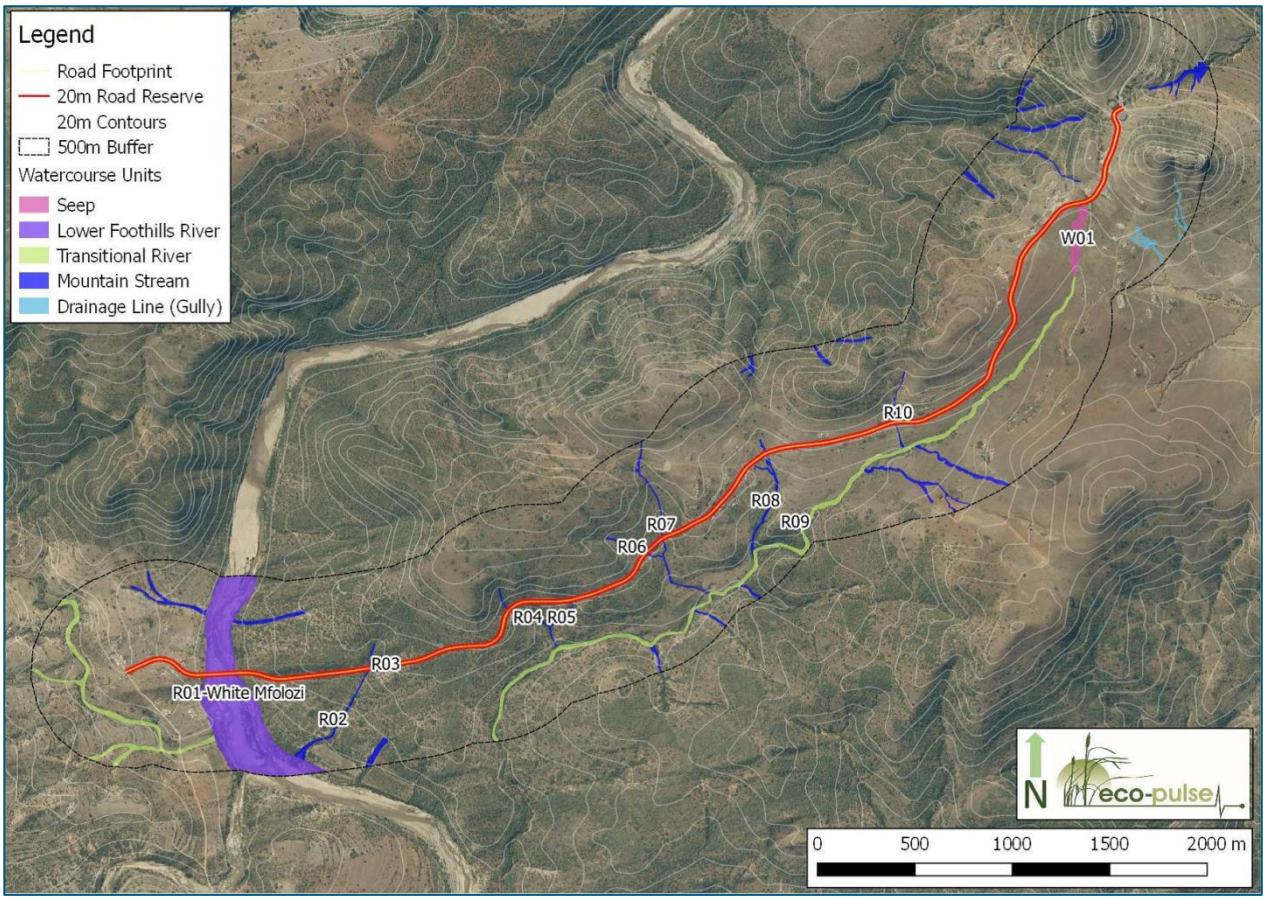


Figure 20: Desktop mapped watercourses classified according to hydro-geomorphic type

6.8 Heritage

6.8.1 Archaeology

The available evidence, as captured in the KwaZulu-Natal Museum heritage site inventories, indicates that this area contains a wide spectrum of archaeological sites covering different time periods and cultural traditions. Six (6) Early Stone Age sites have been recorded that date back to between 300 000 and 1.5 million years ago. Most of these sites are situated in dongas close to water with little in-situ material.

An astonishing fifty nine (59) Middle Stone Age sites have been recorded in the Hluhluwe-iMfolozi Park (HiP). Middle Stone Age sites are associated with anatomically modern people and dates back to approximately 40 000 to 200 000 years ago. The vast majority of Middle Stone Age sites in the HiP are open-air sites. Later Stone Age sites occur in various localities in the HiP. Thirty five (35) Later Stone Age

sites have been recorded. Although the majority of these sites are situated in the open-air context, some are also associated with small shelters and caves. These shelters have archaeological excavation potential. The Later Stone Age is usually associated with San hunter-gatherers or their immediate predecessors and dates back to between 200 and 30 000 years ago. Interestingly, the HiP also contains eleven (11) rare examples of Zululand rock art sites. Although not as well-known as the rock art of the Drakensberg, the art of this region is nevertheless unique as it is probably older and executed in a different style from the Drakensberg rock art.

Archaeological sites have also been recorded outside of the HiP although knowledge of these is more limited. An Early and Middle Stone Age site has been recorded on the farm Moordplaas that is situated directly adjacent to the study area. These tools are associated with erosion dongas and associated paleosoils. AMAFA staff also indicated that unrecorded Later Iron Age material have been noted on the farm Moordplaas (Roodt *pers comm*).

6.8.2 History

The greater Ulundi area is particularly well known for the development of the Zulu state of King Shaka Zulu in the early 1800's. The eMakhosini Valley (Valley of the Kings) is situated in the immediate environs to the south west of Ulundi. Surrounding the valley are several stone-walled structures associated with the once powerful Buthelezi and Khumalo clans. These clans later played a significant role in the formation of the Zulu kingdom. The famous king, Shaka Zulu, was born in the valley around 1785, and it is here that his forebears, King Nkosinkulu Zulu, King Phunga, King Mageba, King Ndaba, King Jama and King Senzangakhona, lie buried. The graves and royal residences of four Zulu rulers - King Shaka, King Dingane, King Mpande and King Cetshwayo, who ruled in succession from 1816 to 1884 – are located in the area around eMakhosini (Derwent, 2006). The valley is regarded as the ancestral homeland of the Zulu nation as such this valley can be classified as a cultural landscape. However, it is interesting to note that eMakhosini has not been nominated as such by the Provincial Heritage Agency (AMAFA).

The colonial history of the greater Ulundi area started around 1820 when early English ivory traders established themselves at Port Natal (Durban). Dutch descendants (i.e. Voortrekkers) moved into the area soon after 1834 and established a short-lived Boer republic called Natalia to the south of the Tugela River. However, by 1845, Natal became a British colony. In 1879, Zululand was invaded by British forces and the area annexed soon thereafter.

Significant heritage sites in the greater Ulundi area include the following:

- King Dingane's Royal Residence (uMgungundlovu) occupied between 1829 and 1838.
- Piet Retief's Grave and Monument - Voortrekker leader, Piet Retief and a group of his followers were put to death on King Dingane's orders at uMgungundlovu, and were buried at kwaMatiwane, the Hill of Execution.
- Biyaela Ancestral Sites.
- Spirit of eMakhosini Monument.
- Mtonjaneni Heights - several earthen mound British fortifications and King Dingane's Spring.
- Ophathe Game Reserve and battle sites.
- KwaGqokli Hill – the site of Shaka's most significant military victory.
- Fort Nolela – the British camped here prior to the Battle of Ulundi in 1879.
- Ondini Historical Reserve - residence of King Cetshwayo. The KwaZulu Cultural Museum is also located here.
- Nodwengu – residence of King Mpande.
- Ulundi Battlefield and Monument.

6.8.3 Palaeontology

The study area falls within stromatolitic dolomite and sedimentary rocks (Chobeni Formation and Dwyka Group) that contain highly significant fossils. No fossils are expected in the granite and dolerite on site, but the alluvium of the White Mfolozi River at the bridge site can contain significant Quaternary aged vertebrate fossils.

6.9 Social Environment

6.9.1 General Overview of the Beneficiary Local Municipality of Ulundi

The Ulundi Local Municipality (ULM) falls within the jurisdiction of the Zululand District Municipality (ZDM). The settlement patterns of the resident population within the local municipality show that 13.3% of the population are within urban centres (such as Ulundi), 80.4% reside on traditional land, and 6.3% reside on farms. The Zululand Growth and Development Plan (2030) states that this kind of settlement pattern has significant implications for development and service delivery throughout the district, as it indicates that the large majority of households in the district are affected by severe issues such as the lack of access to the road network, social facilities and economic opportunities.

Figure 21 illustrates the access to basic services, availed to the ULM population. While 73% of the population have electricity, 56% have access to potable water, with 60% having access to sanitation.

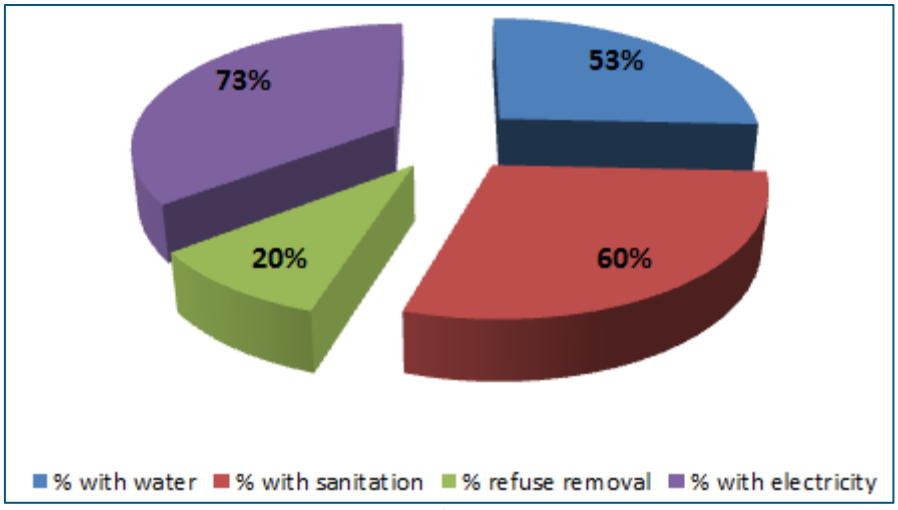


Figure 21: Basic service access in the Ulundi LM[6]

It also states that of the approximately 800 000 people in the District, more than 50% reside in Nongoma and Ulundi in mainly traditional settlement areas. The Ulundi and Nongoma Municipalities are regarded as two of the poorest rural municipalities in South Africa. Subsistence forms of production dominate in traditional areas involving mixed small-scale farming activities and livestock production.

According to the Zululand Growth and Development Plan (2030), the Ulundi Municipality hosts 22% of the District's employed population. The ULM contributed 26% of the District's Gross Value Added (GVA)[7].

[6] *Source Data: Zululand District Growth and Development Plan 2030.*
[7] *Gross Value Added (GVA) is the total of all production or services from every sector within the period of a year, and serves as an indication of the main economic drivers within an economy I.e. which sectors add the most value to the local economy.*

Minimal manufacturing or industrial activities currently exist within the ULM. The railway line which traverses the ULM, as well as the airport in Ulundi Town, might offer some opportunities for small-scale manufacturing activities, although the potential for this still needs to be investigated.

The KZN Provincial Treasury released the KZN Multiple Deprivation Index in 2011 that is based on income levels, employment levels, health, education, access to services, and crime rates. Each local municipality is allocated a score for each of the indicators, which are then totalled in order to derive the deprivation index for each locality. The ULM scored 41/51, with 51 showing the lowest level of deprivation. The results showed that Ulundi is not suffering from low deprivation levels, compared to other LM's within the District.

6.9.2 General Overview of the Relevant Municipal Wards

Ward 17 of the ULM

According to Census 2011, produced by Statistics South Africa, there are 8 694 people living in Ward 17 of the ULM (**Figure 22**). The median age in the Ward is 17 years, with 25.9% of the Ward's population under the age of 18. This is not reflective of a generally healthy age-specific population. Only 22.7% of the population are between the ages of 18 years to 65 years – representative of the working age population, fifty three (53%) percent of the population are recorded as 'female.'

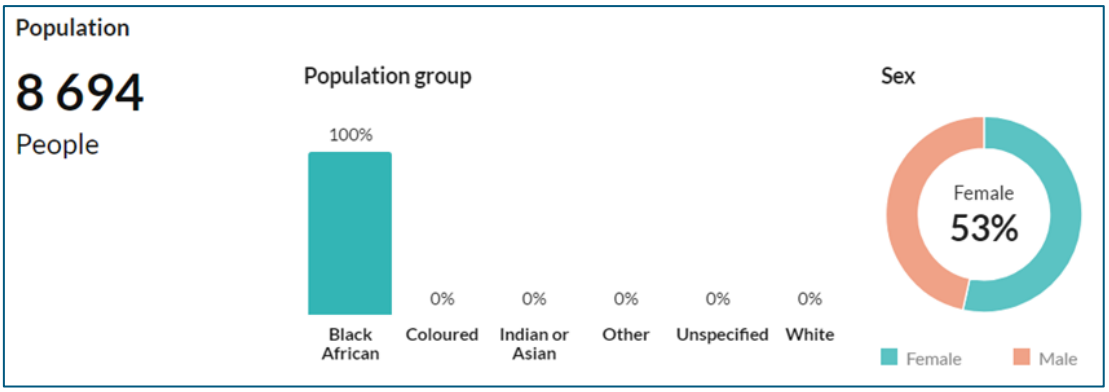


Figure 22: Population and gender in Ward 17

There is a recorded 1 572 homes in the ULM. A rough calculation shows that the average home supports at least 5 people.

Ninety seven percent (97%) of the Ward's population speak isiZulu, and 98.7% of the Ward's population are reportedly born in South Africa. There are 1 572 households in the Ward, with 55.7% of these households living in formal housing and nearly 30.6% residing in 'traditionally built' houses. Seventy two percent (72%) of households either own or are in the process of paying off the costs of their houses. It is reported that 1.8% (of the abovementioned 72%), have confirmed owning but have not fully paid off their residences. Nineteen percent (19%) are occupying their residences, rent free (**Figure 23**).

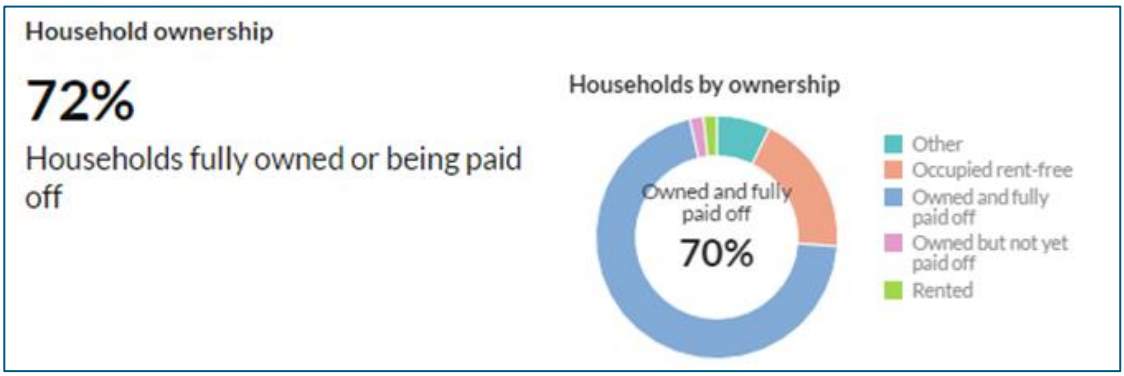


Figure 23: Household ownership in Ward 17

Heads of households are primarily female (59.5%). This may be due to a number of reasons, although the primary reason may be that many working age men tend to migrate to the larger cities in search of work, leaving the female of the household in charge.

The average income of households is R 29, 400 per year, with 34% of income-earning households earning between R 20, 000 to 40, 000 per year. The World Bank International poverty line stands at $1.90 per person per day[8]. In other words this is what a person would require to survive each day. Anything below $1.90 is regarded as being 'below the breadline.'

According to the statistics obtained, households in Ward 17 would each require R 47, 880 per year in order to survive (based on a household count of 5 people). Estimate calculations show that only 9% of the 1 527 households in the Ward are in fact living above the poverty line, meaning that 91% are living below it.

An estimated 79% of the Ward's population utilise the local water service provider for access to water. A relatively smaller portion of the population, that is 8.2%, utilise water from nearby rivers and dams (**Figure 24**). Slightly over 18% (18.2%) of Ward residents have access to flush / chemical toilets while 31% still utilise pit latrines and bucket toilets. Over twenty percent (20.3%) reportedly have no access to any form of toilet facility (**Figure 24**).

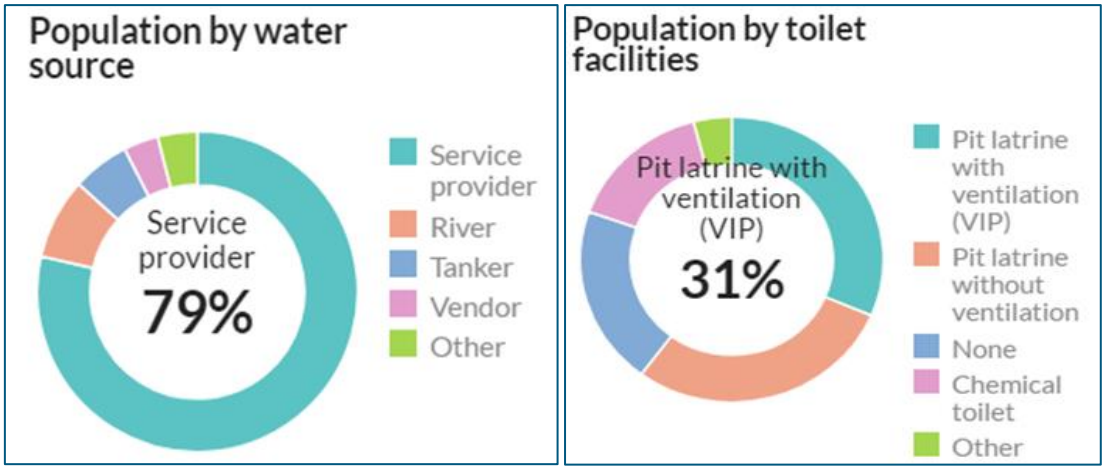


Figure 24: Water and sanitation in Ward 17

[8] *In October 2015, the World Bank updated the international poverty line to $1.90 a day. The new figure of $1.90 is based on ICP purchasing power parity (PPP) calculations and represent the international equivalent of what $1.90 could buy in the US in 2011. The new IPL replaces the $1.25 per day figure, which used 2005 data. (https://en.wikipedia.org/wiki/Poverty_threshold)*

Just over 13% (13.3%) of the Ward's working age population is reportedly employed, with 44.5% being the total employable population in the Ward. Fifty five percent (55%) of the population is recorded as 'not economically active'. This may include the elderly, children and others unable to, or not willing to work (**Figure 25**).

The small employed population is broadly indicative of a subsistence-based economy, where residents are 'living off the land'. This kind of food insecurity will leave the Ward's population very vulnerable during times of severe climatic changes such as droughts and floods. Sixty six percent (66.5%) of the small number of employed individuals (13.3% as reported above), reportedly work in the formal sector within the Ward, with a relatively small percentage (18.6%) in the informal sector (**Figure 25**).

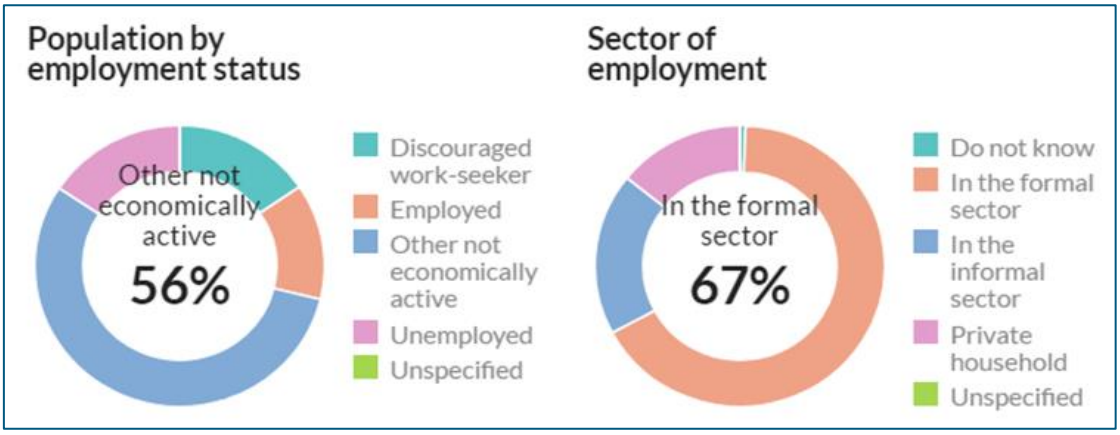


Figure 25: Employment by status and sector in Ward 17

Slightly over 55% of the Ward's population have completed Grade 9 or a higher educational level, with just over 29% of that figure completing Grade 12. Fifteen percent (15%) of individuals have never been to school. Currently 95.5% of children in the Ward are in school, representing a rate that is 10% higher than the average for the province (which is at 87.7%) - **Figure 26**.

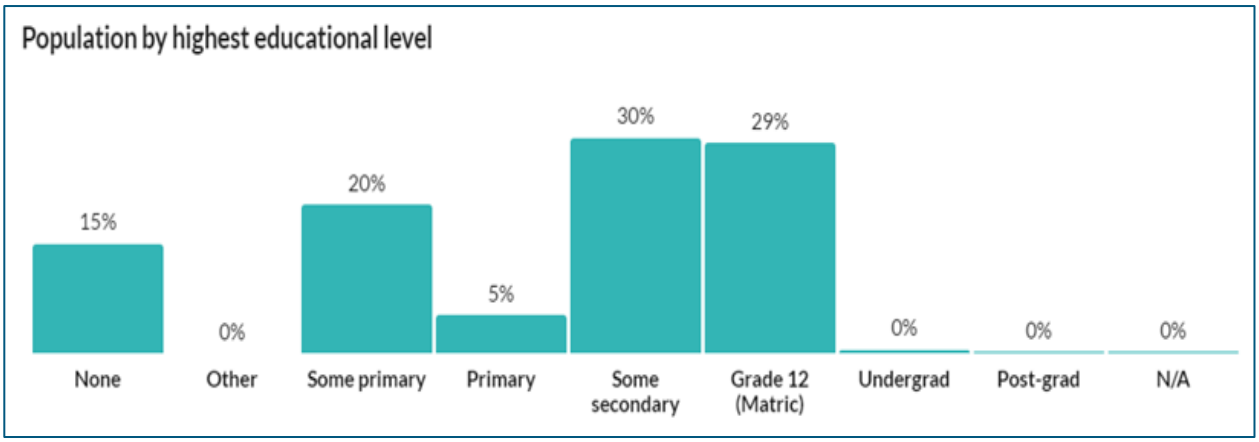


Figure 26: Highest educational level in Ward 17

Ward 23 of the Ulundi Local Municipality

According to Census 2011, produced by Statistics South Africa, there are 6 641 people living in Ward 23 of the ULM. The median age in the Ward is 17 years, with 26.9% of the Ward's population under the age

of 17 years. Fifty one percent (51%) of the Ward's population is over the age of 65 years. This is not reflective of a generally healthy age-specific population. Only 21.8% of the population are between the ages of 18 years to 65 years – representative of the working age population. Fifty four (54%) percent of the population are recorded as 'female' (**Figure 27**).

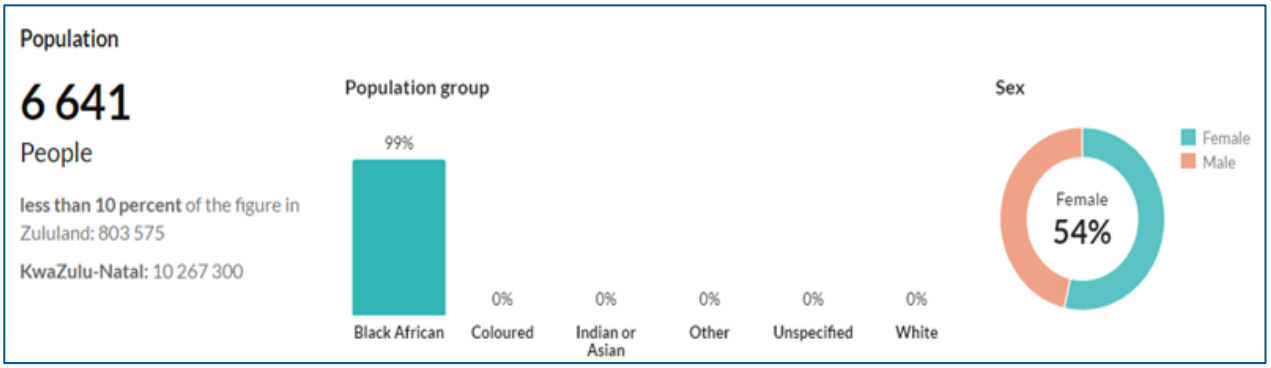


Figure 27: Population and gender in Ward 23

There is a recorded 1 293 homes in the ULM. A rough calculation shows the average home supports at least 5 people.

Ninety seven percent (97%) of the Ward's population speak isiZulu, and 99.2% of the Ward's population are reportedly born in South Africa. There are 1 293 households in the Ward, with 85.2% of these households living in formal housing and nearly 12% residing in 'traditionally built' houses. Ninety four percent (94%) of households either own or are in the process of paying off the costs of their houses. It is reported that 93.7% (of the abovementioned 94%), have confirmed owning and already paid off their residences. A little over 1% (1.4%) are occupying their residences, rent free (**Figure 28**).

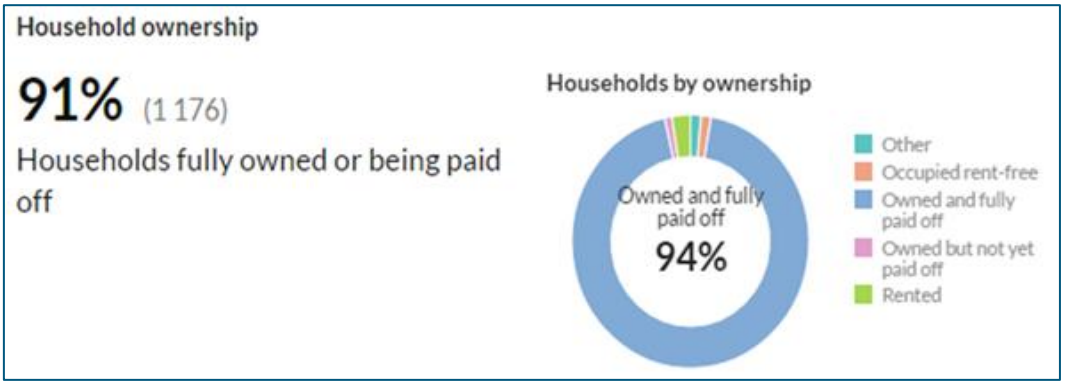


Figure 28: Household ownership in Ward 23

Heads of households are primarily female (58.4%). This may be due to a number of reasons, although the primary reason may be that many working age men tend to migrate to the larger cities in search of work, leaving the female of the household in charge.

The average income of households is R 29, 400 per year, with 32% of income-earning households earning between R 20, 000 to R 40, 000 per year.

According to the statistics obtained, households in Ward 17 would each require R 47, 880 per year in order to survive (based on a household count of 5 people). Estimate calculations show that only 10%[9] of the 1 293 households in the Ward are in fact living above the poverty line, meaning that 90% are living below it.

An estimated 52.9% of the Ward's population utilise the local water service provider for access to water. A relatively large portion of the population, that is 33.7%, utilise water from nearby rivers and dams (**Figure 29**). Slightly over 43% (43.8%) of Ward residents have access to flush / chemical toilets while 31% still utilise pit latrines and bucket toilets. Fifteen percent (15%) reportedly have no access to any form of toilet facility (**Figure 29**).

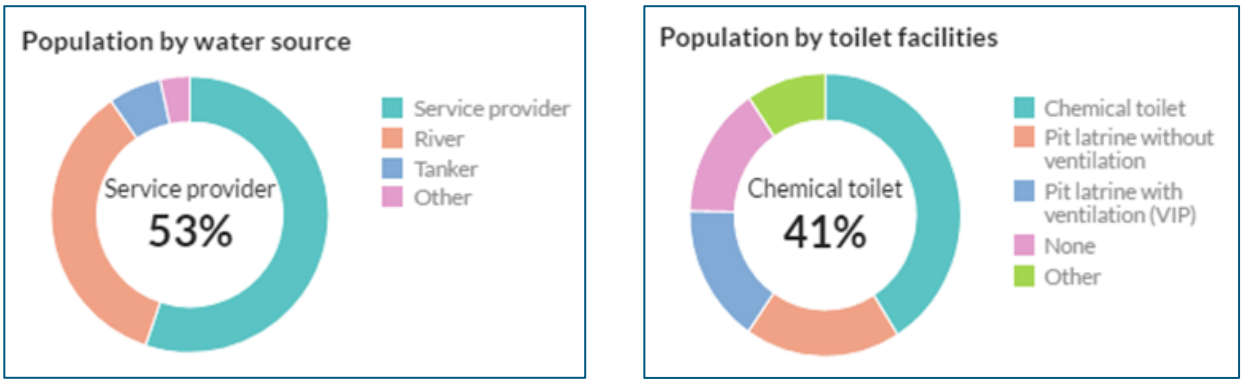


Figure 29: Water and sanitation in Ward 23

Just over 8% (8.5%) of the Ward's working age population is reportedly employed, with 36.1% being the total employable population in the Ward. Over sixty three percent (63.9%) of the population is recorded as 'not economically active'. This may include the elderly, children and others unable to, or not willing to work.

The small employed population is broadly indicative of a subsistence-based economy, where residents are 'living off the land'. This kind of food insecurity will leave the Ward's population very vulnerable during times of severe climatic changes such as droughts and floods. Almost 65% of the small number of employed individuals (of the 8.5% as reported above) reportedly work in the formal sector within the Ward, with a relatively small percentage (17%) in the informal sector (**Figure 30**).

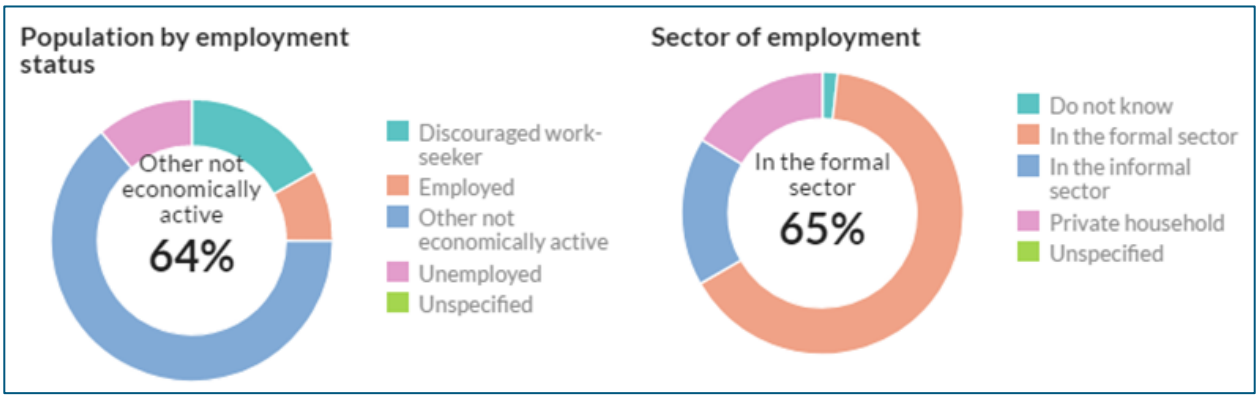


Figure 30: Employment status and sector in Ward 23

[9] *3% of HH's earning in the 40-75k bracket were included within the 10%. The total figure for this bracket earning is 13 %.*

Slightly over 50% (50.9%) of the Ward's population have completed Grade 9 or a higher eduactional level, with just over 24% of that figure completing Grade 12. Almost 15% (14.9%) of individuals have never been to school. These statistics are indicative of a very high uneducated population, higher than the province's and South African national average (**Figure 31**).

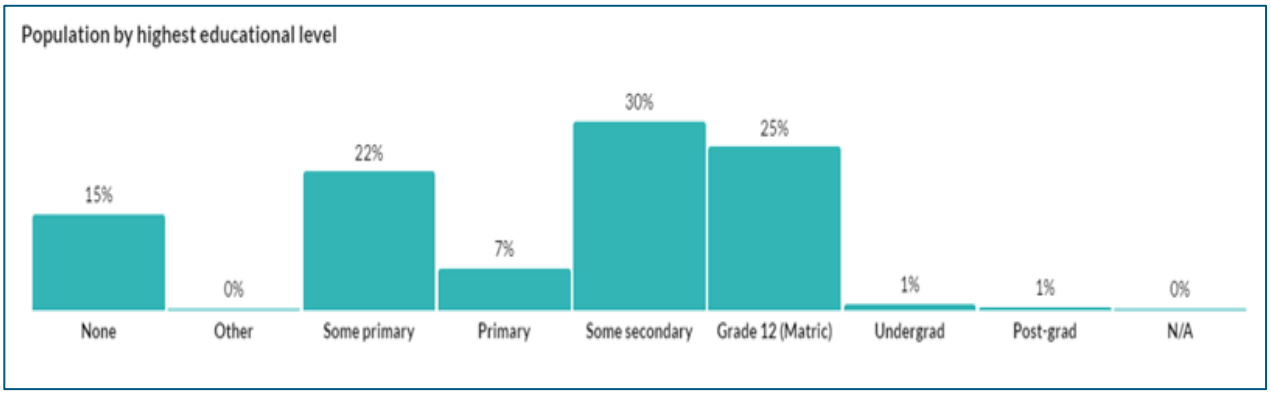


Figure 31: Educational level in Ward 23

6.9.3 Poverty and Vulnerability in the Ulundi Local Municipality

The Office of the Mayor has launched a project focused on the youth called 'Project for Change'. This intervention is designed to create a sustainable programme for child-headed households, children from single parent families, children raised by grandparents, and orphans. Specifically the objectives of the Project for Change are:

- To capacitate children from single parent families, child-headed households, children raised by grandparents and orphans with educational and skills development programmes in an attempt to reduce social ills;
- To break the cycle of poverty by involving youth in the community through the establishment of the Youth Forum;
- To encourage the participation of the youth in social responsibility programmes (for example the flagship programme and the youth ambassador programme in terms of *Sakuma Sakhe*);
- The creation of employment and the upliftment of rural communities; and
- To mitigate the impact of HIV / AIDS.

As part of the process of implementing the HIV / AIDS strategy adopted by the Council of the Municipality, its political office bearers and officials are engaged in the following programmes and initiatives:

- Conduct of HIV / AIDs awareness campaigns (*Operation Mbo*) jointly with Provincial Government Departments in particular the Department of Health and the Department of Social Development. These campaigns are conducted on a quarterly basis and communities from clustered adjacent wards gathered together in order to maximise the impact of the campaign,
- Coordinate the activities within the Municipality on World AIDS Day in December each year;
- The Local AIDS Council (LAC) for the Municipality has been in operation for a period of two years – the Mayor of the Municipality chairs the LAC, the members of which include ward councillors, non-governmental organisations, representatives from Ward Committees and Ward AIDS committees and all government departments. The LAC meets on a monthly basis and the Municipality takes responsibility for the administrative and logistical arrangements of these meetings. The Mayor of the Municipality serves on the District AIDS Council constituted by the Zululand District Municipality;
- Ward AIDS committees have been established in all 24 wards that constitute the Municipality; 10 of these committees were in existence prior to 1 July 2011 and the remaining 14 have been

established during the course of the 2011 / 2012 financial year. Ward AIDS committees are chaired by the Ward Councillor for the particular and are fully representative of the stakeholders in the ward – these committees meet on a monthly basis;

- Identification of orphans and vulnerable children; assistance is provided by facilitating access to grants through the Department of Social Development; and
- With the assistance of the Department of Health, facilitate the provision of social services to households headed by elderly grandmothers and child headed households through food parcels and food vouchers.

The pie chart below illustrates the severity of the HIV / AIDs scenario in the ULM with 15.7% of the population being HIV positive, with 60% of all deaths in the ULM, attributed to HIV / AIDs (Zululand District Growth and Development Plan, 2030).

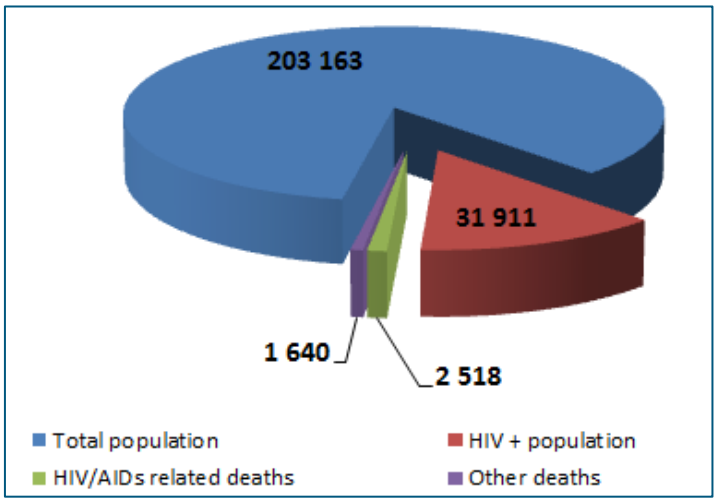


Figure 32: HIV/AIDs status in the Ulundi LM[10]

[10] *Source Data: Zululand District Growth and Development Plan 2030*

7 PUBLIC PARTICIPATION PROCESS

Public participation is a process that is designed to enable all interested and affected parties (I&APs) to voice their opinion and / or concerns which enables the practitioner to evaluate all aspects of the proposed development, with the objective of improving the project by maximising its benefits while minimising its adverse effects.

I&APs include all interested stakeholders, technical specialists, and the various relevant organs of state who work together to produce better decisions.

The primary aims of the public participation process are:

- to inform I&APs and key stakeholders of the proposed application and environmental studies;
- to initiate meaningful and timeous participation of I&APs;
- to identify issues and concerns of key stakeholders and I&APs with regards to the application for the development (i.e. focus on important issues);
- to promote transparency and an understanding of the project and its potential environmental (social and biophysical) impacts (both positive and negative);
- to provide information used for decision-making;
- to provide a structure for liaison and communication with I&APs and key stakeholders;
- to ensure inclusivity (the needs, interests and values of I&APs must be considered in the decision-making process);
- to focus on issues relevant to the project, and issues considered important by I&APs and key stakeholders; and
- to provide responses to I&AP queries.

The public participation process must adhere to the requirements of Regulations 41 and 42 (GNR 982) under the NEMA (as amended).

The public participation process for proposed project will be undertaken according to the stages outlined below.

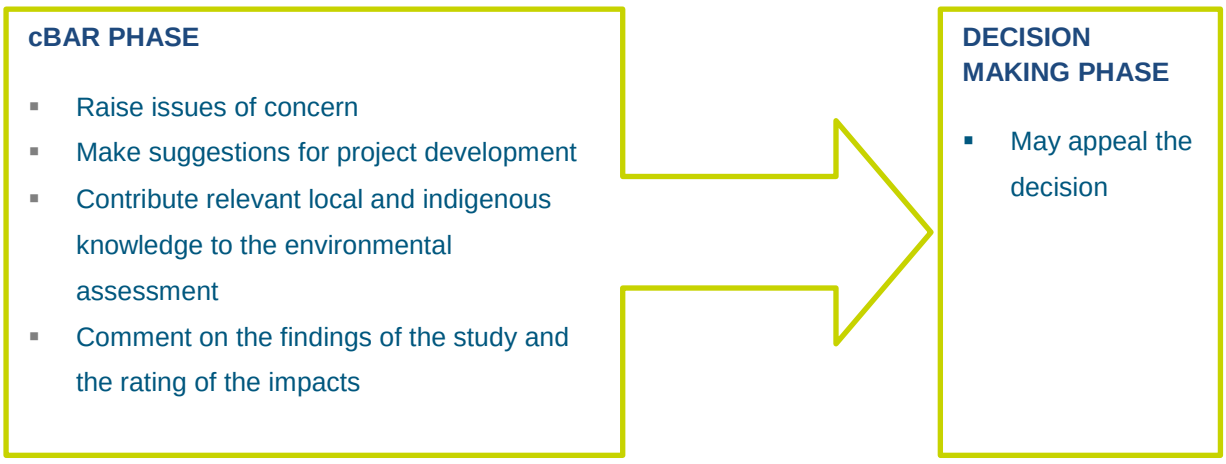


Figure 33: Responsibilities of I&APs

In order to achieve a higher level of engagement, a number of key activities have taken place and will continue to take place. These included the following:

- The identification of stakeholders is a key deliverable at the outset, and it is noted that there are different categories of stakeholders that must be engaged, from the different levels and categories of government, to relevant structures in the non-governmental organisation (NGO) sector, to the communities of wards of residential dwellings which surround the works;
- The development of a living and dynamic database that captures details of stakeholders from all sectors;
- The fielding of queries from I&APs and others, and providing appropriate information;
- The convening of specific stakeholder groupings/forums as the need arises;
- The preparation of reports based on information gathered throughout the BA *via* the PPP and feeding that into the relevant decision-makers;
- The PPP includes distribution of pamphlets or Background Information Documents (BIDs) and other information packs; and
- Where appropriate site visits may be organised, as well as targeted coverage by the media.

The proposed White Mfolozi Bridge and Link Road (inclusive of the culvert replacement on the connecting road) PPP has entailed the following activities.

7.1 Authority Consultation

The competent authority, the KZN EDTEA, is required to provide an EA (whether positive or negative) for the project. The KZN EDTEA was consulted from the outset of this study, and has been engaged throughout the project process.

Authority consultation included the following activities:

- Pre-application consultation with Mr Sibusiso Ndwandwe from the KZN EDTEA on 8th June 2017.
- Submission of an application for the combination of applications.
- Submission of an application for environmental authorisation in terms of **section 26** of the EIA Regulations (2014 as amended in 2017) on 14th November 2017.

7.2 Consultation with Other Relevant Stakeholders

Consultation with other relevant key stakeholders were, and will continue, to be undertaken through telephone calls and written correspondence in order to actively engage these stakeholders from the outset and to provide background information about the project during the BA process.

Relevant key stakeholders were consulted and sent pamphlets or BIDs and other information packs (where requested).

All relevant stakeholders will be allowed an opportunity to comment on the draft cBAR.

The identified stakeholders of this project are provided in **Table 15**.

Table 15: Key stakeholders

OWNERS AND OCCUPIERS OF LAND ADJACENT TO THE SITE
Traditional Authority Leadership Ingonyama Trust Board – Sue Ellis D. Sikhakhane – Community Liaison Officer
LOCAL AUTHORITY

N.G. Zulu S.B. Nkosi	Ulundi Local Municipality
	Zululand District Municipality
K.P Ngema and J.V Buthelezi	Councillors
STATE DEPARTMENTS	
Ms. Bernadet Pawandiwe	AMAFA KwaZulu-Natal
Mr. Sibusiso Ndwandwe	KwaZulu-Natal Department of Economic Development and Environmental Affairs
Ms. Modise	KwaZulu-Natal Department of Agriculture, Forestry and Fisheries
Ms. Jenny Longmore and Mr. Ian Rushworth	*eZemvelo* KZN Wildlife
Ms. Shameela Ramburan	National Department of Water and Sanitation
P. Govender	Eskom

7.3 Site Notification

The EIA Regulations (2014 as amended in 2017) require that a site notice be fixed at a place conspicuous to the public at the boundary or on the fence of the site where the activity to which the application relates and at points of access or high through traffic. The purpose of this is to draw people's attention to the project and make them aware that they are able to play a role in the project.

I&APs were identified primarily from responses received from the notices that were placed, notifying the public of the project and the invitation for the public to register as stakeholders and inform them of the PP Process.

Royal HaskoningDHV erected a number of notices at various prominent locations along the road alignment, at schools in the area and at the Traditional Council (refer to ***Appendix E***).

7.4 Identification of Interested and Affected Parties

E-mails and letters were sent to key stakeholders and other known I&APs, informing them of the application for the project, the availability of the draft cBAR for review and indicating how they could become involved in the project.

The contact details of all identified I&APs are updated on the project database, which is included in ***Appendix E***.

This database will be updated on an on-going basis throughout the BA process.

7.5 Briefing Paper

A Background Information Document (BID) BID for the proposed project was compiled in English and *isiZulu* (refer to ***Appendix E***) and distributed to key stakeholders.

The aim of this document is to provide a brief outline of the application and the nature of the development. It is also aimed at providing preliminary details regarding the BA process, and explains how I&APs could become involved in the project.

The briefing paper was distributed to all identified I&APs and stakeholders, together with a registration / comment sheet inviting I&APs to submit details of any issues, concerns or inputs they might have with regards to the project.

7.6 Focus Group Meeting

A Focus Group Meeting was held with Key Stakeholders (eZemvelo KZN Wildlife and AMAFA) on 28 July 2017. The purpose of the meeting was to introduce *E*KZNW and AMAFA to the proposed project in an attempt to seek guidance on the protected area aspirations and any expansion initiatives so as to incorporate both EKZNW and AMAFA's expectations into the development proposal at the earliest opportunity. the meeting EKZNW requested the Class of the bridge structure is reduced from a Class 3 to a Class 4 bridge structure. This request has been granted.

Minutes of the Focus Group Meeting are included in ***Appendix E***.

7.7 Public Meeting

Two public meetings were held with the local councillors; the local Indunas representing the Traditional Authorities and members of the community on 05 September 2017 at the KwaMpothi Primary School and the Landulwazi Primary School.

Minutes of the Public Meeting are included in ***Appendix E***.

7.8 Advertising

In compliance with the EIA Regulations (2014 as amended in 2017), notification of the commencement of the BA process for the project was advertised in two local newspapers, namely Isolezwe and iLanga on the 30th August 2017 and 31st August 2017 in *isiZulu*. I&APs were requested to register their interest in the project and become involved in the BA process. The primary aim of these advertisements was to ensure that the widest group of I&APs possible was informed and invited to provide input and questions and comments on the project. I&APs were also notified of the details of the public meetings to be held.

Furthermore, notification of the release of the draft cBAR for public review and comment was advertised in the iLanga and Isolewe Newspapers prior to the release of the draft cBAR for public review and comment.

I&APs were requested to register their interest in the project and become involved in the BA process. The primary aim of these advertisements was to ensure that the widest group of I&APs possible was informed and invited to provide input and questions and comments on the project.

7.9 Issues Trail

Issues and concerns raised in the public participation process during the BA process have been and will continue to be compiled into an Issues Trail.

The Issues Trail is attached as ***Appendix E***, in which all comments received and responses provided have been captured.

7.9.1 Key Issues Raised by the Public

The following comments / concerns were raised by EKZNW at the pre-application stakeholder engagement:

- *E*KZNW indicated that the area where the bridge is proposed is ideal black rhino habitat and there are long-term plans to extend the park into this area, although these plans are not concrete and at a very early stage. A proposed future Biodiversity Economy Node with high end tourism is potentially proposed in the area, long-term expansion plans were not made available to consider during the road network planning as *E*KZNW explained that these plans are often conceptual and confidential.
- Therefore, *E*KZNW would not be opposed to a bridge, provided it does not hinder potential future plans. To this end, the intention is not to have a high mobility route but rather access only. *E*KZNW requested the functional classification of the bridge is reduced from a Class 3 (mobility route) to a Class 4 (access route). The engineering team agreed to reconsider the functional classification of the bridge and a Class 4 bridge structure is now proposed.
- *E*KZNW noted that bridge crossing Option 2 was least preferred from *E*KZNW's perspective as the location on the hill would create a visual intrusion for the park.
- *E*KZNW requested that a combination of the bridge and link roads were considered in the BAR. This requested has been granted as presented in ***Section 5.1.5***.
- *E*KZNW presented on Famine Weed (*Parthenium hysterophous*). This is a concern to *E*KZNW for all road projects north of the Tugela River and *E*KZNW requested that this is considered in all EMPRs for roads to the north of the Province. The potential impacts and mitigation for Famine Weed are considered in this cBAR and EMPr.
- *E*KZNW further requested that impacts on the proposed Biodiversity Economy Node, such as visual intrusions and the aesthetics of the structure, ambient noise sounds, etc. are undertaken. The intention being the bridge should blend into the surrounding landscape without compromising safety standards and should facilitate access for the local communities but should not promote high volumes of traffic. Whilst the EAP has attempted to address some of these concerns, the long-term modelling and impact assessment is deemed to be beyond the scope of this site-specific EIA and *E*KZNW are encouraged to pursue a Strategic Environmental Assessment for the area.

The following comments / concerns were raised by AMAFA at the pre-application stakeholder engagement:

- AMAFA indicated that a Heritage Assessment is required which addresses the following requirements:
  - Historical sites in the area;
  - Stone age sites / Iron age sites;
  - Community heritage considerations such as impacts on sources of herbs, biodiversity, sources of clay, etc,;
  - Design and aesthetic considerations of the bridge (sense of place);
  - Map grave sites;
  - Consider Shembe sites;
  - Ensure that consultation is done with the iNkosi and Community.

  The HIA conducted meets these requirements.

The DWS and DAFF commented on the BID and requested further detailed studies are provided in the draft cBAR which the Departments will comment further on.

The following comments / concerns were raised by Community Members and Traditional Leadership at the Public Meetings:

The Matshitsholo Community Conservation Area border is found to be close to the link road, although not impacted by it. All indications at this point are that the Matshitsholo community is pleased with the proposed development, and do not oppose it. Results from two meetings held with the beneficiary communities reflect a positive and constructive engagement between the engineering team and community members in attendance.

The first meeting was attended by members from the communities of Sgodiphola, Mfiliji, Ngono, Mshisampisi, KwaMbambo, Mshiqo (communities along the D2047 road). It was held on the 5th September 2017 at the Landulwazi Primary school.

The Project team posed questions to the community members in attendance, trying to gauge their stance on aspects such as:

- Concerns and foreseeable benefit,
- Grave sites and areas of medicinal and cultural importance,
- Aesthetics and tourism, and
- Other specialist studies to be considered.

Further information relating to employment opportunities was rendered by the project team.

The results of the meeting showed that on the topic of ***Concerns and Foreseeable Benefit*****,** the following results were captured:

Item Results	Raised by
Taxi fares to be more reasonably priced due to a shorter travelling distance	Mr Dlamini
Property near Matshitsholo would be due for compensation if impacted	MJ Ntombela
Improvement in access to public facilities and employment benefits	Community members
Properties in KwaMbambo will not be affected	Mr Xulu

On the topic of ***Gravesites and Areas of Medicinal and Cultural Importance*****,** the following results were captured:

Item Results	Raised by
Confirmation of grave sites and no further graves identified	All community members
No Shembe sites[11] in existence in project area	
No herbs / plants of medicinal use in project area	

On the topic of **Aesthetics and Tourism,** the following results were captured:

Item Results	Raised by
Bridge is not viewed as a visual intrusion	All community members
Project will not deter future tourism potential	

A community member recommended that a Blasting study be undertaken to understand the impacts of such an activity, particularly within the project area of one of the Option routings, due to the common occurrence of large rock in the area. The project team had allayed fears, stating that the particular Option is not a preferred route. However, should blasting occur, due notification to the nearby community will take place to ensure safety of that community and any passers-by.

The project team had also transferred known information with regards to employment opportunities that are likely to result from the project. These include:

[11] *Following consultation of the community members by the Heritage Specialist, a Shembe site was pointed out at S 28° 18' 13.08" E 31° 20' 51.46"*

- The project will possibly require 60 people;
- Manual labour will be used more than machinery where possible;
- As per the KZN DoT request - Joint venture partners will be sought; and
- Training opportunities will be administered on site.

When asked whether the project may enhance criminal elements or criminal incidents such as stock theft in the community,the community participants indicated that they do not see stock theft as a cause for concern.

The second meeting was attended by members from the KwaMphothi community. It was held on the 5th September 2017 at the KwaMphothi Primary School. This meeting was relatively short in duration, as community members did not have pressing issues to be discussed. They did, however show their disappointment in that their expectation was that the meeting was called to announce a date for the commencement of construction, as opposed to a further call for discussions. A brief results table of the discussions is included below.

Item Results - Concerns and foreseeable benefit	Raised by
Drownings will not be an issue any longer	Councillor J. Ngema & Community members
Want the Project to speed up as environmental approval processes are taking too long	Mr Zuma and Councillor J. Ngema
Want to see needs of the people put before needs of the environment	Mr Sikhakhane
Item Results – Grievance channel	**Raised by**
C. Zwane is the community grievance contact person	Mr Zuma
Would like the DoT to look at surfacing the road, as opposed to gravel	Mr Zuma

7.10 Public Review of the draft Consultation BAR

The draft Consultation BAR (cBAR) will be made available for authority and public review for a total of 30 days from 15th November 2017 to 14th December 2017.

The report will be made available at the following public locations within the study area, which are all readily accessible to I&APs:

- Ulundi Public Library: BA 131 Corner of Princess Magogo and King Zwelithini, Ulundi, 3838
- Mbatha Traditional Council
- Mpungose Traditional Council
- Nobamba Traditional Council
- Royal HaskoningDHV Website: www.rhdhv.co.za/pages/services/environmental.php

7.11 Final Consultation BAR

The final stage in the BA process entails the capturing of responses and comments from I&APs on the cBAR in order to refine the cBAR, and ensure that all issues of significance are addressed.

The final cBAR (i.e. final cBAR) will be the product of all comments and studies, before being submitted to KZN EDTEA for review and decision-making.

7.12 PPP Summary

A summary of the PPP is provided in **Table 16** below, with the documents provided in ***Appendix E***.

Table 16: Summary of Public participation process

Activity	Description
Identifying stakeholders	Stakeholders were identified and a database of all I&APs were compiled.
Publishing newspaper adverts	The Isolezwe and The Ilanga.
Distribution of a BID	BIDs were distributed electronically and by hand to I&APs.
Erection of site notices	A number of A2 site notices were erected on the proposed extent.
Preparation of an on-going Issues Trail	Comments, issues of concern and suggestions received from stakeholders thus far have been captured in an Issues Trail.
Release of Draft Report	The draft Consultation Basic Assessment Report (cBAR) has been advertised and made available for a period of 30 days for public review and comment. This cBAR is now available for review until 14th December 2017.
Focus Group Meeting	Not expected.
Release of final Report	The final cBAR will be the product of all comments and studies, before being submitted to KZN EDTEA for review and decision-making.

8 SPECIALIST ASSESSMENTS

8.1 Geotechnical Assessment

Davies Lynn & Partners (Pty) Ltd (DLP) undertook a review of the logs of the boreholes drilled at the site of the proposed White Mfolozi Bridge, and prepared a report providing founding recommendations for the abutments and piers on the basis of an interpretation of these borehole profiles (***Appendix C6***).

The preliminary founding solution comprises shallow isolated spread bases founded within suitable, weathered rock. The founding elevations for the two (2 No.) abutments appear to be 488.94 m MSL, while the intermediate Piers 1 through 5 are founded at an elevation of 488.44 m MSL.

On the basis of a review of the borehole logs and photographs of core boxes, marginal elevation changes should be considered to achieve stable founding for spread foundations exerting net ground bearing pressures of approximately 400 kN / m^2 on the often highly fractured rock.

The isolated spread foundations supporting the bridge structure will be located within rock which is often highly fractured and possesses steeply dipping joints. In terms of the presence of the fractures as well as the probable presence of boulders, there would be merit in making provision for a number of 3 m to 5 m long steel dowels in each isolated base. The purpose of the dowels would largely be to bond the rock together over a 3 to 5 m depth below the foundations, particularly on the upstream side of the foundation bases.

8.2 Agricultural Potential

A Baseline Agricultural Potential assessment was undertaken by Msanzi Agriculture (***Appendix C4***).

8.2.1 BioResource Group (BRG) and BioResource Unit (BRU) Data

The study area falls within the Tb8-Ulundi and UVb1-Ndinde BRU, which in themselves fall within the BRG 22: Lowveld and BRG 16: Dry Lowland Tall Grassland respectively (**Figure 34**).

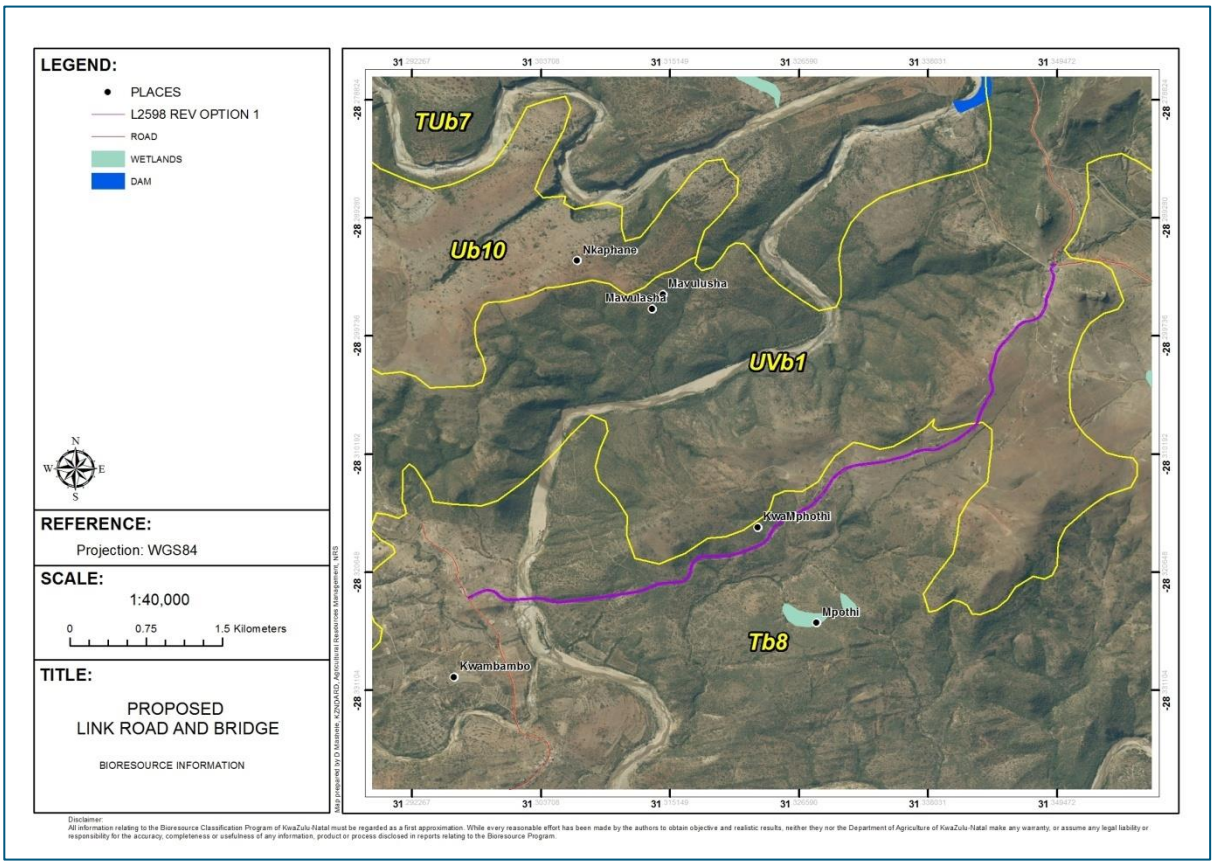


Figure 34: Locality of BRUs

8.2.2 Climate Capability

The climate capability rating for the BRU Tb8-Ulundi is C7. The corresponding rating for BRU UVb1-Ndinde is C5. Both BRUs are described as non-arable due to soil, slope, temperature and rainfall.

Table 17: Climate capability class

Climate Capability Class	Limitation Rating	Description
C5	Moderate to Severe	• Moderately restricted growing season due to low temperatures, frost and / or moisture stress • Suitable crops at risk of some yield loss
C7	Severe to very Severe	• Severely restricted choice of crops due to heat, cold and / or moisture stress

8.2.3 Land Capability Class (LCC)

The land capability of the Mispah, Glenrosa, Dresden and Willowbrook soils in the study area are categorised as Class VII i.e. land in Class VII has very severe limitations that make it unsuited to cultivation and that restrict its use largely to grazing, woodland or wildlife; restrictions associated with this LCC cannot be corrected such as very steep slopes, erosion, shallow soil, stones, wet soil salts or sodicity and unfavourable climate.

8.2.4 Agricultural Impact

The conclusion arrived at during this assessment is that the agricultural impact of the proposed project is negligible, if at all.

8.3 Freshwater Habitat Assessment

This study was undertaken by an **Eco-Pulse Environmental Consulting Services** (***Appendix C1***).

8.3.1 Screening

The screening process revealed that one (1) perennial river (White Mfolozi River), one (1) seasonal river (Mooti River), eight (8) ephemeral streams and one (1) seep wetland were assessed as being at a high 'likelihood of impact', the rationale for which is provided in **Table 18**, below. These watercourses are shown shaded in red for high 'likelihood of impact' (**Figure 35**). The high 'likelihood of impact' watercourse units were taken forward for further formal assessment and effectively formed the extent of the study area for this assessment. Watercourses at low 'likelihood of impact' are shaded in "green" (**Figure 35**), and were excluded from further assessment.

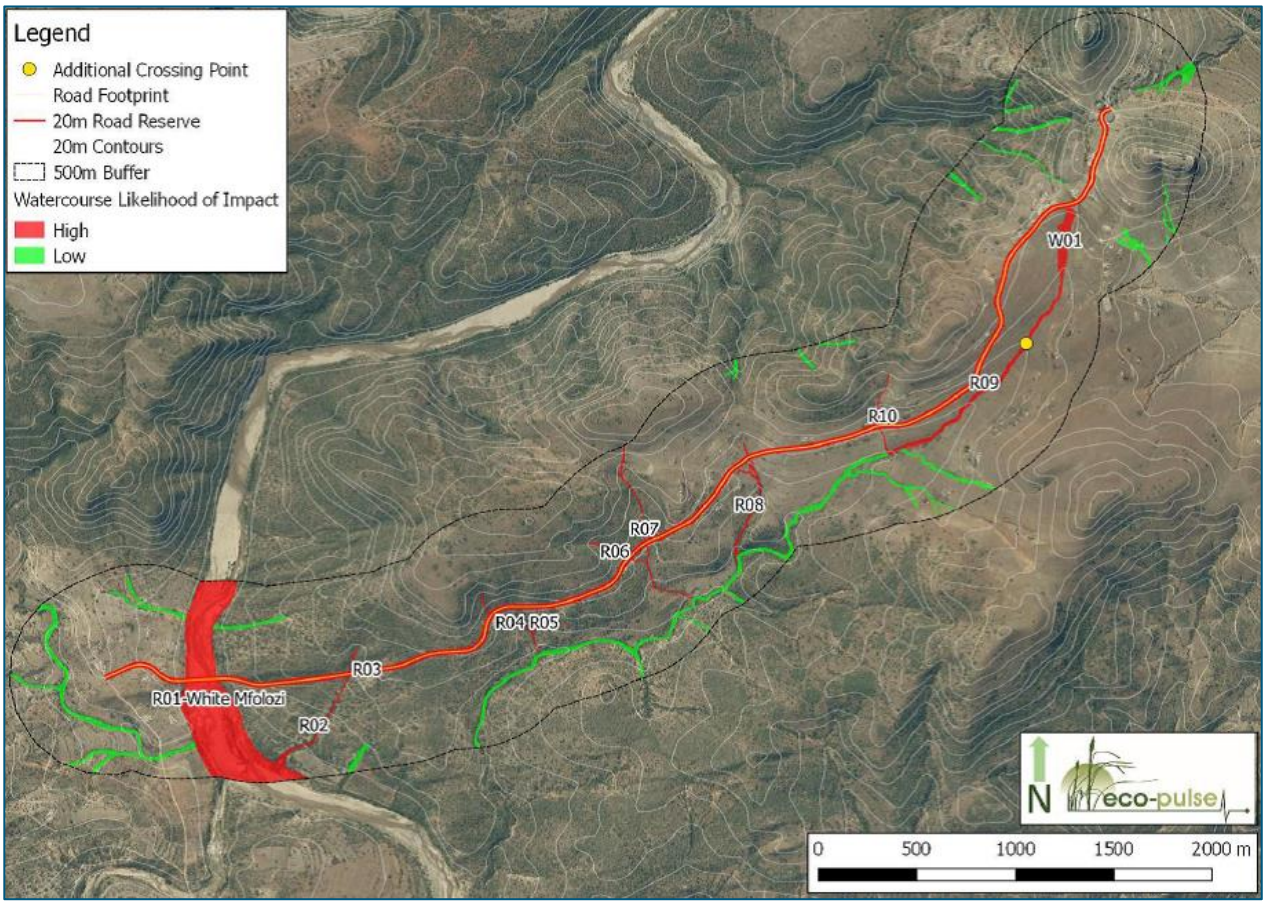
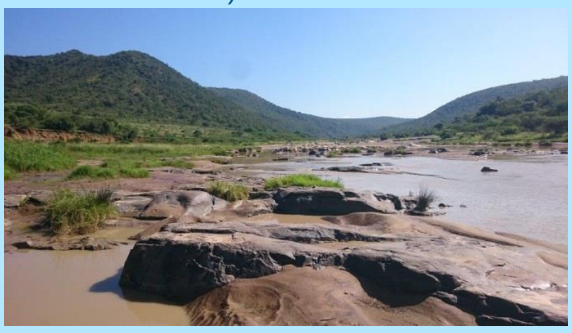


Figure 35: Likelihood of impact rating for the desktop mapped watercourses

Table 18: Preliminary risk ratings for the mapped watercourse units including rationale

Watercourse Units	Impact Potential	Rationale	Constitutes a Water Use
R01 - White Mfolozi High (definite)	High (Definite)	The White Mfolozi River will be crossed by the proposed bridge and incur direct and indirect (secondary) impacts as a result of bridge construction and operation activities.	Yes: Section 21c & i
R02 to R08 and R10	High (Definite)	Small streams are proposed to be crossed by the proposed link road and upgrade of existing road and will incur direct and indirect (secondary) impacts as a result of construction and operational activities.	Yes: Section 21c & i
R09	High (Definite)	The existing minor road that crosses the Mooti River will be upgraded along with the culvert and thus will incur direct and indirect impacts as a result of construction and operational activities relating to the proposed crossing / culvert upgrade.	Yes: Section 21c & i
W01	High (Definite)	Seep wetland located directly adjacent to the proposed link road and is highly likely to incur direct and indirect (secondary) impacts as a result of construction and operational activities relating to the proposed road upgrades.	Yes: Section 21c & i
Remaining watercourse	Low (Unlikely/None)	These watercourses units are either located in adjacent sub-catchments or some distance downslope or downstream/upstream of the proposed development. Activities that could alter the characteristics of these watercourses are therefore highly unlikely and as such, these watercourses will not form part of the water use trigger area.	No

8.3.2 Delineation, Classification and Habitat Characteristics

Watercourse	Description
Perennial Lower Foothills River (Unit R01 - White Mfolozi River)  **Photograph 4: View of the White Mfolozi River from south to north looking upstream from within the channel**	The White Mfolozi River is a perennial, lower foothills river characterised by a low gradient, mixed bedrock-alluvial channel predominantly characterised by an alluvial bed with localised rock outcrops comprising granite and dolerite forming localised knickpoints (areas of bed steepening) along the river. The section of river proposed to be crossed is located at one of these outcrops. At the local scale, the river comprises a relatively wide active channel confined within steep and defined height banks or varying height. The full extent of the active channel is only inundated with flow during and after measurable rainfall events as is typical of local flashy perennial rivers. The vegetation on and along the top of the active banks

Watercourse	Description
	comprised a mix of marginal grass and sedge species dominated by *Paspalum distichum*, *Fimbristylis complanata* subsp. *complanata* and *Juncus effusus*, whilst the vegetation on the terraces was dominated by facultative grass species including *Panicum maximum* and *Cynodon dactylon*. The vegetation on and along the top of the left hand bank of the macro channel banks comprise a narrow riparian zone dominated by *Sesbania punicea, Syzigium cordatum* and *Ficus sur*, that is distinct from the surrounding terrestrial bushveld and thicket vegetation. Human disturbance is evident along the right hand bank in the vicinity of the crossing point that has resulted in the alteration of the woody community which is currently a degraded grassland community dominated by *C. dactylon* with a moderate level of alien plant invasion, most notably *Senna didymobotrya* and *Lantana camara*.
Ephemeral Mountain Streams (Units R02-R08 and R10)  **Photograph 5: View of the Unit R02 channel looking downstream showing the alluvial channel bed and primarily indigenous mixed bushveld communities of the ephemeral streams (R02 – R08). This is an example of typical in-stream and riparian habitat found upstream of the existing road**	Mountain streams characterised by bedrock beds and a steep longitudinal gradient occurring within confined valley floor settings with narrow active channels and limited distinct riparian zones. These systems are characterised by intermittent (ephemeral/ episodic) flows limited to high rainfall events. Vegetation along the stream channels comprises a mixed bushveld community with a diverse mix of typical riverine and dryland bushveld woody species the most prominent of which were *Grewia occidentalis, Ficus sur, Dalbergia obovata, Hippobromus pauciflorus* and *Spirostachys africana*. It is important to note that vegetation within R08 was markedly different from R02-R07 and comprised a dense alien thicket dominated by *Acacia mearnsii* and *Senna didymobotrya*. Unit R10 is largely an incised gulley. The vegetation within R10 was also markedly different from the other ephemeral streams and comprised a degraded hygrophilous grassland community with localised alien and indigenous trees. The unit was dominated by *C. dactylon* with a moderate abundance of *Eragrostis plana, Sporobolus pyramidalis* and *Paspalum dilatatum* and a low abundance of *Melia azedarach* and *F. sur*.
Seasonal Transitional River (Unit R09 – Mooti River)	The Mooti River is a transitional river characterised by a moderate longitudinal gradient occurring within a confined valley floor setting with a relatively narrow active channel. This system is characterised by seasonal flows limited to higher rainfall periods (i.e. summer rains). In the river section sampled in the vicinity of the proposed crossing, in-stream vegetation was limited to localised *Arundinella nepalensis* patches whilst riparian

Watercourse	Description
 **Photograph 6: View of the transitional Mooti River (Unit R09) channel from north to south looking downstream from the right hand bank, showing the high level of river bank degradation**	vegetation comprised a degraded wooded grassland community dominated by *Chloris gayana*, *Setaria sphacelata* var. *sphacelata* and *Acacia nilotica* with a low abundance of woody alien vegetation, namely *Melia azedarach.*
Seep Wetland (Unit W01)  **Photograph 7: View of head of Unit W01 from north to south looking downstream from the culvert, near to the head of the system. Note the extensive gully that is present within the unit which is directly linked to increased canalisation of flow from the culvert**	The seep is located on a moderately steep hillslope at the head of the Mooti River valley. The seep is fed primarily by overland flow and interflow from the surrounding slopes / catchment. Water movement/ through flow is generally via channelled overland flow in gullies with subsurface interflows contributing to a lesser extent. The soils in the temporary wetland areas comprise dark grey-brown clay loam with moderately-low values and chromas and limited mottles that grades into a more grey soil (lower chroma) with increasing abundance of mottles at 40-50 cm. Seasonal wetland soils were dark grey sandy clay-loam characterised by low chromas (1/2) and distinct moderately abundant orange mottles. Vegetation within the wetland comprises degraded hygrophilous grassland dominated by *Sporobolus africanus* and *Sporobolus pyramidalis* with localised low abundances of *Paspalum dilatatum* and *Fimbristylis complanata* subsp. *complanata* specifically within the gullies.

8.3.3 Present Ecological State (PES)

River PES

According the South Africa Scoring System (SASS) Data Interpretation Guidelines (Dallas, 2007) for the Lowveld, lower geomorphic zone, the White Mfolozi River reach assessed should be classified as 'Fair' (Moderately Modified) based on the SASS5 Score (123) and Average Score Per Taxa (ASPT) of 5.3. It is however possible that heavy rainfall preceding the site visit may have affected results, possibly lowering the diversity of biota collected due to downstream flushing. The biotope score (67) suggest a moderate biotope diversity which is also unlikely to limit the diversity and sensitivity macroinvertebrate biota as lowland of this nature typically have lower biotope diversity.

Water Quality

The concentrations of water quality parameters tested were not particularity elevated except for suspended solids and *E. coli* levels. Large alluvial rivers of this nature will experience short-term peaks in suspended solids linked with rainfall events and the flushing of fine soil particles into watercourses. This was the case at the time of sampling with heavy rainfall preceding the field investigations. The elevated *E. coli* levels were likely as a result of cattle excrement entering the river and to a lesser extent sewage from informal settlements. Based on the once off sample taken, water quality at the time of sampling can be considered fair to good[12].

Fish Survey

Only a single fish species, namely *Labeo molybdinus* (Leaden Labeo) was recorded within the river reach sampled during the single sampling session undertaken. *L. molybdinus* is rated as highly sensitive to water quality (physico-chemical), meaning it only breeds under unmodified or near natural physico-chemical conditions. *L. molybdinus* is also highly sensitive to flow (no-flow) modifications and requires flow during all phases of the life-cycle, often preferring fast, clear flows for breeding and feeding purposes. It must be noted that high rainfall events directly preceding the field visit have likely influenced the low species diversity and abundances. This may be as a result of fish species seeking cover in deeper and / or more concealed habitats such as deep pools and undercut banks or even tributary rivers and streams.

A summary of the fish species presence and sensitivity based on DWS desktop dataset (DWS, 2014) is provided in **Table 9** of the Freshwater Habitat Assessment Report (***Appendix C1***).

8.3.4 Index of Habitat Integrity (IHI)

The key findings of the IHI assessment are as follows:

- Overall, the affected reach of the perennial White Mfolozi River (R01) was assessed as being in a Largely Natural condition (reflected by a “B” PES Category). This is due to limited evidence of elevated rates (higher than natural) of erosion and sedimentation, no observable flow modification features / structures and the SASS5 and water quality findings that indicate fair in-stream habitat conditions.
- The ephemeral stream channels R02 – R07 were assessed as being in a Largely Natural condition (reflected by a “B” PES Category). While culverts at road crossings have concentrated flows and caused some localised scour and sedimentation, overall modification to channel hydraulics and form is **low** due to shallow bedrock and flashy discharges. The only exception was along unit R04 where incision as a result of flow concentration was more substantial and thus this unit could be considered moderately modified (Class C). Riparian and bank vegetation at these sites were generally intact both above and below the road with low abundances of alien invasive plants.
- The ephemeral stream channel R08 was assessed as being in a Critically Modified condition (reflected by an “F” PES Category). This is largely due to the substantial deepening / incision and widening of the channel as a result of a combination of factors, namely flow concentration through the culvert at the existing road crossing, the formation of preferential flow routes along cattle tracks that have becoming gullies, and the alteration of catchment runoff patterns by past cultivation activities and existing road runoff discharges. Riparian vegetation observed was generally highly invaded by alien invasive species.
- The seasonal Mooti River (R09) was assessed as being in a Moderately Modified condition (Reflected by a “C” PES Category). This is largely due to the measurable deepening / incision and widening of the channel as a result of a combination of factors, namely upstream flow canalisation within gullies

[12] *It is important to note that without detailed routine water quality monitoring, the once off grab sample cannot be considered conclusive nor representative of ‘normal’ or average conditions for the river reach. The grab sample taken was used as ancillary data to gauge the current integrity, importance and sensitivity of the receiving environment, not for the purposes of a detailed water quality assessment.*

(within Unit W01) and through a culvert at an existing road crossing, alteration of catchment runoff patterns by past cultivation activities and existing road runoff discharges, and cattle bank trampling and modification.

- The ephemeral stream channel R10 was assessed as being in a Seriously Modified condition (reflected by an "E" PES Category). This is largely due to the substantial deepening / incision and widening of the channel as a result of a combination of factors, namely flow concentration through the culvert at the existing road crossing, the formation of preferential flow routes along cattle tracks that have becoming gullies, and the alteration of catchment runoff patterns by past cultivation activities and existing road runoff discharges. Riparian vegetation observed was generally highly invaded by alien invasive species.

8.3.5 Present Ecological Importance & Sensitivity (EIS) Assessment

Unit R01 was assessed as being of a **High** EIS, Units R02 – R07 and R09 of **moderately-low** EIS and Units R08 and R10 of a **Very Low** EIS. The **High** EIS rating for Unit R01 is linked largely with the relatively high diversity of habitats observed, and the presence of rare and sensitive aquatic biota as indicated by DWS (2014).

The **moderately-low** EIS for Units R02 - R07 is due to a **low** diversity of aquatic habitat types (both in-stream and riparian), lower sensitivity to flow regime change and **low** importance in terms of aquatic or freshwater conservation planning.

Unit R09 was also assessed as being of a **moderately-low** EIS for reasons similar to Units R02-R07, however, the sensitivity was slightly higher as the Mooti River is the primary draining watercourse of a sub-quaternary catchment listed as an Upstream Management Area.

The **very low** EIS score for Units R08 and R10 was due to the nature of the streams being ephemeral channels with **low** aquatic habitat diversity and not providing habitat for biota of conservation concern, as well as the units being severely modified.

8.3.6 Wetland PES

The single wetland unit W01 was assessed as being in a poor condition and **Largely Modified** ("D" PES Category) which indicates 'a large change in ecosystem processes and loss of natural habitat and biota and has occurred'.

8.3.7 Wetland Ecosystem Services Assessment

Overall, the importance of the ecosystem services ranged from '**Very Low**' to '**Moderately Low**' and, at present. Thus, the wetland is not considered important in terms of providing regulating and supporting services, provisioning services or cultural services. This is linked to both low levels of supply and limited local demand for these services.

8.3.8 Wetland EIS

W01 was assessed as being of **moderately-low** EIS due to the moderately-low ratings for the ecological importance, socio-cultural importance and ecological sensitivity of the system. The **moderately-low** EIS rating was driven by the moderately-low importance scores for carbon storage, sediment trapping in particular, and the moderately-low socio-cultural importance rating was driven by grazing value.

8.3.9 Recommended Ecological Category (REC) and Management Objectives

The REC and RMO for the delineated watercourse units based on their PES and EIS ratings is presented in **Table 19**.

Table 19: REC and RMO for the delineated watercourse units based on their PES and EIS ratings

Watercourse Units	PES Class	EIS Rating	REC	RMO
R01	B	High	B	Improve
R02 – R07	B	Moderately Low	B	Maintain
R08 & R10	E	Low	E	Maintain
R09	C	Moderately Low	C	Maintain
W01	D	Moderately Low	D	Maintain

8.3.10 Potential Impacts

Physical Habitat Destruction and Modification

Construction Phase Impacts

The construction of the proposed bridge across the White Mfolozi River will involve the clearing of riparian vegetation and the physical modification of in-stream habitat within the bridge footprint and associated construction corridor. It is assumed that the construction corridor will comprise the bridge footprint, vehicle running tracks, coffer dams and in-stream pier construction areas. For the purposes of this study, the extent of the construction area is assumed to be the bridge footprint width buffered by a 10 m construction working areas / servitude that incorporates all construction-related activities. The riverine habitat occurring within the footprint of the bridge piers and embankments will be permanently destroyed with the remaining areas to be modified during construction and thereafter rehabilitated. Under this scenario, the total riverine habitat area to be physically modified is predicted to be 4773.24 m^2 (0.478 ha).

For the proposed new tributary stream crossings proposed at Units R02, R03, R04, R06 and R07, it is assumed that the construction corridor will comprise the road crossing footprint and vehicle running tracks estimated to be approximately 3 m in width. Under this scenario, the total ephemeral riverine habitat area to be physically modified is predicted to be 669.7 m^2 (0.067 ha).

For the widening and upgrading of existing crossings at Units R08, R09 (Mooti River) and R10, it is assumed that the construction corridor will comprise the additional widened road crossing footprint and vehicle running tracks estimated to be approximately 3 m in width either side of the existing road crossings. Under this scenario, the total riverine habitat area to be physically modified could not be predicted but is assumed to be relatively small.

Operational Phase Impacts

Once the road upgrades are completed and the freshwater habitats have been rehabilitated, no planned physical disturbance of freshwater habitat is planned. However, with road crossings, there is always the chance that infrastructure will need to be maintained or repaired which may necessitate some habitat disturbance.

Flow Modification and Erosion / Sedimentation Impacts

Construction Phase Impacts

Activities that are likely to alter flows to and within the watercourses as well as potentially alter the current rates of erosion and sedimentation are:

- Flow impoundment and diversion around working areas within the watercourses and / or dewatering of working areas.
- Physical disturbances of watercourses both planned and accidental e.g. soil stripping / grubbing, vegetation clearing.
- Physical disturbances of catchment slopes in close proximity to the watercourses.

Firstly, it is assumed that the establishment of the Mfolozi River Bridge and possibly the upgrade at the Mooti River will require that flow be temporarily impounded and / or diverted away from the working areas. The use of the coffer dam or flume pipe techniques is typical in such circumstances. Coffer dams can result in habitat backflooding, flow reductions downstream of the impounded area, and increased rates of sedimentation and plant stress (in the case of wetlands) as well as flow concentration with the narrowing of the width of flow. Flume pipes with associated berms / dams can also cause habitat backflooding upstream and flow reductions downstream. The discharge of concentrated water from working area dewatering also poses an erosion risk to wetlands and river beds and banks, especially if positioned poorly in sensitive areas or inadequate energy dissipation and erosion protection measures are implemented at the discharge point.

Secondly, disturbance of vegetation and soils and the exposure of soils to the elements within and in close proximity to the watercourses will likely increase the rates of erosion and sedimentation within and in close proximity to the construction area, and downstream. During rainfall events, soil erosion within exposed areas will be inevitable, which will likely result in increased sediment loads, increased bed sedimentation and increased turbidity that will contribute to decreased local water quality and degradation in local aquatic habitat integrity. Some of the key biological effects related to the elevated levels of deposition and suspended sediment within the water column of rivers may include:

- Habitat alteration downstream of crossing points due to increased sediment deposition.
- The creation of low light conditions reducing photosynthetic activity and the visual abilities of foraging aquatic biota.
- Increased downstream drift by benthic invertebrates causing localised reductions in population densities.
- Reduced density and diversity in benthic invertebrate and fish communities as a result of reduced water quality (suspended solids impacting intolerance taxa), habitat degradation caused by smothering of aquatic habitat, changes in streambed and biotope composition (i.e. reduced habitat suitability through the destruction of pool and / or riffle habitat).

Operational Phase Impacts

During the operational phase the three key flow modification impacts are:

- Alteration of flow patterns as a result of the Mfolozi River Bridge piers.
- Increased concentration of flow within culverts.
- Increased volume of stormwater runoff discharge and increased velocities at outlets.

Dealing firstly with the impact of the bridge across the Mfolozi River, the construction of in-stream piers within the active river channel will interfere with natural flow hydraulics, create turbulence, cause the acceleration of flow around structures and ultimately result in an increase in flow velocities and localised scour around the piers. Also, if the pier bases / footers be established above or below the bed surface

level / elevation, this impact will be exacerbated. Furthermore, the establishment of piers could also result in the cumulative constriction of flow as a result of flow deflection that could increase flow velocities through the bridge resulting in increased localised scour downstream. Furthermore, where bridge abutments and the bridge platforms themselves are within the floodlines of major flood events (>1:50yr flood), flow obstruction and constriction often lead to increased bank scour around abutments or immediately downstream during large floods. In this case, the bridge is aligned along a large rock outcrop across the river bed that will reduce the intensity of the scour impacts. However, some alluvium stripping is likely where shallow alluvium currently covers the outcrop. Bed and bank scour will also be substantially reduced by the design of the bridge and abutments outside of the 100 year flood. The anticipated low levels of scour around the piers will alter in-stream habitat biotopes. However, owing to the flashy nature of the river that experiences episodic high velocity flows with associated periodic scouring and in-stream biotope transformation, the impact on in-stream habitat will be relatively low and small in extent.

The piers are unlikely to interfere with the movement and migration of aquatic biota such as fish in the Mfolozi River between sites upstream and downstream of the proposed crossing.

Secondly, the existing culverts established within the ephemeral and seasonal tributary streams will have a measurable impact on flow, particularly flow constriction through culverts and the resultant increase in flow velocities at the culvert outlets. This ultimately manifests in increased channel bed and bank erosion as the channel adjusts to the increased energy of flows. Thus, the establishment of new road crossings with culverts will likely result in similar channel adjustments, particularly if the culverts are not designed to allow for the full width of flows.

Stormwater generated by the road upgrade will be collected and conveyed in channels and diverted off the road at regular intervals. The proposed upgrade will result in a relatively small increase in catchment surface hardening that will result in a small increase surface runoff volumes, a small reduction in soil infiltration and increased runoff velocities at stormwater outlets.

Water Pollution Impacts

Construction Phase Impacts

Potential construction phase contaminants and their relevant sources may include:

- Hydrocarbons – leakages from petrol / diesel stores and machinery / vehicles, spillages from poor dispensing practices.
- Oils and grease - leakages from oil / grease stores and machinery / vehicles, spillages from poor handling and disposal practices.
- Cement - spillages from poor mixing and disposal practices.
- Bitumen - spillages from poor application, handling and disposal practices.
- Sewage – leakages from and / or poor servicing of chemical toilets and / or informal use of surrounding areas by workers.
- Suspended solids – suspension of fine soil particles as a result of soil disturbance and altered flow patterns (covered above).
- Solid waste - workers are likely to generate solid waste during construction which if not properly managed and monitored may lead to increase litter entering the watercourse.

Operational Phase Impacts

The road surfaces represent the main potential pollutant source for the operation of the proposed activities. A number of pollutants are known to accumulate on urban surfaces over time. Typical and potential water pollutants associated with roads are: Polycyclic aromatic hydrocarbons (PAHs); Heavy

metals such as Lead, Zinc, Iron, Copper, Cadmium, Chromium, Nickel, Manganese and Volatile Organic Compounds (VOCs) such as benzene, toluene, ethylbenzene, xylene, methyl tert-butyl ether (MTBE).

As the proposed road will experience relatively low traffic volumes, hazardous substances are not expected to be transported, and the watercourses crossed are either ephemeral or resilient (in the case of the Mfolozi River), the impact on local physico-chemical conditions and local PES of freshwater ecosystems is expected to be small and are unlikely to cause a measurable negative biotic response within the receiving habitat.

8.4 Terrestrial Habitat Assessment

This study was undertaken by Eco-Pulse Environmental Consulting Services (***Appendix C2***).

8.4.1 Vegetation Communities

The study corridor (20 m wide road reserve and a 20 m buffer of the road reserve) was classified into two vegetation communities namely the Degraded Wooded Grassland and the Mixed Tall Bushveld. The spatial distribution of the Degraded Wooded Grassland and the Mixed Tall Bushveld is shown in **Figure 36.**

These two (2) vegetation communities generally correspond with the national and provincial vegetation types namely, the Zululand Lowveld (Mixed Tall Bushveld) and Northern Zululand Sourveld (Degraded Wooded Grassland) vegetation types as mapped and described by Mucina & Rutherford (2006) as well as Scott-Shaw and Escott (2011). However, the western portion of the Degraded Wooded Grassland likely used to be Zululand Lowveld, which has since been cleared for rural development.

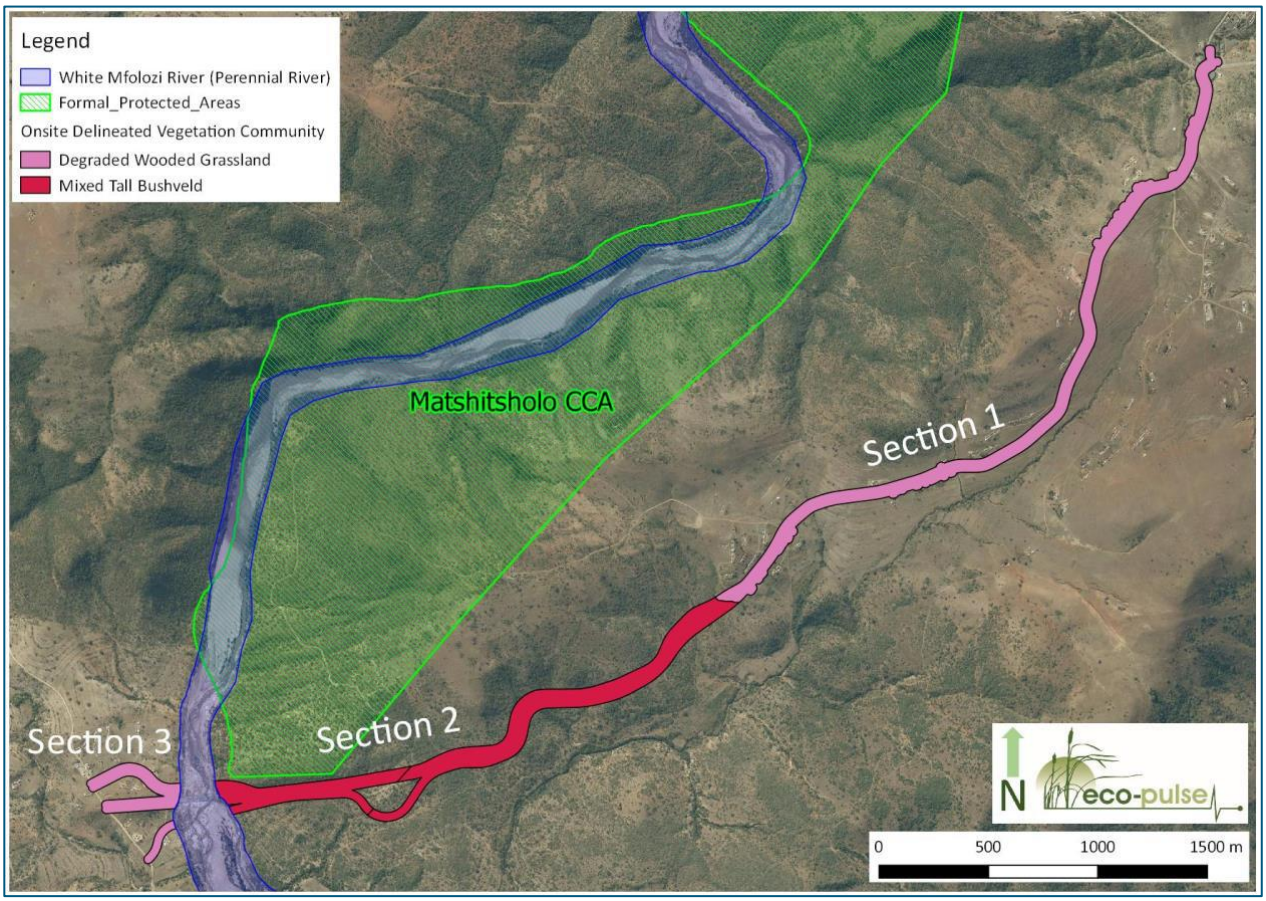


Figure 36: Spatial distribution of identified vegetation communities within the study corridor

Degraded Wooded Grassland (Northern Zululand Sourveld)

The vegetation community within the first ±4.3 km section of the study corridor measured from the eastern end and last ±0.5 km section measured from the west was identified as the Degraded Wooded Grassland community (**Figure 36**). It occupies an area of ±30 ha.

The land cover within the abovementioned two sections is characterised by an intricate mosaic of open medium-tall grassland interrupted by sparsely populated short trees and shrubs; and transformed parcels of land including homesteads, small gardens and existing road infrastructure.

The presence of numerous contour ridges across the slope suggests that the study area has been historically cultivated (rural subsistence agriculture) with the majority of this vegetation community overlapping with historical clearing for rural development and agriculture. Thus, the vegetation community is considered secondary.

In terms of species composition, the grassland is characterised by tall tufted grasses and a low abundance of herbs relative to the benchmark / reference vegetation types. Common and dominant grasses recorded included *Sporobolus africanus, Cymbopogon caesius, Melinis nerviglumis* and *Chloris virgata*. The increased abundance of this grass species confirms both elevated soil disturbance (i.e. clearing for cultivation) and local introduction through subsistence cultivation.

Common woody species include, namely; *Acacia nilotica, A. caffra, A. tortilis, A. sieberiana* var. *woodii* and *Dichrostachys cinerea*. These are characteristic species of the Northern Zululand Sourveld vegetation type and typically found in wooded grasslands and savannah communities. Other woody plants recorded in low abundance include *Erythrina latissima* and *Aloe marlothii*, a provincially protected plant species and *Sclerocarya birrea* subsp. *caffra*, a nationally protected tree. Exotic species were also recorded albeit in low abundances.

Recorded alien species include the following trees: *Melia azedarach* (most conspicuous) and shrubs: *Ipomoea fistulosa, Lantana camara* and *Onopordum acanthium*.

As expected, given the historic disturbance, the alteration of natural disturbance regime (key ecosystem drivers) and the secondary nature of the community, no rare or Red Listed plant species were recorded. It is unlikely that such species could be present.

Photograph 8: Grassland patch adjoining the right bank of the White Mfolozi River (L). View of the most southern end of Option 1 (R)

Mixed Tall Bushveld (Zululand Lowveld)

The vegetation community which occupies the 3 km central and western portion of the study corridor was identified as a Mixed Tall Bushveld community (**Figure 36**).

The Mixed Tall Bushveld community comprises semi-closed woodland and thicket sub-communities. The vegetation community was often closed along ephemeral drainage lines and small watercourses. The Mixed Tall Bushveld community comprised a diverse mix of typical bushveld woody species of which broad-leaved trees were dominant.

Characteristic species recorded include *Acacia caffra, A nilotica, Aloe marlothii, Berchemia zeyheri*, *Combretum apiculatum, C. molle, Dichrostachys cinerea, Diospyros dichrophylla, Euclea daphnoides, E. divinorum, Galpinia transvaalica, Gymnosporia maranguensis, Heteropyxis natalensis, Ozoroa paniculosa* var. *paniculosa, Sclerocarya birrea* subsp. *caffra, Searsia pallens, S. pentheri, Spirostachys africana* and *Ziziphus mucronata*.

Overall, the Mixed Tall Bushveld was found to be intact except for localised areas of disturbance associated with vegetation clearing, wood harvesting and erosion. Disturbed areas were characterised by low woody plant diversity and the dominance of *D. cinerea*. The herbaceous community comprised common forbs and grasses with a few conservation important forbs such as *Ceropegia racemosa* subsp. *setifera, Dietes iridoides* and *Gladiolus* cf. *crassifolius*.

Given that this vegetation community has never been cleared and the species composition is similar to reference condition, it is therefore referred to as being primary.

While no rare or Red Listed plants were found to occur with the areas sampled, plants such as *Commiphora africana* and *Vitex obovata* are not commonly encountered. Two nationally protected trees, namely *S. birrea* subsp. *caffra* and *Sideroxylon inerme* were recorded. The former was noted to be widespread and a very common species of the bushveld whilst the latter was recorded in localised areas particularly along ephemeral drainage channels. Another characteristic species is the provincially protected *A. marlothii*.

Photograph 9: Typical Mixed Tall Bushveld community characterised by a semi-closed vegetation structure (L). View of an area where woody plants were cut down along the existing road footprint. This community occurs at the transition between the Mixed Tall Bushveld community and the Degraded Wooded Grassland (R)

8.4.2 Biota of Conservation Concern Likelihood of Occurrence (LOC) Assessment

Flora LOC

Interrogation of SANBI's online threatened species database for the quarter degree grid square (QDGS) 2831AD highlighted two (2) species recorded within the QDGS. The two species, *Crotalaria dura* subsp. *dura* and *Encephalartos natalensis* (SA Endemics), both have a threat status of Near Threatened.

Both species are unlikely to be present on site for the following reasons:

(i) *C. dura* subsp. *dura* does not occur north of the Tugela River and it is usually in open primary grassland typically the KZN Sandstone Sourveld and Ngongoni Veld; and

(ii) Although the distribution of the *E. natalensis* extends into the study area, it is unlikely to occur in the area because it is too dry. Furthermore, *E. natalensis* is usually found on krantze which do not occur along the route.

Faunal LOC

A summary of faunal species of conservation concern that possibly or are likely to occur within the study area is provided in **Table 20**.

Table 20: Faunal species of conservation concern that possibly or are likely to occur within the study area

Scientific & Common Name	Type	Status	Relevant Onsite Habitat
Woodland thicket rat *Grammomys dolichurus*	Rat	**DD**	Degraded Wooded Grassland & Mixed Tall Bushveld
Single-striped grass mouse *Lemniscomys rosalia*	Mouse	**DD**	Degraded Wooded Grassland & Mixed Tall Bushveld
Bateleur *Terathopius ecaudatus*	Bird	**VU**	Degraded Wooded Grassland & Mixed Tall Bushveld
Black-winged lapwing *Vanellus melanopterus*	Bird	**NT**	Degraded Wooded Grassland & Mixed Tall Bushveld
Red-billed Oxpecker *Buphagus erythrorynchus*	Bird	**NT**	Degraded Wooded Grassland & Mixed Tall Bushveld
Tawny Eagle *Aquila rapax*	Bird	**VU**	Degraded Wooded Grassland & Mixed Tall Bushveld
Common Girdled Lizard *Cordylus laurenti*	Lizard	**N-E**	Degraded Wooded Grassland
Spotted House Snake *Lamprophis guttatus*	Snake	**N-E**	Degraded Wooded Grassland & Mixed Tall Bushveld
Van Son's Thick-Toed Gecko *Pachydactylus vansoni*	Gecko	**N-E**	Degraded Wooded Grassland
Shovel Nosed Frog *Hemisus guttatus*	Frog	**VU**	Degraded Wooded Grassland adjoining the Mfolozi River
Gulella aliciae	Mollusc	**N/A**	Mixed Tall Bushveld
Gulella vallaris	Mollusc	**N/A**	Mixed Tall Bushveld
Gulella genialis	Mollusc	**N/A**	Mixed Tall Bushveld

8.4.3 Protected Flora

A total of nine (9) protected plant species were identified including seven (7) species of specially protected forbs under Schedule 12 of the Natal Nature Conservation Ordinance, No. 15 of 1974 and two (2) nationally protected trees under Section 15(1) of the National Forest Act. Specially protected forbs include *Aloe marlothii, A. parvibracteata, Ceropegia racemosa* subsp. *setifera, Dietes iridoides, Gladiolus* cf. *crassifolius, Ledebouria asperifolia* and *L. zebrina*. In accordance with Section 200, sub-section 5(1) of the Natal Nature Conservation Ordinance, No. 15 of 1974, an Ordinary Permit is required from *eZemvelo* KZN Wildlife if provincially protected species listed are to be handled in any manner during construction of the proposed road.

Nationally protected trees include *Sclerocarya birrea* subsp. *caffra* and *Sideroxylon inerme* and these require a licence from the Department of Agriculture, Forestry and Fisheries (DAFF) if these trees need to be removed during construction.

The locality of protected plants in the study area is provided spatially in **Figure 37**.

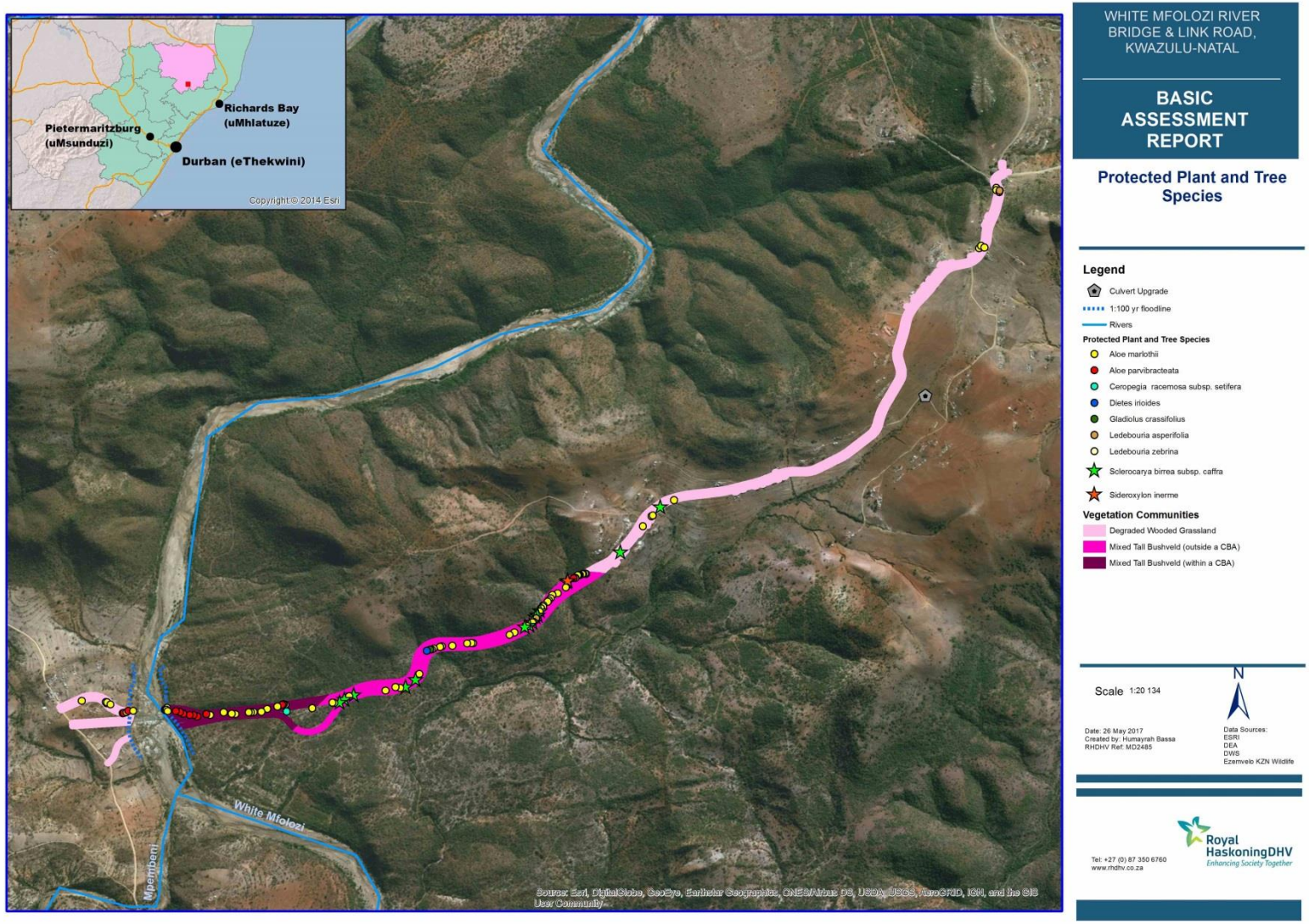


Figure 37: Location of nationally and provincially protected plant species identified within the study corridor

8.4.4 Ecological Importance and Sensitivity of Vegetation Communities

In terms of Ecological Importance, the section of the Mixed Tall Bushveld (Zululand Lowveld) within the KZN CBA was assessed as being of moderately-high ecological importance and the Mixed Tall Bushveld (Zululand Lowveld) outside the KZN CBA was assessed as being of **moderate** ecological importance.

The importance ratings of both the Mixed Tall Bushveld within a CBA and the one outside the CBA are largely attributed to the fact that the vegetation community is intact and representative of the benchmark Zululand Lowveld vegetation type which has a 'Vulnerable' threat status. Furthermore, both vegetation communities are characterised by a high diversity of woody plants and forbs and a high abundance of protected plants. The higher importance rating of the Mixed Tall Bushveld within a CBA is attributed to the fact that this vegetation community has been identified at a provincial level as a CBA elevating its importance category (i.e. higher societal demand).

The Degraded Wooded Grassland (Northern Zululand Sourveld) community was assessed as being of **low** ecological importance. The low importance rating of the Degraded Wooded Grassland is largely attributed to past clearing and physical disturbance of vegetation further exacerbated by a general lack of management in the form of appropriate burning and recent drought conditions. As a result, the Degraded Wooded Grassland is dissimilar to the benchmark Northern Zululand Sourveld vegetation type. Furthermore, the Degraded Wooded Grassland lacks most of the species of conservation importance that would have been locally common. What remains are a few populations of provincially protected plants species that are of Least Concern in terms of the SANBI Red List for plants and those that are not presently important for biodiversity conservation. Nevertheless, the Degraded Wooded Grassland could possibly provide habitat for **Vulnerable** species such as the Bateleur, Tawny Eagle and Shovel-nosed Frog.

In terms of ecological sensitivity, both the Mixed Tall Bushveld communities (within and outside the CBA) were assessed as being of **moderate** ecological sensitivity and the Degraded Wooded Grassland of **low** ecological sensitivity (**Table 21; Figure 38**). The moderate ecological sensitivity of the Mixed Tall Bushveld community is attributed to the intactness of the habitat with associated intact species assemblages. The soils did not appear to be highly erodible although some erosion was evident along preferential flow paths. Thus, sensitivity to erosion did not contribute to the sensitivity rating.

The low sensitivity of the Degraded Wooded Grassland is attributed to the secondary nature of the community that is manifested in the lack of sensitive plants and habitats and low species diversity resulting from historical clearing for rural cultivation and development (homesteads) historic cultivation. In-field observations indicate that soil erosion is prevalent and gullies were noted to be very deep but narrow, indicating possible moderate to high sensitivity to erosion. However, the secondary and degraded nature reduces the overall ecological sensitivity i.e. substantial change in the community has already occurred such that the system is not ecologically sensitive to further impacts.

Table 21: Summary of EIS ratings

Vegetation Community	Ecological Importance	Ecological Sensitivity	Ecological Importance & Sensitivity (EIS)
Degraded Wooded Grassland	Low	Low	Low
Mixed Tall Bushveld (within CBA)	Moderately-high	Moderate	Moderately-high
Mixed Tall Bushveld (outside of CBA)	Moderate	Moderate	Moderate

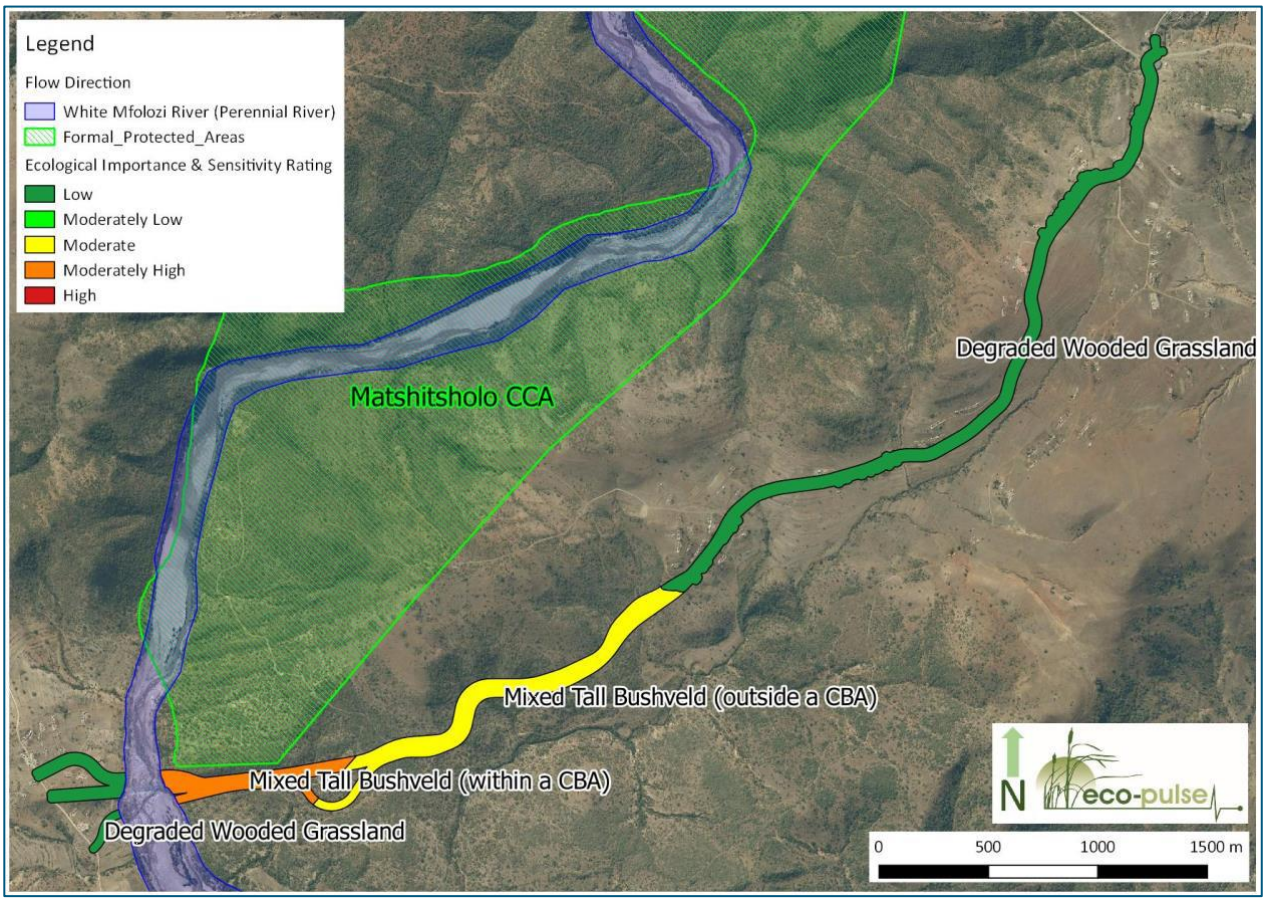


Figure 38: Map showing Ecological Importance and Sensitivity (EIS) ratings for terrestrial vegetation communities

8.4.5 Potential Impacts

Direct physical habitat destruction and modification

In the worst case scenario, it is assumed that the proposed development will result in the direct physical destruction and modification of the terrestrial habitat within the recommended 20 m construction servitude for Option 1. A summary of the total areas to be transformed associated with each of the vegetation community types is provided in **Table 22** below.

A total of ±12.2 ha of indigenous vegetation will be transformed (road footprint) and disturbed (working area around the road footprint). This extent includes 5.25 ha of intact Mixed Tall Bushveld community and 6.95 ha of Degraded Wooded Grassland community (**Table 22**). If construction activities are poorly managed such that areas outside the recommended 20 m construction servitude are disturbed, the extent of disturbed indigenous vegetation will be larger than the anticipated 12.2 ha.

Table 22: Summary of the extent of existing transformed and non-transformed vegetation areas within the 20 m road servitude[13]

Vegetation Community	Area within 20m road servitude		
	Total Extent	Existing Transformed Area	Indigenous Vegetation
Mixed Tall Bushveld (Moderately-high Importance)	1.74ha	0.02ha	1.72ha
Mixed Tall Bushveld (Moderate Importance)	3.55ha	0.02ha	3.53ha
Degraded Wooded Grassland	8.28ha	1.33ha	6.95ha
Total	13.57ha	1.37ha	12.2ha

It is also important to differentiate between permanent habitat loss under the actual road footprint and temporary habitat modification with rehabilitation. A summary of such a distinction is provided in **Table 23** below. For the purposes of calculating the total loss of habitat hectare equivalents[14] of each vegetation community, the current health of the Mixed Tall Bushveld was assumed to be 90% and that of the Wooded Grassland as 40%. For those areas to be disturbed and then rehabilitated, the post-rehabilitation condition of the Mixed Tall Bushveld and Wooded Grassland vegetation were both assumed to be 30% resulting in 60% condition reductions in the Mixed Tall Bushveld vegetation and limited loss of the Degraded Wooded Grassland.

Thus, the total loss of habitat hectare equivalents for the **moderately-high** importance Mixed Tall Bushveld, the **moderate** importance Mixed Tall Bushveld and the Wooded Grassland vegetation communities is predicted to be 1.2, 2.44 and 1.3 habitat hectare equivalents respectively (**Table 22**). The total predicted loss of the **vulnerable** Mixed Tall Bushveld is 3.64 habitat hectare equivalents.

Table 23: Summary of proposed habitat losses

		Mixed Tall Bushveld (Moderately-high Importance)	Mixed Tall Bushveld Moderate Importance)	Degraded Wooded Grassland
Area to be permanently transformed (under road footprint)	Extent (ha)	0.56	1.08	2.01
	Current condition (%)	90	90	40
	Habitat Loss (Hectare Equivalents)	0.50	0.97	0.80
Area to be temporarily transformed and rehabilitated (Area	Extent (ha)	1.16	2.45	4.94
	Speculated Post-Development Health (%)	30	30	30

[13] *These calculations are based on the recommended 20 m construction servitude for Option 1 only.*
[14] *Equivalent area that is considered intact, functional or representative calculated by the multiplication of the total area by the present condition as a percentage.*

		Mixed Tall Bushveld (Moderately-high Importance)	Mixed Tall Bushveld Moderate Importance)	Degraded Wooded Grassland
within servitude but outside road footprint)	Condition Difference (%)	60	60	10
	Habitat Loss (Hectare Equivalents)	0.70	1.47	0.49
Total Loss of Habitat Hectare Equivalents		**1.20**	**2.44**	**1.30**

For the purposes of the above assessment, it is assumed that rehabilitation of the areas disturbed during construction will not be reinstated in line with reference state, and that rehabilitation will be purely functional in terms of reinstating a good grass cover within the servitude. Thus, it has been assumed that the best condition that could be attained for both habitat types is 30%. However, if the rehabilitation of the temporarily physically disturbed areas is poorly undertaken habitat degradation will be more intense over time, manifesting in the form of increased opportunist / weedy plant and invasive alien plant (IAP) proliferation that will hinder natural recruitment of the disturbed areas by locally occurring species. Although the IAP seed sources and propagules are generally limited in the study area, IAP encroachment is always a concern.

Further to the above, *eZemvelo* KZN Wildlife (EKZNW) have highlighted that *Parthenium hysterophous* (Famine weed), a **Category 1B IAP** (NEM:BA), is a major problem along roads located north of the Tugela River. *P. hysterophous* is a fast growing ruderal that is characterised by large seed production and long-lived and rapidly germinating seeds (*E*KZNW Presentation, 2016). In addition, *P. hysterophous* is allelopathic[15] and has no natural enemies being alien / exotic (*E*KZNW Presentation, 2016). These characteristics make it a formidable pioneering competitor in disturbed areas, particularly areas that are left bare or are subjected to on-going disturbance. *P. hysterophous* also poses a major health problem to humans and livestock (*E*KZNW Presentation, 2016). During field work, *P. hysterophous* was not observed along the existing road reserve and in the surrounding landscape indicating that, at worst, it is likely only present in low abundances and thus the risk of its invasion of the road servitude as a result of disturbance during the construction phase will likely be low. However, as the assessment focussed on a narrow corridor of vegetation and much of the degraded wooded grassland community is associated with subsistence cultivation, where *P. hysterophous* is known to proliferate, *P. hysterophous* could be present in the surrounding landscape and its invasion of the road servitude is a possibility.

In terms of direct impacts to fauna, any sedentary fauna (millipedes, molluscs and possibly frogs) occurring within the servitude area to be cleared and / or infilled will likely be killed. Mobile faunal species are likely to flee the site and be temporarily displaced at worst.

During the operation of the road, no destruction and modification impacts are expected. However, it is a reasonable to assume that there is a possibility that habitat could be impacted episodically (infrequently) if road infrastructure repairs and maintenance are required, particularly to the road side drainage.

[15] *Allelopathy is the chemical inhibition of one plant (or other organism) by another, due to the release into the environment of substances acting as germination or growth inhibitors.*

Furthermore, the operation of the road has a potential to impact on faunal species, through increased fatalities and injuries by vehicles and people walking along the road.

Surface runoff alteration impacts

The construction activities will involve the clearing and stripping of topsoil and vegetation within the recommended 20 m construction servitude and the exposure of bare areas and soil stockpiles to the elements (rain and wind). Such exposure of bare soils will definitely lead to localised soil erosion and alter surface runoff distribution and patterns within the construction areas. Such impacts will increase the risks of erosion and sedimentation of adjacent terrestrial habitats as well as potentially alter soil moisture within areas receiving concentrated runoff flows. If such impacts do occur, the affected terrestrial habitats are likely to degrade over time with increased risk of opportunistic / weedy and alien invasive plant invasion to the detriment of local species assemblages.

When in operation, stormwater generated by the compacted gravel surface will be conveyed and discharged into adjoining terrestrial habitats *via* point source outlets. This will result in the concentration of runoff and an increase in the velocities of runoff discharged into the environment, ultimately resulting in an increased risk of erosion and sedimentation. If the stormwater management infrastructure is poorly designed and / or poorly constructed, particularly in terms of unnecessarily concentrating runoff, erosion below the proposed outlets is likely to occur with associated downslope sedimentation impacts. Erosion risks will be most apparent on erodible slopes (steep slopes and / or erosive soils). The risk of erosion will likely be high given that the site is largely characterised by erodible soils. Furthermore, the concentrated discharge of surface runoff at outlets will likely alter the natural soil moisture levels and alter species composition in favour of opportunistic and / or water loving species.

Pollution impacts

Potential construction phase contaminants and their relevant sources may include:

- Hydrocarbons – leakages from petrol / diesel stores and machinery / vehicles, spillages from poor dispensing practices.
- Oils and grease - leakages from oil / grease stores and machinery / vehicles, spillages from poor handling and disposal practices.
- Cement - spillages from poor mixing and disposal practices.
- Bitumen - spillages from poor application, handling and disposal practices.
- Sewage – leakages from and / or poor servicing of chemical toilets and / or informal use of surrounding bush by workers.

If above mentioned contaminants are poorly handled or mismanaged during the construction phase, there is a risk that small areas of the construction soils and surfaces will be contaminated. During rainfall events, such contaminants could be washed into adjacent intact terrestrial habitats. If significant concentrations of contaminants are spilled / leaked and washed into adjacent habitats there could be plant die-offs and / or increased levels of plant stress which could decrease the completive ability of the affected plants and ultimately result in changes in plant species composition in favour of more tolerant species likely manifesting in increased abundances of ruderals, weeds and / or IAPs.

During the operation phase, it is expected that pollutants from the road surface will either be adsorbed by compacted soil or washed into open stormwater channels and adjoining habitats. The concentration of pollutants is likely to be low given expected low traffic volumes and limited levels of exposure and therefore unlikely to have a noticeable influence on species composition within affected vegetation communities.

Indirect ecological disturbance and nuisance impacts

Road construction activities are known to generate substantial amounts of dust, noise and vibrations as a result of clearing, earthworks and the operational of heavy machinery (vehicles and equipment). These impacts are generally short lived and limited to the construction period.

Excessive dust generated during the construction phase will settle on plant leaves and thus reduce the pigmentation of leaves and thus reduce the rate of photosynthesis and productivity of affected plants. This impact is likely to be a concern within the Mixed Tall Bushveld community in the dry season when dust cannot be washed off leaves by rain. Its effect on species composition and vegetation structure is likely to be limited given the short duration of the construction period that generates dust.

Species within the intact patches of habitat (i.e. Mixed Tall Bushveld community), are likely to be sensitive to noise disturbance as they are not habituated to such disturbances due to the limited use of the existing road within this vegetation community. Most fauna are likely to be temporarily displaced during the construction period and faunal abundance in close proximity to the construction corridor will decrease.

There is a likelihood that hunting of fauna may occur during the construction period. In addition, fire outbreaks resulting from construction activities like cooking and / or the inappropriate disposal of cigarettes may occur, which could severely impact adjoining and / or local habitat. This may result in changes in plant species composition (loss of more sensitive species), increased faunal fatalities relative to current levels and habitat degradation manifested in increases in abundance of ruderals, pioneers and opportunistic / tolerant species.

8.5 Baseline Social Impact Assessment

A Baseline Social Impact Assessment (BSIA) was undertaken by Royal HaskoningDHV and peer reviewed by Hilda Bezuidenhout) – ***Appendix C4***.

Pertinent to the BSIA is the understanding of the proximity of households to the proposed bridge and link road.

A visual presentation of the beginning of the bridge is presented in **Figure 39** below. At least 50% of both Options 1 and 3 are designed along rural tracks that are currently accessed by the local community as pathways to the river. Additionally, both options pass by existing residences.

Option 2 is not a desired routing, as the area is currently untouched. Should either Option 1 or 2 be chosen, the road construction must be undertaken with the consent of the most directly affected households and should not hamper the household's right to access the surrounding area or other rural tracks.

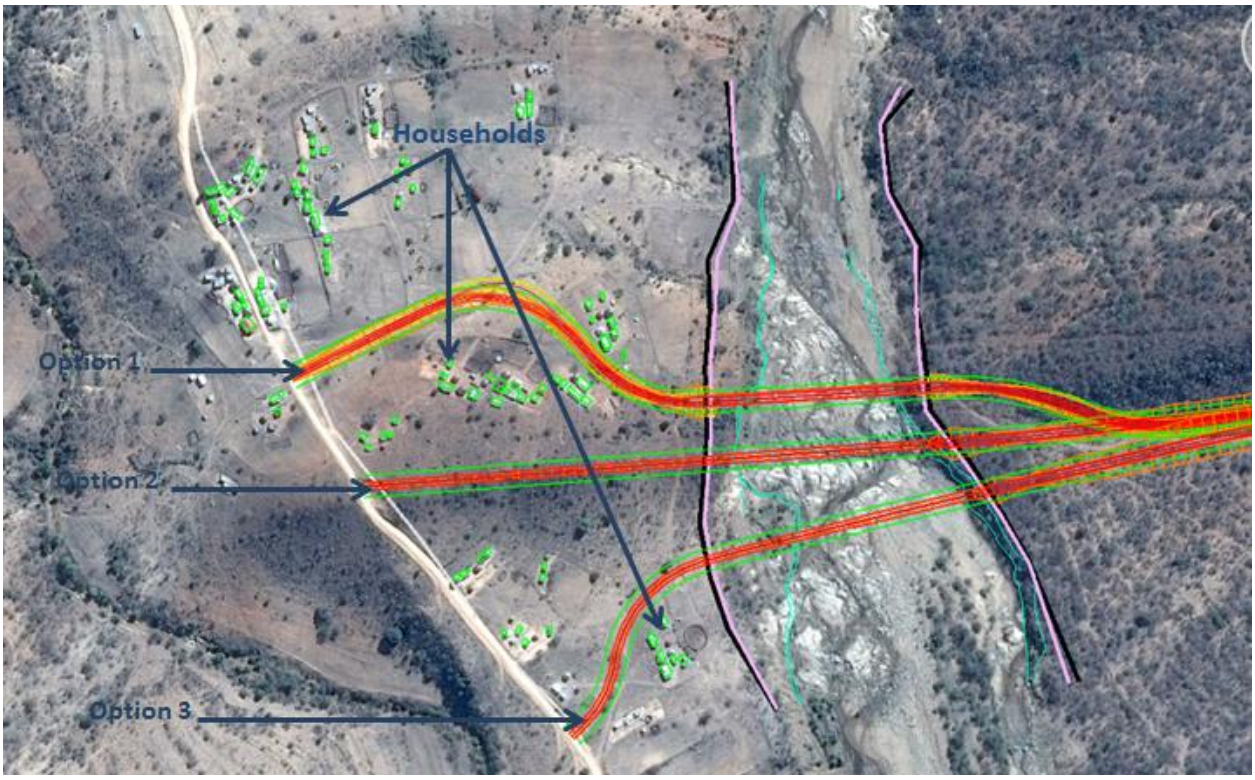


Figure 39: Households near the beginning of the bridge design (Options 1 and 3)

Further along the routing (where the 3 options merge), all three options pass close to existing residences. These are visually presented in the images below. Should farmed land be impacted, it is advised that the extent of the impact be recorded and a compensation process commence (prior to the construction phase of the project) as per the KZN Dot's standard compensation procedures.

Figure 40: Merged road routing nearby homes

The merged road routing design reveals that a single home will be impacted (28°17'57.55" S; 31°20'44.80" E) to the extent that it will be displaced. The traditional leader will advise the owner of a new location (within the community) where the residence can be rebuilt. Additionally, the KZN DoT has its own protocols that are utilised for physical displacement scenarios (and economic, in the case of loss of assets / land only). The relocation and compensation method must be applied, ensuring full engagement with the owner and the traditional leader throughout the process. It is recommended that the engagements between the owner and the DoT be recorded, and an in-principle agreement be achieved. Relocation must take place in the pre-construction phase and be recorded and included in the Environmental Site final.

Figure 41: Location of residence to be displaced

8.5.1 Direct Beneficiary Communities

Visual verification of towns and communities in nearby range to the proposed bridge and link road, show that there are 10 communities that will directly benefit from the said infrastructure. Refer to ***Section 4.4*** for a description.

8.5.2 Community Perceptions of the New Development

The Communities are largely in support of the proposed development. A summary of the Public Participation Process is provided in ***Section 7.9.1***.

8.5.3 Potential Impacts

The first major impact that will be experienced in the pre-construction phase relates to the physical displacement of a single household owner. The KZN DoT will follow its compensation protocol for this displacement, and the moving of the household must be done with the household's consent, under the guidance of the traditional leader. Should any other household fence lines be impacted, compensation must follow an approved process.

The second impact relates to the possible exhumation and relocation of eight (8) graves or alternatively, the deviation of the road routing so as to avoid the grave sites as identified in the Heritage Impact Assessment (***Section 8.6***).

Other impacts likely to occur during the construction phase, with its effects felt for years to come, is the impact of the on-site (residential) labour force that may be housed in a construction camp. Social ills that emanate during this phase have long-term, negative poverty and health impacts. However, on site residences are not expected. Moreover, potential health and safety impacts during the construction and operational phases will need to be mitigated appropriately.

The four measured positive impacts in the operational stage relate to increased access by local communities to local services (education, health facilities), a more effective distribution of emergency services (ambulance, fire trucks, water trucks, police) and the increased mobility of people, thus promoting the opportunity for trade and potentially the subsequent growth of local businesses. The fourth positive impact relates to the opportunity for growing relationships (personal and business) between the communities - that would have otherwise remained partially connected due to the landscape's geography. There are no negative impacts expected during the operational stage if the rules that are applied to all road users are practised and obeyed. The local community that are not familiar with vehicles moving at higher speeds, will have to take care and be more vigilant in their use of the road.

8.6 Heritage

The greater Ulundi area contains many heritage sites and features. It was therefore expected to find some of these sites in the project area. A Heritage Impact Assessment was conducted by Active Heritage (***Appendix C3***).

8.6.1 Early Stone Age Artefacts

Some Early Stone Age tools occurs in erosion dongas directly adjacent to the L2598 in the near vicinity of the proposed bridge crossing (Option 1). These tools, however, are out of context and they have little research value. Consequently they have a low heritage rating.

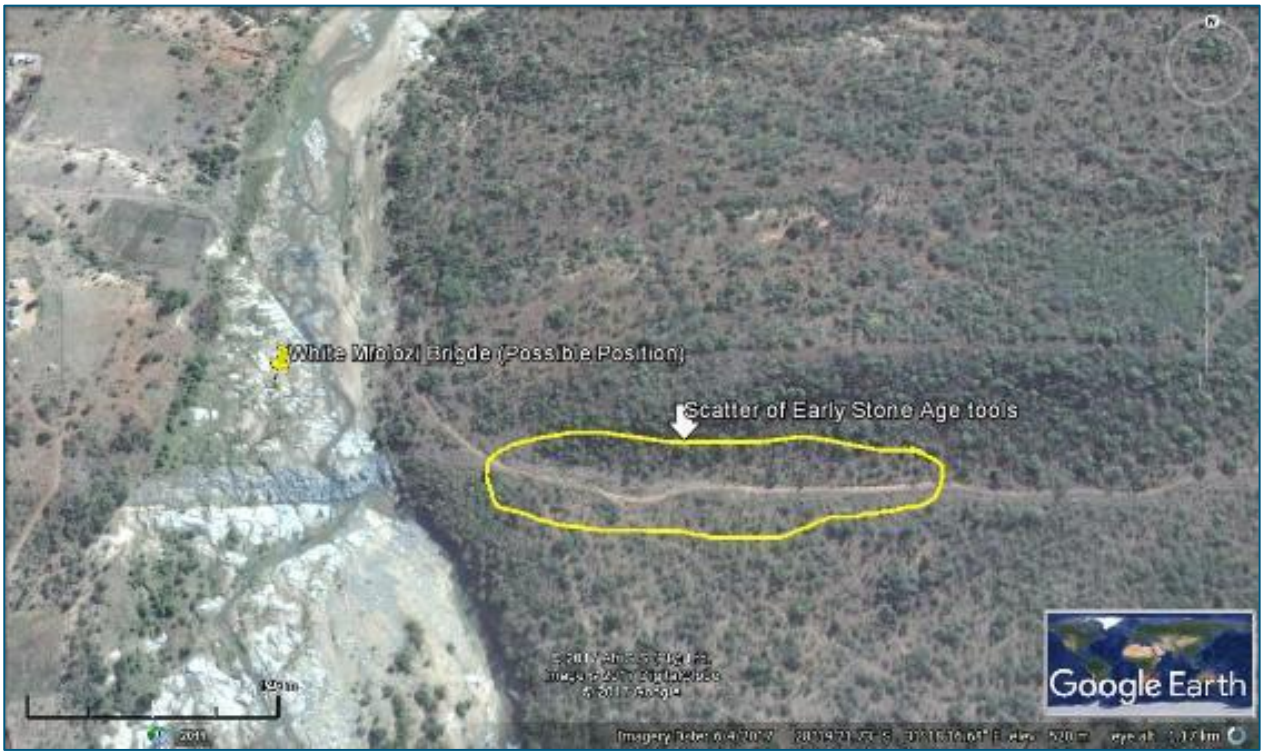


Figure 42: Early Stone Age Artefacts

8.6.2 Shembe Site of Worship

A Shembe Site consisting of a stone circle (painted white) with a diameter of approximately 25 m occurs further than 50 m from Option 3 (**Figure 43**). Modified trees also painted partially white and placed in the

centre of the stone circle. This is a recent feature and has been in existence for the last 6 years. However, it is a place of worship combining indigenous and Christian elements. This site is of local significance (Local grade 111B. It is still in use and has living heritage values. It is therefore protected by heritage legislation).

Figure 43: Shembe Site

8.6.3 Early Iron Age

The expansive flat areas adjacent to the White Mfolozi River are potentially ideal Early Iron Age locales but none of those in the near environs of the proposed development contain any archaeological material.

8.6.4 Graves

Some contemporary homesteads occur adjacent to Option 1 on the western side of the White Mfolozi River. However, none of these had graves situated closer than 50 m to the proposed link road alignment. No grave sites were observed along Options 2. However, graves not in association with any particular homestead, do occur within the near environs of the preferred link road option (i.e. Option 1). Furthermore, three (3) grave sites, Grave Sites 6, 7 and 8 are directly impacted on by Option 3 (**Figure 44**). A description of these follows in **Table 24**.

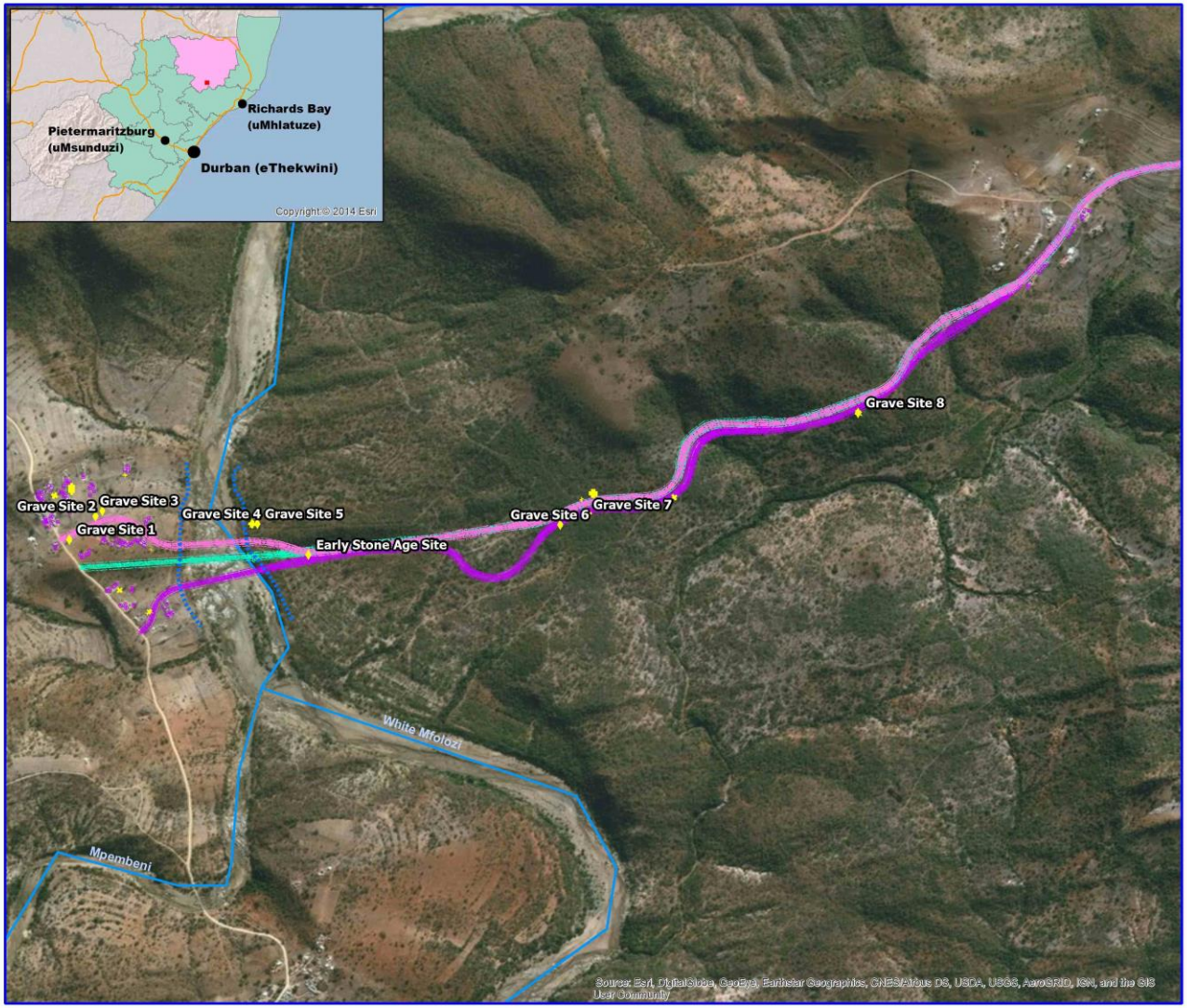


Figure 44: Grave Sites and Potential Grave Sites

8.6.5 Cultural Landscapes

The greater project area has been modified in terms of traditional settlement patterns during the last 10 years or so. The traditional dispersed Nguni settlement pattern, with the associated semi-circular patterning of huts around a central cattle byre, has been replaced by the more modern linear spatial arrangement in recent years. The present trend is for Zulu homesteads (*Umuzi*) to be clustered along the L2598 and other roads in the area rather than dotted all over the landscape. Given these changes in settlement layout it is unlikely that the area forms part of any cultural landscape. In fact, communication with council members of two (2) traditional authorities in the area (i.e. Nobamba / Usuthu and Mbatha Traditional Authorities) confirmed these initial impressions that the area has no cultural landscape significance.

8.6.6 Sense of Place

Given the modification of the landscape and the change in settlement pattern, the proposed bridge will not be an intrusion on the 'sense of place' of the area. Power lines already run across the White Mfolozi River in the immediate vicinity of the proposed bridge crossing. Homesteads in the near vicinity of the proposed bridge crossing site (western bank of the White Mfolozi River) do not reflect the traditional 'central cattle pattern' arrangement as was common in Zululand in the colonial and pre-colonial periods. Today they are clustered together in a linear pattern and are constantly being modified and altered. Interestingly, local community members interviewed also felt that the proposed bridge will not alter the 'sense of place' of the general area.

A 3D Artist Impression of the bridge was presented to the Community's at the Public Meetings held by the EAP (**Figure 45**). The Community were specifically asked if there were any concerns with regard to the aesthetics of the bridge and / or any potential visual intrusions. The Community confirmed that there were none.

Figure 45: Artist Impression of the Bridge

8.6.7 Potential Impacts

Eight grave sites have been identified within 50 m from the proposed White Mfolozi Bridge and associated link road (L2598) (Option 1). These sites have all been rated as locally significant. They are all protected by provincial heritage legislation and may not be removed or altered without the necessary approvals.

The greater project area is relatively rich in archaeological sites and features. It is also possible that “invisible” graves may occur in association with rural homesteads situated along the L2598 leading towards the proposed White Mfolozi Bridge site. Construction activities may expose grave sites and archaeological artefacts not visible on the surface. The KwaZulu-Natal Heritage Act requires that operations exposing archaeological and historical residues should cease immediately pending an evaluation by the Heritage authority (AMAFA).

Table 24: Heritage sites identified in the study area

Number	Heritage Site Category	Brief Description	Rating	GPS Latitude and Longitude
1	Grave site 1	Informal and unmarked grave. Covers an area of approximately 2m x 1.5m. The grave is situated approximately 10 m from the proposed link road (Option 1). It appears to be older than 60 years.	High Significance Locally (Local Grade 111B)	S 28º 19' 22.60" E 31º 17' 51.25"
2	Grave site 2	Two informal graves indicated by stone heaps. The grave site covers an area of approximately 7 m x 4 m. The graves are situated approximately 35 m from the proposed link road (Option 1). They appear to be younger than 60 years.	High Significance Locally (Local Grade 111B)	S 28º 19' 20.04" E 31º 17' 54.23"
3	Grave site 3	An informal grave indicated by a raised soil profile and a heap of stones. The grave covers an area of approximately 1.8 m x 1.3 m. The grave site is situated approximately 50 m from the proposed link road (Option 1). It appears to be younger than 60 years old.	High Significance Locally (Local Grade 111B)	S 28º 19' 19.29" E 31º 17' 55.00"
4	Grave site 4	A small cluster of 5 graves (indicated by informal stone heap structures). The grave site covers an area of approximately 12 m x 15 m. It is situated approximately 40 m from the proposed link road (Option 1). It appears to be younger than 60 years old.	High Significance Locally (Local Grade 111B)	S 28º 19' 20.75" E 31º 18' 12.05"
5	Grave site 5	Singular grave indicated by informal stone heap. It covers an area of approximately 1 m x 1.5 m. The grave is situated approximately 42 m from the proposed link road (Option 1). The grave appears to be older than 60 years.	High Significance Locally (Local Grade 111B)	S 28º 19' 20.68" E 31º 18' 12.64"
6	Grave site 6	Singular grave indicated by informal stone heap. It covers an area of approximately 1.2 m x 1.8 m. The grave is situated approximately 16 m from the proposed link road (Option 1). The grave appears to be older than 60 years.	High Significance Locally (Local Grade 111B)	S 28º 19' 20.93" E 31º 18' 47.28"

Number	Heritage Site Category	Brief Description	Rating	GPS Latitude and Longitude
7	Grave site 7	A small cluster of 5 graves (indicated by informal stone head structures). The grave site covers an area of approximately 10 m x 20 m. It is situated approximately 3 m from the proposed link road (Option 1). It appears to be older than 60 years.	High Significance Locally (Local Grade 111B)	S 28º 19' 19.63'' E 31º 18' 50.15"
8	Grave site 8	A grouping of 2 graves (indicated by informal stone heap structures). The grave site covers an area of approximately 4 m x 25 m. It is situated approximately 30 m from the proposed link road (Option 1). It appears to be older than 60 years.	High Significance Locally (Local Grade 111B)	S 28º 19' 8.47" E 31º 19' 21.32"
9	Shembe 'Site of Worship'	A stone circle (painted white) with a diameter of approximately 25 m. Modified trees also painted partially white, is placed in the centre of the stone circle. This is a recent feature and has been in existence for the last 6 years. However, it is a place of worship combining indigenous with Christian elements. The site has living heritage values.	This site is of local significance (Local grade 111B It is still in use and has living heritage values. It is therefore protected by heritage legislation.	S 28° 18' 13.08" E 31° 20' 51.46"
10	Early Stone Age "tool scatter"	A thin scatter of Early Stone Age tools occurs approximately 30 m – 200 m from the edge of the White Mfolozi River directly adjacent to the L2598. Stone tools include, choppers, cleavers, a possible pick and associated flakes. Most of the tools are made from quarzitic sandstone. However, these stone tools are all out of context and some has clearly been washed down from a higher altitude locality. As they are not in context, they are of little research value. Nevertheless, they may have some educational value and they should be collected, under the auspices of AMAFA, before the construction of the link road commences.	The site has a low heritage rating as it is out of context and of little research value. In addition, similar sites occur widely in parts of Zululand and in similar settings.	S 28° 19' 24.19" E 31° 18' 18.52"

8.7 Palaeontology

A Desktop Palaeontology Impact Assessment was conducted by Dr Gideon Groenewald (***Appendix C3***).

8.7.1 Swazian aged Granites (Zng)

Swazian aged granites will not contain any fossils.

8.7.2 Pongola Supergroup (Nsuze Group)

- Ndlebela Formation (Znl)
  The Swazian aged Ndlebela Formation is a lava deposit and will not contain fossils.

- Thembeni Formation (Zts)
  The Swazian aged Thembeni Formation can contain trace fossils, but no fossils have to date been recorded in these very old sediments. A moderate sensitivity is allocated to this formation.

- Chobeni Formation (Zc)
  The Swazian aged dolomite of the Chobeni Formation contain significant fossils known as "stromatolites". These very highly significant fossilized structures of algal growths in ancient shallow marine environments are very useful for the explanation of the Palaeontological Heritage of KwaZulu-Natal (MacRae, 1999).

8.7.3 Karoo Supergroup

- Dwyka Group
  Trace fossils have been recorded from the fine-grained shales of the Dwyka Group in KwaZulu-Natal (Linstrom, 1987; MacRae, 1999). Trackways, produced mostly by fish and arthropods (invertebrates), have been recovered in shales from the uppermost Dwyka Group. Other trace fossils include coprolites (fossilized faeces) of chondrichthyians (sharks, skates and rays).

  Body fossils include aranaceous foraminifera and radiolarians (single-celled organisms), bryozoans, sponge spicules (internal support elements of sponges), primitive starfish, orthoceroid nautiloids (marine invertebrates similar to the living *Nautilus*), goniatite cephalopods (*Eoasinites* sp.), gastropods (marine snails such as *Peruvispira viperdorfensis*), bivalves (*Nuculopsis* sp., *Phestia* sp., *Aphanaia haibensis, Eurydesma mytiloides*), brachiopods (*Attenuatella* sp.) and palaeoniscoid fish such as *Namaichthys schroederi* and *Watsonichthys lotzi*.

  Fossil plants have also been found, including lycopods (*Leptophloem australe*), moss, leaves and stems (possibly belonging to a proto-glossopterid flora). Fossil spores and pollens (such as moss, fern and horsetail spores and primitive gymnosperm pollens) as well as fossilized wood probably belonging to primitive gymnosperms have also been recorded from Dwyka deposits (MacRae, 1999; McCarthy and Rubidge, 2005).

- Dolerite (Jd)
  Jurassic aged dolerite will not contain fossils.

8.7.4 Potential Impacts

The desktop investigation confirms that the study area is underlain by relatively deep (>2 m) clay soil associated with the ancient granites and metamorphic rocks of the Natal Metamorphic Belt and the Karoo Supergroup.

The areas underlain by the metamorphic rocks and granites will not yield any fossils.

The excavations for the construction of the infrastructure cutting into the Swazian aged Stromatolitic dolomite of the Chobeni Formation will undoubtedly expose significant ancient stromatolites that are very important indicators of palaeo-environments. Swazian aged sediments of the Thembeni and Carboniferous to Permian aged rocks of the Dwyka Group will have a Moderate likelihood of exposing significant fossils. The Jurassic aged dolerite represents volcanic intrusions and will not contain fossils.

Due to the deep weathering it is highly unlikely that any trace and other fossils will be exposed before deep (>1.5 m) excavations into the Chobeni and Thembeni Formations and the Dwyka Group are undertaken.

Refer to

Table 25 and **Figure 46** for the palaeontological sensitivity and significance of the study area.

Figure 46: Palaeontological sensitivity for the study area

Table 25: Paleontological significance

PALAEONTOLOGICAL SIGNIFICANCE/VULNERABILITY OF ROCK UNITS	
The following colour scheme is proposed for the indication of palaeontological sensitivity classes. This classification of sensitivity is adapted from that of Almond et al (2008) and Groenewald et al., (2014)	
RED	Very High Palaeontological sensitivity/vulnerability. Development will most likely have a very significant impact on the Palaeontological Heritage of the region. Very high possibility that significant fossil assemblages will be present in all outcrops of the unit. Appointment of professional palaeontologist, desktop survey, Phase I Palaeontological Impact Assessment (PIA) (field survey and recording of fossils) and Phase II PIA (rescue of fossils during construction) as well as application for collection and destruction permit compulsory.
ORANGE	High Palaeontological sensitivity/vulnerability. High possibility that significant fossil assemblages will be present in most of the outcrop areas of the unit. Fossils most likely to occur in associated sediments or underlying units. Appointment of professional palaeontologist, desktop survey and Phase I Palaeontological Impact Assessment (field survey and collection of fossils) compulsory. Early application for collection permit recommended. Highly likely that a Phase II PIA will be applicable during the construction phase of projects.
GREEN	Moderate Palaeontological sensitivity/vulnerability. High possibility that fossils will be present in the outcrop areas of the unit or in associated sediments that underlie the unit. Fossils described in the literature are visible with the naked eye and development can have a significant impact on the Palaeontological Heritage of the area. Recording of fossils will contribute significantly to the present knowledge of the development of life in the geological record of the region. Appointment of a professional palaeontologist, desktop survey and Phase I PIA (ground proofing of desktop survey) compulsory.
BLUE	Low Palaeontological sensitivity/vulnerability. Low possibility that fossils that are described in the literature will be visible to the naked eye or be recognized as fossils by untrained persons. Fossils of micro-bacteria are extremely important for our understanding of the development of Life, but are only visible under large magnification. Recording of the fossils will contribute significantly to the present knowledge and understanding of the development of Life in the region. Where geological units are allocated a blue colour of significance, and the geological unit is surrounded by highly significant geological units (red or orange coloured units), a palaeontologist must be appointed to do a desktop survey and to make professional recommendations on the impact of development on significant palaeontological finds that might occur in the unit that is allocated a blue colour. At least a Desktop Survey and “Chance Find Protocol” is compulsory. The Chance Find Protocol must be included in the EMPr for the project.
GREY	Very Low Palaeontological sensitivity/vulnerability. Very low possibility that significant fossils will be present in the bedrock of these geological units. It is however essential to note that the geological units mapped out on the geological maps are invariably overlain by Cenozoic aged sediments that might contain significant fossil assemblages and archaeological material. Where geological units are allocated a grey colour of significance, and the geological unit is surrounded by very high and highly significant geological units (red or orange coloured units), a palaeontologist must be appointed to do a desktop survey and to make professional recommendations on the impact of development on significant palaeontological finds that might occur in the unit that is allocated a grey colour. It is important that the report should also refer to archaeological reports and possible descriptions of palaeontological finds in Cenozoic aged surface deposits. At least a Desktop Survey and “Chance Find Protocol” document is compulsory. The Chance Find Protocol must be included in the EMPr of the project.

9 IMPACT ASSESSMENT

9.1 Introduction

Impact assessment must take into account the nature, scale and duration of effects on the environment, whether such effects are positive (beneficial) or negative (detrimental). Each issue / impact is also assessed according to the project stages from planning, through construction and operation to the decommissioning phase. Where necessary, the proposal for mitigation or optimisation of an impact is noted. A brief discussion of the impact and the rationale behind the assessment of its significance is provided in this Section.

The EIA of the project activities is determined by identifying the environmental aspects and then undertaking an environmental risk assessment to determine the significant environmental aspects. The environmental impact assessment is focussed on the following phases of the project namely:

- Planning Phase;
- Construction Phase; and
- Operational Phase.

As the project entails the construction of a bridge and upgrading of existing infrastructure which will be permanent, decommissioning is not applicable to this project, however, impacts associated with post construction clean-up are considered.

9.2 Impact Assessment Methodology

The potential environmental impacts associated with the project will be evaluated according to it nature, extent, duration, intensity, probability and significance of the impacts, whereby:

- ***Nature:*** A brief written statement of the environmental aspect being impacted upon by a particular action or activity;
- ***Extent:*** The area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales. This is often useful during the detailed assessment phase of a project in terms of further defining the determined significance or intensity of an impact. For example, high at a local scale, but low at a regional scale;
- ***Duration:*** Indicates what the lifetime of the impact will be;
- ***Intensity:*** Describes whether an impact is destructive or benign;
- ***Probability:*** Describes the likelihood of an impact actually occurring; and
- ***Cumulative:*** In relation to an activity, means the impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

The criteria to be used for the rating of impacts are provided in **Table 26**.

Table 26: Criteria to be used for the rating of impacts

Criteria	Description			
EXTENT	**National (4)** The whole of South Africa	**Regional (3)** Provincial and parts of neighbouring provinces	**Local (2)** Within a radius of 2 km of the construction site	**Site (1)** Within the construction site

Criteria	Description			
DURATION	**Permanent (4)** Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient	**Long-term (3)** The impact will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter. The only class of impact which will be non-transitory	**Medium-term (2)** The impact will last for the period of the construction phase, where after it will be entirely negated	**Short-term (1)** The impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase
INTENSITY	**Very High (4)** Natural, cultural and social functions and processes are altered to extent that they permanently cease	**High (3)** Natural, cultural and social functions and processes are altered to extent that they temporarily cease	**Moderate (2)** Affected environment is altered, but natural, cultural and social functions and processes continue albeit in a modified way	**Low (1)** Impact affects the environment in such a way that natural, cultural and social functions and processes are not affected
PROBABILITY OF OCCURRENCE	**Definite (4)** Impact will certainly occur	**Highly Probable (3)** Most likely that the impact will occur	**Possible (2)** The impact may occur	**Improbable (1)** Likelihood of the impact materialising is very low

Significance is determined through a synthesis of impact characteristics. Significance is also an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

Table 27: Criteria for the rating of classified impacts

	Class	Description
+	**Any value**	Any positive / beneficial 'impact', i.e. where no harm will occur due to the activity being undertaken.
–	**Low impact (4 -6 points)**	A low impact has no permanent impact of significance. Mitigation measures are feasible and are readily instituted as part of a standing design, construction or operating procedure.
	Medium impact (7 -9 points)	Mitigation is possible with additional design and construction inputs.
	High impact (10 -12 points)	The design of the site may be affected. Mitigation and possible remediation are needed during the construction and / or operational phases. The effects of the impact may affect the broader environment.
	Very high impact	Permanent and important impacts. The design of the site may be affected. Intensive remediation is needed during construction and / or operational phases.

Class	Description
(13 - 16 points)	Any activity which results in a “very high impact” is likely to be a fatal flaw.
Status	Denotes the perceived effect of the impact on the affected area.
Positive (+)	Beneficial impact.
Negative (-)	Deleterious or adverse impact.
Neutral (/)	Impact is neither beneficial nor adverse.
It is important to note that the status of an impact is assigned based on the *status quo* – i.e. should the project not proceed. Therefore, not all negative impacts are equally significant.	

The suitability and feasibility of all proposed mitigation measures will be included in the assessment of significant impacts. This will be achieved through the comparison of the significance of the impact before and after the proposed mitigation measure is implemented. Mitigation measures identified as necessary will be included in an EMPr.

9.3 Potential Impacts and Significance

The following sections will provide a description of the potential impacts as identified by the specialist assessment, EAP and through the PPP as well as the assessment according to the criteria described in **Table 26** and **Table 27**.

All potential impacts associated with the proposed development through the construction and operation of the development life-cycle have been considered and assessed in the following sections. As the infrastructure is expected to be permanent, the decommissioning phase impacts have not been considered.

Furthermore, the impact assessment is done for the preferred option (Option 1) as Options 2 and Option 3 were considered flawed and excluded in ***Section 5.1.6***.

9.3.1 Planning Phase Impacts

Table 28: Planning phase impacts

Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Planning & Design	**Aspect:** Construction of bridge and link road. **Impact:** Impact on protected tree species (*Sclerocarya birrea* subsp. *caffra* and *Sideroxylon inerme* and provincially protected plants (*Aloe marlothii, A. parvibracteata, Ceropegia racemosa subsp. setifera, Dietes irioides, Gladiolus* cf. *crassifolius, Ledebouria asperifolia and L. zebrine).*	**Without**	1	4	2	4	**-11**	**High**
		With	1	1	1	1	**-4**	**Low**
		Key mitigation measures: ▪ Prior to commencement of construction, an ecologist must be appointed to survey the construction footprint and working servitude for protected and important species, mark these species and apply for the necessary permits and licences to destroy or relocate them. ▪ In accordance with the provisions of the Natal Nature Conservation Ordinance of 1974, an Ordinary Permit from the *eZemvelo* KZN Wildlife (*E*KZNW) is required to handle the seven (7) protected plant species. ▪ A licence with regards to nationally protected trees is required to handle the *Sclerocarya birrea* subsp. *caffra* and *Sideroxylon inerme*. The licence must be obtained from the Department of Agriculture, Forestry and Fisheries (DAFF) prior to construction. ▪ The commencement of construction must be preceded by a plant rescue programme, which must be conducted after receipt of the permits issued by *E*KZNW and DAFF respectively. ▪ No clearing of vegetation outside of the defined working servitudes is permitted for any reason (i.e. for fire wood or medicinal use).						
	Aspect: Design of culvert(s). **Impact:** Impact on watercourses.	**Without**	2	3	3	3	**-11**	**High**
		With	1	1	1	1	**-4**	**Low**
		Best practice design measures: ▪ Culverts must be sized to transport not only water, but the other materials that might be mobilised (i.e. debris). ▪ Culverts must be established across the width of the existing watercourses and must not be established outside of the delineated watercourses so as not to create additional channelled flow paths. ▪ The base (invert) of the new portal / box culvert must be at the exact same elevation as the						

Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
		existing channel base, so that there are no significant upstream and downstream adjustments in channel form. In this regard, the levels must be accurately pegged out by an engineer and the engineer must be on-site to guide the setting out of the foundation. ▪ The inlet of the culvert base must match the elevation of the stream bed so that there is no culvert base perching (if culvert inlet higher than river bed) or a drop into the culvert (if culvert inlet lower than bed). ▪ Erosion protection measures (e.g. Reno-mattresses and / or stilling basins) or energy dissipaters must be established at the current stream bed surface.						
Planning & Design	**Aspect:** Design of bridge. **Impact:** Impact on watercourses.	**Without**	2	3	3	3	**-11**	**High**
		With	2	1	1	1	**-5**	**Low**
		Best practice design measures: ▪ Establishment of a spanned bridge above the major storm event flood levels e.g. 1:100 year flood level. ▪ Minimisation of the number, width and footprint (extent) of in-stream piers and their bases / footers. ▪ All piers (and bases / footers) must be aligned parallel to the direction of flow. ▪ The spacing between piers must be large enough to allow for the free movement of anticipated flood debris. ▪ The surface of the pier bases / footers must be established at the existing bed level so that flow and sediment patterns are not altered. Under no circumstances should the pier bases / footers be established above or below the bed surface level / elevation. ▪ The base of the piers must be designed to deflect debris and sediment / alluvium around the pier structures in such a way as to avoid elevated rates of sedimentation and scour. This can be achieved through the use of narrow and / or convex piers that deflect flows around these structures, thus reducing turbulence and therefore scour and increased sedimentation of bridge piers. ▪ What about the issue of a downstream sediment island developing						
	Aspect: Physical and economic	**Without**	1	4	4	4	**-13**	**Very High**
		With	1	4	2	4	**-11**	**High**

Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
	displacement. **Impact:** Possible loss of residence and land / assets.	**Key mitigation measures:** ▪ An approved compensation process which details the values and asset relocation process must be offered for the single home that will be affected by physical displacement. ▪ The potential for impact on fence lines must also be offered a compensation settlement. This process must be undertaken with the consent of the household owner, under the guardianship of the traditional leader. *Note: This impact still remains a high negative impact after mitigation as physical displacement will entail the potential dislocation of family ties and displaced persons will take some time to settle down in a new location.*					

9.3.2 Soils

Table 29: Impact on soils

Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	**Aspect:** Construction activities (site clearing and establishment of lay-down area and construction camp, bridge and road construction). **Impact:** Physical degradation due to the removal and compaction of soil during construction activities.	**Without**	1	2	2	2	**-7**	**Medium**
		With	1	1	1	1	**-4**	**Low**
		Key mitigation measures: ▪ Erosion / sediment control measures such as silt fences or low soil berms must be placed around the stockpiles to limit sediment runoff from stockpiles. ▪ Subsoil and topsoil must be stockpiled separately. Stockpiled soil must be replaced in the reverse order to which it was removed (subsoil first followed by topsoil). ▪ Stockpiles of construction materials must be clearly separated from soil stockpiles in order to limit any contamination of soils. ▪ The stockpiles may only be placed within demarcated stockpile areas at least 50 m away from delineated watercourses to prevent unnecessary sedimentation of the watercourses. The contractor shall, where possible, avoid stockpiling materials in vegetated areas that will not be cleared. ▪ Stockpiled soils must be kept free of weeds and must not be compacted.						

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Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
		▪ The stockpiled soil must be kept moist using some form of spray irrigation on a weekly to bi-weekly basis. ▪ The height of stockpiles must be limited to 2 m to avoid soil compaction and destruction of soil micro-organisms. ▪ When locating the construction camp and equipment yard, watercourses and areas susceptible to soil erosion and /or water contamination must be avoided. The camp must be situated at least 100 m away from the edge of the nearest watercourse. ▪ The camp should be established on level ground. ▪ The location of the camp site should be approved by the appointed ECO. ▪ No material may be stored or equipment repaired beyond the boundaries of the contractor lay-down area.						
	Aspect: Construction activities (site clearing). **Impact:** Physical degradation due to soil: erosion as a result of exposed soil and topsoil.	**Without**	1	2	2	3	**-8**	**Medium**
		With	1	1	1	2	**-5**	**Low**
		Key mitigation measures: ▪ Vegetation / soil clearing and stripping activities must only be undertaken during agreed working times and permitted weather conditions. ▪ Any vegetation clearing should be done immediately before construction activities to avoid prolonged exposure of the soil to weather elements. ▪ Construction activities should be scheduled to minimise the duration of exposure to bare soils on site, especially on steep slopes. ▪ The unnecessary removal of groundcover from slopes must be prevented, especially on steep slopes. ▪ All bare slopes and surfaces to be exposed to the elements during clearing and earthworks must be protected against erosion using rows of silt fences, sandbags, hay bales and / or earthen berms spaced along contours at regular intervals. The spacing interval must be smaller for steeper slopes and if required the ECO should advise in this regard. ▪ All erosion control measures must be regularly maintained and monitored weekly and sediment accumulating behind the structures should be removed and redistributed to ensure that structures do not fail.						

9.3.3 Geohydrology

Table 30: Geohydrology impacts

Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	**Aspect:** ▪ Improper storage of fuels, chemical etc. ▪ Construction equipment, vehicles, workshop and wash bay areas. ▪ Inadequate ablutions. **Impact:** Groundwater contamination as a result of: ▪ Spillage of fuels, lubricants and other chemicals. ▪ Construction equipment, vehicles, workshop and wash bay areas will be a likely source of pollution as a non-point source. ▪ Lack of provision of ablutions that may lead to the creation of informal ablutions.	**Without**	2	2	3	2	-9	Medium
		With	1	1	1	2	-5	Low
		Key mitigation measures: ▪ Potentially hazardous substances must be stored on an impervious surface in a designated bunded area, able to contain 110% of the total volume of materials stored at any given time. ▪ Material safety data sheets (MSDSs) are to be clearly displayed for all hazardous materials. ▪ The integrity of the impervious surface and bunded area must be inspected regularly and any maintenance work conducted must be recorded in a maintenance report. ▪ Employees must be provided with absorbent spill kits and disposal containers to handle spillages. ▪ Employees and contractors must be trained on the correct handling of spillages and precautionary measures that need to be implemented to minimise potential spillages. ▪ All earth moving vehicles and equipment must be regularly maintained to ensure their integrity and reliability. No repairs may be undertaken beyond the contractor lay-down area. ▪ Immediate reporting and rectification of any incident that might lead to pollution. ▪ An Emergency Preparedness and Response Plan will be developed and implemented should an incident occur. ▪ Access to storage areas on-site must be restricted to authorised employees only. ▪ Contractors will be held liable for any environmental damages caused by spillages. ▪ The construction workforce must have adequate sanitation facilities. ▪ The sanitation facilities must be on-site before the extended workforce is employed to ensure that no unauthorised sanitation practices are undertaken on-site. ▪ Potential construction practices that might lead to groundwater contamination must be conducted on areas with impervious surfaces to avoid infiltration of contaminated substances into the groundwater aquifer. ▪ All contaminated stormwater must be treated before being discharged into the surrounding natural environment.						

9.3.4 Vegetation

Table 31: Vegetation Impacts

Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	**Aspect:** Clearing of vegetation for the construction of the bridge and link road **Impact:** Physical destruction and / or modification of terrestrial habitat	**Without**	1	4	2	4	**-11**	**High**
		With	1	3	1	4	**-9**	**Medium**
		Key mitigation measures: ▪ The width of the construction corridor through the Mixed Tall Bushveld type must be minimised. The full 20 m road servitude must not be cleared. Only a 3 m construction working corridor / right of way (RoW) should be established on one(1) side of the road footprint for access and haulage purposes and a 1 – 2 m construction working corridor / RoW along the other side (i.e. maximum of 4 – 5 m working area outside of road footprint). ▪ The width of the construction corridor (area cleared and disturbed) along the entire route must be minimised as far as practically possible and the clearing of the full width of the 20 m servitude must not be undertaken unless necessary for well substantiated reasons. ▪ Site camps, lay-down and storage, and soil / road material stockpile areas must not be located within the Mixed Tall Bushveld community. ▪ Once the construction corridor has been finalised, the outer extent of the entire corridor must be clearly demarcated using brightly coloured shade cloth or orange hazard netting. ▪ Any contractors found working inside the no-go areas should be fined as per fining schedule / system setup for the project.						
Operations	**Impact:** Alien invasive plant (IAP) encroachment.	**Without**	1	2	3	3	**-9**	**Medium**
		With	1	1	1	1	**-4**	**Low**
		Key mitigation measures: ▪ Equipment used on site must be seed free and vehicles must be properly washed before moving onto site. ▪ All invasive alien plants that have colonised the construction site must be removed, preferably by uprooting. ▪ All bare surfaces across the construction site must be checked for IAPs every two weeks and IAPs removed by hand pulling / uprooting and adequately disposed.						

Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		▪ Herbicides should be utilised where hand pulling / uprooting is not possible. Only herbicides which have been certified safe for use in wetlands by independent testing authority are to be used. ▪ Soil for construction activities must be sourced from a source free of Famine Weed. ▪ In the event that Famine Weed is recorded on site, the following mitigation measures must be undertaken: ○ Pull the entire plant out including roots before flowering and place it in a bin bag. Protective gloves, facemasks and protective clothing must be used. ○ Burn all uprooted plants once dry in a controlled environment. Alternatively, spray all emerging plants and leaves with a registered herbicide such as *Access 240 SL*. ▪ It is recommended that bi-annual alien plant clearing be undertaken by the applicant for the first year post-rehabilitation. Thereafter, alien plant clearing should be undertaken annually until such a time that further risks of alien invasion resulting from disturbance factors are considered negligible.					

9.3.5 Freshwater Resources

Table 32: Freshwater resources impacts

Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	**Aspect:** Construction activities within watercourses. **Impact:** Physical destruction and / or modification of aquatic habitat including: ▪ Clearing of riparian vegetation.	**Without**	1	4	1	4	**-10**	**High**
		With	1	2	1	2	**-6**	**Low**
		Key mitigation measures: ▪ It is recommended that construction within the river take place in the winter / dry months (June-September) to reduce erosion and sedimentation risks during the construction phase. If construction is timed correctly the risk and intensity of temporary flow diversion and sedimentation impacts to downstream river reaches will be greatly reduced. ▪ All intact watercourses and riparian vegetation within the construction corridor (working area) that needs to be removed must be rescued and temporarily stored onsite for later						

Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
	▪ Physical modification of in-stream habitat within the bridge footprint and associated construction corridor.	rehabilitation. ▪ A plant rescue plan must be included in the detailed construction phase rehabilitation plan for the project. ▪ A conceptual construction phase watercourse rehabilitation plan (strategy) is provided as an Annexure to the EMPr (***Appendix B***). A detailed construction phase rehabilitation plan must be compiled by a suitably qualified and experienced ecologist and appended to the EMPr prior to construction commencing. ▪ The width of the construction corridor must be minimised to reduce the extent of physical habitat disturbance. In this regard, the following is recommended: ○ For the Mfolozi River Bridge crossing - the construction corridor must be limited to the pier construction areas separated by access tracks to and from these areas. It is recommended that the pier construction areas comprise the pier footprint buffered by a 3 m working area. Between these areas a 3 – 4 m running track must be established for vehicular access only. ○ For the new and existing tributary stream crossings – the construction corridor must be limited to the development footprint and a 3 m working servitude on either side. ▪ The working corridors must accommodate all construction-related activities, including materials storage, access routes, etc. Materials stockpiling and storage must be done outside of the watercourses. ▪ The construction corridor must be clearly demarcated using orange hazard bonnox fencing or brightly coloured shade cloth which should be erected and approved by the ECO prior to the commencement of any construction activities. ▪ All freshwater habitats outside of the demarcated areas must be considered NO-GO areas for the duration of the construction phase. Any contractors found working inside the NO-GO areas should be fined as per fining schedule/system setup for the project. ▪ Should any accidental / unintentional disturbance of watercourses outside of the construction corridor occur, these areas must be rehabilitated immediately. ▪ Prior to any construction commencing, the width of the construction corridor for each of the watercourse crossings must be finalised and approved by the EAP / ECO in light of the width recommendations provided above.						
	Aspect: Construction activities within	**Without**	1	4	1	4	**-10**	**High**
		With	1	2	1	2	**-6**	**Low**

Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
	watercourses. **Impact:** Flow modification and erosion / sedimentation impacts: ▪ Flow impoundment and diversion around working areas within the watercourses and / or dewatering of working areas. ▪ Physical disturbances of watercourses both planned and accidental e.g. soil stripping / grubbing and vegetation clearing. ▪ Physical disturbances of catchment slopes in close proximity to the watercourses.	**Key mitigation measures:** ▪ One of two flow diversion methods is recommended for implementation during the construction phase: ○ Method 1: Full isolation gravity / flume pipe: A whole section of the channel is isolated using barriers that span the full width of the river. This keeps a stretch of the river dry and the water is transferred downstream of the works area through gravity fed flumes / pipes. The flume(s) is normally placed on the bed of the watercourse through the works area and outfalls at the downstream barrier, if present, or far enough downstream to prevent the water backing up into the work area. ○ Method 2: Full isolation over pumping / siphon: A whole section of the channel is isolated using barriers that span the full width of the river. This keeps a stretch of the river dry and the water is transferred downstream of the works area by mechanical assistance (pumping or siphon). The pump and associated pipe work need not be located in the isolated area. ▪ A method statement must be compiled by an aquatic specialist in conjunction with the appointed contractor to guide the flow diversion process from start to finish. This method statement must be approved by the ECO. ▪ Diversions shall be temporary in nature with no permanent walls, berms or dams being installed. ▪ Construction within the channel should progress as quickly as practical to reduce the risk of exceeding the temporary diversion capacity. ▪ Under no circumstances shall a new channel or drainage canal be excavated to divert water away from construction activities. ▪ Erosion and sediment control measures (e.g. silt fences / curtains, sandbags etc.) must be implemented prior to any works within the watercourses. These structures will need to be maintained for the entire duration of the activity and monitored on a weekly basis. The location of these structures must be determined in conjunction with the ECO. Such measures should be located downstream of the working area as well as along the edges of the construction corridor to protect freshwater habitat. ▪ Sandbags used in any diversion or for any other activity within a watercourse must be in a good condition, so that they do not burst and empty sediment into the watercourse. ▪ For all works within the watercourses, the use of heavy machinery should be minimized as					

Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
		far as practically possible. If heavy machinery is required to access freshwater habitat, a running track to the working areas will need to be created that is suitable to the prevailing soil wetness conditions. Where aggregate is required for load bearing purposes, geofabric should underlie all such running tracks to avoid mixing of foreign material with in-stream biotopes and alluvial soils. ▪ If excess debris and sediment has collected up-stream of the structure, this material must be removed and responsibly disposed of before the dam is decommissioned. ▪ Upon completion of the construction activities within the watercourse, all temporary structures must be removed immediately and the disturbed soils, beds, banks and vegetation rehabilitated in line with a detailed rehabilitation plan. Under no circumstances must temporary structures be left in situ for more than a day after completion and rehabilitation must commence within a day of completion. ▪ Detailed stormwater management and erosion controls are provided in the EMPr (***Appendix B***).						
	Aspect: Construction activities within watercourses. **Impact:** Impacts on water quality due to potential contaminants (hydrocarbons; oils and grease; cement; bitumen; sewage; suspended solids and solid waste) released into watercourses.	**Without**	1	2	2	2	**-7**	**Medium**
		With	1	1	1	2	**-5**	**Low**
		Key mitigation measures: ▪ Hazardous storage and refuelling areas must be bunded prior to their use on site during the construction period following the appropriate SANS codes. The bund wall must be high enough to contain at least 110% of any stored volume. ▪ The surface of the bunded surface must be graded to the centre so that spillage may be collected and satisfactorily disposed of. ▪ Fire prevention facilities must be present at all hazardous storage facilities. ▪ The proper storage and handling of hazardous substances (e.g. fuel, oil, cement, bitumen, paint, etc.) must be administered. Storage containers must be regularly inspected to prevent leaks and all hazardous storage must take place in a bunded area or within drip trays to prevent soil / water contamination. ▪ Mixing and / or decanting of all chemicals and hazardous substances must take place on trays, shutter boards or on impermeable surfaces and must be protected from the ingress and egress of stormwater. ▪ Drip trays must be utilised at all dispensing areas.						

Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
		▪ 44-gallon drums must be kept on site to collect contaminated soil. These should be disposed of at a registered hazardous waste site. Refuelling, servicing or chemical storage must not occur within 50 m of the delineated watercourse habitat or within the 100-year flood line, whichever is applicable. ▪ Vehicles transporting concrete, asphalt or any other bituminous product must not be washed on site. ▪ Vehicle maintenance must not take place on site unless a specific bunded area with an oil filter trap is constructed at the site camp for such a purpose. ▪ Correct emergency procedures and cleaning up operations should be implemented in the event of accidental spillage. ▪ If a water pump is required, the water pump must operate inside or on top of a drip tray to prevent any spillage of fuel and limit the risk of soil / water contamination. The drip tray will need to be lined with absorbent pads and checked daily while in use. ▪ All equipment to be used within the sensitive working areas must be checked daily for oil and diesel leaks before gaining access to these working areas. ▪ An emergency spill response procedure must be formulated and staff must be trained in spill response. All necessary equipment for dealing with spills of fuels / chemicals must be available at the site. Spills must be cleaned up immediately and contaminated soil / material must be disposed of appropriately at a registered site. ▪ Waste from chemical toilets must be disposed of regularly (at least once a week) and in a responsible manner by a registered waste contractor. ▪ Workers need to be encouraged to use toilet facilities provided and not the natural environment. ▪ Toilets must not be located within the 1:100 year flood line of a watercourse or closer than 50m or from any natural water bodies including rivers, streams, riparian areas and wetlands.						
Operations	**Impact:** Alien invasive plant (IAP) encroachment.	**Without**	1	3	2	3	**-9**	**Medium**
		With	1	1	1	1	**-4**	**Low**
		Key mitigation measures: ▪ All invasive alien plants that have colonised the construction site must be removed, preferably by uprooting. ▪ All bare surfaces across the construction site must be checked for IAPs every two weeks						

Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
		and IAPs removed by hand pulling/uprooting and adequately disposed. ▪ Herbicides should be utilised where hand pulling / uprooting is not possible. Only herbicides which have been certified safe for use in wetlands by independent testing authority are to be used. ▪ Any action taken to control and eradicate a listed invasive species must be executed with caution and in a manner that may cause the least possible harm to biodiversity and damage to the environment. ▪ The methods employed to control and eradicate a listed invasive species must also be directed at the offspring, propagating material and re-growth of such invasive species in order to prevent such species from producing offspring, forming seed, regenerating or re-establishing itself in any manner. ▪ It is recommended that bi-annual annual alien plant clearing be undertaken by the applicant for the first year post-rehabilitation. Thereafter, alien plant clearing should be undertaken annually until such a time that further risks of alien invasion resulting from disturbance factors are considered negligible.					
	Impact/s: Alteration of flow patterns as a result of the White Mfolozi River Bridge piers. • Increased concentration of flow within culverts. • Increased volume of stormwater runoff discharge and increased velocities at outlets.	**Without**	2	3	2	2	**-9**	**Medium**
		With	1	1	1	1	**-4**	**Low**
		Key mitigation measures: ▪ Adhere to the bridge and culvert design measures provided in the Planning Phase Impacts section (***Section 9.3.1***). ▪ Adhere to the stormwater management system design measures presented in the EMPr (***Appendix B***) and the Stormwater Management Plan (***Appendix BB***). ▪ The applicant is responsible for ensuring that road embankments and servitudes within and adjacent to the watercourses are maintained in perpetuity so that long-term erosion and sedimentation risks are reduced. ▪ The applicant is responsible for the periodic monitoring of the road embankment and servitude vegetation cover and taking corrective action where necessary. ▪ A freshwater habitat monitoring programme must be compiled. It is recommended that fixed point photographs be the main tool utilised and it is important that a baseline photos are taken prior to construction commencing.						

Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
	Impact: Impacts on water quality due to potential contaminants (hydrocarbons; heavy metals; VoC and suspended solids) released into watercourses.	**Without**	1	1	1	1	-4	Low
		With	1	1	1	1	-4	Low
		Key mitigation measures: ▪ Responsible use of roads i.e. no littering, vehicles in road-worthy condition. ▪ Adhere to the stormwater management system design measures presented in the EMPr (***Appendix B***).						
Cumulative	**Aspect:** Water Quality. **Impact:** Ultimately, the potential direct and indirect impacts of freshwater habitat will result in a deterioration in local freshwater ecosystem ecological condition downstream, particularly increased turbidity and sedimentation within the downstream pool habitats. This will result in a local reduction in the availability of intact natural habitat, particularly if mitigation measures are not implemented effectively.	**Without**	1	4	2	4	**-11**	High
		With	1	3	1	4	**-9**	Medium
		Key mitigation measures: ▪ In-stream sediment control measures must be installed. ▪ Before any work commences in the river channel, sediment control / silt capture measures (e.g. bidim / silt curtains) must be installed downstream of the working areas within the river. ▪ Quantities of silt fences / curtains shall be decided on site with the engineer, contractor and ECO. ▪ The ECO must be present during the location and installation of the silt curtains. ▪ During works within the channel, the downstream silt fences / curtains must be regularly checked and maintained (de-silted to ensure continued capacity to trap silt), and repaired where necessary. ▪ Other areas which are eroded or denuded of vegetation should receive topsoil and transplanted grassland sods. ▪ A copy of the method statement will need to be made available at the construction site offices / site camp at all times. ▪ Runoff generated from cleared and disturbed areas / slopes that drains into rivers, streams or wetlands must be controlled using erosion control and sediment trapping measures like silt fences, sandbags, earthen berms and synthetic logs, particularly where slopes are exposed. ▪ These control measures must be established at regular intervals perpendicular to the slope to break surface flow energy and reduce erosion as well as trap sediment. ▪ Sediment barriers (e.g. silt fences, sandbags, hay bales, earthen filter berms, retaining walls and check dams) must be established to protect water resources from erosion and sedimentation impacts from upslope.						

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Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
		▪ Sediment barriers should be regularly maintained and cleared so as to ensure effective drainage. ▪ The berms, sandbags and/or silt fences must be maintained and monitored for the duration of the construction phase and repaired immediately when damaged. ▪ The berms, sandbags and silt fences must only be removed once vegetation cover has successfully re-colonised the disturbed areas post-rehabilitation.						
Cumulative	**Aspect:** Pollution. **Impact:** The construction of the bridge could affect the ecological condition of the freshwater habitat during works being conducted within the freshwater and neighbouring habitats as it involves dust and noise pollution and vibration impacts during the construction and operational phase that could contribute to increased water column turbidity and disturbance impacts for fauna utilising the local freshwater habitat.	**Without**	1	4	2	4	**-11**	**High**
		With	1	3	1	4	**-9**	**Medium**
		Key mitigation measures: ▪ In-stream sediment control measures must be installed. ▪ Before any work commences in the river channel, sediment control / silt capture measures (e.g. bidim / silt curtains) must be installed downstream of the working areas within the river. ▪ Quantities of silt fences / curtains shall be decided on site with the engineer, contractor and ECO. ▪ The ECO must be present during the location and installation of the silt curtains. ▪ During works within the channel, the downstream silt fences / curtains must be regularly checked and maintained (de-silted to ensure continued capacity to trap silt), and repaired where necessary. ▪ Other areas which are eroded or denuded of vegetation should receive topsoil and transplanted grassland sods. ▪ A copy of the method statement will need to be made available at the construction site offices / site camp at all times. ▪ Runoff generated from cleared and disturbed areas / slopes that drains into rivers, streams or wetlands must be controlled using erosion control and sediment trapping measures like silt fences, sandbags, earthen berms and synthetic logs, particularly where slopes are exposed. ▪ These control measures must be established at regular intervals perpendicular to the slope to break surface flow energy and reduce erosion as well as trap sediment. ▪ Sediment barriers (e.g. silt fences, sandbags, hay bales, earthen filter berms, retaining walls and check dams) must be established to protect water resources from erosion and sedimentation impacts from upslope. ▪ Sediment barriers should be regularly maintained and cleared so as to ensure effective						

Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		drainage. ▪ The berms, sandbags and/or silt fences must be maintained and monitored for the duration of the construction phase and repaired immediately when damaged. ▪ The berms, sandbags and silt fences must only be removed once vegetation cover has successfully re-colonised the disturbed areas post-rehabilitation.					

9.3.6 Social

Table 33: Social impacts

Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	**Aspect:** Construction activities. **Impact:** Establishment of informal settlements on community land by people seeking work opportunities.	**Without**	1	1	1	1	-4	Low
		With	1	1	1	1	-4	Low
		Key mitigation measures: ▪ No unknown informal dwellers must be given permission by the local *iNkosi / Induna* to build homes.						
	Aspect: Establishment of an on-site construction camp. **Impact:** Construction staff.	**Without**	2	2	1	2	-7	Medium
		With	1	2	1	2	-6	Low
		Key mitigation measures: ▪ The presence of site staff that will live on the site for months and years (albeit less than 5 years), could prove disruptive to nearby rural communities. The construction camp may constitute caravans, tents and ablution facilities. ▪ The particular health and social ills that may become more predominant at this time may relate to the spread of HIV / AIDs, unplanned pregnancies, and the pronounced use of						

Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
		alcohol, etc. Since freedom of movement of the (residential, onsite) construction workers cannot be controlled, it is important that the construction company put in place ethical codes of behaviour – which will guide the interaction of the onsite labour population with the local population. This must be monitored and any indiscretions must be addressed.						
Construction	**Aspect:** Construction activities. **Impact:** Changes in local employment and incomes through project recruitment.	**Without**	2	2	2	2	+8	Medium
		With	2	2	2	2	+8	Medium
		Key mitigation measures: ▪ A formal recruitment policy must be formulated that will ensure fair access to jobs, especially for local residents. This must be a requirement to be met by companies working in the construction phase. ▪ Appointment of a Community Liaison Officer (CLO) must be undertaken to manage community expectations and equitably share out the employment opportunities.						
	Aspect: Construction activities. **Impact:** Increased business opportunity through the procurement of goods and services.	**Without**	2	2	2	2	+8	Medium
		With	2	2	2	2	+8	Medium
		Key mitigation measures: ▪ This project does not anticipate considerable procurement of goods and services, however, a Contractor Procurement Policy must be maintained.						
	Aspect: Construction activities. **Impact:** Increased opportunity for informal business development.	**Without**	1	1	1	1	+4	Low
		With	1	1	1	1	+4	Low
		Key mitigation measures: ▪ There will not be a dire need for locally produced goods, however, informal trading that may to a small degree supply the contracting staff with daily basic requirements, may establish during the construction period.						

Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
	Aspect: Construction activities. **Impact:** Local dissatisfaction due to finite jobs and perceived preferential access to these jobs and procurement.	**Without**	1	1	2	3	**-7**	**Medium**
		With	1	1	1	1	**-4**	**Low**
		Key mitigation measures: ▪ The establishment of a labour office during construction may dispel fears that the recruitment of local labour is political, gender or culturally biased. ▪ Contractors must develop and implement recruitment and employment policy, and a goods and services procurement policy that will promote fair access to jobs and procurement opportunities, through an objective and transparent process. ▪ The local *iNkosi / Induna* must assist in communicating labour processes and constraints to the local job seekers.						
Operations	**Aspect:** Operation of the bridge and link road. **Impact:** Increased access to local services (education, health facilities, etc.).	**Without**	3	4	4	4	**+15**	**Very High**
		With	3	4	4	4	**+15**	**Very High**
		Key mitigation measures: ▪ No mitigation required. The surrounding communities will have greater access to critical services such as education and health care facilities due to increased mobility.						
Operations	**Aspect:** Operation of the bridge and link road. **Impact:** Increased access and quicker response by emergency services.	**Without**	3	4	4	4	**+15**	**Very High**
		With	3	4	4	4	**+15**	**Very High**
		Key mitigation measures: ▪ No mitigation required. Emergency health services (ambulances) would have quicker, safer access to people in need. Fire and water services will also benefit from reaching beneficiaries in a more effective manner.						
	Aspect:	**Without**	1	4	4	4	**+13**	**Very High**
		With	1	4	4	4	**+13**	**Very High**

Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
	Operation of the bridge and link road. **Impact:** Increased business opportunity through greater road mobility.	**Key mitigation measures:** ▪ No mitigation required. All communities that lie directly in the beneficiary area will stand the best opportunity for increased mobility. Increased mobility could increase business trade.						
	Aspect: Operation of the bridge and link road. **Impact:** Relationship building and familial reconnection (personal and business).	**Without**	1	4	3	3	**+11**	**High**
		With	1	4	3	3	**+11**	**High**
		Key mitigation measures: ▪ No mitigation required. It has been reported that the communities that lie at a constant disadvantage by local geography are the KwaMbambo and KwaMphothi communities. While the possibility that friendship and familial relationships do exist, the proposed bridge and link road will heighten their ability to pursue and maintain closer ties with each other. Historical and ancestral relationships are promoted.						
Operations	**Aspect:** Sense of place. **Impact:** Visual intrusions. Impact on sources of medicinal plants and clay. Deteriorates community 'sense of place'.	**Without**	1	1	2	3	**-7**	**Medium**
		With	1	1	2	3	**-7**	**Medium**
		Key mitigation measures: ▪ No mitigation provided. The bridge will be a structure that intrudes on the natural environment, however, Focus Group Meetings and Public Meetings have indicated that the Community is in support of the bridge and have not raised any concerns relating to loss of medicinal plants and clay; visual intrusions and/or sense of place.						

9.3.7 Heritage

Table 34: Heritage impacts

Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	**Aspect:** Construction activities. **Impact:** Potential impact on Grave sites 1 – 8.	**Without**	1	4	3	3	**-11**	**High**
		With	1	2	2	2	**-7**	**Medium**
		Key mitigation measures: ▪ Grave site 1 - maintain a 2 m buffer zone around the grave. ▪ Grave site 2 - maintain a 10 m buffer zone around the grave site. ▪ Grave site 3 - maintain a 10 m buffer zone around the grave site. ▪ Grave site 4 - maintain a 10 m buffer zone around the grave yard. ▪ Grave site 5 – maintain a 10 m buffer zone around the grave site. ▪ Grave site 6 – maintain a 2 m buffer zone around this grave site ▪ Grave site 7 – maintain a 2 m buffer zone around this grave site. ▪ Grave site 8 - maintain a 10 m buffer zone around this grave site. ▪ If the buffers proposed cannot be maintained, a Phase II HIA, by a grave relocation expert must be conducted. A comprehensive community consultation process will have to be initiated to arrange for potential grave exhumation and reburial.						
	Aspect: Construction activities. **Impact:** Potential impact on a Shembe site.	**Without**	1	4	1	1	**-7**	**Medium**
		With	1	2	1	1	**-5**	**Low**
		Key mitigation measures: ▪ There is no need for mitigation as this site occurs outside of the project area near alternative Option 3. A buffer zone of 20 m around this site must be maintained as best practice.						
Construction	**Aspect:** Construction activities. **Impact:** Impact on an Early Stone Age 'tool scatter' site.	**Without**	1	4	1	1	**-7**	**Medium**
		With	1	1	1	1	**-4**	**Low**
		Key mitigation measures: ▪ As this site has a low rating there is no need for formal mitigation before destruction. ▪ However, it is suggested that a surface collection of all the Stone Tools be made before						

Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
		development commences. The collecting should be done by a heritage consultant under the supervision of AMAFA. The collection can be used for teaching purposes.						

9.3.8 Palaeontology

Table 35: Palaeontology impacts

Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	**Aspect:** Construction activities. **Impact:** Impact on palaeontological resources underlain by the Chobeni Formation and the Dwyka Group.	Without	1	4	3	4	-12	High
		With	1	1	1	2	-5	Low
		Key mitigation measures: ▪ The EAP and ECO must be informed of the fact that a High Palaeontological Sensitivity is allocated to the study area underlain by the Chobeni Formation and the Dwyka Group. ▪ A "Chance Find Protocol" has been included in the EMPr (***Appendix BE***). ▪ A Phase 1 PIA document and revision of the "Chance Find Protocol" must be prepared in all areas where excavation will exceed 1.5 m in the sensitive formations. ▪ If fossils are recorded, a revised "Chance Find Protocol" must be prepared by a suitably accredited Palaeontologist and recommendations contained in the Phase 1 PIA must be approved by AMAFA for inclusion in the EMPr of the project.						

9.3.9 Waste

Table 36: Waste impacts

Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	Aspect:	Without	1	2	2	3	-8	Medium

Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
	Construction activities. **Impact:** Waste generation during the construction phase will have a negative impact on the environment, if not controlled adequately. Waste includes general construction rubble and hazardous waste (used oil, cement and concrete etc.).	**With**	1	2	1	2	**-6**	**Low**
		Key mitigation measures: ▪ Adequate rubbish bins and waste disposal facilities must be provided onsite and at the construction camp. ▪ All bins must be animal proof. ▪ The construction site must be kept clean and tidy and free from rubbish. ▪ Recycling / re-use of waste must be encouraged. ▪ No solid waste must be burned on site. ▪ Eating areas must not be located within 30 m of the watercourse habitats. ▪ Waste bins must be provided at the eating areas. ▪ Bins and / or skips must be supplied at convenient intervals on site for disposal of waste within the construction camp. The bins must have liner bags for easy control and safe disposal of waste. ▪ Bins should be provided to all areas that generate waste e.g. worker eating and resting areas and the camp site. General refuse and construction material refuse must not be mixed. ▪ Regular clearing of bins is required. ▪ All general waste, constructional plant, equipment, surplus rock and other foreign materials must be cleared and completely removed from site once construction has been completed. ▪ Should rubble be required as a raw material for the construction, it must be taken to a designated stockpile area - which must be approved by the ECO.						

9.3.10 Air Quality

Figure 47: Air quality impacts

Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	**Aspect:** Construction activities (site	**Without**	1	2	1	2	**-6**	**Low**
		With	1	1	1	2	**-5**	**Low**

Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
	clearing; operation of vehicles, equipment etc.). **Impact:** Fugitive dust emissions from debris handling and debris piles; mobile plant / machinery and general construction activities.	**Key mitigation measures:** ▪ Dust must be suppressed on the construction site during dry periods by the regular application of water. ▪ Water used for this purpose must be used in quantities that will not result in the generation of runoff. ▪ Dust dispersion from construction activities, roads, soil stockpiles and other construction locations must be limited and suppressed to the maximum extent practical. ▪ Surplus fill material sites and stockpiles must be positioned such that they are not vulnerable to wind erosion. ▪ Cover skips and trucks which are loaded with construction materials. ▪ All stockpiles must be maintained for their lifetime, and retained for as short a time as possible. Stockpiles should be enclosed by wind-breaking enclosures of a similar height to the stockpile. ▪ Stockpiles must be situated away from the site boundary, watercourses and nearby receptors and must take into account the predominant wind direction. ▪ A speed limit of 40 km/hr must be set for all vehicles travelling over exposed areas or near stockpiles. ▪ Dust and mud must be controlled at vehicle exit and entry points to prevent the dispersion of dust and mud beyond the site boundary.						
	Aspect: Construction activities (site clearing; operation of vehicles, equipment etc.). **Impact:** Generation of fumes from vehicle emissions may pollute the air.	**Without**	1	2	2	2	**-7**	**Medium**
		With	1	1	1	2	**-5**	**Low**
		Key mitigation measures: ▪ All mobile plant and equipment must be in good working order. ▪ A register must be maintained for vehicle maintenance. ▪ All mobile plant that are unable to be repaired immediately must be removed from service until such time as they are in good working condition.						
	Aspect:	**Without**	1	2	2	2	**-7**	**Medium**
		With	1	1	1	2	**-5**	**Low**

Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
	Chemical toilets. **Impact:** Release of odours as a result of the chemical toilets on-site.	**Key mitigation measures:** ▪ Chemical toilets must be provided and cleaned on a regular (weekly) basis. ▪ Servicing receipts must be maintained and kept on site within the site environmental file.						

9.3.11 Noise

Table 37: Noise impacts

Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	**Aspect:** Constructions staff, vehicles, equipment and piling activities. **Impact:** Increase in noise pollution.	**Without**	1	1	3	3	**-8**	**Medium**
		With	1	1	1	2	**-5**	**Low**
		Key mitigation measures: ▪ All construction activities must be undertaken according to daylight working hours. ▪ Surrounding communities and adjacent landowners are to be notified upfront (48 hours) of noisy construction activities (blasting, excavations and piling activities). ▪ The Contractor may consider providing all equipment with standard silencers. Maintain silencer units in vehicles and equipment in good working order. ▪ All mobile plant and equipment must be regularly maintained to ensure their integrity and reliability. ▪ Construction staff working in an area where the 8-hour ambient noise levels exceed 75 dBA must have the appropriate Personal Protective Equipment (PPE) (earmuffs). ▪ All operations should meet the noise standard requirements of the Occupational Health and Safety Act (Act No. 85 of 1993). ▪ A Complaints Register is to be kept at the Site Office at all times.						
Operations	**Aspect:**							

Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
	Vehicular traffic. **Impact:** Increase in noise pollution.	**Key mitigation measures:** ▪ All construction activities must be undertaken according to daylight working hours. ▪ Surrounding communities and adjacent landowners are to be notified upfront (48 hours) of noisy construction activities (blasting, excavations and piling activities). ▪ The Contractor may consider providing all equipment with standard silencers. Maintain silencer units in vehicles and equipment in good working order. ▪ All mobile plant and equipment must be regularly maintained to ensure their integrity and reliability. ▪ Construction staff working in an area where the 8-hour ambient noise levels exceed 75 dBA must have the appropriate Personal Protective Equipment (PPE) (earmuffs). ▪ All operations should meet the noise standard requirements of the Occupational Health and Safety Act (Act No. 85 of 1993). ▪ A Complaints Register is to be kept at the Site Office at all times.					

9.3.12 Safety

Table 38: Safety impacts

Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	**Aspect:** Construction traffic. **Impact:** Impact on pedestrian, motorists and construction workers.	**With**	1	2	2	3	**-8**	**Medium**
		Without	1	2	1	2	**-6**	**Low**
		Key mitigation measures: ▪ Maintaining a safe flow of traffic during construction must be carefully planned and executed. Due to the numerous rural settlements along the existing section of the L2598 it is strongly advised that the local community is engaged in all planning relating to accommodation of traffic. ▪ A policy on Contractor Health and Safety for the duration of their work on site, must be						

Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
		applied and be monitored. ▪ Regular information sharing discussions with the Contractor's must be pursued, giving residents an opportunity to voice concerns and grievances throughout the project construction duration. ▪ The existing section of the L2598 must be constructed using half widths construction methods. ▪ Keep to safe speed limit of (recommended 25 km/hr) when driving on the gravel road to site. The current speed limit on these roads is 40 km/hr. ▪ The layout of construction areas and detours in the use of delineators and warning devices must be in accordance to the latest South African Roads and Traffic Signs Manual. The establishment of areas for contractor operations is necessary to minimise the impact on the safety of motorists, pedestrians and workers.						
Construction	**Aspect:** Constructions activities. **Impact:** Children / residents and community livestock accessing the construction site.	**With**	1	2	2	2	**-7**	**Medium**
		Without	1	2	1	1	**-5**	**Low**
		Key mitigation measures: ▪ When encountering any livestock on the road, drivers must slow down and stop and sound the hooter. ▪ Drivers are not permitted to use their vehicles to push the livestock off the road. ▪ When approaching any pedestrians / scholars appropriate action must be implemented which will include the following: ○ If roads are dry, slow down when travelling past any pedestrians to mitigate the dust exposure. ○ If roads are wet, drive slowly past any pedestrians to prevent the splashing of water / mud. ○ If any pedestrian is walking on the road allow them to move to a safe section of the road as there are no sidewalks before passing them. ○ If pedestrians are identified on the road from a distance, sound the hooter to warn them.						
Operations	**Aspect:** Operation of the bridge and link	**With**	1	3	2	2	**-8**	**Medium**
		Without	1	3	1	1	**-6**	**Low**

Phase	Potential Aspect and / or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
	road. **Impact:** Pedestrian, motorist and livestock safety.	**Key mitigation measures:** ▪ A speed of 60 km/hr must be obeyed on the link road and bridge. ▪ The road signs must be designed according to the latest South African Roads and Traffic Signs Manual. ▪ Traffic calming measures must be implemented. ▪ Bridge design to make provision for pedestrian sidewalk and guardrails. ▪ A rounded pipe cattle grid must be installed (on the road) and on each end of the bridge to prevent any livestock from crossing over.					

10 ENVIRONMENTAL IMPACT STATEMENT

10.1 Key Findings

10.1.1 Freshwater Resources

The infield sampling of soil and vegetation in conjunction with the recording of diagnostic topographical / terrain indicators and features, enabled the delineation of ten (10) watercourses including nine (9) river / stream units and one (1) wetland unit.

Owing to the largely rural and low density nature of local settlements in the area, many of the watercourses units were in a relatively good condition (Class B – Largely Natural) as assessed using the Index of Habitat Integrity (IHI). In particular the relevant reaches of the Mfolozi River (R1) and Ephemeral Stream Units R02, R03, R05, R06 and R07 were assessed as being '**Largely Natural**'. The rest of the units ranged in condition from **moderately modified** (Units R04 and R09) to **seriously-critically modified** (Units R08 and R10).

The main impact observed was the substantial deepening / incision and widening of the channels as a result of a combination of factors, namely flow concentration through the culvert at the existing road crossing, the formation of preferential flow routes along cattle tracks that have become gullies, and the alteration of catchment runoff patterns by past cultivation activities and existing road runoff discharges. Riparian vegetation observed was generally intact in the less degraded units and highly invaded by alien invasive species in the more degraded units. The single wetland unit (W01) was assessed as being **largely modified** due to gully erosion and associated impacts to hydrology and vegetation.

This freshwater habitat impact assessment revealed that the proposed project activities stand to have measurable but **low** to **moderately-low** significance impacts on local ephemeral, seasonal and perennial watercourses. The most important and sensitive system is the White Mfolozi River, a regionally important main stem, perennial river. However, owing to the linear nature of the project, the associated small development footprint, the naturally high disturbance regime of the riverine habitat, and the extent of the greater assessment reach, the overall impact to the White Mfolozi system was assessed as being **moderately-low** under a poor mitigation scenario and **low** under a good mitigation scenario.

On the other hand the smaller ephemeral and seasonal streams stand to experience a higher degree of change in terms of PES and habitat condition but are generally of **low** ecological importance and sensitivity, thus reducing the overall significance of the impacts. The most significant impacts resulting from the proposed activities are the direct habitat losses associated with the development footprint and the indirect flow, erosion and sedimentation impacts during the construction and operational phases.

For those watercourses to be directly affected by the project activities, the developer / applicant is responsible for the rehabilitation of all construction impacts as well as the maintenance of the road servitude. A construction phase rehabilitation guideline has been provided in the EMPr (***Appendix B***).

10.1.2 Terrestrial Habitat

The terrestrial vegetation assessment of the area to be impacted by the proposed road project confirmed the presence of two vegetation communities, namely Degraded Wooded Grassland (Northern Zululand Sourveld) and the Mixed Tall Bushveld (Zululand Lowveld). The latter is in a good state. A few biota of

conservation concern were flagged to possibly or likely occur onsite but were all generally Near-threatened to Vulnerable indicating that highly important species are not likely to be present.
Ultimately the assessment confirmed that the destruction and transformation of habitat during the construction phase and erosion during operation phase are the most significant impacts with both being rated as being of **moderately-low** significance under a realistic poor mitigation scenario.

Overall, the destruction and transformation of habitat is the most significant ecological impact driven by the proposed loss of 5.25 ha of Mixed Tall Bushveld. It is also important to note that the proposed habitat area losses assume a worst case scenario where the entire 20 m servitude is transformed, which is unlikely.

Although the proposed development will result in the destruction of a number of protected plants and possibly sedentary range restricted fauna like millipedes and molluscs, the impact on species of conservation concern was still assessed as being of **low** significance. Furthermore, most highly mobile faunal species flagged to potentially occur locally are likely to flee from any disturbance and thus avoid being killed.

Whilst the proposed development is generally acceptable from a terrestrial ecosystem and biodiversity perspective based on the impacts assessed, the formalisation of the road could impact on the future plans of the **E**KZNW to establish formal ecological corridors and reserves along the current CBA and ESA that links the Matshitsholo CCA to the Ophathe Game Reserve. These plans are still at a very early stage. In particular, such formation could reduce future opportunities to establish movement corridors for large fauna like the Black Rhino that is flagged as a key conservation feature of the CBA and ESA. **E**KZNW confirmed that they are not opposed to a bridge, provided it does not hinder potential future plans. To this end, the intention is not to have a high mobility route but rather access only and therefore, the engineering design team agreed to reconsider the functional classification of the bridge proposed to a Class 4 bridge structure. It is also worth mentioning that presently, the CBA-ESA has not been identified as a strategic priority in terms of the National Protected Areas Expansion Strategy (NPAES).

With the effective implementation of the recommended mitigation measures, the significance of all the impacts will be reduced. It is important to mention that special consideration must be given to finding ways to reduce the irreplaceable loss / destruction of the Mixed Tall Bushveld (particularly that of **moderately-high** significance within the CBA). This can be achieved by minimising the width of the construction servitude through only clearing the actual road footprint and not utilising the entire 20 m construction servitude. Ideally only a 3 m construction working corridor / right-of-way should be established along one side of the road footprint for access and haulage purposes and a 1 – 2 m construction working corridor / right-of-way along the other side (i.e. maximum of 4 – 5 m working area outside of road footprint).

Plant permits will also need to be acquired to destroy and / or relocate protected plants occurring within the road footprint to be cleared. The affected protected plants include: *Aloe marlothii, A. parvibracteata, Ceropegia racemosa* subsp. *setifera, Dietes iridoides, Gladiolus* cf. *crassifolius, Ledebouria asperifolia* and *L. zebrina*. An Ecologist has been appointed to obtain the required permits.

Nationally protected trees include *Sclerocarya birrea* subsp. *caffra* and *Sideroxylon inerme* and these require a licence from the Department of Agriculture, Forestry and Fisheries (DAFF) if these trees need to be removed during construction. An Ecologist has been appointed to obtain the required licence.

10.1.3 Social

The first major impact that will be experienced in the pre-construction phase relates to the physical displacement of a single household owner. The KZN DoT will follow its compensation protocol for this

displacement, and the moving of the household must be done with the household's consent, under the guidance of the traditional leader. Should any other household fence lines be impacted, compensation must follow an approved process.

The second major impact relates to the possible exhumation and relocation of graves or alternatively, the deviation of the road routing so as to avoid the grave sites as identified in the Heritage Impact Assessment (***Appendix C4)***.

Other impacts likely to occur during the construction phase, with its effects felt for years to come, is the impact of the on-site (residential) labour force that may be housed in a construction camp. Social ills that emanate during this phase have long-term, negative poverty and health impacts. However, on site residences are not expected. Moreover, potential health and safety impacts during the construction and operational phases will need to be mitigated with appropriate.

While impacts related to the construction phase of the proposed bridge (and link road) development are for the most part, short-term, impacts experienced during the longer term operational phase of the project which is of significance. Traffic which could include larger and heavier vehicles at increased frequency, could put pedestrians at risk, if both users (drivers and pedestrians alike) do not conform to the safety precautions and road safety rules. Pedestrians must refrain from walking on the road (unless in pedestrian designated zones), and motor vehicle drivers must maintain the speed and following distances that are put in place. It would be crucial that bicycle users also follow precautionary habits, as non-motorised modes of transport are expected to follow the rules applied to pedestrians.

The positive impacts in the operational phase relate to increased access by local communities to local services (e.g. education, health facilities), a more effective distribution of emergency services (ambulance, fire trucks, water trucks, police) and the increased mobility of people, thus promoting the opportunity for trade and potentially the subsequent growth of local businesses. An additional positive impact relates to the opportunity for growing relationships (personal and business) between the communities - that would have otherwise remained partially connected due to the landscape's geography.

10.1.4 Heritage

Eight grave sites have been identified within 50 m from the proposed White Mfolozi Bridge and associated link road (L2598) (Option 1). These sites have all been rated as locally significant. They are all protected by provincial heritage legislation and may not be removed or altered. In terms of mitigation the following is suggested:

- Grave Sites 2, 3, 4, 5, 6, 7 and 8 should have buffer zone of at least 10 m. No development or alteration may take place within this buffer zone.
- It is also important to note that Grave Sites 6, 7 and 8 are situated within the construction servitude of Option 3 and will require a Phase 2 HIA and permitting if this option is pursued.
- Grave Site 1 should have a buffer zone of at least 2 m due to its close proximity to the proposed link road (and existing road trajectory).
- Should it not be possible to implement these buffer zones then it is suggested that the developer alter the link road trajectory, in the near vicinity of these grave sites, in order to ensure the integrity of these graves. A heritage specialist would need to inspect the new road trajectory before any development may occur.
- Should it not be possible to implement any of the above mentioned measures then the developer must conduct a Phase II Heritage Impact Assessment by a grave relocation specialist. This second phase may entail grave exhumation and reburial following a lengthy community consultation process.

- There is no need for mitigation for the identified Shembe Site of Worship as this site is situated outside of the footprint near Option 3. The site is not threatened by the proposed development. However, it is strongly advised that the developer maintain a buffer zone of 20 m around this locally important site.
- The Early Stone Age Site is rated as having a low significance. However, it is situated on the L2598 approximately 150 m – 200 m from the preferred bridge crossing over the White Mfolozi River. It is strongly advised that a surface collection of all the stone artefacts be made by a heritage consultant or AMAFA prior to any construction activities. These artefacts are out of context and of little research value, however, the collection can be used for teaching purposes.
- Interviews with local community members supported the independent point of view of the consultant that the proposed development will not have any major effect on the known heritage resources of the project area. These included, archaeological and historical sites, living heritage sites (including the Shembe Site of Worship), sources of clay for pottery and medicinal purposes, areas used by traditional healers for the harvesting of medicinal herbs, and cultural landscape values. These views were also reflected by two community and feedback meetings held by the EAP on 05 September 2017.

10.1.5 Palaeontology

Very significant fossils or “stromatolites” are expected in the Chobeni Formation and several significant fossils in the Dwyka Group. No fossils will be exposed before deep excavations (>1.5m) are done. As soon as excavation starts, it will be very important that a suitably accredited Palaeontological Specialist be appointed to do a Phase 1 PIA and to upgrade the “Chance Find Protocol” (CFP) document. The CFP document must be included as part of the EMPr (***Appendix B-F***), to record all fossils associated with the highly sensitive Chobeni Formation and Karoo Supergroup rocks that underlie the majority of the L2598 road development site. The entire area where the bridge over the White Mfolozi River is planned is underlain by Swazian aged granite and no mitigation for Palaeontological Heritage is needed unless extensive excavation into alluvium of the river is planned.

10.2 Sensitivity Map

The sensitivity map presented in **Figure 48** must be considered when determining if the proposed project should be authorised.

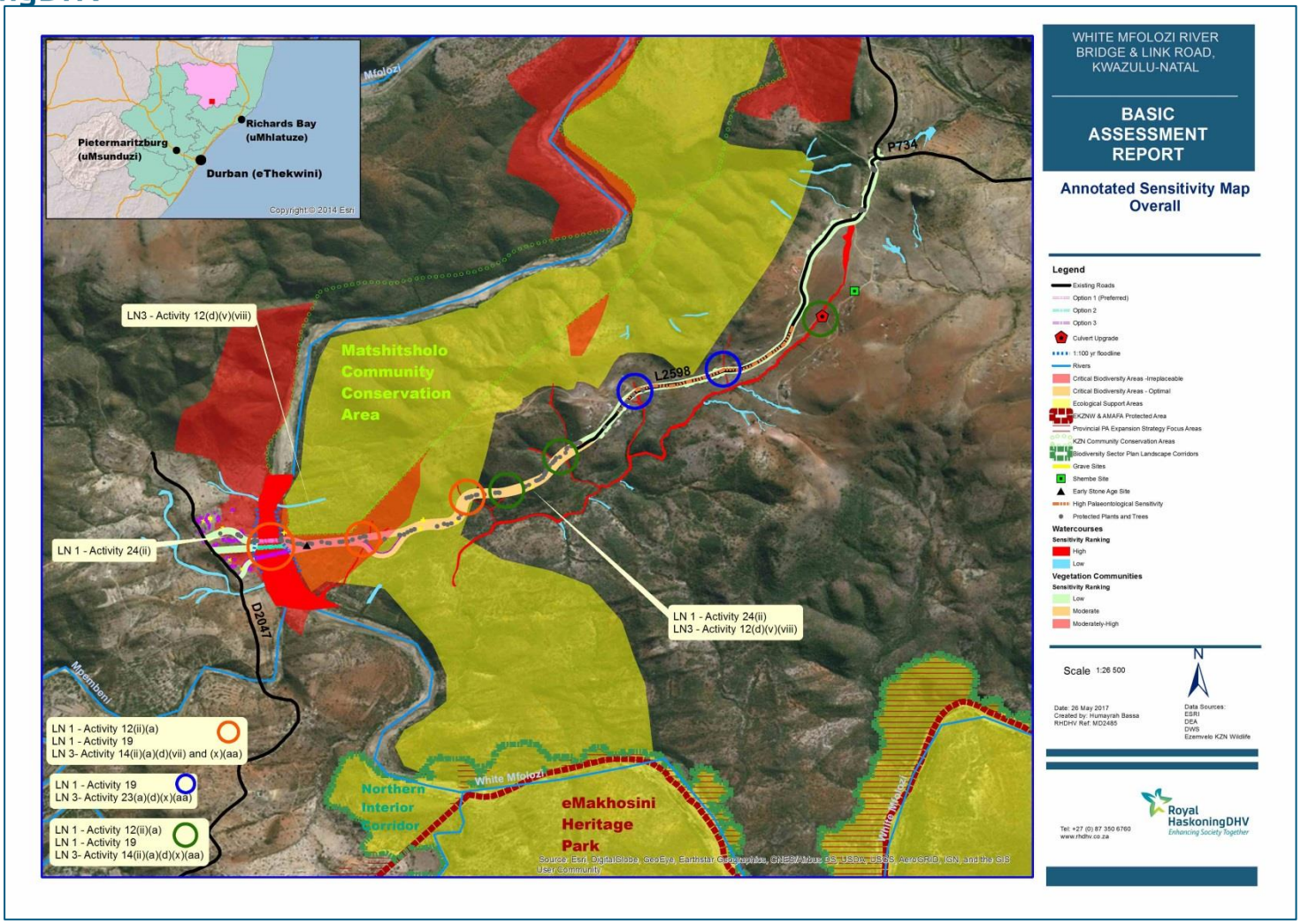

Figure 48: Sensitivity map[16]

[16] *An enlarged map is included in Appendix F.*

A summary of the impacts is provided in **Table 39**.

Table 39: Summary of negative and positive impacts

Impacts	Without Mitigation	With Mitigation
Planning Phase		
Impact on 2 protected tree species (*Sclerocarya birrea* subsp. *caffra* and *Sideroxylon inerme*) and 7 provincially protected plants (*Aloe marlothii, A. parvibracteata, Ceropegia racemosa subsp. setifera, Dietes irioides, Gladiolus cf. crassifolius*, *Ledebouria asperifolia* and *L. zebrine*)	High (-11)	Low (-4)
Inadequate culvert design and construction	High (-11)	Low (-4)
Design of bridge with respect to impact on the White Mfolozi River	High (-11)	Low (-5)
Physical and economic displacement causing the loss of residence and land / assets	Very High (-13)	High (-11)
Construction Phase		
Physical degradation of soils due to removal and compaction	Medium (-7)	Low (-4)
Erosion as a result of exposed soil and topsoil	Medium (-8)	Low (-5)
Establishment of camp infrastructure and impact on soils	Medium (-7)	Low (-4)
Groundwater contamination (spillage of fuels, chemicals and lubricants; lack of ablution facilities; wash bay areas)	Medium (-9)	Low (-5)
Clearance of vegetation for the construction of bridge, road and culvert	High (-11)	Medium (-9)
Physical destruction and /or modification of aquatic habitat	High (-10)	Low (-6)
Flow modification and erosion / sedimentation impacts	High (-10)	Low (-6)
Impact on water quality	Medium (-9)	Low (-5)
Establishment of informal settlements on community land by people seeking work opportunities	Low (-4)	Low (-4)
Establishment of an on-site construction camp	Medium (-7)	Low (-6)
Changes in local employment and incomes through project recruitment	Medium (+8)	Medium (+8)
Increased business opportunity through the procurement of goods and services	Medium (+8)	Medium (+8)
Increased opportunity for informal business development	Low (+4)	Low (+4)
Local dissatisfaction due to finite jobs and perceived preferential access to these jobs and procurement	Medium (-7)	Low (-4)
Potential impact on grave sites	High (-11)	Medium (-7)
Potential impact on a Shembe site	Medium (-7)	Low (-5)

Impacts	Without Mitigation	With Mitigation
Impact on an Early Stone Age 'tool scatter' site	Medium (-7)	Low (-4)
Impact on palaeontological resources underlain by the Chobeni Formation and the Dwyka Group	High (-12)	Low (-5)
Waste generation (demolished culverts, general construction rubble and hazardous waste (used oil, cement and concrete etc.).	Medium (-8)	Low (-6)
Fugitive dust emissions from debris handling and debris piles; mobile plant/machinery and general construction activities	Low (-6)	Low (-5)
Generation of fumes from vehicle emissions may pollute the air	Medium (-7)	Low (-5)
Release of odours as a result of the chemical toilets on-site	Medium (-7)	Low (-5)
Noise pollution from construction vehicles, construction staff and construction activities e.g. piling	Medium (-8)	Low (-5)
Construction activity impacts on pedestrians, motorists and construction workers	Medium (-8)	Low (-6)
Children / residents and community livestock accessing the construction site	Medium (-7)	Low (-5)
Operational Phase Impacts		
Alien invasive plant encroachment (terrestrial habitat)	Medium (-9)	Low (-4)
Alien invasive plant encroachment (freshwater habitat)	Medium (-9)	Low (-4)
Water quality	Low (-4)	Low (-4)
Increased access to local services (education, health facilities, etc.).	Very High (+15)	Very High (+15)
Increased access and quicker response by emergency services	Very High (+15)	Very High (+15)
Increased business opportunity through greater road mobility	Very High (+13)	Very High (+13)
Relationship building and familial reconnection (personal and business)	High (+11)	High (+11)
Sense of place	Medium (-7)	
Cumulative Impacts		
Water Quality	High (-11)	Medium (-9)
Pollution	High (-11)	Medium (-9)

10.3 Conclusion and Recommendations

The BA Study has been undertaken in accordance with the EIA Regulations (2014 as amended in 2017) in terms of Section 24(5) of the National Environmental Management Act (Act No. 107 of 1998) (as amended).

In order to protect the environment and ensure that the proposed project is constructed and operated in an environmentally responsible manner, there are a number of significant pieces of environmental legislation that have been taken into account during this study. These include:

LEGISLATION
The Constitution of South Africa (No. 108 of 1996)
National Environmental Management Act (Act No. 107 of 1998) (as amended) and EIA Regulations (2014 as amended in 2017)
National Environmental Management: Waste Act (Act No. 59 of 2008) (as amended)
National Environmental Management Biodiversity Act (Act No. 10 of 2004)
National Environmental Management: Protected Areas Act (Act No. 57 of 2003)
National Environmental Management: Air Quality Act (Act No. 39 of 2004)
National Water Act (Act No. 36 of 1998) (as amended)
National Forests Act (Act No. 84 of 1998)
National Heritage Resources Act (Act No. 25 of 1999)
Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)
KZN Nature Conservation Ordinance (Ordinance No.15 of 1974)
Hazardous Substance Act (Act No. 15 of 1973) and Regulations
Occupational Health and Safety Act (Act No. 85 of 1993)

This relevant legislation has informed the identification and development of appropriate management and mitigation measures that should be implemented in order to minimise potentially significant impacts associated with the project.

The conclusions of this draft cBAR including comments and concerns from I&APs are as a result of a comprehensive BA study. The public consultation process has been inclusive, and every effort has been made to include representatives of all stakeholders within the process.

10.4 Assumptions, Uncertainties or Gaps in Knowledge

10.4.1 Basic Assessment Study

The BA process followed the legislated process required and as governed and specified by the EIA Regulations (2014 as amended in 2017). Inevitably, when undertaking scientific studies, challenges and limitations are encountered. For this specific BA, the following challenges were encountered:

- All information provided by the Engineering team to the EAP was correct and valid at the time it was provided.
- The EAP does not accept any responsibility in the event that additional information comes to light at a later stage of the process.

- All data from unpublished research is valid and accurate.
- The scope of this investigation is limited to assessing the potential environmental impacts associated with the White Mfolozi Bridge and Link Road.
- The *E*KZNW have requested an additional specialist study on the Biodiversity Economy Node that looks at the following aspects:
    - Visual impacts – the engineering design team have considered the aesthetics of the bridge in their design process. Furthermore, the Heritage Specialist has dealt with the sense of place impacts and visual intrusions in the HIA. The impacts were assessed after consultation with community members via Focus Group Meetings. The concern of potential visual intrusions were queried at the Public Meetings by the EAP and the community did not have any concerns relating to visual impacts of the bridge.
    - Noise impacts – these impacts have been addressed in the cBAR. *E*KZNW requested noise modelling of the future impacts on the future Biodiversity Economy Node. After consultation with DEA and KZN EDTEA, this is deemed to be beyond the scope of this site-specific EIA, considering specific plans for the future Biodiversity Economy Node are not available.
    - Impact of Famine weed - this impact has been addressed in the cBAR and EMPr.
    - Tourism impacts – this study is considered to be beyond the scope of this site-specific EIA and the *E*KZNW should explore the option of a Strategic Environmental Assessment (SEA) for their protected land in the area.
    - Settlement patterns – modelling of future settlement patterns and the implications for the proposal for a Biodiversity Economy Node in the long term is considered to be beyond the scope of this site-specific EIA.
    - Traffic patterns – According to the Transport and Traffic Engineers, Traffic Impact Assessments (TIAs) are not required for minor roads of this nature. TIA's are only required where there are existing or planned major developments that could generate sufficient traffic to have a significant impact on traffic flows on a road.

In addition to the assumptions above, the following assumptions and limitations were noted by the specialist team.

10.4.2 Freshwater Habitat Assessment

- Sampling by its nature, means that generally not all aspects of ecosystems can be assessed and identified. For the purposes of this assessment, formal sampling was focussed in areas to be measurably negatively affected by the proposed project activities, which are considered the areas where water uses are applicable. More specifically, formal sampling and assessment focussed on those watercourses to be crossed and / or are within close proximity (within 15 m upslope and 32 m downslope) of the proposed new road alignment and bridge.
- In light of the above approach, wetlands and rivers that occur within the 500 m of the proposed activities but will not be measurably affected by the proposed project activities were not formally delineated and assessed.
- The spacing of sampling transects and sampling points along transects means that the exact boundary of the wetland is largely an approximation with extrapolation between transects using contours and aerial photographic analysis.
- The accuracy of the delineations are based solely on the recording of the on-site wetland and riparian indicators using a hand-held GPS. GPS accuracy will therefore influence the accuracy of the mapped sampling points and therefore water resource boundaries, and an error of 1 – 5 m can be expected.
- All vegetation information recorded was based on the on-site observations by the author and no formal vegetation sampling was undertaken. Furthermore, the vegetation information provided only gives an indication of the dominant and / or indicator wetland and riparian species and only provides a

general indication of the composition of the vegetation communities. Thus, the vegetation information provided has limitations for true botanical applications.

- Although every effort was made to correctly identify the plant species encountered on-site, wetland plants, particularly the *Cyperaceae* (sedge) family, are notoriously difficult to identify to species level. Every effort as made to accurately identify plants species but where identification to species level could not be determined, such species were only identified to genus level.
- The PES and EIS assessments undertaken are largely qualitative assessment tools and thus the results are open to professional opinion and interpretation. We have made an effort to substantiate all claims where applicable and necessary.
- In wetland and riverine assessments, the assessment unit is typically the hydro-geomorphic unit for wetlands and the reach unit for rivers. However such units may extend well beyond the extent of the area being affected / impacted by the project activities. In cases where sampling is only undertaken within a small area of the greater unit, the approach taken was to base the assessment on what was observed at the sample site and revise this assessment where analysis of aerial photography showed clear and distinct differences upstream of downstream of the study area. Thus, if applicable, the lack of infield verification of the greater assessment unit must be noted as a limitation.
- Inferences made about the ecological integrity / river health of the rivers / stream assessed was based on selected variables, sampled on selected occasions at selected geographic locations. This limits the degree to which this information can be extrapolated spatially (within or across river systems) and temporally (i.e. over seasons). Rivers by nature are highly variable ecosystems and can display fine and large scales changes in the structure, composition and quality of the habitat over short periods of time.
- Although the South African Scoring System (SASS5) macroinvertebrate assessment can be a useful tool for assessing baseline water quality conditions and in-stream habitat quality, it adds to the cost of the assessment. In this regard, the SASS5 was applied to moderate and to high risk activities, and particularly in instances where planned activities pose a real risk to water quality and in-stream habitat quality. It is also worth noting that SASS 5 is not an appropriate tool for assessing wetlands and ephemeral river systems.
- The Ecological Importance and Sensitivity assessment did not specifically address the finer-scale biological aspects of the rivers such as fauna (amphibians and invertebrates) occurring. No detailed assessment of aquatic fauna / biota was undertaken. Fauna documented in the specialist report are based on site observations during site visits and are therefore not intended to reflect the overall faunal composition of the habitats assessed.

10.4.3 Terrestrial Habitat

- The field assessment was undertaken in summer (March 2017). The assessment therefore may have missed winter flowering cryptic forbs.
- With ecology being dynamic and complex, there is a possibility that some aspects may have been overlooked. Sampling by its nature means that generally not all aspects of ecosystems can be assessed and identified.
- The 0.5 km long sections of Alternative Route 2 and 3 falling south of the White Mfolozi River were not visited in the field. This is because the alignments of the two alternative routes were amended following field work. A decision was made to not revisit of the site because Alternative 2 and 3 are unlikely to be pursued due to challenges with crossing the river and the presence of graves within the impact zone.
- Information on the threat status of plants species was informed largely by the SANBI Threatened Species Online database, which was assumed to be up to date and accurate at the time of compiling the report.

- The assessment of the potential occurrence of fauna was informed by the presence and condition of ideal habitat for each faunal species. The habitat condition / integrity was used as a surrogate indicator of the likelihood of a particular species being present.
- The assessment of impacts and recommendation of mitigation measures was informed by the site-specific ecological concerns arising from the vegetation field surveys and based on the assessor's working knowledge and experience with similar development projects.
- Additional information used to inform the assessment was limited to data and GIS coverage's available for the province and district municipality at the time of the assessment.
- No formal faunal survey was undertaken. The focus was on recording any faunal species and faunal habitat recorded during the vegetation survey in order to improve the confidence of the likelihood of occurrence assessment.

10.4.4 Heritage

It must be pointed out that the greater project area is relatively rich in archaeological sites and features. It is also possible that "invisible" graves may occur in association with rural homesteads situated along local road (L2598) leading towards the proposed White Mfolozi Bridge. It would therefore be wise to avoid existing homesteads and allow a buffer of at least 15 m around these. Construction activities may expose grave sites and archaeological artefacts not visible on the surface. The KwaZulu-Natal Heritage Act requires that operations exposing archaeological and historical residues should cease immediately pending an evaluation by the heritage authorities.

10.4.5 Palaeontology

The key assumption for the study is that the existing geological maps and datasets used to assess site sensitivity are correct and reliable. However, the geological maps used were not intended for fine scale planning work and are largely based on aerial photographs alone, without ground-truthing. There is also an inadequate database for fossil heritage for much of the South Africa, due to the small number of professional palaeontologists carrying out fieldwork in South Africa and the Kingdom of Lesotho. Most development study areas have never been surveyed by a palaeontologist.

These factors may have a major influence on the assessment of the fossil heritage significance of a given development and without supporting field assessments may lead to either:

- An underestimation of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or
- An overestimation of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by weathering, or are buried beneath a thick mantle of unfossiliferous "drift" (soil, alluvium etc.).

10.5 Recommendations

10.5.1 Recommendations to the CA

This draft cBAR provides an assessment of both the benefits and potential negative impacts anticipated as a result of the proposed White Mfolozi River Bridge and the L2598 Link Road as well as the one (1) culvert replacement on a connecting informal road, in the Ulundi Local Municipalities, KwaZulu-Natal.

The findings conclude that there are potential negative impacts as highlighted in ***Section 10.1*** that can be mitigated provided that the recommended mitigation and management measures contained within the EMPr are implemented. Furthermore, the proposed bridge and link road will serve to benefit the local

community who have unanimously expressed support for the project at both Public Meetings and have further expressed concerns at the delays in implementing the proposed bridge.

The project, in the EAP's opinion, does not pose a detrimental impact on the receiving environment and it inhabitants and can be mitigated significantly. Therefore, the EAP recommends the construction of the White Mfolozi Bridge (Option 1 – preferred alternative) and link road (Option 1 – preferred alternative) as well as the replacement of the culvert.

The following recommendations are elaborated on:

- Bridge Crossing Option 1 is recommended as it is the shortest river bridge crossing, avoids Eskom Power Lines, crosses the river at right angles and does not result in large cuts and blasting operations.
- Link Road Option 1 is recommended as this alignment involves the least impact on Eskom Power lines, does not require any grave relocations and is the safest as it meets the geometric design standards. Whilst Option 1 requires the most clearance of indigenous vegetation, the need to relocate Eskom Power lines and graves for the other options are not favoured and the geometric safety standards are not met for both Option 2 and 3 when intersecting with the existing D2047.
- The replacement of the one (1) culvert on the existing informal road is recommended to a three (3) pipe culvert.

Construction is expected to commence in May 2018 and last 36 months. An EA with a validity of 5 years is recommended. The culvert will be replaced within 30 days of commencement of the culvert replacement.

The Applicant should be bound to stringent conditions to maintain compliance and a responsible execution of the project.

In order to achieve appropriate environmental management standards and ensure that the findings of the environmental studies are implemented through practical measures, the recommendations from this BA study are included within an EMPr (refer to ***Appendix B***).

The EMPr must be used to ensure compliance with environmental specifications and management measures.

The implementation of this EMPr for the construction and post-construction (rehabilitation) phase of the project is considered to be vital in achieving the appropriate environmental management standards as detailed for this project.

In addition, the following key conditions should be included as part of the authorisation:

a) The Developer is not negated from complying with any other statutory requirements that is applicable to the undertaking of the activity. Relevant key legislation that must be complied with by the proponent includes *inter alia*:
    i. Provisions of the National Environmental Management Waste Act (Act No. 59 of 2008) (as amended);
    ii. Provisions of the National Water Act, 1998 (Act No. 36 of 1998) (as amended);
    iii. Provisions of the National Forests Act (Act No. 84 of 1998); and
    iv. Provisions KwaZulu-Natal Nature Conservation Ordinance (Ordinance No. 15 of 1974);

b) The Developer must appoint a suitably experienced (independent) Environmental Control Officer (ECO) for the construction phase of the development that will have the responsibility to ensure that the mitigation / rehabilitation measures and recommendations are implemented and to ensure compliance with the provisions of the EMPr.

c) All supporting plans (e.g. Stormwater Management Plan, Rehabilitation Plan and Alien Invasive Management Plan, Construction Method Statement, Spill Contingency Plan and Chance Find Protocol) included in the EMPr must be complied with.

d) Prior to commencement of construction, an ecologist must be appointed to survey the construction footprint and working servitude for protected and important species, mark these species and apply for necessary permits and licences to destroy or relocate them.

e) An Ordinary Permit from the *eZemvelo* KZN Wildlife (*E*KZNW) is required to handle the *Aloe marlothii, A. parvibracteata, Ceropegia racemosa* subsp. *setifera, Dietes iridoides, Gladiolus* cf. *crassifolius, Ledebouria asperifolia* and *L. zebrine)* and a licence is required to handle *Sclerocarya birrea* subsp. *caffra* and *Sideroxylon* inerme which can be obtained from the Department of Agriculture, Forestry and Fisheries. (DAFF) for the rescue and relocation of this species which may potentially be impacted upon during construction.

f) All necessary permits, licences and approvals must be obtained prior to the commencement of construction.

g) An approved compensation process which details the values and asset relocation process must be offered for the single home that will be affected by physical displacement. The potential for impact on fence lines must also be offered a compensation settlement. This process must be undertaken with the consent of the household owner, under the guardianship of the traditional leader.

h) In the event that Famine Weed is recorded on site, the following mitigation measures must be undertaken:
    a. Pull the entire plant out including roots before flowering and place it in a bin bag. Protective gloves, facemasks and protective clothing must be used.
    b. Burn all uprooted plants once dry in a controlled environment. Alternatively, spray all emerging plants and leaves with a registered herbicide such as Access 240 SL.

10.5.2 Recommendations to the Applicant

The Applicant must adhere to the recommendations provided by the specialist and the EAP. The EMPr summarises these recommendations. The Applicant must take full responsibility for the execution of the project in a manner which does not negatively impact on the environment by ensuring that responsible decisions are made.

10.6 Declaration by the EAP

The following is hereby affirmed by the EAP to be included in this report:

- the correctness of the information provided in the reports;
- the inclusion of all comments and inputs from stakeholders and I&APs;
- the inclusion of all inputs and recommendations from the specialist reports where relevant; and

- any information provided by the EAP to I&APs and any responses by the EAP to comments or inputs made by interested and affected parties.

_____

Signed: Humayrah Bassa *Pr.Sci.Nat.*

Appendix A

Minutes of the EDTEA Pre-application Meeting

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Appendix B

Environmental Management Programme

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Appendix C

Specialist Studies

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Appendix D

EAP CV and Knowledge Group Profile

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Appendix E

Public Participation Summary

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Appendix F

Maps & Facility Illustrations

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Appendix G

Photographs

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Appendix H

Other Items

Royal HaskoningDHV

With its headquarters in Amersfoort, The Netherlands, Royal HaskoningDHV is an independent, international project management, engineering and consultancy service provider. Ranking globally in the top 10 of independently owned, nonlisted companies and top 40 overall, the Company's 6,500 staff provide services across the world from more than 100 offices in over 35 countries.

Our connections

Innovation is a collaborative process, which is why Royal HaskoningDHV works in association with clients, project partners, universities, government agencies, NGOs and many other organisations to develop and introduce new ways of living and working to enhance society together, now and in the future.

Memberships

Royal HaskoningDHV is a member of the recognised engineering and environmental bodies in those countries where it has a permanent office base.

All Royal HaskoningDHV consultants, architects and engineers are members of their individual branch organisations in their various countries.

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