*May 2017*

*MDARDLEA Ref: 1/3/1/16/1 E - 91*

# ENVIRONMENTAL IMPACT ASSESSMENT REPORT

## Bruintjieslaagte Dam – Devil's Creek – Schoemanskloof

## MDARDLEA Reference Number 1/3/1/16/1E-91

REPORT FOR COMMENT

ENPACT ENVIRONMENTAL CONSULTANTS CC
REG. 2004/051532/23

# I. PROJECT INFORMATION

| PROJECT DETAILS | |
|---|---|
| **TITLE** | Bruintjieslaagte Dam – Devil's Creek – Schoemanskloof. |
| **REPORT STATUS:** | Environmental Impact Assessment Report (Public review). |
| **LOCATION:** | Bruintjieslaagte 465 JT Schoemanskloof, City of Mbombela, Mpumalanga. The site is located south west of the N4 Schoemanskloof road on the Devil's Creek which is a tributary to the Crocodile River. |
| **SG 21 DIGIT CODE:** | T O J T 0 0 0 0 0 0 0 0 0 4 6 5 0 0 0 0 0 |
| **EAP:** | Enpact Environmental Consultants CC<br>PO Box 12027, Nelspruit, 1200<br>Tel: 013 752 6766<br>Fax: 088 013 7526766<br>E-mail: info@enpact.co.za |
| **REPORT COMPILED BY:** | Heinrich Kammeyer<br>Enpact Environmental Consultants CC<br>E-mail: heinrich@enpact.co.za |
| **APPLICANT:** | FJ Joubert & Seuns (Pty) Ltd<br>Mr FJ Joubert<br>PO Box 29, Schagen, 1207<br>Tel: 083 227 2415 |
| **REPORT PREPARED FOR SUBMISSION TO:** | **Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs: DARDLEA**<br>Ehlanzeni District Offices<br>The Directorate: Environmental Impact Management<br>18 Jones Street<br>Nelspruit, 1200 |
| **DATE OF COMPILATION:** | **May 2017** |
| **ACTIVITIES APPLIED FOR:** | Notice no. R 983, 2014: Activity 12, 19, 27.<br>Notice no. R 984, 2014: Activity 16.<br>Notice no. R 985, 2014: Activity 12. |
| **MDARDLEA REFERENCE NUMBER:** | 1/3/1/16/1E-91 |

**EAP Declaration**

I hereby affirm/confirm:

- The correctness of the information provided in the report;
- I will ensure compliance with the EIA Regulations 2014;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the application;
- I will take into account, to the extent possible, the matters listed in regulation 18 of the regulations when preparing the application and any report, plan or document relating to the application;
- I will disclose to the proponent or applicant, registered interested and affected parties and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority or the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority (unless access to that information is protected by law, in which case I will indicate that such protected information exists and is only provided to the competent authority);
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I am aware that it is an offence in terms of Regulation 48 to provide incorrect or misleading information and that a person convicted of such an offence is liable to the penalties as contemplated in section 49B(2) of the National Environmental Management Act, 1998 (Act 107 of 1998).

Signature of the environmental assessment practitioner

19 May 2017
Date

# EXECUTIVE SUMMARY

Submitted to the Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (MDARDLEA) in terms of the requirements of Government Notices no. R982, R983, R984 and R985 for the Scoping and Environmental Impact Assessment (EIA) process in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998).

## Application Summary

Project: Bruintjieslaagte Dam – Devil's Creek – Schoemanskloof.

Location: The dam site will be located on a Portion of the farm Bruintjieslaagte 465 JT, Devil's Creek, Schoemanskloof, City of Mbombela Local Municipality, Mpumalanga. The site is located south west of the N4 Schoemanskloof road in The Devil's Creek that is a tributary to the Crocodile River. Refer to the locality map.

Activities:
EIA Regulations, 2014 published in the Government Notice No. R982, R983, R984 and R985 under Section 24(5) of the National Environmental Management Act, 1998 (Act No. 107 of 1998):

| **Listed activity:** | **Project description:** |
|---|---|
| **Description of the relevant Basic Assessment Activities as per Listing Notice 1 (GN No. R983)** | |
| R.983, 2014: Activity 12 - The development of - (iv) dams, where the dam, including infrastructure and water surface area, exceeds 100 square metres in size; where such development occurs -<br>(a) within a watercourse; excluding -<br>(aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour; (bb) where such development activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies; (cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies; (dd) where such development occurs within an urban area; or (ee) where such development occurs within existing roads or road reserves. | The construction of a dam with a capacity of approximately 1 000 000$m^3$ and surface area of approximately 13 hectares. |
| R.983, 2014: Activity 19 - The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from (i) a watercourse - but excluding where such infilling, depositing, dredging, excavation, removal or moving a) will occur behind a development setback; (b) is for maintenance purposes undertaken in accordance with a maintenance management plan; or c) falls within the ambit of activity 21 in this Notice in which case that activity | The construction of a dam which will require the excavation, removal or moving of soil, sand or rock or/and the infilling or depositing of any material of more than 5 cubic meters. |

| | |
|---|---|
| applies. | |
| R.983, 2014: Activity 27 - The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for- (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan. | The establishment of the Bruintjieslaagte dam will require the removal of more than 1 hectare of indigenous vegetation, approximately 13 hectares. |
| **Description of the relevant Scoping and EIA Activities as per Listing Notice 2 (GN No. R984)** | |
| R.984, 2014: Activity 16 - The development of a dam where the highest part of the dam wall, as measured from the outside toe of the wall to the highest part of the wall, is 5 metres or higher or where the high water mark of the dam covers an area of 10 hectares or more. | The construction of a dam with a wall height of approximately 20m and the high water mark of the dam will covers an area of approximately 13 hectares. |
| **Description of the relevant Basic Assessment Activities as per Listing Notice 3 (GN No. R985)** | |
| R.985, 2014: Activity 12 - The development of – (iv) dams, where the dam, including infrastructure and water surface area exceeds 10 square metres in size;<br><br>ii. Outside urban areas, in: (bb) National Protected Area Expansion Strategy Focus areas; and (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans. | The construction of a dam with a capacity of approximately 1 000 000 $m^3$ and the surface area of the dam will covers an area of approximately 13 hectares. |

**Conclusion and Recommendations**

The "critical biodiversity" in terms of the Mpumalanga Biodiversity Plan was taken into account and several specialist assessments were done to assess the application site.

The footprint area of the dam is small relative to similar habitat in the Devil's Creek catchment as well as adjacent farms.

The potential impact on Blue Swallows would be small and appropriate mitigation measures were identified to lower the risk of impact on the Blue Swallows more.

No fish were found in the upper reaches of the Devil's Creek above the waterfall. Mitigation measures were defined to lower the risk on fish downstream from the dam during the construction period.

Conservation-important plant species that may occur on site are listed in the Emross Consulting and Taylor Environmental Report. Of all these plant species only *Eucomis autumnalis* (Common Pineapple Lily) was identified on the site. ECO (ecologist) will survey site and identify, rescue and relocate conservation important plant species prior to start of construction.

In order to mitigate against the loss of plants of conservation- importance that are present on the footprint, it is essential that a conservation-important plant (*Eucomis autumnalis* and *Encephalartos humulis*, amongst others) walk-through and rescue plan be established and implemented prior to construction.

The hydrology study confirmed that sufficient water is available in the Devil's Creek and that a yield of approximately 1.2 million cubic meters per annum, after allowance for the Ecological Water Requirement (EWR) is available from the dam. Controlled discharge of

water from the dam will maintain the Ecological Water Requirement (EWR) during the operational period.

There are sufficient irrigation water use rights available and there will not be any new abstraction water use rights for the new dam. The dam is an alternative abstraction point for water other than directly from the Crocodile River.

A total of 4 211 200 $m^3$/annum of irrigation water use rights are available from the Crocodile River for the Joubert & Seuns farming activities in Schoemanskloof.

As indicated in the hydrology and yield assessment report the mean annual runoff (MAR) from the Devil's Creek for the Bruintjieslaagte dam is 6 600 000 $m^3$/annum and the yield (water available for abstraction) from the proposed 842 000 $m^3$ capacity dam is approximately 1 200 000 $m^3$/annum. There is therefore more than sufficient irrigation water and the storage and abstraction from the Bruintjieslaagte dam will be well within the existing water use rights limit.

Water abstraction from the dam and the utilisation of the gravitational head would bring about larger electricity savings as it would save pumping costs from the Crocodile River. This is environmentally preferred as electricity generation from coal is known to have a very high negative environmental impact.

Water use licence application for the dam (storage of water) will be submitted to the IUCMA (Department of Water and Sanitation).

The dam will only impact on some of the similar stonewall archaeological sites found on the Bruintjieslaagte farm. A permit will be obtained from SAHRA and the affected sites will be surveyed, excavated and documented.

**Positive aspects of the proposed dam project**

- A new area for the Blue Swallows (*Hirundo atrocaerulea*) was discovered during the site investigations and further work will be done to study and protect the Blue Swallows:
    - Support a project to determine the population size, number of breeding pairs, foraging areas and nesting and breeding sites of the Blue Swallows in the area in conjunction with the Endangered Wildlife Trust (EWT) and the Blue Swallow Working Group.
    - Establish a monitoring program for the Blue Swallows in conjunction with the EWT and Blue Swallows Working Group.
    - Investigate the viability in conjunction with the Blue Swallow Working Group to create artificial nesting sites in suitable areas (Dr Garth Batcher's suggestion).
- Additional storage capacity for irrigation water is created in the Crocodile River catchment and it will make water available for use during drought or low-flow periods.
- The footprint area of the dam is small relative to the large natural area and the ecological impact of the dam is small after mitigation.
- No fish was found in the Devil's Creek upstream from the waterfall and the upper catchment where the dam would be located.
- Mitigation measures area available to mitigate the impact on aquatic species during the construction and operational periods.
- Investigations for the inclusion of the Bruintjieslaagte farm into the National Protected Area Expansion Strategy have started. Protection status of the farm and critical biodiversity area would be increased.

**Negative aspects of the proposed dam project**

- The dam is located in an area that is classified as "critical biodiversity" in terms of the MBSP.
- The construction of the dam could impact on the Blue Swallows if construction is not done during the period May to mid-August. (This will be a condition in the EMPr and Authorisation.)
- A section of an Archaeological site will be lost due to the dam construction.

**Background**

Enpact Environmental Consultants CC was appointed by FJ Joubert & Seuns (Pty) Ltd to do the environmental impact assessment process in order for the applicant to apply for environmental authorisation to construct an irrigation storage dam of a capacity and area size that meets the thresholds as listed in the EIA Regulations, 2014.

The applicant is a well-known and established farmer in the area and has large areas under cultivation. The dam is proposed as an additional irrigation storage dam that will be utilised to irrigate the nearby citrus orchards.

**Description of Activity**

A dam for irrigation purposes will be constructed on the Devil's Creek, a tributary of the Crocodile River located in Schoemanskloof. The dam will be located on the Bruintjieslaagte 465JT farm. There is an existing irrigation storage dam downstream from the proposed dam also on the Devil's Creek.

The dam wall length is approximately 340 m and dam wall height 23.6 m. The dam storage capacity will be approximately 842 308 $m^3$ and the surface area at full supply level (FSL) approximately 12.7 hectare. The overflow will be 60m wide and the freeboard level is 4 m.

**Need and Desirability**

Irrigation water is normally abstracted from the Crocodile River for the irrigation of the citrus orchards. During drought periods and a low water level of the Kwena dam, abstraction from the Crocodile River is limited. It is the intention of the applicant to create additional storage capacity for irrigation purposes so that water is available during drought periods and to allow for an alternative abstraction point other than directly from the Crocodile River.

There is an existing dam downstream from the proposed dam also located on the Devil's Creek. This dam is located on the farm Koedoeshoek 301JT. The Devil's Creek is a perennial river and there is sufficient flow in the river for the existing as well as the proposed dam.

There is insufficient storage capacity in the Inkomati (Crocodile) catchment and the IUCMA, Water Affairs and the Mbombela Municipality is evaluating alternatives for dams to provide higher water security for the area. This private initiative to construct the dam will add approximately 840 000$m^3$ of storage capacity at a cost of approximately R 15 million.

Citrus orchards are highly reliant on irrigation and if water is not available for irrigation it would severely affect the size and quality of the crop. Citrus is exported and the quality of the citrus is critical for success in this highly competitive market.

**Water Availability and Water Use Rights**

Please note that there will not be an increase requested in the abstraction water use rights. The dam is purely an alternative abstraction point rather than directly from the Crocodile River.

The proposed dam is located in the X21E quaternary catchment with a natural flow of 56.0 million $m^3$/annum. The Mean Annual Runoff for the Bruintjieslaagte dam catchment was determined by IWR Water Resources, Stephen Mallory, to be 6.66 million $m^3$/annum, the Ecological Water Requirement (EWR) as 2.29 million $m^3$/annum and the potential yield (water available for abstraction) from the Bruintjieslaagte dam as 1.2 million $m^3$/annum.

Water use rights from the Crocodile River in Schoemanskloof, as confirmed by the Crocodile River Major Irrigation Board, is 4 211 200 $m^3$/annum. As can been seen this is far in excess of the water available for abstraction of 1.2 million $m^3$/annum from the Bruintjieslaagte dam.

A Section 21 (b) – storage of water use licence is needed and this application process with the IUCMA has started.

**River Ecosystems and Ecological Water Requirement**

The potential zones of direct influence of the proposed dam options on river ecosystems comprise:

- Devil's Creek within the proposed Full Supply Levels of the two dam options. The length of river that will be inundated is estimated at 0.7 km, similar to the existing dam.
- Devil's Creek between the proposed dam options and the top end of the existing dam, a distance of 2.9 km.

The potential zones of indirect Influence of the proposed dam options on river ecosystems comprise:

- Upper portion of Devil's Creek, upstream of the proposed Full Supply Level. No fish were recorded upstream of the waterfall, so the proposed dam option is not expected to affect the upstream migration of any species of fish. However, it is highly likely that fish will eventually colonise the new impoundment, by whatever means, and this will facilitate colonisation of Devil's Creek upstream of the proposed Full Supply Level.
- Lower portion of Devil's Creek between the existing dam and the confluence with the Crocodile River, a distance of 2.2 km.

The present state of water quality in Devil's Creek upstream of the existing dam was classified with a high level of confidence, as Category A. All metrics were considered unmodified, except for turbidity, which is likely to be slightly elevated for short periods during high flows because of timber production, particularly during harvesting.

The Present Ecological State of aquatic macroinvertebrates was rated, with high confidence, as Category A/B, with a MIRAI score of 92%. A total of 34 SASS5 taxa were recorded, and these gave a Total SASS5 Score of 241, and an average score of 7.1.

Fourteen sensitive taxa were recorded, including Oligoneuridae and Blephariceridae, both of which have a sensitivity rating of 15/15, which indicates excellent quality water. Mayflies included members of the genus *Demoreptus*, which is also highly sensitive to water quality deterioration. The fauna was characterised by absence of alien taxa and moderate abundance of Blephariceridae, Heptageniidae, Leptoceridae and Corduliidae.

Population densities were low to moderate, and no taxa were rated as abundant or very abundant, which is also indicative of unmodified conditions. Water pennies (Psephenidae) were present, but at lower abundance than expected. All other taxa were present in abundances expected under natural conditions.

**Fish – Present Ecological Status**

Nine species of fish were recorded in Devil's Creek during baseline surveys between February and April 2017.

Reach A: Upstream of Waterfall (area for new dam)
No fish were recorded despite the suitability of in-stream habitats. The apparent absence of fish in this reach is attributed to the waterfall, and therefore considered natural.

Reach B: Waterfall to Existing Dam
The Present Ecological State of fish was rated, with low confidence, as Category C, with a FRAI score of 67.3%. Four species of fish were expected at this site, and all four are likely to still occur in this reach, even though only one species was recorded, namely *Enteromius cf motebensis.*

Impoundment
High numbers of juvenile *Coptodon rendalli* were recorded in the upper reaches of the existing impoundment. This species is unlikely to have been present in Devil's Creek before impoundment, but the impoundment has created ideal habitat. How this species colonised the impoundment is unknown, but however this took place, there is a high probability this species will also colonise proposed impoundment.

Reach C: Existing Dam to Confluence
Eight species of fish were recorded in this section of the river. The abundance of fish was low, and dominated by juveniles, indicative of post-drought recovery. The composition was dominated by cichlids, which were not expected in this river under natural conditions, so they appear to have benefited from the drought conditions. Only one flow-dependent fish species, namely *Chiloglanis pretoriae*, comprising a single individual, was recorded despite the availability fast-flowing habitats, and this further confirms that fish composition and abundance had not yet recovered from the effects of the drought. The Present Ecological State of fish at this site was not assessed because this was not needed for this report.

Ecological Importance and Sensitivity (EIS) of Devil's Creek within the potential zone of impact was rated as High.

The Desktop Ecological Flow Requirement for a Category B ecological state below the new dam is an annual volume of 2.405 million $m^3$/annum.

Median environmental low flow requirements ranged between 0.036 and 0.106 $m^3$/s in September and February respectively. These flows will provide good wetted perimeter (5.8 m) and small areas with current speeds that exceed 0.34 m/s. The recommended flows are therefore suitable for maintaining flow-dependent fish species, such as *Amphilius* spp and *Chinoglanis pretoriae.*

**River Ecosystem Impact Assessment**

| **Potential Impact** | **Impacts Before Mitigation** | | | | | | **Impacts After Mitigation** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Construction Phase** | | | | | | | | | | | | |
| | **I** | **D** | **E** | **P** | **Total** | **Significance** | **I** | **D** | **E** | **P** | **Total** | **Significance** |
| Disturbance of Riverine Habitats | -7 | 7 | 2 | 7 | **-112** | **Major (-)** | -7 | 7 | 1 | 7 | **-105** | **Moderate (-)** |
| Impact of Water Quality Deterioration on River Ecosystems | -6 | 2 | 3 | 7 | **-77** | **Moderate (-)** | -1 | 2 | 3 | 7 | **-42** | **Minor (-)** |
| **Operational Phase** | | | | | | | | | | | | |
| Inundation of Riverine Habitats | -7 | 7 | 1 | 7 | **-105** | **Moderate (-)** | -7 | 7 | 1 | 7 | **-105** | **Moderate (-)** |
| Impact of Altered Water Quality on River Ecosystems | -5 | 7 | 3 | 7 | **-105** | **Moderate (-)** | -4 | 7 | 3 | 7 | **-98** | **Moderate (-)** |
| Impact of Altered Hydrology on River Ecosystems | -6 | 5 | 4 | 7 | **-105** | **Moderate (-)** | -2 | 5 | 3 | 7 | **-70** | **Minor (-)** |
| Impact of Alien and/or Translocated Fish | -4 | 7 | 3 | 7 | **-98** | **Moderate (-)** | -4 | 7 | 3 | 4 | **-56** | **Minor (-)** |
| Bed Armouring | -2 | 7 | 3 | 6 | **-72** | **Minor (-)** | -2 | 7 | 3 | 6 | **-72** | **Minor (-)** |

**Wetlands, Riverine and Terrestrial Ecology**

The method employed in this investigation is adapted from that suggested by the Mpumalanga Tourism and Parks Agency (MTPA), entitled "Minimum requirements for EMPRs when applying for authorisation for an activity that may have a detrimental effect on the environment". The riverine and riparian vegetation was assessed during field surveys in November and December 2016 using the VEGRAI 3 technique, along three transects of 154, 669 and 826m, respectively. An Ecological Category (EC) and Present Ecological Status (PES) for the riparian vegetation state was determined. A field survey was undertaken to identify any wetland areas on the site and to delineate the wetlands. GPS positions were taken at each survey point. The PES, Ecological Sensitivity and Functional Assessment was carried out using the Manual for the Assessment of Wetland Index of Habitat Integrity and WET-EcoServices. The ecological sensitivity of the area is based on available data and the results obtained in the field during the site visits in November and December 2016 and January and March 2017. The sensitivity is determined on a descriptive scale from Very Low to High. The significance of the impact of the proposed dam, in terms of construction, on the wetland, was estimated using the extent (spatial scale), magnitude and duration (time scale) of each impact. Mitigation measures were proposed.

A total of 60 species of plants were collected and identified in the area and along part of the Devil's Creek River on the footprint of the proposed dam site. The only plant of conservation-importance collected was Eucomis autumnalis (Declining). The rest of the plants collected were determined to be of Least Concern, with the presence of 32 to be likely, the presence of 25 unlikely and three undetermined.

As a result of the historic and present anthropogenic activity in the area, in terms of landuse and impact (vegetation removal, water quantity and water quality), the presence of alien vegetation and perceived change from the reference state (non- woody and woody cover and abundance in the marginal and non-marginal zones), it is estimated that the marginal vegetation has changed by 22.5% and the non- marginal vegetation by 26.3%, giving an overall VEGRAI Level 3 score of 76.1%, classified as an Ecological Category of a high C, or Moderately Modified. The Present Ecological Status (PES) may thus be described as being characterized by a system that has experienced a moderate loss of habitats, biota and basic ecosystems functioning. These figures represent the conditions along the more impacted right bank of the Devil's Creek River at. The relatively inaccessible left bank is less impacted and probably reflects conditions more closely associated with a PES of B (largely natural with few modifications).

The wetlands (4,1ha) delineated for the site included (1) a broad seasonal wetland (Wetland A, 1,8ha), (2) a permanent wetland (Wetland B, 0,8ha), situated below Wetland A, (3) a temporary wetland (Wetland C, 0,8ha), separated from Wetland B by a rocky outcrop, (4) a permanent wetland (Wetland D, 0,1ha) forming a narrow line into the Devil's Creek River and into which Wetland A drains, and (5) a temporary wetland (Wetland E, 0,6ha), situated downstream of Wetland D and above the riparian area of the Devil's Creek River. The overall Present Ecological Status (PES) of the wetlands at the site using the Wetland-IHI Assessment was estimated to be Unmodified, Natural, with a score of 92,4% (Category A). The score for the vegetation alteration was 93,5% (A), for hydrology 96% (A), geomorphology 86% (B) and water quality 97% (A). The key characteristics of the assessed wetlands were (1) its small size relative to its overall catchment, (2) its channelled nature and the (3) pristine state of its catchment. These factors reduced its overall significance relative to the impact that construction of the dam will have on ecosystem services and function. Its most significant ecosystem services related to erosion control, biodiversity maintenance and carbon storage. Stream flow regulation and flood attenuation services were identified as intermediate services.

The Biodiversity classification in terms of the Mpumalanga Biodiversity Sector Plan (MBSP) of the footprint of dam and surrounding area is classified as CBA "Irreplaceable".

In terms of Ecological Sensitivity, the area upstream of the dam site is considered to be Medium-High to High, with high ecological significance and ecological functions varying from that with few modifications to unmodified. The dam site Ecological Sensitivity as Medium to Medium- High, with medium to high ecological significance and ecological functions varying from medium to largely natural with few modifications. Downstream of the dam site the Ecological Sensitivity is classified as Low to Medium-Low.

The impacts considered for the proposed dam included
(1) Impact on the riparian vegetation at site DP1 and the Devil's Creek River (determined to be of Low significance);
(2) Impact on the wetlands and wetland ecosystem services associated with site DP1 and the Devil's Creek River (Low significance);
(3) Impact of the potential for increased invasion by alien plant species (Medium significance);
(4) Impact of loss of habitat for conservation-important fauna and disruption to the life-history cycles (Medium significance);
(5) Impact of disruption to fauna due to construction activities (dust, noise, chemical pollutants) (Low significance).

**Avifauna including Blue Swallow**

In the early stages of the Environmental Impact Assessment (EIA) process, Blue Swallows *(Hirundo atrocaerulea)* had unexpectedly been recorded in the area of the proposed dam site. This was a new locality for this species, as it was previously not known to occur there. This species is Red Data listed as Critically Endangered (Taylor, Peacock & Wanless 2015). This initiated a visit to the site to confirm their presence at the site and to make recommendations (Whyte 2017). Subsequently, it was then decided that a more comprehensive avifauna study/impact assessment for the dam area should be conducted.

A total of 77 species was recorded during different site visits. This was fewer than might have been expected, which is certainly due to the late timing of the survey. The species recorded were all those which would have been expected to occur on the site, and none were of particular conservation interest. The species list must be seen as minimal as it is expected that many more species would be shown to occur at the site over time.

The general conclusion is that, in the broader perspective, the impacts on the avifauna of the area will be low. Some species, particularly those dependent upon the indigenous riparian vegetation may have small numbers displaced. These include the Apalises, Cape batis, Greenbacked Camaroptera, Ashy Flycatcher, Terrestrial Brownbul, Grey Cuckooshrike, Yellow-fronted Tinkerbird, Knysna Turaco, These species are common to relatively common but none, given the small size of the impacted area, are at any particular risk and populations could be expected to remain intact in the area.

Other species may benefit from the presence of the dam and the stabilised flow in the downstream area of the new dam. These include African Black Duck, Pied Wagtail, the Kingfishers, Egyptian Geese, White-throated and Wire-tailed Swallows.

The Red Data species are also believed to be at no particular risk - the Blue Swallow being the main species to be considered here. The mist-belt grasslands appear to be in a pristine state, which might be expected if Blue Swallows are still to be found there, so the habitat is not a cause for concern. The major consideration is the disturbance factor when these birds return from migration.

There are only limited options for the implementation of meaningful mitigation measures. The construction phase will be high impact in a limited area over a limited time period, but the following two measures can be implemented. The first of these will be crucial.

1. The construction phase (and therefore the disturbance) must be entirely complete before the advent of summer and the arrival of the migrant species, particularly the Blue Swallows which will arrive in mid-August.
2. The pushed out trees and bush should be burned inside the dam before inundation to prevent further impacts and disturbances away from the dam site.

**Heritage and Archaeology**

An Archaeological Impact Assessment and heritage study was undertaken by Kudzala Antiquity CC.

A total of seven archaeologically significant sites were recorded during the survey and comprise of Late Iron Age (1650-1820's) stone-walled enclosures and a historic stone-walled enclosure. The Late Iron Age sites are relatively far apart but forms part of a single occupation unit of which two sections will be affected by the expected construction of the dam wall and overflow and water level of the dam.

As part of mitigation measures, it is recommended that the affected archaeological sites be mapped and recorded by archaeological excavation, pending a successful permit application from SAHRA. In terms of the built environment in the area (section 34 of the Act) no significant buildings were identified.

**Palaeontology**

The desktop Palaeontological Impact Assessment for the area in and around Schoemanskloof Valley and the farm Bruintjieslaagte 465 JT in particular has been completed.

The rocks in the area are ancient sediments of the Timeball Hill Formation, Pretoria Group with nearby volcanic granites and gneisses of the Mpuluzi, Nelspruit and Kaapvaal plutons. They do not contain any fossils because they are igneous in origin and too old for body fossils. Microbial mats have been reported from slightly younger rocks, and also from the rocks of the Barberton Greenstone Belt which are mostly igneous and very old but microfossils have been found in the Fig Tree Formation. These rocks are too far away to be affected.

There is a very small chance that trace fossils (ripple marks and microbial mats) could occur in the Bushveld Complex rocks but have not been recorded from this particular Formation.

The palaeosensitivity map is probably inaccurate for this area. It is concluded that the project may continue as far as the paleontology is concerned and no further impact assessments are required.

## Project Team

**Environmental Assessment Practitioner:**
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Maryke Relling has 12 years' experience in the EIA consulting industry of which 10 years with Enpact Environmental Consultants. Qualifications include a Btech Nature Conservation degree. Experience in Environmental Impact Assessments spans a wide range of projects including residential and business developments, tourism developments, infrastructure projects (roads, water, sewer and renewable power generation), concentrate farming and waste management facilities. She also deals extensively with the compilation of waste management and water use licence applications.

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***** For the Terms of References, methodologies and Specialist Declarations please refer to the attached Specialist reports**

# Bruintjieslaagte dam – Devil's Creek - Schoemanskloof

## 1. Introduction and Motivation

### 1.1 Background

Enpact Environmental Consultants CC was appointed by FJ Joubert & Seuns (Pty) Ltd to do the environmental impact assessment process in order for the applicant to apply for environmental authorisation to construct an irrigation storage dam of a capacity and area size that meets the thresholds as listed in the EIA Regulations, 2014.

This report serves to present information that is necessary for a proper understanding of the application process and to assess environmental aspects associated with the proposed dam.

The applicant is a well-known and established farmer in the area and has large areas under cultivation. The dam is proposed as an additional irrigation storage dam that will be utilised to irrigate the nearby citrus orchards.

The Environmental Impact Assessment Report (EIR) was prepared and evaluated on information provided to the consultant by the applicant and specialists. The final EIR submitted to the Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (MDARDLEA) will also include comments received from Interested and or Affected Parties (I&AP's). It is important that all the issues that require assessment are identified during the scoping process to ensure that they are included in the environmental impact assessment.

The Scoping Report was approved by MDARDLEA on 25 April 2017 and the Environmental Impact Assessment process commenced. The Environmental Impact Assessment Report (EIR) will be made available to registered I&AP's for comments. It is in the EIR where the potential impacts are fully considered and assessed and where mitigation measures are proposed.

A water use licence is also required for the storage dam and a separate application will be submitted to the IUCMA.

This Environmental Impact Assessment Report was compiled in terms of the National Environmental Act, 1998 and Environmental Impact Assessment Regulations, 2014. The environmental impact assessment evaluates the aspects and potential impacts of the proposed development on the natural and social environment. Information for the evaluation was obtained from the applicant, professional team, environmental specialists and the interested and affected parties.

The Environmental Impact Assessment Report contains the following information:

- Detailed description of the proposed activity;
- Description of the property on which the activity is to be undertaken;
- Description of the process undertaken to reach the proposed development footprint within the site;
- Description of the environment that may be affected by the activity;
- Details on the public participation process;
- The need and desirability of the proposed activity;
- Evaluation of alternatives;
- Specialist reports and findings;
- Description of environmental issues that were identified;
- Assessment of environmental issues;

- Environmental impact statement with key findings of the environmental impact assessment;
- Environmental Management Programme (EMPr).

The Environmental Impact Assessment Report is first made available for comment to Interested and Affected Parties which includes State Departments and relevant authorities. The report will then be submitted to the Department of Agriculture, Rural Development, Land and Environmental Affairs (DARDLEA) for consideration in order to reach a decision on the application.

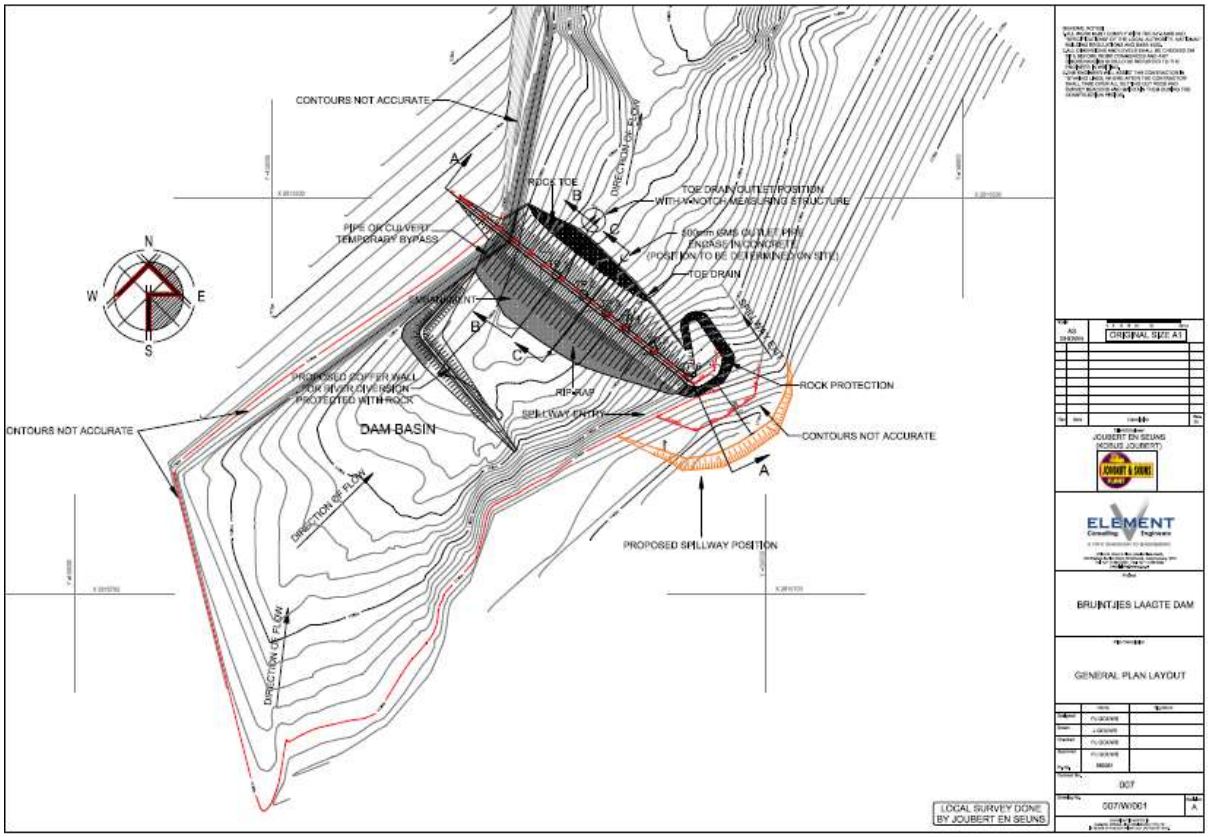
## 1.2 Description of activity

The applicant, FJ Joubert & Seuns, proposes to construct a dam for irrigation purposes on the Devil's Creek, a tributary of the Crocodile River located in Schoemanskloof. The dam will be located on the Bruintjieslaagte 465JT farm. There is an existing irrigation storage dam downstream from the proposed dam also on the Devil's Creek.

The dam wall length is approximately 340 m and dam wall height 23.6 m. The dam storage capacity will be approximately 842 308 $m^3$ and the surface area at full supply level (FSL) approximately 12.7 hectare. The overflow will be 60m wide and the freeboard level is 4 m.

**Main features of the proposed dam:**

| | |
|---|---|
| Maximum wall h eight (from preliminary design drawings) | 23.6m |
| Full Supply Level | CL 1109.00m |
| NOC Level | CL 1113.00m |
| NOC crest width | 3m |
| Crest length (from survey) | 340m |
| Upstream slope gradient | 1(V):3(H) |
| Downstream slope gradient | 1(V):2(H) |
| Gross storage capacity | ± 842 308 $m^3$ |
| Water surface area at FSL | ±12.7 ha |
| Total freeboard (to NOC) | 4,0m |
| Type of spillway | Uncontrolled side channel |
| Outlet works encased in concrete | 1x500mm dia. steel pipe |



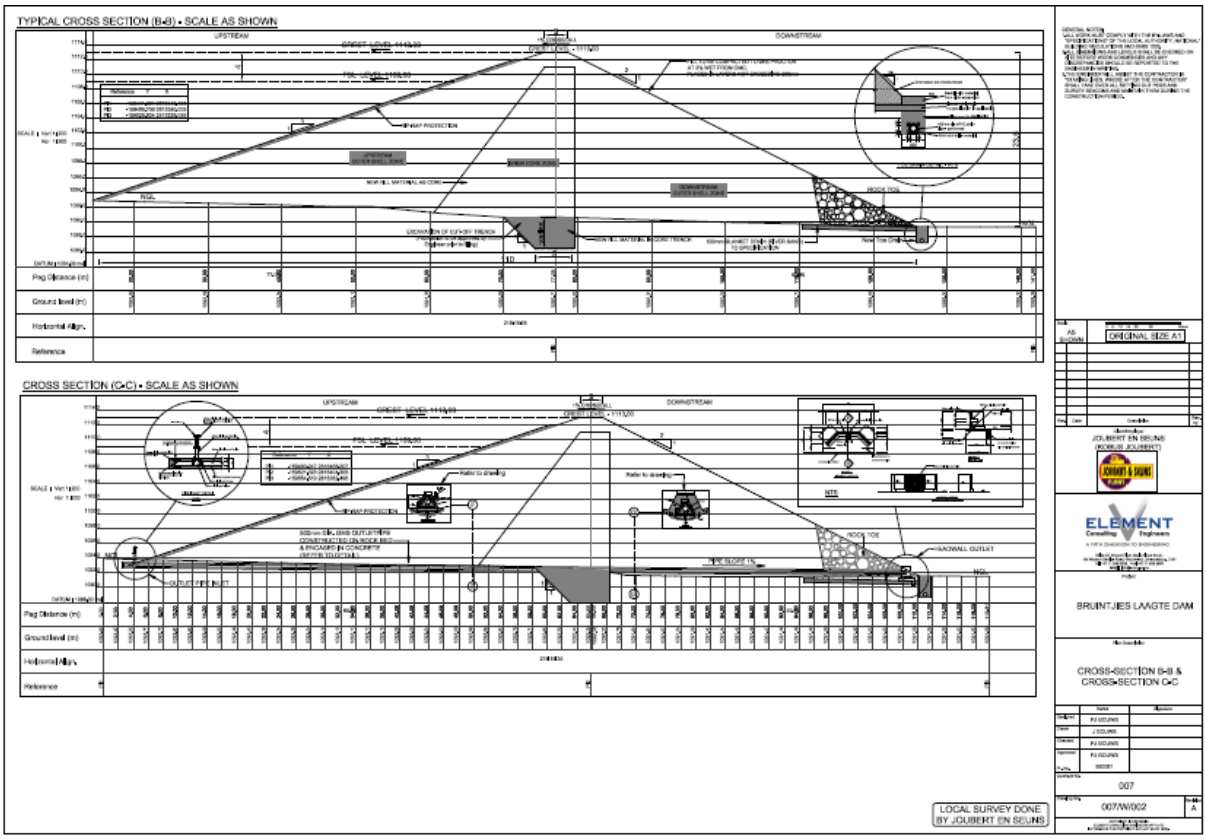




**Figure 1.2.1. General layout of dam.**

## 2. Need and desirability of the activity

### 2.1 Need and Desirability

Irrigation water is normally abstracted from the Crocodile River for the irrigation of the citrus orchards. During drought periods and a low water level of the Kwena dam abstraction from the Crocodile River is limited. It is the intention of the applicant to create additional storage capacity for irrigation purposes so that water is available during drought periods.

There is an existing dam downstream from the proposed dam also located on the Devil's Creek. This dam is located on the farm Koedoeshoek 301JT. The Devil's Creek is a perennial river and there is sufficient flow in the river for the existing as well as the proposed dam.

There is insufficient storage capacity in the Inkomati (Crocodile) catchment and the IUCMA, Water Affairs and the Mbombela Municipality is evaluating alternatives for dams to provide higher water security for the area. This private initiative to construct the dam will add approximately 840 000$m^3$ of storage capacity at a cost of approximately R 15 million.

Water abstraction from the dam and the utilisation of the gravitational head would bring about larger electricity savings as it would save pumping costs from the Crocodile River. This is environmentally preferred as electricity generation from coal is known to have a very high negative environmental impact.

Citrus orchards are highly reliant on irrigation and if water is not available for irrigation it would severely affect the size and quality of the crop. Citrus is exported and the quality of the citrus is critical for success in this highly competitive market.

Please note that there will not be an increase requested in the abstraction water use rights. The dam is purely an alternative abstraction point rather than directly from the Crocodile River.

### 2.2 Benefit to society

The Joubert & Seuns farming activities is providing work for many workers and the large quantities of citrus exported is earning foreign revenue.

Loss of trees or export quality citrus caused by a shortage of irrigation water will be highly detrimental. This would cause significant job losses and income for many workers associated with the farming and exporting activities.

## 3. Site Specifications

### 3.1 Locality of proposed activity

The dam will be located on the farm Bruintjieslaagte 465 JT, on the Devil's Creek in Schoemanskloof, City of Mbombela Local Municipality, Mpumalanga. The dam site is located south west of the N4 Schoemanskloof road on the Devil's Creek that is a tributary to the Crocodile River. The dam site is approximately 6 km from the confluence with the Crocodile River.

Refer to the locality map Appendix 1.

### 3.2 Local authority

The development area falls under the jurisdiction of the City of Mbombela Local Municipality.

### 3.3 Land use zoning

The area is zoned for agriculture.

### 3.4 Existing land use

The farm Bruintjieslaagte 465JT is natural grassland with game farming on a section of the farm. There is no cultivation of citrus on this farm and this farm will remain uncultivated in future.

### 3.5 Surrounding land use

The prominent land uses within 1 km from the site:

| | | | | |
|---|---|---|---|---|
| Natural area | Low density residential | Medium density residential | High density residential | Informal residential |
| Retail | Commercial & warehousing | Light industrial | Medium industrial | Heavy industrial |
| Power station | Office/consulting room | Military or police base/station/compound | Casino/entertainment complex | Hospitality facilities |
| Open cast mine | Underground mine | Spoil heap or slimes dam | Quarry, sand or borrow pit | Dam or reservoir |
| Hospital/medical center | School | Tertiary education facility | Church | Old age home |
| Sewage treatment plant | Train station or shunting yard | Railway line | Major road (4 lanes or more) | Airport |
| Harbour | Sport facilities | Golf course | Polo fields | Filling station |
| Landfill or waste treatment site | Plantation | Agriculture | River, stream or wetland | Nature conservation area |
| Mountain, koppie or ridge | Museum | Historical building | Graveyard | Archaeological site |
| Other land uses (describe): | | | | |

## 4. Site Assessment – Physical Characteristics

### 4.1 Topography

Open valley in a mountainous area with steep slopes. Devil's Creek, with several tributaries, draining the catchment area towards the north and Crocodile River. The watershed is on approximately 2000m-, the dam at 1100m- and the confluence with the Crocodile River at 870m- above sea-level.

**Figure 4.1.1. Topography of dam catchment.**

## 4.2 Geology and soil conditions

*Preliminary design report: Construction of a new earthfill dam on the farm Bruintjieslaagte 465 JT, Element Consulting Engineers, Mpumalanga Province, project no. 1601781 April 2017 (refer to Appendix 4)*

According to the available geological information, the portion of interest (including the catchment area) is underlain by shale and quartzite of the Pretoria formation, Transvaal Super-group. Based on rock outcrops which were visually observed on either bank of the river, it is anticipated that rock may be present in the riverbed and along the entire centre line at both banks, at a depth of approximately 3m. This will allow for adequate founding of the new embankment.

During the preliminary investigation, a TLB excavator was used, which limited deep and proper foundation investigations. During detail design, an adequate excavator will be used.

During the site visit conducted on the 3rd of February 2017, soil samples were taken by the client and sent for testing of basic foundation indicators by Letaba Labs (Pty) Ltd, in order to determine the specific material properties. Strength and permeability testing to be done during detail design. Two samples were taken, one on the centreline of the proposed embankment and another within the dam basin. These materials were also mixed and tested to give an average representative sample. These results were evaluated during the preliminary design phase.

The following table gives a summary of the results from the materials testing, along with ideal material parameters;

| SOIL PROPERTIES | IDEAL MATERIAL FOR DIFFERENT EMBANKMENT ZONES | | TEST RESULTS |
|---|---|---|---|
| | CORE / INNER | OUTER | |
| Grading | More than 60% through 0,425mm sieve | More than 40% through 0,425mm sieve | 91% Passing |
| Clay content (%) < 0,002mm | 10 - 30 | < 10 | 14.7 |
| Plasticity Index (PI) (%) | 12 - 24 | 4 - 12,5 | 12 |
| Liquid Limit (LL) (%) | 30 - 60 | < 30 | 31 |
| Maximum Dry Density (MDD) (kg/m³) * | 1590 – 1830 | 1750 - 1990 | 1746 |
| Linear Shrinkage (%) | 4 - 10 | 0 - 5 | 5.7 |
| Optimum Moisture Content (W) (%) * | 14 - 22 | 10 - 16 | 16.4 |
| MDD PIxW | 2 - 11 | 13 - 28 | 9.68 |

**Table 4.2.1. Soil Properties**

The above preliminary results indicate that the material on site is adequate for placement in the core as well as throughout the entire embankment.

## 4.3 Surface Water Hydrology – Devil's Creek

*Yield analysis of the proposed Bruintjieslaagte dam, Devils Creek, Mpumalanga, IWR Water Resources, Stephen Mallory, April 2017 (Refer to Appendix 5).*

### 4.3.1 Introduction

The purpose of this study is to undertake a yield analysis of a proposed dam on the farm Bruintjieslaagte on the Devil's Creek River, which is a tributary of the Crocodile River in Mpumalanga.

A yield analysis determines how much water can be abstracted from a dam (or river) on a sustainable basis. This has been done for two scenarios, one in which the water is used continuously and a second scenario in which the water use from the dam is subjected to the catchment operating rules established by the Inkomati-Usuthu Catchment Management Agency (IUCMA).

The proposed dam, referred to in this report as the Bruintjieslaagte Dam, is located in the X21E quaternary catchment, as indicated in Figure 4.3.1. The relevance of this is that water resources and hydrological information is readily available at quaternary catchment scale from the Inkomati Water Availability Assessment Water Study (DWA, 2009). This information was used to estimate the yield of the proposed dam.

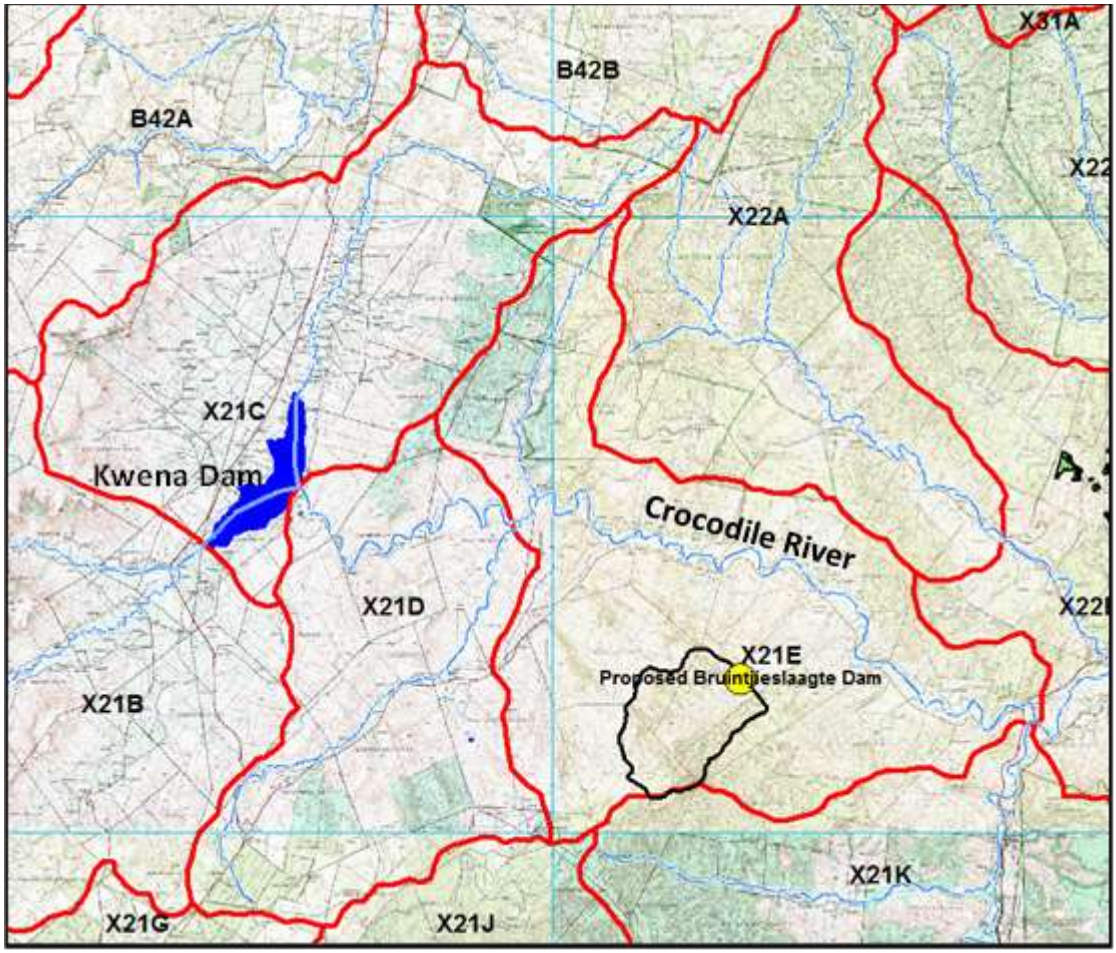



**Figure 4.3.1. Catchment of proposed Bruintjieslaagte Dam.**

The hydrological information for the X21E catchment, available from the IWAAS study, is summarised in Table 4.3.1.

| Catchment Area ($km^2$) | Mean Annual Evaporation (MAE) | Mean Annual Precipitation (MAP) | Mean Annual Runoff (MAR) |
|---|---|---|---|
| | mm/annum | | million $m^3$/annum |
| 345 | 1 447 | 873 | 56.0 |

**Table 4.3.1. Summary of Climate and Hydrology information for the X21E Catchment.**

### 4.3.2 Determination of natural flow

It is accepted practice when dealing with sub-catchments within a quaternary catchment to scale the natural hydrology for the quaternary catchment linearly. This is demonstrated in the example below.

X21E catchment area: 345 $km^2$
Bruintjieslaagte Dam catchment area: 27.1 $km^2$
X21E MAR: 56.0 million $m^3$/annum

Bruintjieslaagte Dam MAR = (27.1/345) x 56.0
= 4.40 million $m^3$/annum (based on linear scaling)

This linear scaling assumes that the rainfall in the X21E catchment is uniformly distributed, which clearly it is not. Due to a lack of rainfall gauges it can often be difficult to quantify the MAP in small catchments but fortunately there is reliable rain gauge at Elandshoogte, not far from the Bruintjieslaagte catchment.

Assuming that the Elandshoogte rain gauge is representative of the rainfall in the Bruintjieslaagte catchment, the runoff from this catchment can be estimate. The area and MAP ratio for the catchment are given in Table 4.3.2.

| Catchment | MAP | Area | Area Ratio | MAP Ratio | Factor | MAR (natural) |
|---|---|---|---|---|---|---|
| | mm/annum | $Km^2$ | | | | million $m^3$/annum |
| X21E | 873 | 345 | | | | 56.0 |
| Bruintjieslaagte | 968 | 27.1 | 0.0786 | 1.109 | 0.0119 | 6.66 |

**Table 4.3.2. Area and MAP Ratios.**

It is clear from the above analysis that the MAR of the Bruintjieslaagte catchment is much higher if the higher rainfall is taken into account, as suggested by Hughes (Hughes, 2004).

Refer to the time series of natural runoff for the Bruintjieslaagte which was derived by scaling the natural flow time series for the X21E catchment by a factor of 0.01119 so as to obtain an MAR of 6.66 million $m^3$/annum (Appendix 5).

### 4.3.3 Existing water use

It is important when estimating the yield of a dam to take into account the existing water use within the catchment of the dam since this will reduce the inflow into the dam and hence reduce the yield. While there is no direct use upstream of the proposed dam there is a significant area of afforestation within the catchment, estimated at 3.33 $km^2$ or 12.3% of the catchment.

It is widely accepted that exotic plantations, and especially Pine and Eucalyptus, reduce the natural runoff from a catchment. The methodology proposed by Mallory and Hughes (2011) was used to estimate this reduction in runoff and this was taken into account when determining the yield of Bruintjieslaagte Dam. The reduction in runoff was estimated to be 0.57 million $m^3$/annum or 8.6% of the natural MAR.

### 4.3.4 Ecological Water Requirements

It is a requirement in terms of South Africa's National Water Act to allow some water to remain in the river to sustain its ecological functioning of the river. This water is referred to as the ecological Reserve or ecological water requirement (EWR). The EWR for the Bruintjieslaagte catchment has been estimated by Palmer (Palmer and Birkhead, 2017) and is attached as Appendix 6 and summarised in Table 4.3.3.

| MAR (natural) | EWR | |
|---|---|---|
| million $m^3$/annum | million $m^3$/annum | % of MAR |
| 6.66 | 2.29 | 34.4% |

**Table 4.3. 3. Summary of Ecological Reserve in terms of MAR.**

### 4.3.5 Yield analysis

A yield analysis entails determining how much water can be abstracted from a dam (or system of dams) on a sustainable basis. The term 'sustainable' has different connotations to different users. Industrial users generally require water all the time and will not accept periods of reduced or zero water supply. Irrigators, on the other hand, usually accept a reduced assurance in exchange for a greater volume supplied on average over the long term. Since the purpose of the proposed Bruintjieslaagte Dam is to irrigate crops, the yield has been determined at a 70% assurance of supply. It has also been assumed that water use from this dam will be subjected to the operating rules of the Crocodile catchment established by the IUCMA. The historical yield, which is the yield at 100% assurance, has also been determined for comparison purposes.

The yield of a dam depends largely on the size of the dam relative to the inflow. In this case the size of the dam has already been determined as summarised in Table 4.3.4 while the area capacity curve for the dam was used to estimate evaporation losses from the surface of the dam.

| | |
|---|---|
| Full supply capacity | 842 000 $m^3$ |
| Full supply area (ha) | 12.7 ha |

**Table 4.3.4. Dam Parameters.**

The yield calculations were carried out using the Water Resources Modelling Platform (Mallory et al, 2013). This is a monthly time step simulation model. It was assumed that water will be released from the Bruintjieslaagte Dam for the ecological Reserve as a priority and take into consideration streamflow reduction of 0.57 million $m^3$/annum due to afforestation.

The results of the yield analysis are given in Table 4.3.5.

| Scenario | Yield (million $m^3$/annum) |
|---|---|
| Historical yield | 0.74 |
| 70% assurance | 1.20 |

**Table 4.3.5. Yield results.**

### 4.3.6 Conclusion and Recommendation

The proposed Bruintjieslaagte Dam is located favourably in a catchment with high runoff and very little water use upstream of the dam. A dam with a full supply capacity of 842 000 $m^3$ will be able to yield an estimated 1.2 million $m^3$/annum at 70% assurance after meeting a B class Ecological Reserve.

## 4.4 River Eco Systems and Aquatic Reserve

*River Ecosystems, Bruintjieslaagte dam - Devil's Creek – Schoemanskloof, Nepid Consultants, Dr Rob Palmer, 13 April 2017 draft 1.1. (Refer to Appendix 6).*

### 4.4.1 General

The proposed dam is located on the farm Bruintjieslaagte 465JT, in the Schoemanskloof Valley, 40 km west of Nelspruit (Figure 4.4.1). The Study Area for this report was defined as the zones of potential direct and indirect influences on river ecosystems, detailed in Section 2.4.

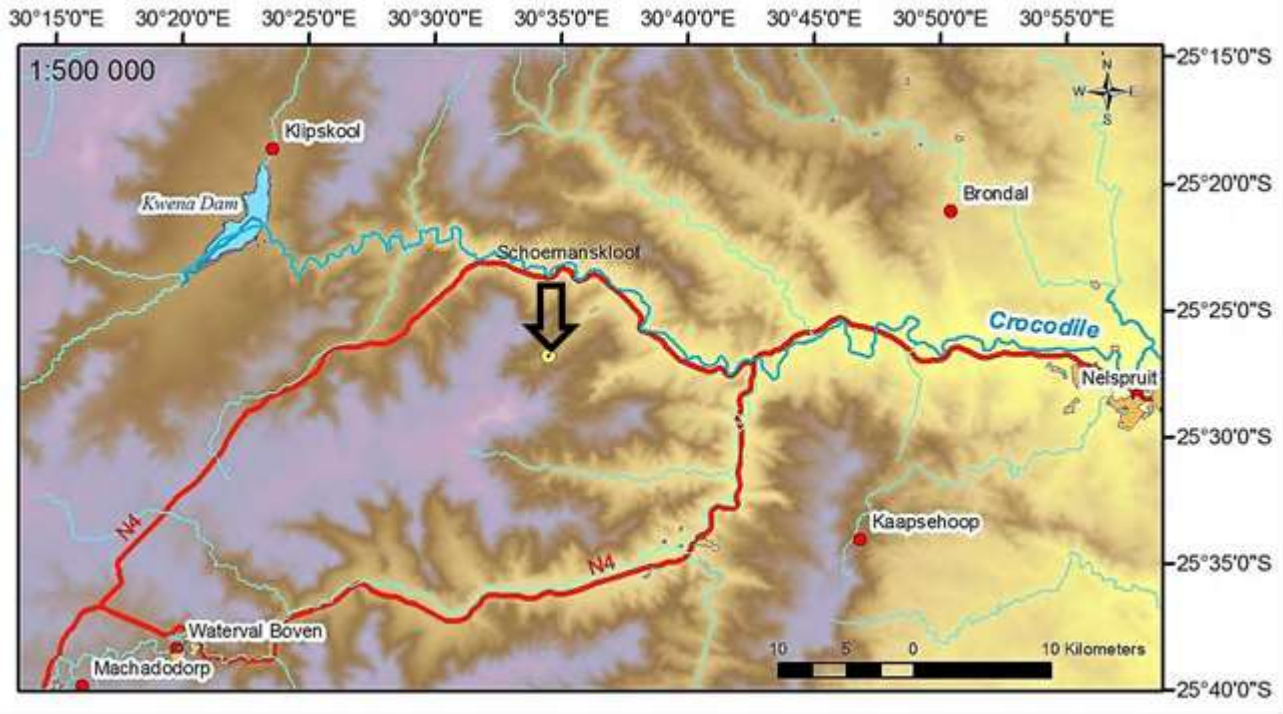



**Figure 4.4.1. General Location of Map.**

### 4.4.2 River Reaches

Three river reaches, A to C, were identified along the length of Devil's Creek for the purposes of this report, as indicated in Figure 4.4.2. The delineation was based on a waterfall and existing dam, both of which constitute significant barriers to upstream migration of fish (Figure 4.4.3).

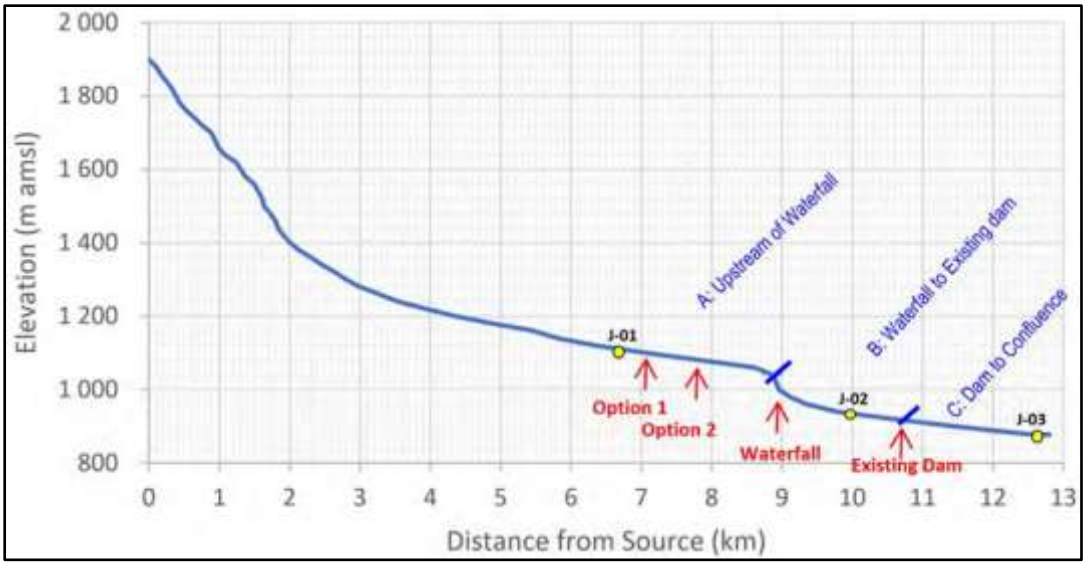



**Figure 4.4.2. Longitudinal Profile of Devil's Creek Showing River Reaches.**

**Figure 4.4.3. Fish Migration Barriers in Devil's Creek: Waterfall (A), and Existing Dam (B).**

### 4.4.3 Zones of Influence

The potential zones of direct influence of the proposed dam options on river ecosystems comprise:

- Devil's Creek within the proposed Full Supply Levels of the two dam options. The length of river that will be inundated is estimated at 0.7 km, similar to the existing dam.
- Devil's Creek between the proposed dam options and the top end of the existing dam, a distance of 2.3 or 2.9 km for Options 2 and 1 respectively (Figure 4.4.4).

The potential zones of indirect Influence of the proposed dam options on river ecosystems comprise:

- Upper portion of Devil's Creek, upstream of the proposed Full Supply Level. No fish were recorded at J-01, upstream of the waterfall, so the proposed dam options are not expected to affect the upstream migration of any species of fish. However, it is highly likely that fish will eventually colonise the new impoundment, by whatever

means, and this will facilitate colonisation of Devil's Creek upstream of the proposed Full Supply Level.

- Lower portion of Devil's Creek between the existing dam and the confluence with the Crocodile River, a distance of 2.2 km (Figure 4.4.4).

The total zone of influence of the proposed dam on river ecosystems is therefore 5.2 or 5.8 km portion of Devil's Creek for Options 2 and 1 respectively, plus an unknown length of river upstream of the Full Supply Level. The most likely extent of this stretch would be to the base of the Mountain Headwaters, which is about 3 km.

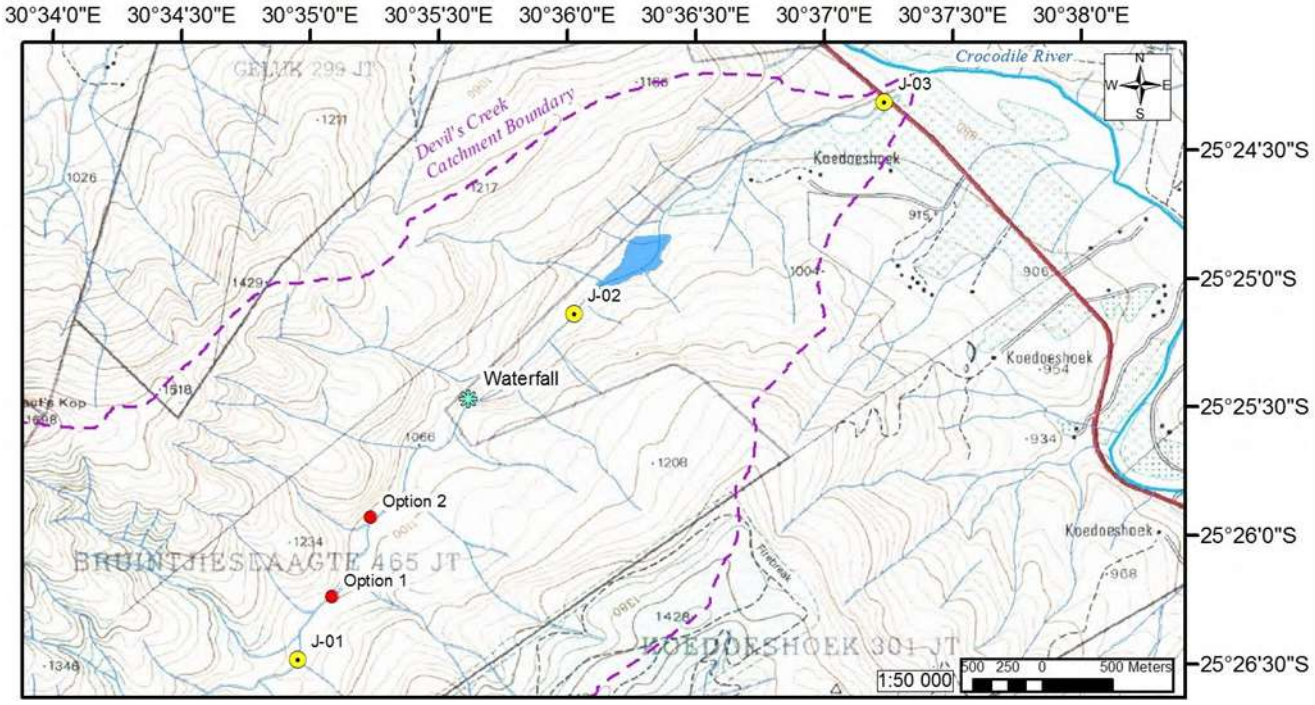



**Figure 4.4.4. Topographical Map (extracted from 1:50 000 scale map 2530BC).**

### 4.4.4 River Ecosystem Type

Four geomorphological zones were identified along the length of Devil's Creek, two of which are located within the potential zone of influence of the proposed dam, namely Transitional Stream and a short section of Rejuvenated Mountain Stream (Figures 4.4.5). The three sites sampled for this report were located in the Transitional Zone. A detailed ecological classification of the three sites is included in Appendix 6. Biotopes were dominated by rapids, riffles, runs and glides. Riparian vegetation cover comprised open and closed-canopy indigenous forest with dense growth of herbs, grasses and shrubs. Alien invasive vegetation was present at all three sites, but prevalent only at SiteJ-03. Marginal and emergent vegetation was dominated by River grass Cenchrus macrourus. Bed substrates at all three sites were dominated by large and small cobbles, with smaller patches of coarse gravel, while fine gravel and course sands present along the margins.

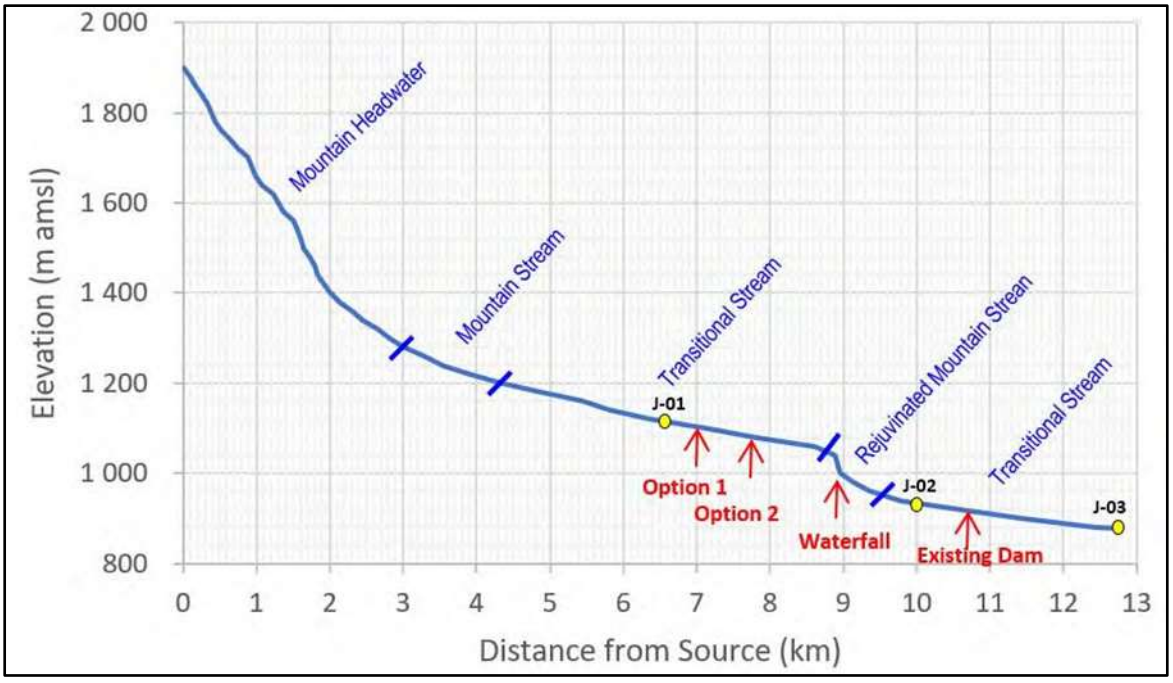



**Figure 4.4.5. Longitudinal Profile of Devil's Creek showing Geomorphological Zones.**


**Figure 4.4.6. Google Earth Satellite image showing location of aquatic sampling sites.**

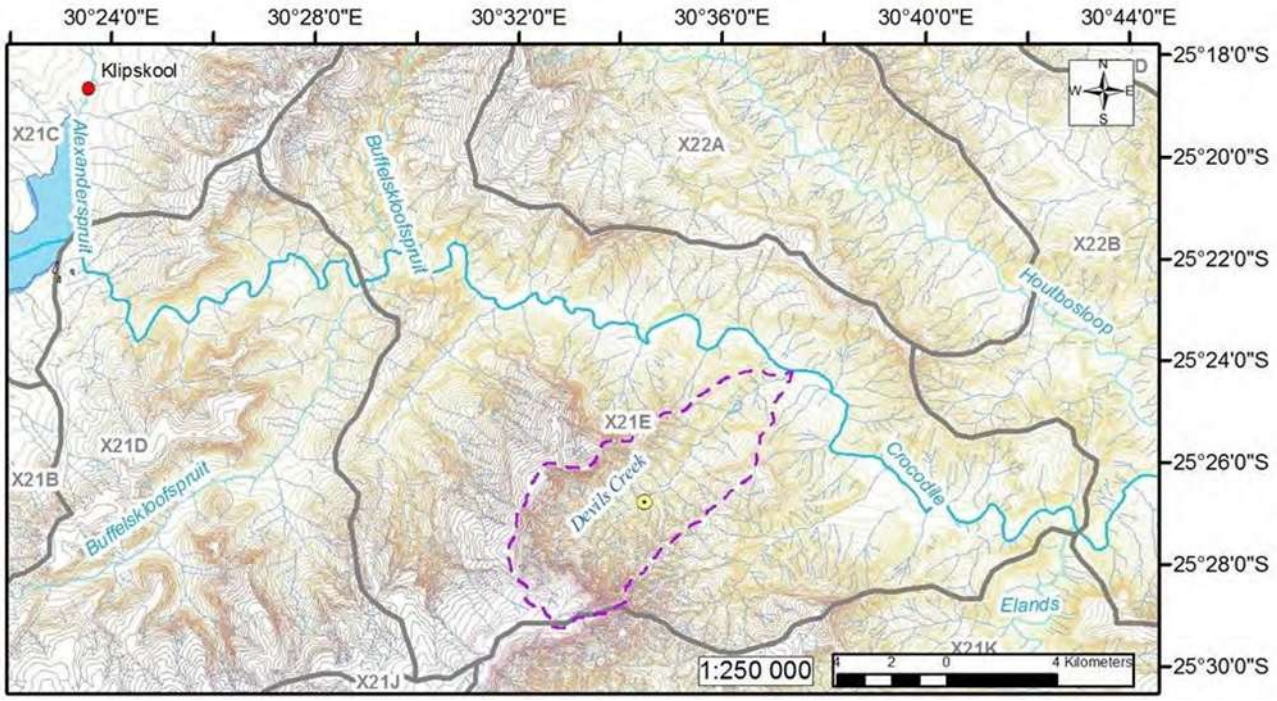



**Figure 4.4.7. Quaternary Catchments.**

### 4.4.5 Hydrology

Mean Annual Runoff

Extrapolation of data presented in the Water Resources 2012 (WR2012) study indicates that the natural Mean Annual Runoff (nMAR) of Devil's Creek at the confluence with the Crocodile River is 6.47 $Mm^3$, but there is significant variation between years, ranging between 2.16 $Mm^3$ in 2007, and 23.41 $Mm^3$ in 1999. An implication of this is that the aquatic biota that occur naturally in the area are likely to have evolved life history strategies to cope with large variations in flow.

Low Flows - Dry Season

Examination of WR2012 natural monthly flows for Devil's Creek shows that the dry season usually occurs between May and September. The dry season low flows are likely to be maintained mainly by seepage from valley head and hillslope seepage wetlands in the upper catchment. The median natural dry season low flow at the confluence with the Crocodile River is 0.047 $m^3/s$, but ranges between 0.033 and 0.093 $m^3/s$ at the 90 and 10th percentile respectively.

Wet Season

Examination of WR2012 natural monthly flows for Devil's Creek shows that the wet season usually occurs between November and March. Wet season flows are driven mainly by surface runoff from thunderstorms, which tend to be short-term, extreme events. Wet season low flows cannot be reliably calculated from monthly data because the data include both low and high (peak) flow, but a rough estimate of the likely range of wet season low flows was based on the assumption that half the flow during the wet season was attributed to peak flows, and the remaining half to low (base) flows. As such, the WR2012 data indicate that the median natural wet season low flow at the confluence with the Crocodile River is 0.139 $m^3/s$, and ranges between 0.070 and 0.808 $m^3/s$ at the 90 and 10th percentile respectively.

### 4.4.6 Hydraulics

A cross-sectional profile of Devil's Creek at J-02 shows the channel is about 8 m wide and incised by 1.4 m. The median water depth at the profile on 23rd March 2017 was 0.19 m, and the maximum depth was 0.34 m. Flow volume at the profile was estimated at 0.745 $m^3/s$, while flow volume at a pipe culvert a short distance downstream was estimated at 0.685 $m^3/s$. The latter is likely to be more accurate than the former. The data were used to generate hydraulic and habitat parameters for macroinvertebrates and fish for water levels between 0 and 0.5 m depth.

### 4.4.7 Water Quality

a) Conductivity

Conductivities in Devil's Creek during the field surveys in February and March 2017 were very low and ranged between 3 mS/m in the upper reaches at J-01 and J-02, to 5 mS/m in the lower reaches at J-03. These values were recorded during the wet season, and conductivity is expected to be slightly higher during the dry season.

| Site | Date | Flow | Conductivity (mS/m) | Spot Water Temperature (ºC) | pH | Turbidity (NTU) |
|---|---|---|---|---|---|---|
| J-01 | 2017/02/20 | V High | 3 | 18.7 | 8.0 | 22 |
| J-02 | 2017/03/22 | High | 3 | 21.4 | 8.1 | 11 |
| J-03 | 2017/02/20 | V High | 5 | 22.0 | 7.9 | 32 |

**Table 4.4.1. Field Water Quality recorded in 2017.**

b) Water Temperature

Spot water temperatures were recorded during the field surveys, but there is not much that can be read into such values because of natural daily variation, other than to note that water temperatures at Sites J-01 and J-02 reflected natural conditions, whereas temperatures at Site J-03 are likely to be less variable because of the stabilising effect of the existing dam.

c) pH

The pH was slightly alkaline, and ranged between 7.9 and 8.1.

d) Turbidity

Turbidity was moderate (22 to 32 NTU) during the field survey in February 2017, when flow was very high. The values indicate that sediment transport was very low, and this reflects the overall natural state and high vegetation cover in the catchment as a whole. Turbidity during the field survey in March 2017, when flow was moderate, was low (11 NTU).

e) Ionic Composition

Ionic composition was dominated by total alkalinity (TAL) and magnesium. The results indicate unimpacted conditions.

f) Metals

Concentrations of metals were low and mostly below instrument detection limits

g) Present State of Water Quality

The present state of water quality in Devil's Creek upstream of the existing dam was classified in March 2017, with a high level of confidence, as Category A. All metrics were considered unmodified, except for turbidity, which is likely to be slightly elevated for short periods during high flows because of timber production, particularly during harvesting.

Turbidity was recorded at J-01 when the flow was very high on 20th February 2017, and the value was slightly higher than what may be expected under natural conditions.

| PHYSICO-CHEMICAL EC | | | | | |
|---|---|---|---|---|---|
| Physico-chemical Metrics | Rank | %wt | Rating | CONFIDENCE | WEIGHTED RATING |
| pH | 3 | 40 | 0 | 5 | 0.00 |
| SALTS | 2 | 80 | 0 | 5 | 0.00 |
| NUTRIENTS | 2 | 80 | 0 | 4 | 0.00 |
| TEMPERATURE | 1 | 100 | 0 | 5 | 0.00 |
| TURBIDITY | *2* | 80 | 1 | 4 | 0.80 |
| OXYGEN | 1 | 100 | 0 | 5 | 0.00 |
| TOXICS | 1 | 100 | 0 | 4 | 0.00 |
| PHYSICO-CHEMICAL PERCENTAGE SCORE | 97 | | | | |
| PHYSICO-CHEMICAL CATEGORY | A | | | | |

**Table 4.4.2. Physico-chemical Driver Assessment Index for Devil's Creek at J-02 in March 2017.**

### 4.4.8 Aquatic Macroinvertebrates

#### 4.4.8.1 Habitat Suitability

Instream habitats at J-02 in March 2017 were moderately suitable for aquatic invertebrates (59%), and included highly suitable stones-in-current (4/5), and highly suitable marginal vegetation out-of- current (4/5). Marginal vegetation in-current and aquatic vegetation were both absent. Filamentous algae (Oedogonium sp.) and the submerged plant Sphaerothylax algiformis (Podostemaceae) were present on some stones-in-current, but in low abundance (2%), and therefore they did not influence habitat suitability.

#### 4.5.8.2 Present Ecological State

The Present Ecological State of aquatic macroinvertebrates at J-02 in March 2017 was rated, with high confidence, as Category A/B, with a MIRAI score of 92%. A total of 34 SASS5 taxa were recorded, and these gave a Total SASS5 Score of 241, and an average score of 7.1. Detailed results are presented in Appendix 6.

Fourteen sensitive taxa were recorded, including Oligoneuridae and Blephariceridae, both of which have a sensitivity rating of 15/15, which indicates excellent quality water. Mayflies included members of the genus Demoreptus, which is also highly sensitive to water quality deterioration. The fauna was characterised by absence of alien taxa and moderate abundance of Blephariceridae, Heptageniidae, Leptoceridae and Corduliidae.

The proportion of air-breathing taxa was moderate (24%), and this suggests that faunal composition had not yet recovered from the drought.

Median longevity of adults was short (<1 month), which also suggests that conditions were in flux, so not yet recovered from the drought.

Despite the abundance of fast-flowing habitat, a large proportion of taxa (63%) had current speed preferences that range between zero and slow, which also indicates that species composition had not yet recovered from the drought.

Blackflies were present in moderate abundance, and dominated by Simulium vorax, which is restricted to fast-flowing mountain streams. However, Simulium hargreavesi was also

present, and this species is typically associated with temporary rivers, and this is further evidence that species composition had not yet recovered from the drought.
A wide range of Functional Feeding Groups were recorded, and included predators (39%), filterers (19%), gatherers (19%), scrapers (11%), and shredders (10%), and this is indicative of unmodified conditions.

Population densities were low to moderate, and no taxa were rated as abundant or very abundant, which is also indicative of unmodified conditions. Water pennies (Psephenidae) were present, but at lower abundance than expected. All other taxa were present in abundances expected under natural conditions.

### 4.4.9 Fish

#### 4.4.9.1 Fish Habitat

Flow-depth classes at all three sites sampled in Devil's Creek were typical of a transitional stream, and dominated by fast (>0.3m/s) and shallow (<0.5 m) runs, riffles and rapids, and good cover was provided mainly by large cobbles and boulders. Marginal vegetation was sparse, but there was a localised open area at J-02 where marginal grasses provided good cover. Some cover was provided by woody debris and undercut banks, but these habitats were not sampled.

#### 4.4.9.2 Present Ecological State

Nine species of fish were recorded in Devil's Creek during baseline surveys between February and April 2017 (Table 4.4.3). Photographs of fish recorded are shown in Appendix 6. The following section details the results at each site sampled.

<u>Site J-01 (Reach A: Upstream of Waterfall)</u>
No fish were recorded at J-01, despite the suitability of instream habitats. The apparent absence of fish in this reach is attributed to the waterfall, and therefore considered natural.

<u>Site J-02 (Reach B: Waterfall to Existing Dam)</u>
The Present Ecological State of fish at J-02 was rated, with low confidence, as Category C, with a FRAI score of 67.3% (Table 4.4.3). The low confidence is attributed to a combination of uncertainty about reference conditions, low abundance of fish that can be attributed to the recent drought, and sampling gear that was limited to the use of a seine net, which is not ideal for sampling in riffles and rapids with fast current speeds. Four species of fish were expected at this site, and all four are likely to still occur in this reach, even though only one species was recorded, namely Enteromius cf motebensis. This species has a preference for slow-shallow habitat, and is moderately tolerant of water quality deterioration. Three species with a strong preference for fast- flowing water of high quality were expected but not recorded, despite suitable habitat being present. Their absence is attributed to a combination of recent drought conditions, the sampling gear used, and prevention of upstream migration caused by the existing dam.

<u>Impoundment</u>
High numbers of juvenile Coptodon rendalli were recorded in the upper reaches of the existing impoundment (Table 4.4.3). This species is unlikely to have been present in Devil's Creek before impoundment, but the impoundment has created ideal habitat. How this species colonised the impoundment is unknown, but however this took place, there is a high probability this species will also colonise proposed impoundment.

Site J-03 (Reach C: Existing Dam to Confluence)

Eight species of fish were recorded at J-03 (Table 4.4.3). The abundance of fish was low, and dominated by juveniles, indicative of post-drought recovery. The composition was dominated by cichlids, which were not expected in this river under natural conditions, so they appear to have benefited from the drought conditions. Only one flow-dependent fish species, namely Chiloglanis pretoriae, comprising a single individual, was recorded at J-03, despite the availability fast-flowing habitats, and this further confirms that fish composition and abundance had not yet recovered from the effects of the drought. The Present Ecological State of fish at this site was not assessed because this was not needed for this report.

| **Site Code** | **J-01** | **J-02** | **Dam** | **J-03** |
|---|---|---|---|---|
| **Date** | 23/03/2017 | 23//03/2017 | 23/03/2017 | 05/04/2017 |
| **Flow** | High | High | n/a | Moderate |
| ***Flow-Depth Classes (1-5)*** | | | | |
| *Slow-Shallow* | 1 | 2 | 4 | 3 |
| *Slow-Deep* | - | - | 4 | - |
| *Fast-Shallow* | 4 | 4 | - | 4 |
| *Fast-Deep* | - | - | - | 1 |
| *Rating: 1=rare (1-5%); 2=sparse (5-25%); 3=common (25-75%); 4=abundant (75-90%); 5=very abundant (>90%)* | | | | |
| *Slow = <0.3m/s; Shallow = >0.5m* | | | | |
| ***Cover (1-5)*** | | | | |
| *Marginal vegetation* | 2 | 3 | 2 | 2 |
| *Macrophytes* | - | - | - | - |
| *Undercut banks & roots* | - | - | - | - |
| *Woody debris* | - | - | 1 | - |
| *Bed substrate* | 3 | 3 | - | 3 |
| ***Fish Species*** | | | | |
| *Amphilius natalensis* | | - | | - |
| *Amphilius uranoscopus* | | - | | - |
| *Enteromius crocodilensis* | - | - | - | 2J |
| *Enteromius cf motebensis* | - | 6J 2A | - | - |
| *Enteromius neefi* | - | - | - | 2A |
| *Coptodon rendalli* | - | - | 40J | 2J |
| *Oreochromis mossambicus* | - | - | - | 24J 2A |
| *Pseudocrenilabrus philander* | - | - | - | 20J 3A |
| *Tilapia sparrmanii* | - | - | - | 1J 1A |
| *Clarias gariepienus* | - | - | - | 1J |
| *Chiloglanis pretoriae* | - | - | - | 1A |
| *Total Abundance* | 0 | 8 | 40 | 59 |
| *Number of Species* | 0 | 1 | 1 | 8 |
| *Present Ecological State* | n/a | C (67.3%) | n/a | - |

*J = Juvenile; A=Adult*

**Table 4.4.3. Fish Habitats and Fish Species recorded in Devil's Creek.**

### 4.4.9.3 Fish of Conservation Concern

Enteromius cf motebensis

One fish species of conservation concern was confirmed with the Study Area and is referred to here, tentatively, as Enteromius cf motebensis. This species is a member of the 'anoplus' group, and tentative identity given here is because the taxonomy of this group is uncertain, and it could be one of three lineages of the 'anoplus' group that has been recorded in the wider area:

- Lineage A (north motebensis) that stretches from the Free State across into Mpumalanga
- Lineage D reaching down into Kwazulu-Natal uplands
- Lineage E 'upper Mpumalanga'

(Paul Skelton, pers. comm).

The IUCN classifies the conservation status of E. motebensis as "Vulnerable", but this refers to a population that is centred in the Waterberg. The conservation status of the 'motebensis' population recorded in Devil's Creek is unknown, but based on the recommendation of Paul Skelton, should be treated as equivalent to E. motebensis until further information is available. Enteromius cf motebensis has been recorded in the upper reaches of the Elands River and tributaries, but is otherwise rare in the Crocodile River Catchment.

Amphilius natalensis

*Amphilius natalensis*is fairly widespread in smaller tributaries in the upper Crocodile River catchment and therefore expected in Devil's Creek downstream of the waterfall. The conservation status of *Amphilius natalensis* is referred to as "Data Deficient" by Nel *et al.* (2011), but listed as "Least Concern" by the IUCN (www.iucnredlist.org)

Chiloglanis bifurcus

*Chiloglanis bifurcus* is classified as "Endangered" by the IUCN, and has been recorded within Quaternary Catchment X21E. However, examination of available records show that this species is restricted to larger systems, such the Elands, Houtbosloop and Crocodile Rivers, and does not occur in smaller river. This species is therefore not expected in Devil's Creek.

Kneria sp. 'kwena'

*Kneria* sp. 'kwena" classified as "Critically Endangered" by the IUCN, and has been recorded in the adjacent Sterkspruit and Buffelskloofspruit. This raises the possibility that these fish may also occur in Devil's Creek. Closer examination of the distribution records shows that this species is restricted to a narrow elevation range of between 960 and 1,440 m amsl. This species may therefore be expected in Devil's Creek upstream of the waterfall only. No fish were recorded in Devil's Creek upstream of the waterfall, so it is reasonable to conclude that *Kneria* is unlikely to be present in Devil's Creek.

#### 4.4.9.4 Ecological Importance and Sensitivity

Ecological Importance and Sensitivity of Devil's Creek within the potential zone of impact was rated as High (Table 4.4.4).

| DETERMINANTS | SCORE | Comments |
|---|---|---|
| **BIOTA** | | |
| Rare & endangered | 3 | *Enteromius moteb ensis:* Vulnerable |
| Unique (endemic, isolated, etc.) | 2 | *Sphaerothylax algiformis* (Podostemaceae) |
| Intolerant (flow & flow related water quality) | 4 | Blephariceridae; Psephenidae; Perlidae etc |
| Species/taxon richness | 3 | 34 SASS5 taxa recorded in one sample |
| **HABITATS** | | |
| Diversity of types | 3 | Waterfall, Cascade, Rapids, |

| | | |
|---|---|---|
| | | Riffles, Backwaters |
| Refugia | 2 | Naturally perennial |
| Sensitivity to flow changes | 3 | Naturally perennial |
| Sensitivity to flow related water quality changes | 4 | Water quality excellent: Conductivity low (3 m S/m) |
| Migration route/corridor | 0 | Waterfall restricts migration of fish |
| Importance of conservation & natural areas | 3 | Near-Pristine state |
| **MEDIAN** | **3** | |
| **ECOLOGICAL IMPORTANCE AND SENSITIVITY CATEGORY (EISC)** | **HIGH** | |
| *Scoring: 0 = Zero; 4 = Very High* | | |

**Table 4.4.4. Ecological Importance and Sensitivity.**

## 4.5 Wetland and Riparian

*Wetland Delineation, Present Ecological Status and Functional Assessment for wetland and riverine areas for a Water Use License application for the proposed new dam upstream of the existing dam on the Devil's Creek River on the farm Bruintjieslaagte 465JT, EMROSS Consulting Pty Ltd and Taylor Environmental CC, 2017 (Refer to Appendix 7).*

### 4.5.1 Summary

The method employed in this investigation is adapted from that suggested by the Mpumalanga Tourism and Parks Agency (MTPA), entitled "Minimum requirements for EMPRs when applying for authorisation for an activity that may have a detrimental effect on the environment". The riverine and riparian vegetation was assessed during field surveys in November and December 2016 using the VEGRAI 3 technique, along three transects of 154, 669 and 826m, respectively. An Ecological Category (EC) and Present Ecological Status (PES) for the riparian vegetation state was determined. A field survey was undertaken to identify any wetland areas on the site and to delineate the wetlands. GPS positions were taken at each survey point. The PES, Ecological Sensitivity and Functional Assessment was carried out using the Manual for the Assessment of Wetland Index of Habitat Integrity and WET-EcoServices. The ecological sensitivity of the area is based on available data and the results obtained in the field during the site visits in November and December 2016 and January and March 2017. The sensitivity is determined on a descriptive scale from Very Low to High. The significance of the impact of the proposed dam, in terms of construction, on the wetland, was estimated using the extent (spatial scale), magnitude and duration (time scale) of each impact. Mitigation measures were proposed.

A total of 60 species of plants were collected and identified along a 154m terrestrial and upper non-marginal zone transect, and 1495m marginal zone transect, in the area and along part of the Devil's Creek River on the footprint of the proposed site DP1. The only plant of conservation-importance collected was Eucomis autumnalis (Declining) along the terrestrial portion of the transects. The rest of the plants collected were determined to be of Least Concern, with the presence of 32 to be likely, the presence of 25 unlikely and three undetermined. Eight prominent species of alien plants collected included Solanum mauritianum (Bugweed), Rubus cuneifolius (American Bramble), Bromus catharticus (Rescue Grass), Arundo donax (Giant Reed), Phaeoceros laevis (Smooth hornwort), Persicaria lapathifolia (Pale Persicaria), Ricinus communis (Castor-oil Bush) and Lantana camara (Lantana).

As a result of the historic and present anthropogenic activity in the area, in terms of landuse and impact (vegetation removal, water quantity and water quality), the presence of alien

vegetation and perceived change from the reference state (non- woody and woody cover and abundance in the marginal and non-marginal zones), it is estimated that the marginal vegetation has changed by 22.5% and the non- marginal vegetation by 26.3%, giving an overall VEGRAI Level 3 score of 76.1%, classified as an Ecological Category of a high C, or Moderately Modified. The Present Ecological Status (PES) may thus be described as being characterized by a system that has experienced a moderate loss of habitats, biota and basic ecosystems functioning. These figures represent the conditions along the more impacted right bank of the Devil's Creek River at site DP1. The relatively inaccessible left bank is less impacted and probably reflects conditions more closely associated with a PES of B (largely natural with few modifications).

The wetlands (4,1ha) delineated for site DP1 included (1) a broad seasonal wetland (Wetland A, 1,8ha), (2) a permanent wetland (Wetland B, 0,8ha), situated below Wetland A, (3) a temporary wetland (Wetland C, 0,8ha), separated from Wetland B by a rocky outcrop, (4) a permanent wetland (Wetland D, 0,1ha) forming a narrow line into the Devil's Creek River and into which Wetland A drains, and (5) a temporary wetland (Wetland E, 0,6ha), situated downstream of Wetland D and above the riparian area of the Devil's Creek River. The overall Present Ecological Status (PES) of the wetlands at site DP1 using the Wetland-IHI Assessment was estimated to be Unmodified, Natural, with a score of 92,4% (Category A). The score for the vegetation alteration was 93,5% (A), for hydrology 96% (A), geomorphology 86% (B) and water quality 97% (A). The key characteristics of the assessed wetlands were (1) its small size relative to its overall catchment, (2) its channelled nature and the (3) pristine state of its catchment. These factors reduced its overall significance relative to the impact that construction of the dam site DP1 will have on ecosystem services and function. Its most significant ecosystem services related to erosion control, biodiversity maintenance and carbon storage. Streamflow regulation and flood attenuation services were identified as intermediate services.

The conservation-status of the footprint of site DP1, as considered by MPTA (2014) in the MBSP (2014), is classified as CBA Irreplaceable.

Blue Swallows, listed as critically endangered within the borders of South Africa, were observed flying over the site on 4 separate field visits between November 2016 and March 2017. No nesting sites were found within the proposed dam footprint, although numerous aardvark burrows (potential breeding sites) were found, both within the proposed dam footprint and in the surrounding areas. The most likely nesting areas would be where the birds were seen displaying breeding flight behaviour and other areas within the undisturbed grasslands and outside of the wetland areas. Of the total dam catchment area of 34 510ha, the proposed dam will impact 14.7ha (0,04%), all of which represents suitable foraging habitat and 8,4ha of which represents low potential breeding habitat.

In terms of Ecological Sensitivity, the area upstream of site DP1 is considered to be Medium-High to High, with high ecological significance and ecological functions varying from that with few modifications to unmodified, site DP1 Medium to Medium- High, with medium to high ecological significance and ecological functions varying from medium to largely natural with few modifications, and downstream of site DP1 Low to Medium-Low.

The negative impacts considered for the proposed site DP1 included (1) Impact on the riparian vegetation at site DP1 and the Devil's Creek River (determined to be of Low significance), (2) Impact on the wetlands and wetland ecosystem services associated with site DP1 and the Devil's Creek River (Low significance), (3) Impact of the potential for increased invasion by alien plant species (Medium significance), (4) Impact of loss of habitat for conservation-important fauna and disruption to the life-history cycles (Medium

significance) and (5) Impact of disruption to fauna due to construction activities (dust, noise, chemical pollutants) (Low significance). The positive impact of the creation of "artificial wetlands", habitats and water resources for riparian plants and freshwater animals may be considered to be of medium significance.

### 4.5.2 Vegetation

The vegetation at site DP1 may be described as Northern Mistbelt (or Mpumalanga Mistbelt) Forest (FOZ4) (NMF) (Figure 4.5.2.1), situated in the north-south orientated North Eastern and Mpumalanga escarpments. The tall moist evergreen forest occurs in the mistbelt at altitudes up to 1800 m (site DP1 at approximately 1110m), and semi-deciduous forest occurs as scrub or regrowth forest on the lower slopes and foothills and as riverine forest along the upper reaches of the main river systems (Geldenhuys, 2002). In the region of the site DP1 the mistbelt is surrounded by Lydenburg Montane Grasslands and Legogote Sour Bushveld.

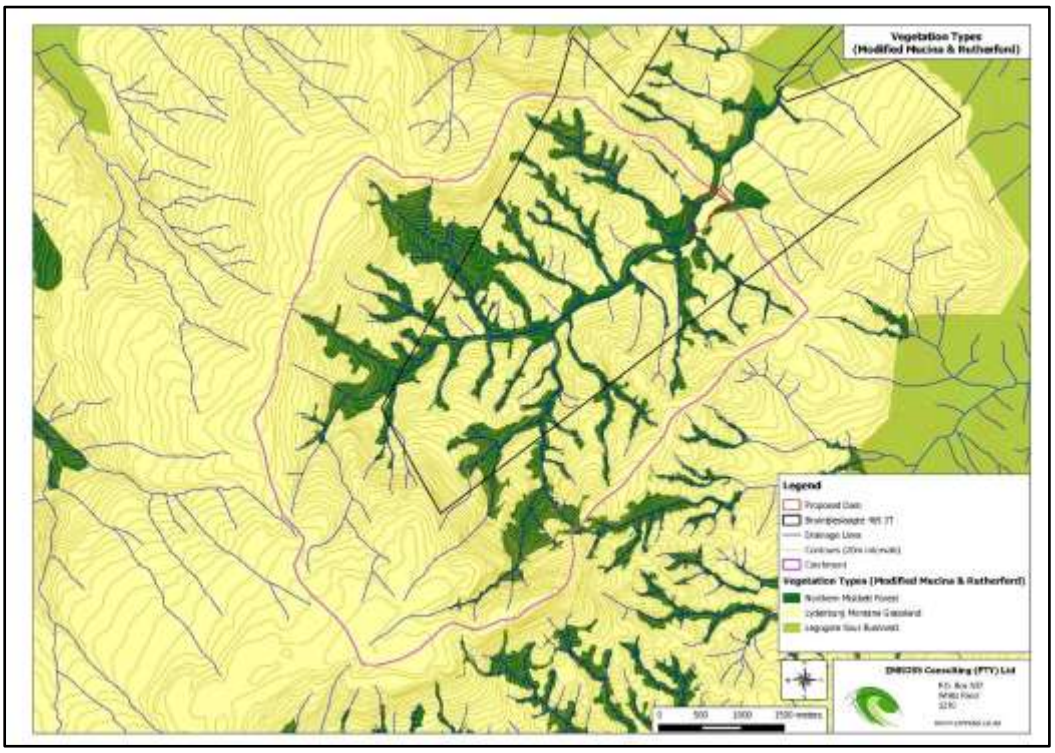



**Figure 4.5.1. The vegetation map, catchment and site for proposed dam DP1.**

In terms of Conservation Status the **Northern Mistbelt Forest** (NMF) is considered Least Threatened, with a Target of 30%. About 10% is statutorily conserved in Blyde River Canyon, Lekgalameetse, Songimvelo, Makobulaan, Malalotja, Nelshoogte, Barberton and Starvation Creek Nature Reserves. More than 25% enjoys protection in privately owned nature reserves, including for instance the Wolkberg Wilderness Area, and In- De-Diepte, Sudwala, Mac Mac, Buffelskloof and Mount Sheba areas.

**Lydenburg Montane Grasslands (LMG)** is classified as Vulnerable. The conservation target is 27%, with 2.4% formally protected within reserves (Gustav Klingbiel, Makobulaan, Mt Anderson, Ohrigstad Dam, Sterkspruit and Verlorenvlei) as well as in a number of private conservation areas (Buffelskoof, Crane Creek, In-de-Diepte, Kaalboom, Kalmoesfontein, Mbesan, Mondi Indigenous Forest, Mt Sheba, Waterval). The level of transformation is relatively high at 23% with mostly alien plantations (20%) and cultivated lands (2%). Erosion potential very low (74%) and low (12%) (Mucina and Rutherford 2006).

**Riverine and Riparian Vegetation collected**

A total of 60 species of plants were collected and identified along the 154m terrestrial and upper non-marginal zone (transect 1), and 1495m marginal zone (transects 2 and 3) in the area and along part of the Devil's Creek River on the footprint of the proposed site DP1. The only plant of conservation-importance collected was *Eucomis autumnalis* (Declining) along the terrestrial portion of the transect. The rest of the plants collected were determined to be of Least Concern, with the presence of 32 to be likely, the presence of 25 unlikely and three undetermined. Three prominent species of alien plants collected included the Castor-oil Bush (*Ricinus communis*), Bugweed (*Solanum mauritianum*) and American Bramble (*Rubus cuneifolius*).

### 4.5.3 A description of the longitudinal boundary and marginal and non- marginal zones of the footprint of the dam

The catchment includes 19 short, steep-sloped $1^0$ single channel streams and riverine valleys and adjacent high altitude (> 1117m amsl) grasslands. The $1^0$ streams feed into a $2^0$ stream, which comprises the main discharge of Devil's Creek into the Crocodile River, at $25^0$ 24.208'S and $30^0$ 37.382'E, approximately 5.96km to the north-east. Historic anthropogenic activity in these upper catchment areas was limited to low impact crop cultivation and stock grazing. To the south of the affected stream is a large plantation. There is significant active anthropogenic activity downstream, including an in-stream dam and citrus farming.

The marginal zone of the $2^0$ stream is narrow (single channel) to broader (braided channels) and is characterized by small chutes, riffles and boulder-bed and alluvial in-stream pools.

**Figure 4.5.2. a) The marginal zone. b) The marginal zone and part of non-marginal zone.**

The lower non-marginal zone along the Left Bank (LB) is short and steep and characterized by dense riverine woody vegetation. The zone is primarily undisturbed by anthropogenic activity and relatively inaccessible. The zone along the Right Bank (RB) is relatively flat and broader. There is historical anthropogenic activity along the RB. There is clear evidence of contouring and the construction of earthen canals and berms. The anthropogenic activity is likely to have been the cultivation of crops and stock farming.

**Figure 4.5.3. The upper non-marginal and terrestrial zones adjacent to the Right Bank of the stream in the impact area of the dam**.

As a result of the anthropogenic activity in the area and the concomitant changes to the riparian vegetation, it is estimated that the marginal vegetation has changed by 22.5% and the non-marginal vegetation by 26.3%, giving an overall VEGRAI Level 3 score of 76.1%, classified as an Ecological Category of a high C, or Moderately Modified. The Present Ecological Status (PES) may thus be described as being characterized by a system that has experienced a moderate loss of habitats, biota and basic ecosystems functioning.

These figures represent the conditions along the more impacted right bank of the Devil's Creek River at site DP1. The relatively inaccessible left bank is less impacted and probably reflects conditions more closely associated with a PES of B (largely natural with few modifications).

### 4.5.4 Wetland delineation and the Wetland-IHI of the footprint of site

The wetlands were delineated from 28 final auger points within the proposed dam footprint (Figure 4.5.1). The delineation identified one HydroGeomorphic Unit (HGM unit) namely a valley bottom with a channel (HGM 1) covering an area of 4.1 ha.

The valley bottom consists of five wetland areas, namely,

(1) A broad seasonal wetland, 1.8 ha (Wetland A),
(2) A permanent wetland, 0.8 ha (Wetland B), situated below Wetland A,
(3) A temporary wetland, 0.8 ha (Wetland C), separated from Wetland B by a rocky outcrop,
(4) A permanent wetland, 0.1 ha (Wetland D) forming a narrow line into the Devil's Creek River and into which Wetland A drains, and,
(5) A temporary wetland, 0.6 ha (Wetland E), situated downstream of Wetland D and above the riparian area of the Devil's Creek River.

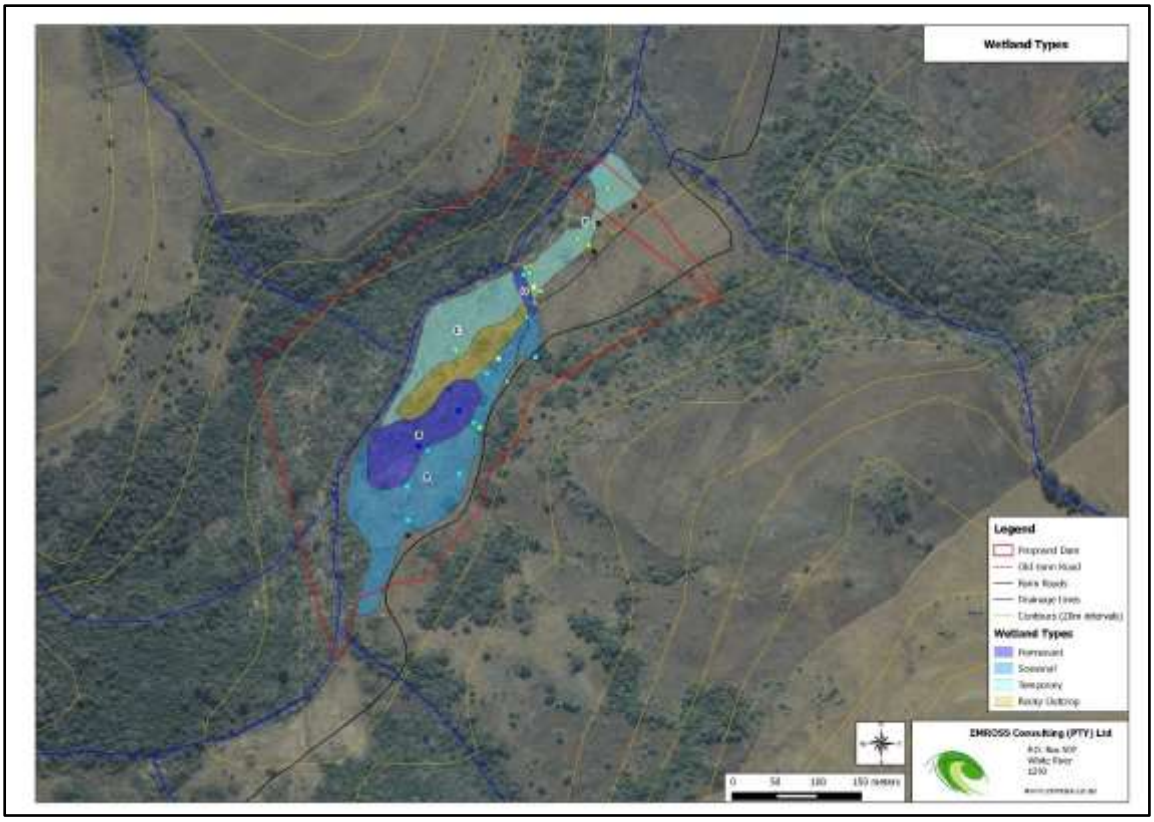



**Figure 4.5.4. The wetlands delineated.**

**Wetland A (1.8ha):**
is a seasonal wetland that drains into wetlands B and D and into the Devil's Creek River. The wetland has been impacted historically by cultivation and an old farm road. The historic cultivation has impacted on the species diversity of the vegetation of the wetland. Alien plants *Lantana camara* (Lantana) and *Solanum mauritianum* (Bugweed) are present within the wetland. There is a farm road situated directly above the wetland and the remnants of an old farm road that went through the wetland. The roads do not have a significant impact on the functioning of the wetland system. Below the road there are remnants of a small furrow draining the wetland into Wetland D. This has an insignificant impact on Wetland A.

**Wetland B (0.8ha):**
is a permanent wetland which is partially cut off from Wetland C by a rocky outcrop. The wetland drains into the lower section of Wetland A and into the Devil's Creek River. The wetland is relatively undisturbed.

**Wetland C (0.8 ha):**
is a temporary wetland situated between a rocky ridge and the Devil's Creek River. The wetland is undisturbed.

**Wetland D (0.1ha):**
is a channelled permanent wetland. The wetland has been impacted by an old farm road that crossed over the wetland area. The wetland drains wetlands A, B and C into the Devils' Creek River.

**Wetland E (0.6 ha):**
is a temporary wetland that is situated above the riparian area of the Devil's Creek River. The wetland has been impacted by an old road running just above the wetland. The wetland is impacted by alien vegetation *L. camara* and *S. mauritianum*.

### 4.5.5 Wetland Ecological Functional Assessment

Wetlands provide a wide range of functional and ecosystem services to society. The level to which these services are provided depend on the type, size and environmental and social context of the wetland. The WET-EcoServices (Kotze et al, 2009) is a technique developed to assess the ecosystem services supplied by a wetland. The technique identifies and assesses indirect benefits such as flood attenuation, streamflow regulation, sediment trapping, erosion control, biodiversity maintenance and nitrate, phosphate and toxin assimilation. Direct benefits such as the provision of water, harvestable resources and cultivated food, cultural significance, tourism and recreation, and education and research, are also considered.

The key characteristics of the assessed wetland were (1) its small size relative to its overall catchment, (2) its channelled nature and the (3) pristine state of its catchment. These factors reduced its overall significance. Its most significant ecosystem services related to erosion control, biodiversity maintenance and carbon storage (Table 4.5.1). Streamflow regulation and flood attenuation services were identified as intermediate services.

| **Ecosystem Services** | **Importance Score** | **Importance** | **Comment** |
|---|---|---|---|
| Flood attenuation | 1.5 | Intermediate | Driven by slope of wetland and catchment and rainfall intensity. |
| Streamflow regulation | 1.7 | Intermediate | Driven by links to stream network. |
| Sediment trapping | 1.0 | Moderately Low | Limited services provided during flood events. |
| Nitrate removal | 1.2 | Moderately Low | Limited services provided during flood events. |
| Toxicant removal | 1.6 | Intermediate | Limited services provided during flood events. |
| Erosion control | 3.3 | High | Provided by wetland vegetation on erodible soils. |
| Carbon storage | 2.3 | Moderately High | Provided by hydrological zones and limited disturbance. |
| Biodiversity maintenance | 2.6 | Moderately High | Wetlands in high biodiversity area |
| Water supply | 0.8 | Moderately Low | Small size of wetland and no human use of wetland. |
| Natural resources | 0.0 | Low | Inaccessible access and no demand and small size of |

| | | | |
|---|---|---|---|
| | | | wetland. |
| Cultivated food | 0.0 | Low | Inaccessible access and no demand and small size of wetland. |
| Cultural significance | 0.0 | Low | None |
| Tourism and recreation | 0.0 | Low | Inaccessible access. |
| Education and research | 0.0 | Low | Inaccessible access. |
| Threats | 0.0 | Low | None |
| Opportunities | 0.0 | Low | None |

**Table 4.5.1. Summary of Ecosystem Goods and Services and their importance for the Wetlands of the DP1.**

### 4.5.6 The Present Ecological Status of the wetlands at dam site

The overall Present Ecological Status (PES) of the wetlands at DP1 using the Wetland-IHI Assessment was estimated to be Unmodified, Natural, with a score of 92,4% (Category A) (Table 4.5.2). The score for the vegetation alteration was 93,5% (A), for hydrology 96% (A), geomorphology 86% (B) and water quality 97% (A).

| **Driver** | **Score (%)** | **Category** | **Description** | **Confidence** |
|---|---|---|---|---|
| Vegetation alteration | 93,5 | A | Unmodified, natural. | 3,9 |
| Hydrology | 96 | A | Unmodified, natural | 3,7 |
| Geomorphology | 86 | B | Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged. | 3,0 |
| Water quality | 97,0 | A | Unmodified, natural | 3,0 |
| Overall | 92,4 | A | Unmodified, natural | 3,4 |

**Table 4.5.2. Present Ecological Status (PES) of Wetlands using the Wetland-IHI Assessment.**

### 4.5.7 Other Biota

#### 4.5.7.1 Aves

Blue Swallows (*Hirundo atrocaerulea*) are classified globally as Vulnerable and nationally as Critically Endangered and South Africa's most endangered bird species (Hockey *et al*, 2005). The total global population is estimated between 1169 and 1338 pairs (Birdlife

International, 2016), with South Africa's population being estimated at less than 40 pairs in 2011/12 (Birdlife International, 2016). The greatest threats to the birds are the destruction and fragmentation of their sour grassland habitat by commercial forestry and agriculture.

The Blue Swallow is an intra-Africa migratory species which breeds in the eastern highlands of South Africa and Zimbabwe, western Swaziland and Mozambique, highlands of Malawi, northeaster Zambia, south-western Tanzania, and southeaster Democratic Republic of Congo. It winters in north-eastern Democratic Republic of Congo, south Uganda northern Tanzania and western Kenya (Hockey *et al*, 2005).

In South Africa the birds are normally present from October to March with departure date dependent on breeding success (Hockey *et al*, 2005). Nests are a half-bowl of grass and evenly applied mud and lined with dry grass, feathers or fine roots. The nests are attached to the sides of Aardvark (*Orycteropus afer*) burrows, mine shafts, dongas, river banks or potholes. Within Mpumalanga the birds are known to nest near Kaapsehoop, Longtom Pass, and the grasslands near Graskop. Currently there are only 4 known nesting pairs within Mpumalanga (Lotter, *pers. comm*.).

Blue Swallows were observed flying over the site on 4 separate field visits. It is the first known recording of Blue Swallows within the 2530BC quarter degree square and the first for the mountains above Schoemanskloof (South African Bird Atlas Project 2, http://sabap2.adu.org.za/).

Two separate sightings (1 male and a pair) were observed on the 22 November 2016 by Mr A. Emery and Dr L. Taylor, a single male was observed on the 7 December 2016 by Mr. A. Emery and Miss. L. Cohen, a single female, a single male and a pair performing courtship flight behaviour were seen on the 24 January 2017 by Mrs R. Theron, Miss J. Newenham, Dr, I Whyte, Mr. H. Kammeyer and Mr. A. Emery and four were seen flying on the 14 March 2017 by Dr G. Batchelor, Mrs R. Luyt and Mr H. Kammeyer.

The pair performing courtship flight behaviour were observed near the proposed dam footprint on the north-eastern grassland slopes approximately 350m to the northwest of the proposed dam wall and approximately 60m higher in altitude. The pair seen on the 22 November 2016 were seen near an open grassland wetland area above the proposed dam footprint. This area may provide the birds with a suitable mud collection point. The remaining sightings were of birds foraging in areas upstream of the dam footprint or within the dam footprint.

No nesting sites were found within the proposed dam footprint. Numerous aardvark burrows were found, both within the proposed dam footprint and in the areas surrounding the proposed development. The most likely nesting areas would be where the birds were seen displaying breeding flight behaviour and other areas within the undisturbed grasslands and outside of the wetland areas. The proposed dam will impact 14.7ha of the dam catchment area of 34 510ha (0.04%). The proposed dam site will impact on 14.7ha of foraging habitat and approximately 8.4 ha of low potential breeding habitat.

The birds forage on aerial insects by flying low over open intact mistbelt grasslands, particularly doing repeated flights up and down valleys. The valley and surrounding grasslands are therefore important for foraging. The dam will impact approximately 650m of the 6km long main valley above the waterfall.

#### 4.5.7.2 Other Vertebrata and Invertebrata

According to the Species Status Report, as derived from the Mpumalanga Parks and Tourism Agency (MTPA), for grid reference 2530BC, the following conservation- important vertebrates may be found on or near site DP1 on the Farm Bruintjieslaagte 465JT, or on neighbouring Farms Koedoeshoek 301JT, Geluk 299JT, Loopfontein 298JT, McKenzie 475JT, Mooiplaats 300JT, Olivier 498JT or St Paul's 1013JT, namely the fish *Chiloglanis bifurcus* (Incomati Suckermouth) and *Amphilius uranoscopus* (Common Mountain Catfish) (Lotter, pers. comm.) and mammals *Mellivora capensis* (Honey Badger) (Endangered, EN) and *Ourebia ourebi* (Oribi) (Near Threatened, NT). In addition, the butterfly *Aloeides nubilulus* (Cloud Copper) (EN) is also listed as present in the region (Lotter, *pers. comm.*). The present study did not include determining the fish species found in the Devil's Creek River, and no Honey Badgers or Oribis were observed. A significant number of burrows that may that of *Orycteropus afer* (Aardvark) were present throughout site DP1.

### 4.5.8 Conservation-importance of the footprint of site DP1.

The conservation-status of the footprint of site DP1, as considered by MPTA (2014) in the MBSP (2014), is classified as CBA Irreplaceable. This would also be the case for sites DP2 and DP3 as described in Section 1. It is also noteworthy to state that the area in the lower reaches of the Devil's Creek River, before the river passes under the Road R539, and into the Crocodile River, is also considered CBA Irreplaceable and an ESA Protection Area Buffer. At present this area is heavily modified by anthropogenic activity (citrus farming). The area between the R539 and the Crocodile River is classified as Heavily Modified, and is also under citrus cultivation. The area upstream of all three sites does include one (188,917ha) that is classified as CBA Optimal. A further area (527,275ha) to the west of this is also classified as CBA Optimal. An area to the east of the three sites (246,924ha) is under forestation and thus classified as Heavily Modified.

### 4.5.9 Ecological Sensitivity Analysis for site DP1

In order to determine the Ecological Sensitivity of site DP1 and its environs, an analysis was undertaken for (1) the area upstream of site DP1 (which would include site DP3 nearly adjacent to site DP1), (2) site DP1 itself and (3) downstream of site DP1 (including site DP2 and the existing in-stream dam) as far as the confluence of the Devil's Creek River with the Crocodile River (Table 4.5.9.1.).

The Ecological Sensitivity of the area upstream of site DP1 is considered to be Medium-High to High, with high ecological significance and ecological functions varying from that with few modifications to unmodified. Given the proposed in-stream dam, the existing dam downstream of that and the heavily modified areas in the lower reaches of the Devil's River as far as the confluence with the Crocodile River, it is essential that the entire catchment above site DP1 be maintained in a near-unmodified to unmodified state in the future. It should be a requirement of the Environmental Authorization for the present project that this be the case. In addition, given that there is the presence of *H. atrocaerulea* in the catchment, the Environmental Authorization, and hence Environmental Management Plan, must include measures to protect the Blue Swallows in the catchment.

In the case of site DP1 the Ecological Sensitivity is considered to be Medium to Medium-High, with medium to high ecological significance and ecological functions varying from medium to largely natural with few modifications. Although there is evidence of historical anthropogenic activity at site DP1, the riparian vegetation is diverse. In order to mitigate against the loss of plants of conservation-importance that are present on the footprint of site

DP1, it is essential that a conservation-important plant (*Eucomis autumnalis* and *Encephalartos humulis*, amongst others) walk-through and rescue plan be established and implemented prior to construction. In addition, the management plan to protect the Blue Swallow must also include the area around site DP1.

Downstream of site DP1 the Ecological Sensitivity is considered to be Low to Medium-Low. There is significant anthropogenic activity, which includes an area in which indigenous game animals are stocked, the existing in-stream dam in the Devil's Creek River is present and citrus farming to the confluence of the Devil's Creek River with the Crocodile River.

| Part of development site and environs | Ecological sensitivity | Description | Comment |
|---|---|---|---|
| Upstream (Devil's Creek River) of the wetted area of site DP1 | Medium-High to High | High ecological significance with ecological functions varying from that with few modifications to unmodified. | (1) Large catchment area of nearly 35 500ha of undisturbed, natural NMF and LMG (PES not determined).<br>(2) Potential foraging and breeding areas for *Hirundo.atrocaerulea* (Blue Swallow).<br>(3) MBSP (MTPA, 2014) classification of area as CBA Optimal and CBA Irreplaceable. |
| The wetted area of site DP1 | Medium to Medium-High | Medium to high ecological significance, with ecological functions varying from medium to largely natural with few modifications. | (1) Footprint of proposed dam small (14,7ha),<br>(2) RB VEGRAI Level 3 score of 76,1%, EC of high C, Moderately Modified,<br>(3) Presence of *Eucomis autumnalis* (Pineapple Lily), Declining,<br>(4) LB not assessed due to inaccessibility, steep sloped, narrow marginal and non-marginal zone, probably EC of B, Largely Natural with few modifications,<br>(5) Five wetland areas (4,1ha) along RB, including permanent, seasonal and temporary ones,<br>(6) Reduced significance of wetlands because (i) wetlands of small size, (ii) channeled nature and (iii) pristine state of the large catchment (34510ha),<br>(7) Wetland-IHI PES score of 92,4%, EC of A, Unmodified, natural.<br>(8) Presence of *Hirundo atrocaerulea* (Blue Swallow), Endangered.<br>(9) MBSP (MTPA, 2014) classification of area as CBA Irreplaceable. |
| Downstream (Devil's Creek River) of the dam wall of site DP1 | Low to Medium-Low | Low to medium ecological significance with ecological functions largely modified to highly transformed and dominated by agriculture development. | (1) Based on a visual comparison with the wetted area of site DP1, the area downstream in all likelihood will have a VEGRAI Level 3 EC of C or D, implying Moderately (upper reaches) to Largely (lower reaches) Modified conditions, where as much as a large loss of habitats, biota and basic ecosystem function has occurred.<br>(2) Although the MBSP classifies the area as CBA Irreplaceable and an ESA Protection Area Buffer upstream of the R539 and Heavily Modified downstream of the R539, the rapid increase in citrus farming in the area recently would make the latter classification more realistic.<br>(3) There is an existing In-stream dam in the Devil's Creek River in this area. |

**Table 4.5.3. The Ecological Sensitivity Analysis for the area upstream, the footprint at site DP1 and the area downstream, in Devil's Creek River.**

## 4.6 Mpumalanga Biodiversity Sector Plan (MBSP) classification

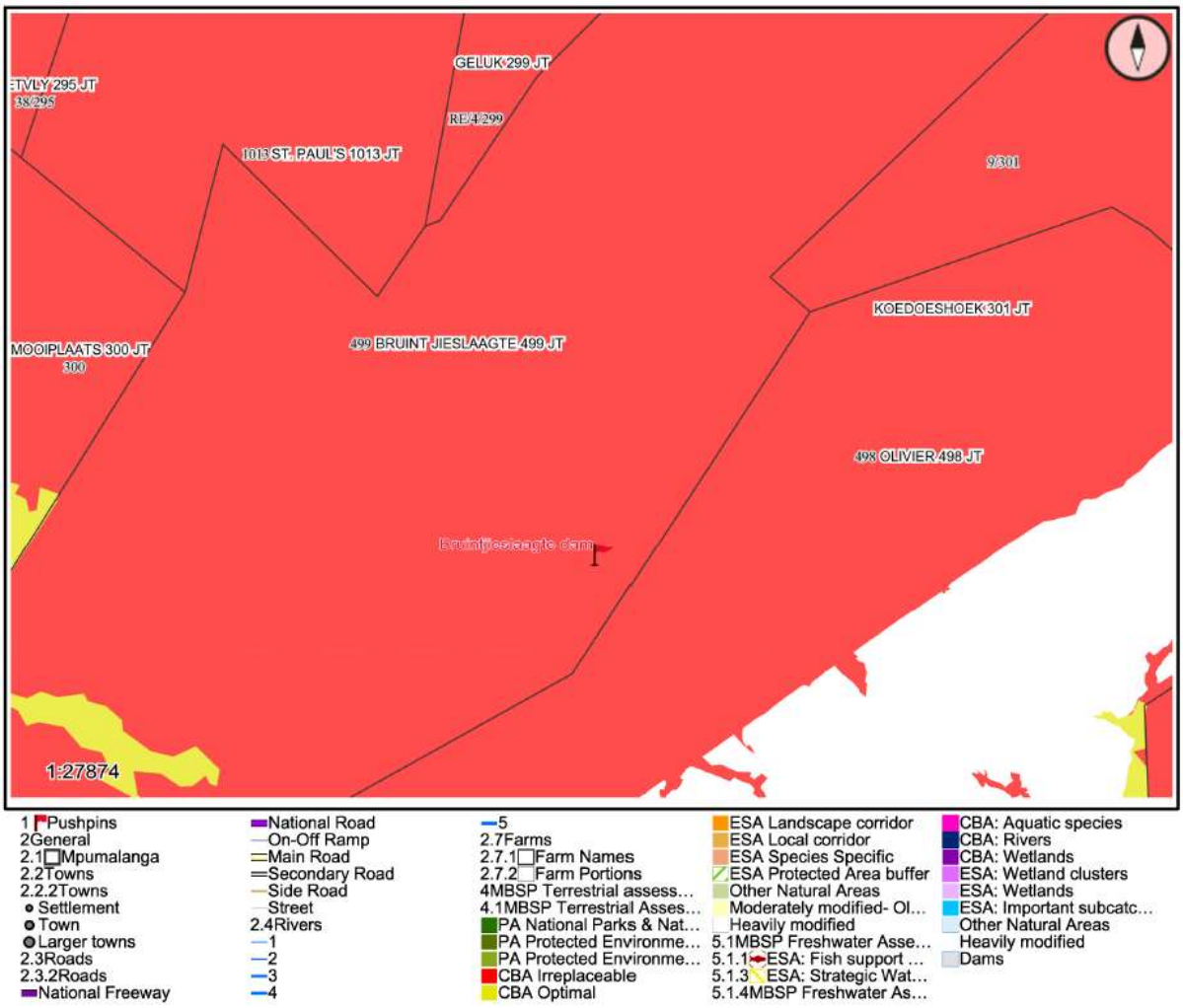



**Figure 4.6.1. MBSP Terrestrial Assessment - Critical Biodiversity.**

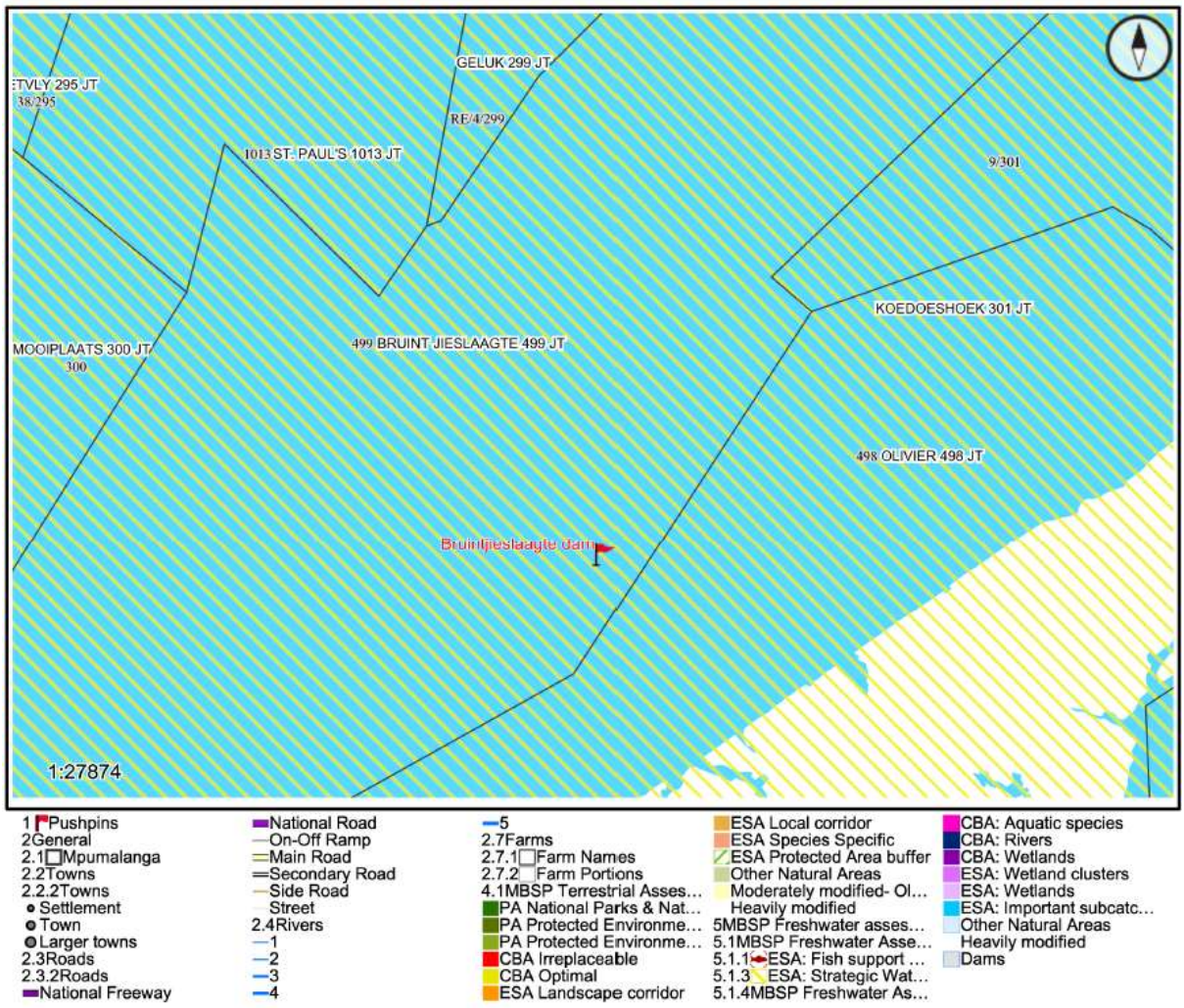



**Figure 4.6.2. MBSP Aquatic Assessment - Important Sub-catchment -ESA Strategic Water Source Area.**

## 4.7 Avifauna

*An assessment of the impact of the proposed "Bruintjieslaagte" dam on the avifaunal populations in the immediate area of the site in the Schoeman's kloof valley, Mpumalanga province, Dr Ian Whyte, 12 and 13 April 2017 (Refer to Appendix 8).*

In the early stages of the Environmental Impact Assessment (EIA) process concerned with the development of this new "Bruintjieslaagte" Dam, Blue Swallows *(Hirundo atrocaerulea)* had unexpectedly been recorded in the area of the proposed dam site. This was a new locality for this species, as it was previously not known to occur there. This species is Red Data listed as Critically Endangered (Taylor, Peacock & Wanless 2015). This initiated a visit to the site to confirm their presence at the site and to make recommendations (Whyte 2017). Subsequently, it was then decided that a more comprehensive avifauna study/impact assessment for the BLG area should be conducted. This forms the basis of this report.

### 4.7.1 *Timing of the survey*

It is recognised that the optimum time to conduct such monitoring is in the early summer months (November and early December) as all of the migrant species have by then arrived for the austral summer, and breeding and territorial calling and displays for most species are at their peak. Surveying on the BLG site was conducted on 12th and 13th April 2017, but at this late stage of the summer, the breeding activities of most species had been concluded, and calling and territorial displays were no longer part of the birds' activities. Bird calls are the major source of data on such surveys, as the bird does not have to be seen to be recorded. The birds also did not respond readily to recorded sounds, so detecting the various species was far less effective, which affected the quality of the survey.

This survey was therefore not conducted at the optimum time, so in order to gain a more representative list of species occurring on the site, other data sources were accessed. These include a list from an earlier visit to the site by me on Tuesday 24th January 2017 which was submitted to the South African Bird Atlas Project (SABAP**2**), a list from Mr Anthony Emery compiled during his earlier visits, and data accessed from the SABAP**2** database submitted by other independent observers. Some of the data from this database originate from the earlier Bird Atlas Project (SABAP**1**) which used quarter degree squares (QDGC) as the basic mapping units. The Government Survey map reference for the Bruintjieslaagte site is the 1:50 000 Quarter degree square map 2530BC Boshalte. The SABAP**1** data was derived from the whole area while data from SABAP**2** were recorded pentad. A pentad is a 3 x 3 subdivision of a QDGC. Relevant pentad numbers for BLG are 2525_3030 and 2525_3035. The SABAP**1** data may therefore not be entirely representative of the avifauna of BLG, but the majority of these species will almost certainly be recorded there over time.

### 4.7.2 *Habitat types*

From an avian perspective, seven habitat types were identified. These are:

- The area of the "footprint" of the dam, or the area that will be inundated when the dam is full, and includes the dam wall construction.
- The riparian zone both upstream and downstream as far as the existing dam (± 2.7 km).
- The grassland and/or savanna in the immediate area surrounding the dam.
- Indigenous forest patches in the immediate area surrounding the dam.
- The existing lower man-made dam.
- Aerial or species recorded flying overhead which might not be associated with a particular habitat.
- Other habitats: Anthropogenic habitats (habitats created or altered by man such as living areas, office complexes with lawns, orchards and gardens).

The extensive mist belt grassland above the dam site was not included in the survey, as they lie at higher altitudes which are above the area of impact.

### 4.7.3 *Birds recorded during the survey*

A total of just 60 species was recorded during the two surveying days (see Table 4.7.1.). This was fewer than might have been expected, which is certainly due to the late timing of the survey. The species recorded were all those which would have been expected to occur on the site, and none were of particular conservation interest. The species list must be seen

as minimal as it is expected that many more species would be shown to occur at the site over time.

In Table 4.7.1, the right hand column indicates the number of habitats in which each species was recorded. This serves as an indication of abundance. Low recording rates are an indication of rarity, cryptic habits or a high degree of habitat specificity (e.g.). High recording rates indicate conspicuous, common species which occur over a wide range of habitats (e.g. Dark-capped Bulbul, Sombre Greenbul, Black-backed Puffback and Red-eyed Dove).
Totals on the bottom line of the table indicate the species richness of each habitat. Clearly, the riparian zones, followed by the savanna / grasslands are the most important in terms of species richness.

The following 14 additional species were recorded during my earlier visit on 24th January 2017 but not during this survey. They have not been included in Table 1 as they were not recorded in the habitats specified in the above table, but are included in the section on "Status":

Cuckoo, African Emerald
Cuckoo, Black
Cuckoo, Red-chested
Eagle, Martial
Goose, Egyptian
Grassbird, Cape
Martin, Common House
Neddicky
Pigeon, African Olive
Swallow, Barn
Swallow, Blue
Swift, Black
Swift, Palm
Waxbill, Common

In addition, a list of species recorded by Mr Anthony Emery on his respective visits to the site included another three not recorded by me. They too are included in the section on "Status": Swallow, Lesser-striped; Dove, Laughing; and Sunbird, Amethyst.

| No. | SPECIES | Footprint | Riparian | Savanna/Grassland | Forest Patches | Lower Dam | Overhead | Other | HABITAT TOTALS |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Apalis, Bar-throated | 1 | 1 | 1 | 1 | | | | 4 |
| 2 | Apalis, Yellow-breasted | 1 | 1 | 1 | 1 | | | | 4 |
| 3 | Barbet, Black-collared | | 1 | | 1 | | | | 2 |
| 4 | Batis, Cape | | 1 | | 1 | | | | 2 |
| 5 | Bee-eater, European | | | | | | 1 | | 1 |
| 6 | Boubou, Southern | 1 | 1 | | 1 | | | | 3 |
| 7 | Brownbul, Terrestrial | | | | 1 | | | | 1 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 8 | Bulbul, Dark-capped | 1 | 1 | 1 | 1 | 1 | | 1 | 6 |
| 9 | Bush-shrike, Olive | | 1 | | 1 | | | | 2 |
| 10 | Bush-shrike, Orange-breasted | | 1 | 1 | | | | | 2 |
| 11 | Buzzard, Jackal | | | 1 | | | 1 | | 2 |
| 12 | Camaroptera, Green-backed | 1 | 1 | | 1 | | | | 3 |
| 13 | Canary, Cape | | | 1 | | | | | 1 |
| 14 | Canary, Yellow-fronted | | | 1 | | | | | 1 |
| 15 | Cisticola, Lazy | | | 1 | | | | | 1 |
| 16 | Cuckooshrike, Grey | | 1 | | | | | | 1 |
| 17 | Dove, Red-eyed | 1 | 1 | 1 | 1 | | | | 4 |
| 18 | Drongo, Fork-tailed | 1 | 1 | 1 | | | | | 3 |
| 19 | Duck, African Black | | 1 | | | | | | 1 |
| 20 | Firefinch, African | 1 | 1 | 1 | | | | | 3 |
| 21 | Flycatcher, Ashy | | 1 | | | | | | 1 |
| 22 | Goshawk, African | | | | 1 | | | 1 | 2 |
| 23 | Greenbul, Sombre | 1 | 1 | | 1 | | | | 3 |
| 24 | Honeyguide, Scaly-throated | | | | 1 | | | | 1 |
| 25 | Ibis, Hadeda | | | | | 1 | 1 | 1 | 3 |
| 26 | Kingfisher, Brown-hooded | | 1 | | | | | | 1 |
| 27 | Masked-weaver, Southern | 1 | | 1 | | | | | 2 |
| 28 | Mousebird, Red-faced | | | 1 | | | | | 1 |
| 29 | Mousebird, Speckled | | 1 | | | | | | 1 |
| 30 | Nightjar, Fiery-necked | | | 1 | | | | | 1 |
| 31 | Olive-pigeon, African | | 1 | | | | 1 | | 2 |
| 32 | Oriole, Black-headed | | 1 | | 1 | | | | 2 |
| 33 | Pipit, African | | | 1 | | | | | 1 |
| 34 | Prinia, Tawny-flanked | 1 | | 1 | 1 | | | | 3 |
| 35 | Puffback, Black-backed | 1 | 1 | 1 | 1 | | | 1 | 5 |
| 36 | Robin-chat, Cape | | | | 1 | | | | 1 |
| 37 | Robin-chat, Red-capped | | | | 1 | | | | 1 |
| 38 | Saw-wing, Black | | 1 | | 1 | | 1 | 1 | 4 |
| 39 | Scimitarbill, Common | | 1 | 1 | | | | | 2 |
| 40 | Scrub-robin, White-browed | | | 1 | 1 | | | | 2 |
| 41 | Sparrow, South. Grey-headed | | | | | | | 1 | 1 |
| 42 | Spurfowl, Natal | 1 | 1 | 1 | | | | | 3 |
| 43 | Spurfowl, Swainson's | | 1 | 1 | | | | | 2 |
| 44 | Starling, Red-winged | | 1 | | | | | 1 | 2 |
| 45 | Sunbird, Malachite | | 1 | | | | | | 1 |
| 46 | Swallow, White-throated | | | | | 1 | 1 | | 2 |
| 47 | Tchagra, Black-crowned | | 1 | 1 | | | | | 2 |
| 48 | Tinkerbird, Yellow-fronted | | 1 | | 1 | | | | 2 |
| 49 | Turaco, Knysna | | 1 | | 1 | | | | 2 |
| 50 | Turaco, Purple-crested | | 1 | | 1 | | | | 2 |
| 51 | Turtle-dove, Cape | 1 | | 1 | | | | | 2 |
| 52 | Wagtail, Cape | | | | | | | 1 | 1 |
| 53 | Wagtail, Pied | | | | | 1 | | | 1 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 54 | Waxbill, Swee | | | 1 | | | | | 1 |
| 55 | Weaver, Golden | | | 1 | | | | | 1 |
| 56 | White-eye, Cape | | 1 | | 1 | | | | 2 |
| 57 | Whydah, Pin-tailed | | | 1 | | | | 1 | 2 |
| 58 | Widowbird, Red-collared | 1 | | 1 | | | | | 2 |
| 59 | Wood-dove, Emerald-spotted | | 1 | 1 | | | | | 2 |
| 60 | Woodpecker, Olive | | 1 | | | | | | 1 |
| | **SPECIES TOTALS:** | **15** | **34** | **28** | **24** | **4** | **6** | **9** | |

**Table 4.7.1. Bird Species recorded during survey.**

### 4.7.4 Status of red data species which occur or possibly occur on Bruintjieslaagte

The World Conservation Union (IUCN) has defined seven categories of vulnerability (Gärdenfors et al. 1994; IUCN 1994). These are as follows: *"Extinct"; "Extinct in the wild"; "Critically Endangered"; "Endangered"; Vulnerable"; "Near-Threatened"* and *"Least Concern"*. The first two categories are not applicable to this report, but the remaining categories are of relevance here. The Red Data Lists have recently been updated by Taylor, Peacock & Wanless (2015). Four Red data species have been recorded on BLG. Their status on the plantation is discussed in a bit more detail.

#### 4.7.4.1 Critically Endangered Species (CR):

**Blue Swallow *(Hirundo atrocaerulea)***

Justification for Red list classification: This species satisfies the population size criteria for Regionally Critically Endangered (population numbers <250 individuals and a decline of at least 25% is predicted in the next three years).

In the early stages of the Environmental Impact Assessment (EIA) process concerned with the development of this new "Bruintjieslaagte" Dam, Blue Swallows (Hirundo atrocaerulea) had unexpectedly been recorded in the area of the proposed dam site. This was a new locality for this species, as it was previously not known to occur there. This species is Red Data listed as Critically Endangered (Taylor, Peacock & Wanless 2015). This initiated a visit to the site to confirm their presence at the site which was achieved. We were able to establish that Blue Swallows were definitely present at the site. A single bird was seen higher up the valley, and a pair was seen from where we were standing at the proposed dam site. It was possible that the single bird was one of the pair seen later. The conclusion drawn from this visit (Whyte 2017) was that the vegetation communities that will be inundated by a dam constructed at either of the proposed sites, only represent marginal foraging areas for the swallows, and in an ecological context, would represent only a small fraction of the birds' total foraging range. I do not believe that the shrub-lands offer the swallows any suitable habitat for nesting sites, as they prefer climax, mist-belt grasslands, large areas of which still exist at higher altitudes above and adjacent to the dam sites. While we watched these birds at the site, it was these higher level grassland which they were favouring for their foraging. During a later visit by others, four birds were seen - probably two adults and two juveniles (Kammeyer pers. comm.).

This has now become an extremely important site for this species, as the birds have showed a steady decline wherever they have occurred in Mpumalanga. From my personal observations, it would seem that the problem is not a local one, as most pairs in the area regularly raised two broods to the fledgling stage per year. Each year however, fewer birds returned from their migration to the Central African "great lakes" area. It is therefore not suspected that local conditions, or the management of the grasslands, play any part in the

decline, but that some factor elsewhere on their migratory travels has reduced the numbers of these birds.

Hopefully this "Bruintjieslaagte" area will prove to be crucial to the survival of this species in Mpumalanga, and as it seems that there are still fairly large areas of what appears to be suitable habitat, more pairs of the species may be found to occur there.

#### 4.7.4.2 Endangered Species (EN):

**Eagle, Martial,** *Polemaetus bellicosus*.

***Justification for Red list classification:*** *The regional population of the Martial Eagle is estimated at c. 800 mature individuals and is believed to be undergoing continuous population decline of >20% over a period of two generations. In addition, there appears to have been a suspected population size reduction of >30% over the last three generations where the reduction or its causes may not have ceased or may not be understood or may not be reversible. For these reasons it is listed as regionally Endangered.*

An adult (probably a male) was seen upstream of the dam on 24th January 2017. It had recently fed as its crop was full. May be a breeding resident, but would likely have a much wider home range, so might not nest on Bruintjieslaagte. Given the wide ranging habits of this species, the proposed new dam site would represent only a tiny fraction of its home range, so it is unlikely that the dam will have any negative consequences for this species. Indeed, as Monitor lizards (Varanus spp.) make up a large proportion of their prey, it is likely that the dam may prove beneficial.

No other species on the "Endangered" list were recorded during the survey or are known to possibly occur there.

#### 4.7.4.3 Vulnerable Species (V):

No species on the "Vulnerable" list were recorded during the survey, though it is probable that the following two species will be found to occur there:

***Crowned Eagle*** *(Stephanoaetus coronatus).*

***Justification for Red list classification:*** *The regional population of this species meets the criterion for regionally Vulnerable (population size estimated to number <1 000 mature individuals). In addition, the regional population is projected to undergo a continuous decline that may exceed 10% over the next three generations.*

Crowned Eagles are known (from SABAP data) to occur in the wider QDGC, but they were not recorded in these surveys. Their nesting biology in the Lowveld is currently under study by the Crowned Eagle Working Group which is based in Nelspruit. This is a forest species, and though a small patch of riparian forest would be lost to the proposed dam, this species prefers to breed in tall trees higher up the slopes and not in river valley bottoms. Given the wide ranging habits of this species, the proposed new dam site would represent only a tiny fraction of its home range, so it is unlikely that the dam will have any negative consequences for this species.

***Secretary Bird*** *(Sagittarius serpentarius).*

***Justification for Red List classification:*** *The regional population of this species satisfies the criteria for regionally Vulnerable, having undergone a population size reduction of >30% over the past ten years; this reduction and its causes may not have ceased, is not fully understood and may not be reversible. Trends are based are based on data from direct observation, a decline in area of occupancy, extent of occurrence and/or quality of habitat, and levels of exploitation. In addition, the population size is estimated to number <10 000*

*individuals and is projected to undergo a continuing decline of at least 10% within the next three generations.*

This species is a Highveld grassland species which will almost certainly visit this area from time to time, but has not been recorded during these surveys. Riparian or other forest patches do not form part of their normal habitat, so it is unlikely that the dam will have any negative consequences for this species.

**Near-Threatened Species (NT):**

***Half-collared Kingfisher*** *(Alcedo semitorquata).*

***Justification for Red List classification:*** *As is the case for several other river specialists, this species is suspected to have undergone population declines due to a reduction in the extent and quality of its sensitive riverine habitat. Declines appear to have approached 30% over the last ten years, and the regional population is suspected to be fewer than 10 000 mature individuals, occupying a range that maybe .2 000km2, qualifying the species as Near Threatened.*

Half-collared Kingfishers were not recorded during these surveys, but it has been recorded in SABAP's database for the larger QDGC. As its habitat usually is on quiet, flowing streams and rivers, is very likely to occur here. As with the Giant Kingfisher, it is a fish eater, so will probably benefit from the development of the proposed new dam. Many small Tilapia were seen in the existing dam downstream, so the food supply should be ensured, and seepage and releases from the dam will ensure a more consistent flow in the stream below the dam wall.

#### 4.7.4.4 Species of Least Concern (LC).

All other species recorded on BLG fall into this category.

### 4.8 Cultural and Historical Features

### 4.8.1 Description and findings:

An Archaeological Impact Assessment and heritage study was undertaken by Kudzala Antiquity CC in respect of the proposed construction of an irrigation dam on the farm Bruintjieslaagte 465 JT located in Schoemanskloof and within Mbombela Local Municipality in Mpumalanga Province. The study was done with the aim of identifying sites which are of heritage significance on the identified project area and assess their current preservation condition, significance and possible impact of the proposed action. This forms part of legislative requirements as appears in section 38 of the National Heritage Resources Act (Act No. 25 of 1999) and the National Environmental Management Act (NEMA, 17 of 1998). Refer to Appendix 9.

The survey was conducted on foot and with the aid of a motor vehicle in an effort to locate archaeological remains and historic sites, structures and features. An archival study which includes the scrutiny of previous heritage surveys of the area formed the baseline information against which the survey was conducted. It is not within the expertise of this report or the surveyor to comment on possible paleontological remains which may be located in the study area.

A total of seven archaeologically significant sites were recorded during the survey. They were numbered BL1-7 and comprise of Late Iron Age (1650-1820's) stone-walled enclosures and a historic stone-walled enclosure. The Late Iron Age sites are relatively far apart but forms part of a single occupation unit of which two sections (sites BL 2 and BL 4) will be affected by the expected water level of the proposed dam. Upon completion, the water level

of the dam is expected to rise to a level where sites BL2 and BL4 will be submerged. As a result of this the affected sites will have to be properly documented and certain features of these sites archaeologically excavated in an effort to mitigate the expected impact of the dam's construction.

In terms of the archaeological component of the Act (25 of 1999, section 35) seven sites were located and documented and management and mitigation measures recommended in this report. As part of mitigation measures, it is recommended that the affected archaeological sites be mapped and recorded by archaeological excavation, pending a successful permit application from SAHRA. In terms of the built environment in the area (section 34 of the Act) no significant buildings were identified.

The later phases of the Iron Age (AD 1600-1800's) are represented by various tribes including Ndebele, Swazi, BaKoni, and Pedi, marked by extensive stonewalled settlements found throughout the escarpment and particularly around Machadodorp, Lydenburg, Badfontein, Sekhukuneland, Roossenekal and Steelpoort. The BaKoni were the architects of a unique archaeological stone building complex who by the 19th century spoke seKoni which was similar to Sepedi. The core elements of this tradition are stone-walled enclosures, roads and terraces. These settlement complexes may be divided into three basic features: homesteads, terraces and cattle tracks. Researchers such as Mike Evers (1975) and David Collett (1982) identified three basic settlement layouts in this area. Basically these sites can be divided into simple and complex ruins. Simple ruins are normally small in relation to more complex sites and have smaller central cattle byres and fewer huts. Complex ruins consist of a central cattle byre, which has two opposing entrances and a number of semi-circular enclosures surrounding it. The perimeter wall of these sites is sometimes poorly visible. Huts are built between the central enclosure and the perimeter wall. These are all connected by track-ways referred to as cattle tracks. These tracks are made by building stone walls, which forms a walkway for cattle to the centrally located cattle byres.

A combination of these features occurs on a few dispersed sites on the farm Bruintjieslaagte, some of which are located near the proposed construction site of an irrigation dam. Though spatially clustered and some distance separating individual sites, it forms part of one large settlement. The individual sites range from simple enclosures, which consist of single or two concentric stonewalled circles found in isolated small settlements, to complex sites with large central enclosures which have smaller enclosures attached to their outer walls. The walls are built with undressed locally occurring stone. Walls on average are 0.5 to approximately 1 meter high, although as often only the foundation stones are left.

| Site No. | Description | Type of significance | Degree of significance | NHRA heritage resource & rating |
|---|---|---|---|---|
| BL 1 | Historic stone-walled Dwelling | Historic architecture | Archaeological: Medium<br>Historic: Low | Structures (Sect. 34).<br>Medium.<br>**GPB.** |
| BL 2 | LIA stone-walled Enclosures | Archaeological | Archaeological: High<br>Historic: High | Archaeological (Sect. 35).<br>High.<br>**GPA.** |
| BL 3 | LIA stone-walled enclosure | Archaeological | Archaeological: Medium<br>Historic: Medium | Archaeological (Sect. 35).<br>Medium.<br>**GPB.** |
| BL 4 &BL 4B | LIA stone-walled Enclosures | Archaeological | Archaeological: High<br>Historic: High | Archaeological (Sect. 35).<br>High.<br>**GPA.** |
| BL 5 | LIA stone-walled Enclosures | Archaeological | Archaeological: High<br>Historic: High | Archaeological (Sect. 35).<br>High. |

| | | | | |
|---|---|---|---|---|
| | | | | **GPA.** |
| BL 6 | LIA stone-walled enclosures & terraces | Archaeological | Archaeological: High<br>Historic: High | Archaeological (Sect. 35). High.<br>**GPA.** |
| BL 7 | LIA site perimeter | Archaeological | Archaeological: High<br>Historic: High | Archaeological (Sect. 35). High.<br>**GPA.** |

**Table 4.8.1. General description of located sites and field rating.**

***LIA – Late Iron Age: GPA – Generally Protected Areas High/medium significance: GPB – Generally Protected Areas Medium Significance.***

| **Site no.** | **Type of Heritage Resource** | **Integrity of cultural material** | **Preservation condition of site** | **Quality of archaeological/ historic material** | **Quantity of site features** | **Recommended conservation management** |
|---|---|---|---|---|---|---|
| BL 1 | Historic Architecture | Fair | Fair | Archaeology: Not known Historically: Poor | 1 | None. Not located near project area. |
| BL 2 | LIA stone-walled enclosures | Fair | Fair-Good | Archaeology: Fair Historically: Fair | 2 | Older than 60 years, mitigation before destruction |
| BL 3 | LIA stone-walled Enclosure | Poor | Poor | Archaeology: Poor Historically: Poor | 1 | None. Not located in the project area. |
| BL 4 & BL 4B | LIA stone-walled enclosures | Fair | Fair-Good | Archaeology: Fair Historically: Fair | 2 | Older than 60 years, mitigation before destruction |
| BL 5 | LIA stone-walled Enclosure | Fair | Fair | Archaeology: Fair Historically: Fair | 1 | None. Not located in the project area. |
| BL 6 | LIA stone-walled enclosures & Terraces | Fair | Fair-Poor | Archaeology: Fair Historically: Fair | 4 | None. Not located in the project area. |
| BL 7 | LIA site perimeter | Poor | Poor | Archaeology: Poor Historically: Poor | 1 | None. Not located near project area. |

**Table 4.8.2. Site Condition Assessment and Management Recommendations.**

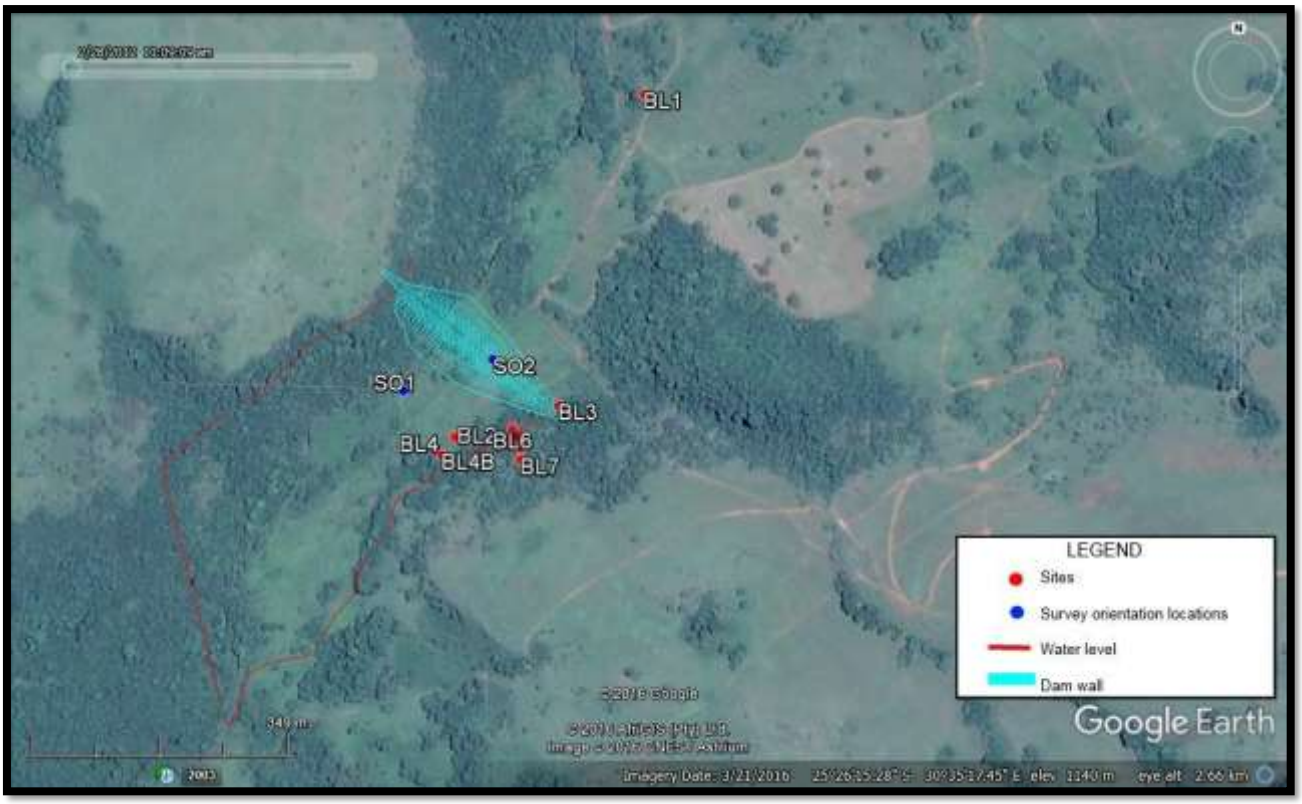



**Figure 4.8.1. Location of sites**

**Figure 4.8.2. Typical stonewall structures.**

### 4.8.2 Summary of findings and recommendations

In terms of the archaeological component of the Act (25 of 1999, section 35) seven sites were located and documented and management and mitigation measures were recommended in this report.

As part of mitigation measures, it is recommended that the affected/ impacted archaeological sites be mapped and recorded by archaeological excavation, pending a successful permit application from SAHRA. In terms of the built environment in the area (section 34 of the Act) no significant buildings were identified. It is not within the expertise of this report or the surveyor to comment on possible palaeontological remains which may be located in the study area.

The bulk of archaeological remains are normally located beneath the soil surface. It is therefore possible that some significant cultural material or remains were not located during this survey and will only be revealed when the soil is disturbed. Should excavation or large scale earth moving activities reveal any human skeletal remains, broken pieces of ceramic

pottery, large quantities of sub-surface charcoal or any material that can be associated with previous occupation, a qualified archaeologist should be notified immediately. This will also temporarily halt such activities until an archaeologist has assessed the situation. It should be noted that if such a situation occurs it may have further financial implications.

## 4.9 Palaeontology

*Palaeontological Impact Assessment for the proposed construction of a dam wall on farm Bruintjieslaagte 465JT, in the Schoemanskloof Valley Mpumalanga Province, Prof Marion Bamford, desktop study, 18 April 2017 (Refer to Appendix 10).*

A desktop palaeontological impact assessment has been requested for the proposed construction of an irrigation dam wall on the farm Bruintjieslaagte 465 JT. The farm is located in the Schoemanskloof valley approximately 40km west of Nelspruit, Mpumalanga.

### 4.9.1 Project location and geological setting

The site for the proposed dam wall lies on ancient rocks of the Timeball Hill Formation, Pretoria Group.

### 4.9.2 Geology

The rocks in this region have been well studied as they are amongst the oldest rocks in the world. To the south east in a northeast – southwest orientation are the oldest rocks, those of the Barberton Greenstone Belt. To the west in a more north-south orientation are the Bushveld Complex rocks of the Chuniespoort and Pretoria Supergroups, while in between are the granite batholiths and plutons of the mid Archean.

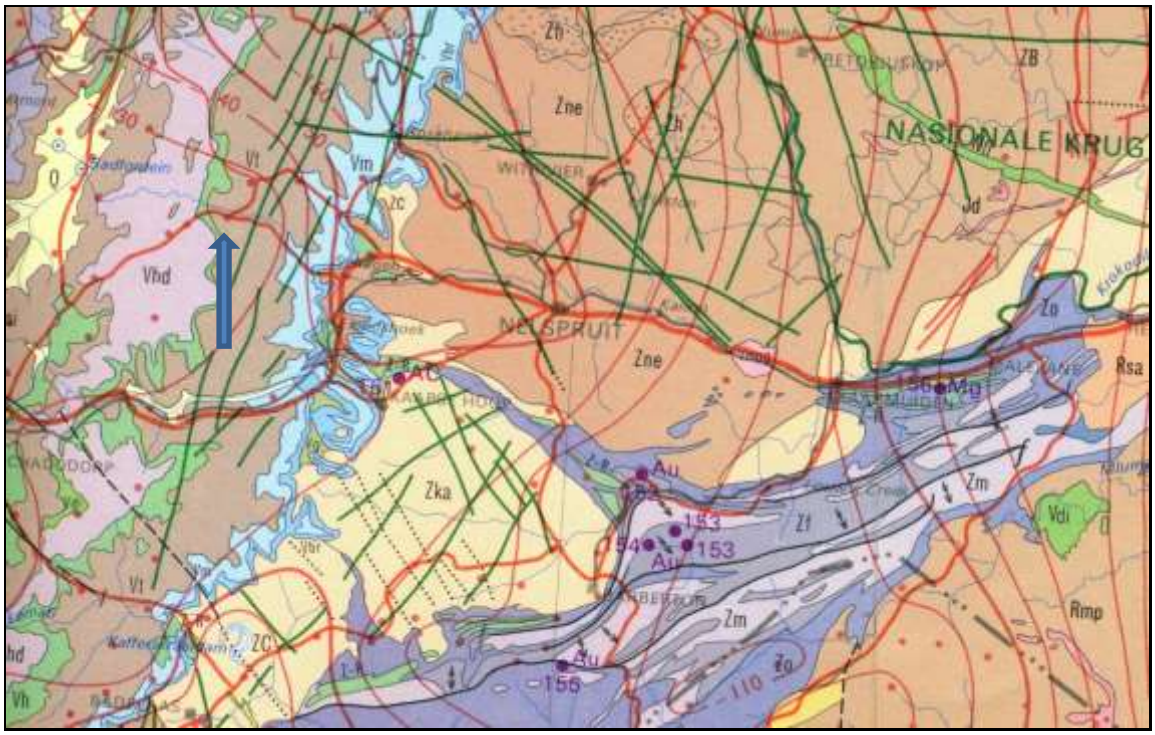



**Figure 4.9.1. Geological map of the area around Schoemanskloof Valley, about 40km to the west of Nelspruit, where the Farm Bruintjieslaagte465JT is located.**

***The approximate location of the proposed project is indicated with the arrow. Map enlarged from the Geological Survey 1: 1 000 000 map 1984.***

### 4.9.3 Palaeontology

(Refer to Figure 4.9.2 for SAHRIS palaeosensitivity map)

To the west are rocks of the Pretoria Group and the site is on the shale, quartzite, conglomerate, breccia and diamictites of the Timeball Hill Formation, Pretoria Group. There are two models proposed for the formation of the Pretoria Group, that of sedimentation in a shallow marine setting or deposition in a closed basin, but there are no invertebrate fossils to support the models. More recent workers have suggested that initially there was a closed basin (Rooihooghte to Strubenkop Formations) followed by alternating transgressive and regressive cycles in a shallow marine setting (Erikssen et al., 2006), or deep marine (Erikssen et al., 2012).

Trace fossils, in the form of microbial mats that have formed on or preserved ripple marks, have been found in the Daspoort and Magaliesberg Formations (underlying and overlying the Silverton Formation, respectively; Erikssen et al., 2012; Parizot et al., 2005) but they do not provide localities. According to the authors the trace fossils would have formed on the shores of the sea (Erikssen et al., 2012), but no body fossils have been found as the rocks are too old. To date no microbial mats have been reported from the Silverton Formation or from the Timeball Hill Formation so the SAHRIS palaeosensitivity map (Figure 4.9.2.) is questionable.

The Black Reef Formation and Malmani Subgroup banded ironstone and dolomites, although formed by the chemical activities of ancient algae, photosynthesis and oxygen production, are not known to have preserved fossil algae near Nelspruit.

Batholiths and plutons do not preserve any fossils as they are igneous in origin. These particular ones, the Mpuluzi and Nelspruit batholiths are also too old to preserve fossils even if any life forms were around as they are over 3300 Ma. At this time there were only single-celled algae or bacteria present (Knoll, 1984).

There are also no records of fossils from the Quaternary alluvium in this region.

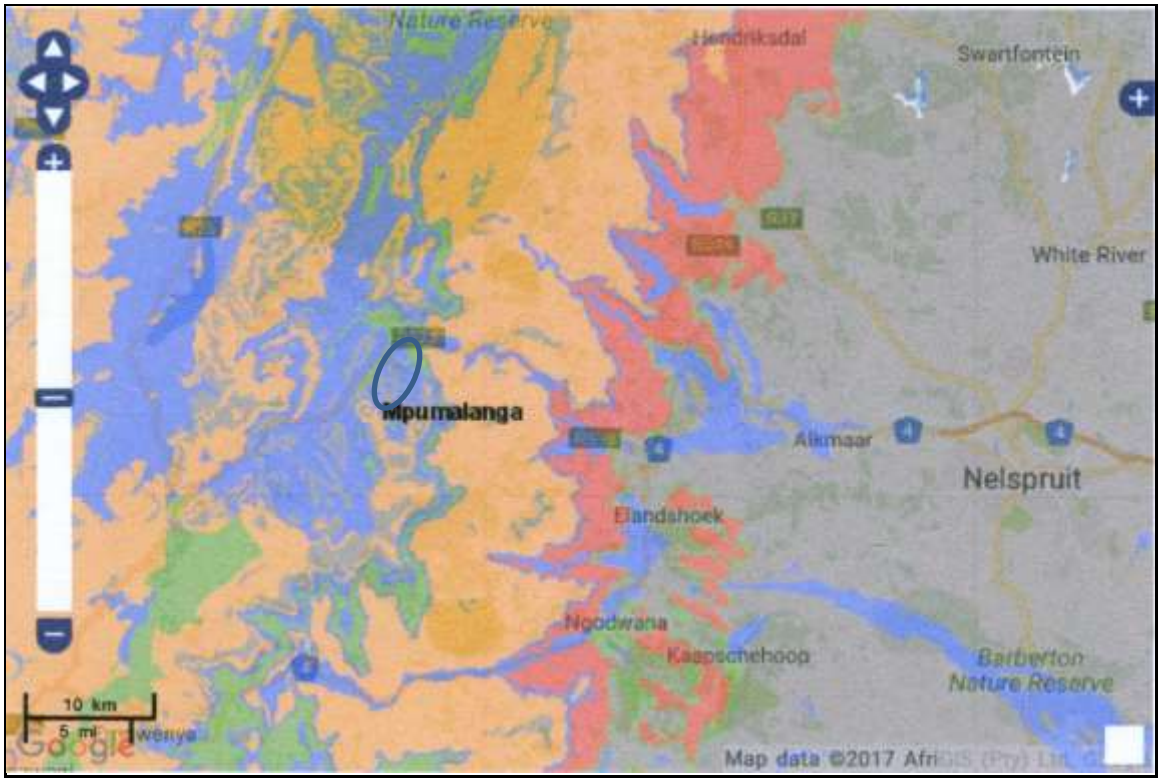



**Figure 4.9.2. SAHRIS palaeosensitivity map.**

***The proposed site for the dam wall is within the oval outline. Colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.***

### 4.9.4 Impact Assessment

The surface activities would not impact on the fossil heritage as the rocks are ancient and volcanic so there are no fossils present. The IMPACT is nil.

Excavation for the roads to the dam wall site would penetrate only a few metres below ground surface at the most so there would be minor deterioration of the surface of sites and an impact on any potential fossils. Therefore the SEVERITY/NATURE of the environmental impact would be L.

There is a very small chance of finding trace fossils on the surface as these have been reported from older and younger Formations, but not where the dam wall would be built. Therefore, the PROBABILITY of affecting any fossils is unlikely or seldom: L

### 4.9.5 Conclusion and Recommendation

It is extremely unlikely that any fossils occur in the sites for the proposed dam wall because mostly the rocks are much too old and volcanic in origin. Although there are rare reports of microbial mats from similar aged rocks, none has been reported from this particular Formation.

As far as the palaeontology is concerned the proposed development can go ahead. Any further palaeontological assessment would be unnecessary.

## 5. Other considerations

### 5.1 Water Use Rights

| Farm | Water ha | $m^3$ /a |
|---|---|---|
| Remaining Extent of Portion 3 of the Farm Mooiland 294 | 20.2 | 161600 |
| Portion 5 of Farm Rietvly 295 | 47.5 | 380000 |
| Remaining Extent of the Farm Mooiland 294 | 21.2 | 169600 |
| Remaining Extent of Portion 9 of Koedoeshoek 301 | 159.1 | 1272800 |
| Remaining extent of Portion 3 of the Farm Geluk 299 | 40 | 320000 |
| Remaining extent of Portion 4 of the Farm Geluk 299 | 44.1 | 352800 |
| Bruintjieslaagte 465 | 7.1 | 56800 |
| Portion 1 of the Farm In De Middel 293 | 2.9 | 23200 |
| Portion 1 of the Farm Geluk 299 | 50 | 400000 |
| Remaining extent of Portion 1 of the Farm Rietvlei 295 | 37 | 296000 |
| Remaining extent of Portion 8 of the Farm Rietvlei 295 | 50 | 400000 |
| Remaining extent of Portion 10 of the Farm Rietvlei 295 | 6.5 | 52000 |
| Portion 2 In de Middel 293 JT | 35.8 | 286400 |
| Remaining extent of Portion 2 of the farm Montrose | 5 | 40000 |
| | **526.4** | **4211200** |

**Table 5.1.1. Water Use Rights.**

A total of 4 211 200 $m^3$/annum of irrigation water use rights are available from the Crocodile River for the Joubert & Seuns farming activities in Schoemanskloof.

As indicated in the hydrology and yield assessment report the mean annual runoff (MAR) from the Devil's Creek for the Bruintjieslaagte dam is 6 600 000 $m^3$/annum and the yield (water available for abstraction) from the proposed 842 000 $m^3$ capacity dam is approximately 1 200 000 $m^3$/annum. There is therefore more than sufficient irrigation water and the storage and abstraction from the Bruintjieslaagte dam will be well within the existing water use rights.

### 5.2 Access to the construction site

There are existing roads from the farm Koedoeshoek over Bruintjieslaagte to the dam construction site. These roads can be utilised but some upgrading maybe be required to accommodate the larger construction vehicles.

## 6. Consideration of alternatives

### 6.1 Locality alternatives

The Devil's Creek, a tributary of the Crocodile River was identified as the potential water source for the dam. There is an existing dam and the Devil's Creek is a perennial river with sufficient flow for both the storage dams. The Bruintjieslaagte farm is owned by the applicant and the dam would provide irrigation water under gravitational pressure for the orchards near the dam. Electricity costs for pumping will be saved.

Please note that the Devil's Creek catchment and the proposed dam site are located mainly on the farm Bruintjieslaagte and that the existing dam is located downstream on the farm Koedoeshoek. These farms are owned by the applicant. The other nearby catchments and

rivers draining towards the Crocodile River are located on property owned by others. It is therefore the preferred and logical option to consider the Devil's Creek for the dam.

Large areas of Citrus orchards, owned by the applicant, are located near the Devil's Creek catchment. It is therefore ideal to have irrigation water under gravitational pressure available for irrigation.

### 6.2 Layout alternatives within the site

Different positions for the dam wall were investigated by the engineers and the applicant. Originally 3 positions were investigated to determine the technical feasibility of the sites i.e. Dam capacity, geotechnical, dam wall construction and overflow structure. The position 3 was discarded and positions 1 and 2 were further investigated. The sites for the 2 dam positions were surveyed and based on this information; position 1 (slightly revised) was confirmed as the preferred technical option.

The ecology for the alternatives 1 and 2 were also investigated. The riparian and terrestrial ecology is similar for the alternative sites and there is no difference in the aquatic ecology. It is therefore not scientifically possible to differentiate between these two alternatives.


**Figure 6.2.1. Alternative dam positions – Alternative Dam P1 was, after investigation, confirmed as the preferred site.**

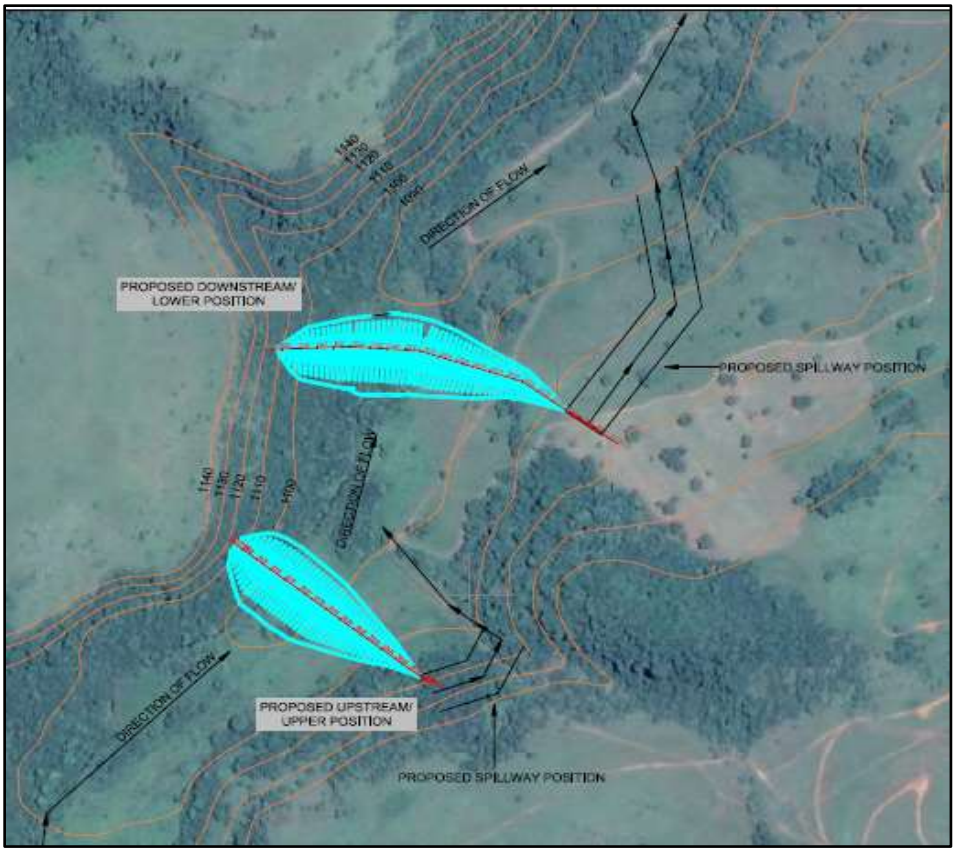



**Figure 6.2.2. Alternative dam wall positions – the upstream position (P1 on other map) is preferred option.**


**Figure 6.2.3. Preferred dam wall site and footprint area- full supply level (FSL).**

### 6.3 No-go alternative

The "no-go" alternative would entail that a dam will not be constructed and that the area included in the application is not transformed into a dam.

Irrigation water is normally abstracted from the Crocodile River for the irrigation of the citrus orchards. With the recent drought and the low water level of the Kwena dam abstraction from the Crocodile River was limited. It is the intention of the applicant to create additional storage capacity for irrigation purposes so that water is available during drought periods.

There is an existing dam downstream from the proposed dam also located on the Devil's Creek. This dam is located on the farm Koedoeshoek 301JT. The Devil's Creek is a perennial river and there is sufficient flow in the river for the existing as well as the proposed dam.

There is insufficient storage capacity in the Inkomati (Crocodile) catchment and the IUCMA, Water Affairs and the Mbombela Municipality is evaluating alternatives for dams to provide higher water security for the area. This private initiative to construct the dam will add approximately 840 000m3 of storage capacity at a cost of approximately R15 million.

Citrus orchards are highly reliant on irrigation and if water is not available for irrigation it would severely affect the size and quality of the crop. Citrus is exported and the quality of the citrus is critical for success in this highly competitive market.

It was found in the specialist studies that water is available in Devil's Creek to support the dam and that the ecological impact of the dam is acceptable.

The opportunity cost (reduced risk of financial loss) of building the dam should exceed the environmental cost (loss of ecology).

The no-go alternative is not preferred or recommended.

## 7. Public Participation Process

### 7.1 Introduction

In order to afford the Interested and Affected Parties (I&AP's) the opportunity to become involved and be part of the process a public participation process, the terms of the 2014 EIA Regulations will be followed.

During the process I&AP's will be given the opportunity to raise issues of concern that would be recorded and included in the Scoping Report and/or the Environmental Impact Assessment Report. All identified and registered I&AP's will be consulted during the public participation process. (Refer to Appendix 3).

### 7.2 Identification of Interested and Affected Parties

At the start of the assessment effort was made to identify all potential interested and affected parties. This included people who may be affected by the activity and includes the ward councillor representative of the community, adjacent- and downstream- landowners, environmental organisations as well as all relevant authorities.

Other parties requesting to be included on the Register for Interested and Affected Parties during the public participation were added. Refer to Appendix 3A for the updated list of I&AP's.

### 7.3 Newspaper and Site Notices

A notice in the prescribed format was placed in the Lowvelder of 17 February 2017. A site notice was placed at the entrance to the Bruintjieslaagte farm (at the Farm Stall) on 19 February 2017. Refer to Appendix 3C.

The notices informed potentially interested and/or affected parties of the process and the opportunity to review the Scoping Report that was available for comment.

### 7.4 Public Participation Meeting

A public participation meeting was not scheduled.

No request for a meeting was received during the Scoping phase and a meeting is not considered necessary at this stage of the process. Public participation and comments received during the EIA period will determine if a public participation meeting has to be scheduled.

### 7.5 Scoping Report

The Scoping report and Plan of Study was made available to the Interested and Affected parties, with the request to register and comment on the Scoping Report. The Scoping Report was made available from 17 March 2017 for a 30-day period. The relevant State departments that may have jurisdiction over the area or type of activity were included in the list of interested and affected parties.

The comments received during the scoping phase have been included in the submission of the Scoping Report to the Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (MDARDLEA). We received only a general comment from Sappi and a request from MTPA to include and provide additional individuals at MTPA with the Scoping Report.

Comments received from MDARDLEA on 16 March 2017 were incorporated in the final Scoping Report. The Plan of Study was revised and it complies with Appendix 2, paragraph 2(i).

The Scoping Report was approved by MDARDLEA on 25 April 2017. Refer to Appendix 12.

### 7.6 EIA Report

The Environmental Impact Assessment (EIA) report comprises an overview of the proposed activity (dam), specialist studies and impact assessment. The specialist studies are attached to the EIA Report.

The environmental impacts of the proposed dam has been assessed and rated and mitigation and management measures were defined.

The EIA report will be made available to the Interested and Affected Parties including State Departments for a minimum 30 days commenting period.

Any comments received will be incorporated into the EIA report to be submitted to the Department for consideration. Direct consultation will take place with the commenting parties to ensure that the concerns or issues are appropriately addressed in the report and that no comments are outstanding.

### 7.7 Environmental Authorisation

On review of the information submitted the Department will either decide to grant or deny Environmental Authorisation for the proposed activity. If authorisation is granted the Environmental Authorisation would include conditions that will apply to the activities.

The Authorisation or decision will be communicated to all registered I&AP's as soon as received from DARDLEA in line with Chapter 2 of the EIA Regulations, 2014.

### 7.8 Schedule of Tasks

| Schedule of Tasks | Timing |
|---|---|
| Specialist studies | January to March 2017 |
| Scoping report for public review | February/March 2017 |
| Submit Scoping Report to MDARDLEA | March 2017 |
| EIA Report available for public review | May/June 2017 |
| EIA Report to MDARDLEA | July 2017 |

### 7.9 Authority Liaison

An application with the relevant documentation was submitted to the Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs on 16 February 2017.

A site visit with the MDARDLEA official, Robyn Luyt was done on 14 March 2017. The Devil's Creek catchment, proposed dam site areas, archaeological features and general site characteristics was viewed and discussed.

The 2014 EIA Regulations also require that both the Scoping and Environmental Impact Assessment Reports must be made available for comment to the Competent (deciding) Authority (CA) (MDARDLEA) at the same time that it is available for public review.

The draft Scoping Report was made available to MDARDLEA on 17 February 2017. MDARDLEA's comments on the draft Scoping Report and Plan of Study for environmental impact assessment was received on 16 March 2017. Comments were incorporated in this final Scoping Report and Plan of Study.

The draft EIR will be made available to MDARDLEA at the same time it is circulated to the I&AP's and the final EIR after conclusion of the public participation process for the EIR.

## 8. Environmental Legislation and Policy

### 8.1 The National Environmental Management Act, 1998 (Act No.107 of 1998)

The Environmental Impact Assessment Regulations, 2014, published under Section 24(5) of the National Environmental Management Act (NEMA) of 4 December 2014 is applicable.

The Scoping and Environmental Impact Assessment is undertaken in terms of the EIA regulations published in the Government Notice No. R982, R983 and R984 under Section 24(5) of the National Environmental Management Act, 1998 (Act No. 107 of 1998).

The activities requiring the Scoping and Environmental Impact Assessment Process are as follows:

R984, 2014, Activity 16: The development of a dam where the highest part of the dam wall, as measured from the outside toe of the wall to the highest part of the wall, is 5 metres or higher or where the high water mark of the dam covers an area of 10 hectares or more.

R.983, 2014: Activity 12 - The construction of: - (iv) dams, where the dam, including infrastructure and water surface area, exceeds 100 square metres in size; where such development occurs - (a) within a watercourse; excluding - (aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour; (bb) where such development activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies; (cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies; (dd) where such development occurs within an urban area; or (ee) where such development occurs within existing roads or road reserves.

R.983, 2014: Activity 19 – The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from (i) a watercourse - but excluding where such infilling, depositing, dredging, excavation, removal or moving a) will occur behind a development setback; (b) is for maintenance purposes undertaken in accordance with a maintenance management plan; or c) falls within the ambit of activity 21 in this Notice in which case that activity applies.

R.983, 2014: Activity 27 - The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for- (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan.

R385, 2014, Activity 12: The development of – (iv) dams, where the dam, including infrastructure and water surface area exceeds 10 square metres in size; (v) weirs, where the weir, including infrastructure and water surface area exceeds 10 square metres in size; ii. Outside urban areas, in: (bb) National Protected Area Expansion Strategy Focus areas; and (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans.

The Scoping and Environmental Impact Assessment application process is required.

As required by the EIA Regulations an environmental authorisation from the Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs would be required before the applicant can commence with the proposed activities.

### 8.2 The National Water Act, 1998 (Act No. 36 of 1998)

Agricultural water use rights are available and will be utilised. Water use licence is required in terms of the National Water Act and the application process would be a process separate from the EIA. Enpact Environmental Consultants was appointed to do the water use licence application.

- Section 21 (b) Storage of water

### 8.3 National Heritage Act

Section 38 of the National Heritage Resources Act, 1999 (Act no.25 of 1999) stipulates that: 38(1)(c) any development or other activity which will change the character of a site – (i) exceeding 5000 $m^2$ in extent would require the approval from the relevant heritage authority.

In addition section 34 (1) No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by relevant provincial resources authority.

Archaeological Impact Assessment and Permit Application and Mitigation in terms of section 34 and 38 of the NHRA are required and will be done.

### 8.4 National Veld and Forest Fire Act, 1998 (Act No. 101 of 1998)

The purpose of this Act is to prevent and combat veld, forest and mountain fires. The applicant must be aware of the duty on owners to prepare and maintain firebreaks irrelevant of the applied for activities or the proposed land use.

### 8.5 Other relevant legislation

**Legislation aimed at the protection of natural resources:**

- The Environment Conservation Act, 1989 (Act No. 73 of 1989)
- The Mpumalanga Conservation Act, 1998 (Act No. 10 of 1998)
- National Forest Act, 1998 (Act No. 84 of 1998)
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
- National Veld and Forest Fire Act, 1998 (Act No. 101 of 1998)
- Promotion of Access to Information Act (Act No. 2 of 2000)

The main objective of the legislation listed above is to ensure a safe and healthy environment as well as the sustainable use of natural resources.

The activity can comply with the mentioned legislation by means of the applicant having to apply for the necessary permits in terms of relevant legislation for the removal of conservation important plants and animals and exercising the conditions as put forward in the applicable legislation.

The Mpumalanga Conservation Act, 1998 and NEMBA, 2004 pertaining to biodiversity were also taken into consideration by the specialist that conducted the biodiversity assessment.

## 9. Environmental Issues and Potential Impacts

### 9.1 Assessment Methodology

The following criteria and rating mechanism is used for the evaluation of significance of potential environmental impacts.

### 9.2 Impact Assessment Rating Criteria

| Nature of Potential Impact | Rating or Category | Description of Impact on the Environment |
|---|---|---|
| **Extent** | Site | Limited to the site and its immediate surroundings |
| | Local | Up to 5km from the project site |

| | | |
|---|---|---|
| | Regional | Beyond 5km of site. Up to 20km radius from the project site |
| | Provincial/National | Will affect beyond 20km from the site |
| **Duration** | Short term | 0 - 5 years. Construction and early operation. |
| | Medium term | Operational phase up to 25 years |
| | Long term | Operational phase longer than 25 years |
| | Permanent | Impact will continue after the operational phase |
| **Intensity** | Very low | Limited damage to a small area. Natural, cultural or social functions or processes are not affected/negligible. |
| | Low | Where the affected environment is altered but natural, cultural or social functions or processes are only marginally affected. |
| | Medium | Natural, cultural or social functions or processes is notably altered but can continue although in a modified way. |
| | High | Where the natural, cultural or social functions or processes are severely altered to the Extent that they temporarily/permanently cease. |
| | Very high | Where the natural, cultural or social functions or processes are altered in such a way that they will permanently cease. Irreparable damage. |
| **Probability** | Unlikely | Less than 20% probability that impact may occur. |
| | Probable | There is a good chance that the impact may occur. |
| | High Probability | It is most likely that the impact will occur, more than 50% probability that impact may occur. |
| | Definite | More than 90% probability that impact may occur. |
| **Significance** | Very low | Impact likely to be very low and mitigation is not required |
| | Low | Impact likely to have little real effect or Mitigation is easily achieved or little will be required. |
| | Medium | Moderate impact and could influence decision if not mitigated or Mitigation is both feasible and fairly easily possible. Modification of the project design or alternative action may be required. |
| | High | Mitigation essential to reduce to acceptable level or Mitigation difficult, time-consuming and/expensive and it may affect the decision to continue or approve. |
| | Very High | No possible mitigation or mitigation is extremely difficult, time consuming and/or expensive. Decision to approve will be affected. |

Environmental impacts are assessed with reference to the nature, extent, duration, intensity and probability of identified impacts. The significance of the potential impact is a qualitative assessment based on the rating of the different criteria. The significance of impacts before and after mitigation will be indicated in the report.

### 9.2 Environmental Impact Assessment

This section assesses the identified environmental aspects and potential impacts of the proposed Bruintjieslaagte dam.

| Impact description | Period | Extent | Duration | Intensity | Probability | Significance pre-mitigation | Significance post mitigation |
|---|---|---|---|---|---|---|---|
| Air pollution – dust | Construction | Local | Short | Low | Probable | Low | Low |
| Air pollution – smoke | Construction | Local | Short | Medium | Probable | Medium | Medium |
| Geology Excavation of soil for dam wall | Construction | Local | Short | Medium | Probable | Medium | Low |
| Riparian vegetation | Construction Operations | Local | Long term | Low | Definite | Low | Low |
| Wetlands | Construction Operations | Local | Long term | Low | Definite | Low | Low |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Invasion of weeds and alien vegetation | Construction Operations | Site | Long | Medium | Probable | Medium | Low |
| Impact on fauna | Construction | Site | Short | Medium | Probable | Low | Low |
| Terrestrial Loss of vegetation | Construction | Site | Long term | Low | Definitely | Low | Low |
| Terrestrial Loss of conservation important flora & fauna | Construction | Site | Long term | Medium | Probable | Medium | Low |
| Terrestrial Invasion of weeds and alien vegetation | Construction Operations | Site | Long term | Medium | Probable | Medium | Low |
| Impact on fauna | Construction | Site | Short | Medium | Probable | Low | Low |
| Avifauna Loss of habitat – avifauna general | Construction Operations | Local | Long term | Low | Probable | Low | Low |
| Avifauna Loss of habitat – blue swallow | Construction Operations | Local | Long term | Low | Probable | Medium | Low |
| Disruption of breeding cycle – blue swallow | Construction | Local | Short | Medium | High | Medium | Low |
| Loss of archaeological site | | | | | | | |
| BL 1 | Construction | Site | Short | Low | Unlikely | Low | Low |
| BL 2 | Construction | Site | Long term | High | Definite | High | Medium |
| BL 3 | Construction | Site | Short | Low | Unlikely | Low | Low |
| BL 4 &BL 4B | Construction | Site | Long term | High | Definite | High | Medium |
| BL 5 | Construction | Site | Short | Low | Unlikely | Low | Low |
| BL 6 | Construction | Site | Short | Low | Unlikely | Low | Low |
| BL 7 | Construction | Site | Short | Low | Unlikely | Low | Low |
| Palaeontology impact | Construction | Local | Long term | Low | Unlikely | Low | Low |
| Socio- Economic Water quality – suspended solids | Construction | Regional | Short | Low | Unlikely | Low | Low |
| Socio-economic Water quantity in Crocodile River | Operations | Regional | Long term | Low | Probable | Medium | Low |
| | | | | | | | |

**Biophysical impacts**

### 9.2.1 Topography

The construction of a dam will require excavation and construction of the 20m high dam wall and overflow structure. This will impact on the site topography but the impact on the topography of catchment area will be small.

### 9.2.2 Air quality

| Nature of Impact | Period | Extent | Duration | Intensity | Probability | Significance before mitigation | Significance after mitigation |
|---|---|---|---|---|---|---|---|
| Air pollution – dust | Construction | Local | Short | Low | Probable | Low | Low |
| Air pollution - smoke | Construction | Local | Short | Medium | Probable | Medium | Medium |

Construction
The removal of the vegetation, excavation and construction activities of the dam wall will cause dust pollution during the construction period.

The impact will be for a short duration and will not result in significant air pollution impact.

Removal of trees and scrubs inside the dam footprint is required. Due to the volume of biomass it is recommended that the trees and scrubs should be burned on site inside cleared footprint area of the dam. Smoke will be generated during the burning period.

The impact will be for a short duration and should not cause significant air pollution.

A few mitigation measures can be implemented to manage the impact and may include:
- Utilise water spraying if and when excessive dust is generated.
- Fast-burn stripped vegetation to minimise smoke generated.

Operations:
There is no air quality impact during the operational period of the dam.

### 9.2.3 Geology and soil conditions

| Nature of Impact | Period | Extent | Duration | Intensity | Probability | Significance before mitigation | Significance after mitigation |
|---|---|---|---|---|---|---|---|
| Excavation of soil for dam wall | Construction | Local | Short | Medium | Probable | Medium | Low |

Construction:
Soil will be excavated to construct the dam wall. The expected volume of earth fill required for the forming of the dam wall is estimated at approximately 220 000m³.

The impact is in dam footprint area and soil will not be excavated from outside the footprint area.

The impact is low and mitigation is that soil will only be excavated from the footprint area

Mitigation measures may include:

- Clear footprint area of vegetation cover and stockpile topsoil separately.
- Utilise topsoil for rehabilitation of transformed areas and to establish vegetation cover on the outside embankment.
- Excavation of material for the dam wall must only be from within in the footprint area of the dam and not from outside areas.

### 9.2.4 Surface Water and Aquatic Ecology impacts and management

Unmodified impact assessment of Nepid Consultants, Dr Rob Palmer

| Potential Impact | Impacts Before Mitigation | | | | | | Impacts After Mitigation | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Construction Phase** | | | | | | | | | | | | |
| | I | D | E | P | Total | Significance | I | D | E | P | Total | Significance |
| Disturbance of Riverine Habitats | -7 | 7 | 2 | 7 | **-112** | **Major (-)** | -7 | 7 | 1 | 7 | **-105** | **Moderate (-)** |
| Impact of Water Quality Deterioration on River Ecosystems | -6 | 2 | 3 | 7 | **-77** | **Moderate (-)** | -1 | 2 | 3 | 7 | **-42** | **Minor (-)** |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Operational Phase** | | | | | | | | | | | | |
| Inundation of Riverine Habitats | -7 | 7 | 1 | 7 | **-105** | **Moderate (-)** | -7 | 7 | 1 | 7 | **-105** | **Moderate (-)** |
| Impact of Altered Water Quality on River Ecosystems | -5 | 7 | 3 | 7 | **-105** | **Moderate (-)** | -4 | 7 | 3 | 7 | **-98** | **Moderate (-)** |
| Impact of Altered Hydrology on River Ecosystems | -6 | 5 | 4 | 7 | **-105** | **Moderate (-)** | -2 | 5 | 3 | 7 | **-70** | **Minor (-)** |
| Impact of Alien and/or Translocated Fish | -4 | 7 | 3 | 7 | **-98** | **Moderate (-)** | -4 | 7 | 3 | 4 | **-56** | **Minor (-)** |
| Bed Armouring | -2 | 7 | 3 | 6 | **-72** | **Minor (-)** | -2 | 7 | 3 | 6 | **-72** | **Minor (-)** |

***I – Intensity; D – Duration; E – Extent; P – Probability***

### 9.2.4.1 Disturbance of Riverine Habitats

*Nature of Impact:* Bulk earthworks and stream diversion during construction are certain to have permanent localised negative impacts on riverine habitats and associated aquatic biota.
Intensity: Complete Destruction (-7).
Duration: Permanent (7).
Extent: Site (2).
Probability: Definite (7).

Significance before mitigation: **Major**

Mitigation:
An Environmental Compliance Office (ECO) should be appointed before any construction starts. The ECO should be responsible for ensuring that contractors and subcontractors comply with the Environmental Management Plan.

Demarcate Work Areas. Construction activities in riparian zones should be minimised, and all support operations should be done outside the riparian zone. A buffer zone of at least 50 m from the edge of the riparian zone is recommended for all activities that are not needed within the riparian zone. The Full Supply Area should be demarcated where necessary, and work activities should be focussed in this area, where feasible

Protect Stream Banks. Reasonable steps should be taken to protect and maintain a riparian corridor on either side of the river channel to ensure that stream banks are not destabilised and to ensure that sediment transport into the river is minimised. All areas close to the river that are disturbed by bulk earthworks during construction should be protected to minimise elevated turbidity in the river. Sediment barriers in the form of berms and/or silt fences made from geotextiles and/or indigenous grasses should be placed strategically around disturbed areas to minimise sediment transport and maintain water quality.

Rehabilitate Disturbed Areas. Rehabilitation of disturbed areas outside the area of inundation should aim to recreate the same mix of habitats, including stream substrates that were present prior to disturbance. Seeding of grasses is a priority, particularly along drainage lines, streams and river banks.

Stream Diversion. The length of the stream diversion should be minimised as far as practically possible.

Significance after mitigation: **Moderate**

### 9.2.4.2 Impact of Water Quality Deterioration on River Ecosystems

*Nature of Impact:*
Turbidity in Devil's Creek is likely to increase during construction and this will impact directly on macroinvertebrates and fish, particularly predatory species that rely on sight for feeding, and indirectly by affecting instream habitats. Concentrations of suspended solids below 80 mg/ℓ suspended solids are unlikely to affect the fish community, but there is evidence to suggest that concentrations between 80 and 400 mg/ℓ have detrimental impacts on fish, and that concentrations exceeding 400 mg/ℓ could seriously harm the fish community (Alabaster and Lloyd 1987). Elevated turbidity also reduces light penetration and this affects primary production, which in turn affects the diversity and abundance of aquatic biota.

Water quality in the river downstream is also expected to deteriorate because of washing and maintenance of equipment and vehicles, stormwater runoff from disturbed areas, as well as discharge from batching plants and accidental spills of hazardous substances, such as hydrocarbons and cement.

Intensity: Critical (-6). Devil's Creek is currently in a largely natural state and turbidity is low and there are numerous macroinvertebrate taxa that are highly sensitive to changes in water quality. Sensitive species of fish, such as *Amphilius* spp. and *Chiloglanis pretoriae,* are also likely to occur downstream of the waterfall, even though they were not recorded in this reach during the baseline survey. Of particular concern is the impact that elevated turbidity during construction could have on *E. cf motebensis,* which appears to be restricted within Devils Creek to the short reach of river between the waterfall and the top end of the existing dam.

Duration: Short-term (2). This impact is expected to persist for the duration of the construction phase.

Extent: Local (3). Increased turbidity and altered water quality during construction is expected extend no further than to the top end of the existing dam, and is therefore rated as local.

Probability: Definite (7).

Significance before mitigation: **Moderate**

Mitigation:
Stream Diversion. Prior to construction a pipeline with sufficient capacity to carry dry season flows should be installed to divert the stream during construction to ensure that turbidity in the river downstream of construction is not impacted. The pipeline should be sized to carry at least 119 ℓ/s, a recommendation based on the 10th percentile natural flows. The outlet of the pipe should be positioned in the river to prevent erosion, and stabilised with gabions if necessary.

Construction Schedule. Construction of the dam should be restricted to the low-flow period (i.e. June to August).

Manage Stormwater. Stormwater runoff from access roads and all construction areas should be directed to buffer zones before reaching rivers and streams. Temporary silt fences downstream of disturbed areas should be constructed, where appropriate. Drainage ditches or sandbag bunds should prevent straight run-off of wash water, especially cement, from entering the rivers or drainage lines.

House Keeping. Standard practises for good housekeeping should be applied. Site tools and equipment such as pumps, compressors and generators should be placed on bermed

impermeable sheeting (e.g. polyethylene or other similar material) to prevent hydraulic fluid or fuel leaks from contaminating soil or ground water.

Washing and Maintenance. No washing of vehicles or equipment should be located within 50 m of the river. Washing and maintenance of vehicles and equipment should be conducted in the areas designated for this purpose.

Refuelling. Diesel/fuel should be stored on an impermeable surface and surrounded by a bund wall, in order to ensure that accidental spillage does not pollute local soil or water resources. No refuelling should be allowed within 50 m of the river.

Significance after mitigation: **Minor**

**Operational Phase**

### 9.2.4.3 Inundation of Riverine Habitats

*Nature of Impact:* There appear to be no fish upstream of the waterfall, where the dam is proposed, but various flow-dependent taxa will be permanently eliminated from the area of inundation, and replaced with taxa that occur in standing water. Taxa that are certain to be impacted include the following:

Flow-dependent macroinvertebrates, such as stoneflies, mountain midges, water pennies, caddisflies, oligoneurid mayflies, flat-headed mayflies and blackflies.
River weed *Sphaerothylax algiformis* (Podostemaceae)
Natal cascade Frog *Hadromophryne natalensis.*

Intensity Complete destruction (-7).

Duration: Permanent (7).

Extent: Site (1). Closure of the proposed dam is expected to inundate 0.7 km of riverine habitat.

Probability: Definite (7).

Significance before mitigation: **Moderate**

Mitigation: No mitigation possible.

Significance after mitigation: **Moderate**

### 9.2.4.4 Impact of Altered Water Quality on River Ecosystems

*Nature of Impact:* Initial filling of the impoundment will increase concentrations of nutrients and organic matter because of the decomposition of inundated vegetation, and this is likely to have negative impacts on biodiversity in the river downstream during the first few years (i.e. the period of maturation). In the long-term impoundments tend to reduce the natural seasonal variation in downstream water temperatures, and may delay early season water temperature increases that provide spawning cues in fish. Temperature variability provides a range of thermal optima, and is considered to be one of the most important factors for maximizing aquatic biodiversity. The low biodiversity commonly reported downstream of impoundments may be attributed, in part, to a reduction in daily and seasonal temperature variation. Furthermore, impoundments create conditions suitable for the

development of phytoplankton and zooplankton, so water discharged downstream tends to support large populations of filter-feeding macroinvertebrates, such as caddisflies and blackflies, that feed on plankton. Water released from the bottom of the impoundment may also contain anoxic compounds, such as elevated manganese, iron and hydrogen sulphide, particularly in summer when the impoundment is likely to stratify.

Intensity: Serious (-5). Devil's Creek supports a high diversity of macroinvertebrates that are sensitive to water quality deterioration. Aquatic biota are particularly sensitive to impacts which occur when water temperatures are high and flows are low (i.e. summer drought).

Duration: Permanent (7). Maturation of an impoundment of this size is likely to take up to five years, after which conditions stabilise, but the long-term changes to water temperature and plankton discharged downstream are permanent.
Extent: Local (3). Altered water quality during operation is expected extend no further than to the top end of the existing dam, and is therefore rated as local.

Probability: Definite (7).

Significance before mitigation: **Moderate**

Mitigation: Clear woody vegetation. Woody vegetation within the Full Supply Level should be removed, where feasible, before closure. The material should be either used or burnt. The ash should be removed as far as feasible to reduce impacts kin nutrient levels.

Significance after mitigation: **Moderate**

#### 9.2.4.5 Impact of Altered Hydrology on Aquatic Ecosystems

*Nature of Impact:* Operation of the proposed dam is expected to have direct negative impacts on the downstream aquatic ecosystem because of alterations in flow patterns, particularly low flows. There are no significant tributaries between the proposed dam and the confluence with the Crocodile River, so all environmental flow requirements will need to be met from releases from the proposed and existing dam. The impoundment will change the timing, size and frequency of flow events in the river downstream. Altered flow patterns lead to changes in sediment dynamics and habitat availability, and this affects species composition and abundance. Sensitive is high because of the high proportion of flow-dependent macro-invertebrates. Various components of the flow regime are expected to be change, as follows:

- **Filling Period.** The time for the impoundment to become operational following closure is a critical period because there is usually a strong motivation not to supply the downstream water requirements until the dam has filled sufficiently to start supplying users (i.e. at least filed the dead storage). Flow stoppage would be highly detrimental to all flow-dependent riverine species.

- **Total Annual Flows.** Total annual flows are expected to decline because of increased evaporation and increased consumptive use associated with the irrigation development.

- **Low flows.** Low flows are likely to be altered, but these could be managed to provide the recommended Environmental Water Requirement (EWR). However, the impacts are likely to be negative if the dam is managed without supplying the EWR.

- **High Flows.** Dams typically reduce or eliminate small to medium-sized high flows, but the proposed dam has a small capacity relative to runoff, so high flows are unlikely to be affected significantly.

- **Seasonal Flow Patterns.** Dams typically delay or even eliminate seasonal variation in downstream flow, because the impoundments first need to fill before they can spill. The consequences of unseasonal releases on river flora and fauna are unknown, but are likely to be detrimental because reproductive and other life cycle cues may be affected. Little change in flow seasonality is anticipated if the EWR is supplied, but detrimental impacts can be expected if the EWR is not provided. The timing of large floods is unlikely to be delayed because of the limited capacity of the dam.

Intensity: Critical (-6). Devil's Creek supports a high proportion of flow- dependent taxa that are sensitive to changes ion flow patterns.

Duration: Project Life (5). The duration of the filling period is unknown, but is likely to take several months. However, altered flow patterns are likely to persist for the duration of irrigation use (i.e. project life).

Extent: Municipal (4). Hydrology is likely to be altered at least as far as the confluence with the Crocodile River (i.e. 5.5 km), but there could also an impact on water availability further downstream. Under natural conditions Devil's Creek Catchment would have contributed, on average, about 3% of flow to the Crocodile River at their confluence, but under present conditions the proportional contribution from Devils Creek Catchment has increased because of use in the Crocodile River catchment.

Probability: Definite (7).

Significance before mitigation: **Moderate**

Mitigation:
Environmental Flow Requirements.
Environmental flows as specified in Table 5-7 should be released at all times from the impoundment, including the period when the impoundment first fills. During normal rainfall years (non-drought), the recommended monthly low flows for the 50% time of exceedance should be implemented and monitored at J-02. This means that the minimum flows should vary seasonally between 0.036 m3/s (September), and 0.106 $m^3$ /s (in February). During drought years, the recommended monthly low flows for the 90% time of exceedance should be implemented and monitored at J-02. This means that the minimum flows during drought periods should vary seasonally between 0.017 $m^3$/s (September), and 0.046 $m^3$/s (in February). The natural seasonal flow variability should be maintained, and in particular, winter low flows should not exceed summer low flows.

Significance after mitigation: **Minor**

#### 9.2.4.6 Impact of Alien and/or Translocated Fish

*Nature of Impact:*
The proposed impoundment could enable alien fish species, such as *Micropterus salmoides* to become established in Devil's Creek, and this could impact on macroinvertebrates, as well as indigenous fish downstream of the waterfall. Furthermore, indigenous species that have a preference for standing water, such as *Coptodon rendalli*, are expected to colonise the impoundment, as they have done in the existing impoundment. The mechanism of such colonisations is assumed be in the form of fish eggs attached to waterfowl.

Intensity:
Large (-4). There are currently no records of fish in Devil's Creek upstream of the waterfall, so the environmental sensitivity is rated as high.

Duration: Permanent (7).

Extent: Local (3).
Alien and/or translocated fish that are expected to colonise the new impoundment could move upstream as far as the base of the Mountain Headwaters, which is about 3 km.
However, translocated species with a preference for standing water are likely to remain in the impoundment, and not move upstream.

Probability:
Highly probable (6). There is a high probability that *Coptodon rendalli*, or other indigenous species with preference for standing water, will colonise the impoundment.

Significance before mitigation: **Minor**

Mitigation:
Environmental Awareness. Awareness of the potential problems of introducing fish into the new impoundment should be fostered among staff working at the dam as well as the irrigation scheme. The aim of the awareness programme should be to prevent introductions of unwanted aliens taking place. It should be noted that translocation of fish is regulated by provincial and national legislation.

Significance after mitigation: **Minor**

#### 9.2.4.7 Bed Armouring

*Nature of Impact:*
The proposed dam is expected to have a direct negative impact on the quality of downstream aquatic habitats, as water released from the dam is likely to be clear because of sedimentation within the reservoir. Clear water has the capacity to carry more sediment than turbid water. The release of clear water is therefore likely to increase erosion in the river downstream of the dam, a process referred to as "bed armouring". Geomorphological and biotope diversity in the river directly downstream of the dam is therefore likely to be reduced. Particle size diversity and the size and diversity of tributary bars are likely to be reduced. These changes are likely to lead to an impoverished section of river because reduced particle size diversity reduces the range of habitats available for plants, invertebrates and fishes, and this is likely to lead to reduced biological diversity and abundance. Furthermore, wave action and fluctuating water levels are also likely to lead to armouring of the impoundment shoreline.

Intensity:
Minor (-2).
The river downstream of the proposed dam has a steep gradient and is geomorphologically stable.

Duration: Permanent (7).

Extent: Local (3).
Altered sediment transport is expected extend no further than to the top end of the existing dam, and is therefore rated as local.

Probability: Highly probable (6).

Significance before mitigation: **Minor**

Mitigation: No mitigation feasible.

Significance after mitigation: **Minor**

### 9.2.5 Riparian and Wetlands

| Nature of Impact | Period | Extent | Duration | Intensity | Probability | Significance before mitigation | Significance after mitigation |
|---|---|---|---|---|---|---|---|
| Riparian vegetation | Construction Operations | Local | Long term | Low | Definite | Low | Low |
| Wetlands | Construction Operations | Local | Long term | Low | Definite | Low | Low |
| Alien invasive plant species | Operations | Local | Long term | Medium | Probable | Medium | Low |
| Loss of habitat – blue swallow | Construction Operations | Local | Long term | Low | Probable | Medium | Low |
| Disruption of life-history cycle – blue swallow | Construction | Local | Short | Medium | High | Medium | Low |

**Impact Assessment as abstracted from Emross Consulting and Taylor Environmental report, Dr L R Taylor and Anthony Emery**

#### 9.2.5.1 Impact on the riparian vegetation

Although the VEGRAI Level 3 score of 76,1% (EC of high C, Moderately Modified) for the right bank riparian vegetation and probable EC of B (Largely Natural with few modifications) for the left bank implies high biodiversity and good ecosystems functioning, and should therefore be protected (classified as CBA Optimal and Irreplaceable), the footprint (wetted area) of site DP1 includes only 14,7ha (0,04%) of the total catchment area of 34510ha. The fact that the catchment above the dam is considered to be undisturbed and natural, and hence includes riverine ecosystems in good order, suggests that the impact of damming site and losing riparian vegetation may be considered to be of local extent, low magnitude, long term duration and low significance.

Mitigation Measures: This reasoning, however, can only be justified on condition that in terms of mitigation, however, it is essential that the entire catchment above site DP1 be maintained in a near-unmodified to unmodified state in the future. It should be a requirement of the Environmental Authorization for the present project that this be the case. In order to

mitigate against the loss of plants of conservation- importance that are present on the footprint of site DP1, it is essential that a conservation-important plant (*Eucomis autumnalis* and *Encephalartos humulis*, amongst others) walk-through and rescue plan be established and implemented prior to construction.

#### 9.2.5.2 Impact on the wetlands and wetland ecosystem services

Similarly to that expressed in Section 9.2.5.1 above, although the Wetland-IHI PES score for the five permanent, seasonal and temporary wetlands (4,1ha) at site DP1 is 92,4%, with an EC of A, and described as unmodified and natural, and should therefore be protected (classified as CBA Optimal and Irreplaceable), the footprint (wetted area) of site DP1 includes only 14,7ha (0,04%) of the total catchment area of 34510ha.

The impact on the wetlands and wetland ecosystems services associated with site DP1 and the Devil's Creek River may thus also be considered to be of local extent, low magnitude, long term duration and low significance.

Mitigation Measures: Once again, however, although significance of the wetlands may be reduced due to the relative size of the catchment compared to the wetted area (footprint) of the dam site, it is important that wetland ecosystem services and function be maintained in a good state. Consideration must be given to erosion control, biodiversity maintenance and high carbon storage, as well as to the maintenance of base flow throughout the year, where possible. The exception should only be during drought conditions. Clearly natural flood attenuation services should also be maintained and protected and the hydrological regime must not be significantly altered, other than what the new dam and its normal maintenance and management may create.

It is recommended that (1) strict erosion control measures be implemented during construction, (2) that all areas exposed during construction that are not part of the wetted area be rehabilitated with indigenous vegetation as soon as possible after use and that the hardening of surfaces be avoided as far as possible. Such areas must be cleared and loosened after use and rehabilitated with indigenous vegetation.

#### 9.2.5.3 Impact of the potential for increased invasion by alien plant species

Eight species alien plants, including Solanum mauritianum (Bugweed), Rubus cuneifolius (American Bramble), Bromus catharticus (Rescue Grass), Arundo donax(Giant Reed), *Phaeoceros laevis* (Smooth hornwort), *Persicaria lapathifolia* (Pale Persicaria), *Ricinus communis* (Castor-oil Bush) and *Lantana camara* (Lantana) were found along the three transects on site. There is no doubt that there will be other alien plants on site and in the area. Given the potential for the expansion of the stands of these alien plants on site and in the region as a result of the increased wetted area due to the presence of the proposed dam, the impact of the potential for the increased invasion by alien plant species at the dam site and the Devil's Creek may be considered to be of local extent, medium magnitude, long term duration and medium significance.

Mitigation Measures: An alien plant eradication program must be implemented for the Devil's Creek and its catchment area. A program of this nature also serves as an "offset" action to improve the biodiversity, ecological state and ecosystems services condition of the river system.

#### 9.2.5.4 Impact of loss of habitat for conservation-important fauna and disruption to life-history cycles (this impact is also addressed in the Avifauna section)

The presence of *H. atrocaerulea* (Blue Swallow) and immediately upstream of the site must be considered as a *red flag* and compelling reasons need to exist for the case of accepting site DP1 as the preferred and only site for the proposed dam. The fact that three visits were made by a total of seven persons in December 2016, January 2017 and March 2017 to validate the first sighting in November 2016 testifies to the importance of the sighting as a new locality for the species. Following discussion with officials of the MTPA it was agreed that there are sufficient areas upstream of site DP1 for the birds to forage and find suitable nesting and breeding sites to obviate the loss of foraging areas and nesting and breeding sites on the footprint of site DP1. Hence the impact of loss of habitat for conservation-important fauna may be considered to be of site-specific extent, medium magnitude, long term duration and medium significance.

**Mitigation Measures**: It is important that a short term project with appropriate scale of funding be initiated to determine the population size, number of breeding pairs, foraging areas and nesting and breeding sites of the Blue Swallow in the area. This information must be used to establish a monitoring program for the Blue Swallows and must be incorporated into the Environmental Management Program.

Further to this, and to be included in the recommendations, no construction must be allowed during the Blue Swallow breeding season between September and March in any given year.

### 9.2.6 Terrestrial ecology – flora and fauna (excluding avifauna)

| Nature of Impact | Period | Extent | Duration | Intensity | Probability | Significance before mitigation | Significance after mitigation |
|---|---|---|---|---|---|---|---|
| Loss of vegetation | Construction | Site | Permanent | Low | Definitely | Low | Low |
| Loss of conservation important flora & fauna | Construction | Site | Permanent | Medium | Probable | Medium | Low |
| Invasion of weeds and alien vegetation | Construction Operations | Site | Long | Medium | Probable | Medium | Low |
| Impact on fauna | Construction | Site | Short | Medium | Probable | Low | Low |

The terrestrial component (other than wetlands and riparian) of the dam footprint area (full supply level – FSL) is small (<5ha) and mainly restricted to the upper eastern area of the dam site (right bank). A section is grassland whilst the rest on the eastern boundary of the FSL is a rocky outcrop with large trees of which only a small section will be affected. Although Lydenburg Montane Grasslands (LMG) is classified as Vulnerable the Bruintjieslaagte farm and dam area is classified as "critical biodiversity" in the MBSP.

Conservation important plant species that may occur on site are listed in the Emross Consulting and Taylor Environmental Report. Of all these plant species only *Eucomis autumnalis* (Common Pineapple Lily) was identified on the site.

In order to mitigate against the loss of plants of conservation- importance that are present on the footprint, it is essential that a conservation-important plant (*Eucomis autumnalis* and

*Encephalartos humulis*, amongst others) walk-through and rescue plan be established and implemented prior to construction.

According to the Species Status Report, as derived from the Mpumalanga Parks and Tourism Agency (MTPA) mammals *Mellivora capensis* (Honey Badger) (Endangered, EN) and *Ourebia ourebi ourebi* (Oribi) (Near Threatened, NT) could be present on the farm but no honey badgers or oribis were observed during site visits. A significant number of burrows that may be that of *Orycteropus afer* (Aardvark) were present throughout site.

It is possible that construction activities, including the generation of dust, noise due to the use of machinery and the spillage of chemical pollutants to the environment may have an effect on resident biota.

Mitigation Measures:

- Allow animals to escape from construction area and don't kill snakes, aardvark or any other animal found. ECO to assist in capturing of animals found on the construction site and releasing of animals outside construction area.
- ECO (ecologist) to survey site and identify, rescue and relocate conservation important plant species prior to start of construction.
- ECO to identify trees and other plant species and obtain the required permits for destruction or relocation from the DAFF or MMTPA.
- Ahead of any construction or excavation, topsoil and vegetation must be stripped from the required footprints and kept to be spread over areas that need to be rehabilitated on completion of construction.
- Boundaries of construction area must be demarcated before start of construction.
- Construction camp must be located at least 50m away from any stream.
- After construction period the construction camp area must be cleared from all concrete, buildings and hardened surface and rehabilitated. Area must be ripped, topsoil spread and indigenous grass replanted (topsoil with grass residue should re-establish vegetation cover but if not hydro seeding must be done).
- Fuel for construction vehicles must be stored in tanks on concrete bunded areas.
- Construction vehicles must be refuelled in a dedicated area on a hardened surface where spillage of diesel can be contained.
- Clean and rehabilitate accidental spillage of fuel or lubricants.
- Monitor dust generated during construction and movement of vehicles and use water spraying to reduce dust if required.
- Strict measures must apply where materials in powder form, such as cement, lime, concrete additives, etc. are stored, handled or used, and for the proper disposal of packaging of any such materials.
- Limit disturbances to the demarcated construction sites and footprints.
- The collection of firewood or any other plant resources by construction staff is prohibited.
- Temporary access and construction roads must not result in the removal of trees. Make use of existing roads and tracks. Must be strictly monitored, the route approved by the ECO and vegetation clearance kept to a minimum. The area must be appropriately rehabilitated afterward.
- All reasonable steps to avoid spreading of any fires must be taken.
- Burning of woody material must be done inside the footprint area of the dam.
- Engineering designs, methods and specifications should be strictly adhered to.
- Target and control alien invasive plants at the construction site and dam area in general.

### 9.2.7 Avifauna including Blue Swallow

| Nature of Impact | Period | Extent | Duration | Intensity | Probability | Significance before mitigation | Significance after mitigation |
|---|---|---|---|---|---|---|---|
| Loss of habitat – avifauna general | Construction Operations | Local | Long term | Low | Probable | Low | Low |
| Loss of habitat – blue swallow | Construction Operations | Local | Long term | Low | Probable | Medium | Low |
| Disruption of breeding cycle – blue swallow | Construction | Local | Short | Medium | High | Medium | Low |

#### 9.2.7.1 Summary

**Dr Ian Whyte stated in his report the following**: The general conclusion is that, in the broader perspective, the impacts on the avifauna of the area will be low. Some species, particularly those dependent upon the indigenous riparian vegetation may have small numbers displaced. These include the Apalises, Cape batis, Greenbacked Camaroptera, Ashy Flycatcher, Terrestrial Brownbul, Grey Cuckooshrike, Yellow-fronted Tinkerbird, Knysna Turaco, These species are common to relatively common but none, given the small size of the impacted area, are at any particular risk and populations could be expected to remain intact in the area.

Other species may benefit from the presence of the dam and the stabilised flow in the downstream area of the new dam. These include African Black Duck, Pied Wagtail, the Kingfishers, Egyptian Geese, White-throated and Wire-tailed Swallows.

The Red Data species are also believed to be at no particular risk - the Blue Swallow being the main species to be considered here. The mist-belt grasslands appear to be in a pristine state, which might be expected if Blue Swallows are still to be found there, so the habitat is not a cause for concern. The major consideration is the disturbance factor when these birds return from migration. As mentioned in the section on Mitigation Measure, I believe that it is crucial that the construction work on the dam wall, and the disturbances associated with that work, must be completed by mid-August.

#### 9.2.7.2 Mitigation Measures

I believe that there are only limited options for the implementation of meaningful mitigation measures. The construction phase will be high impact in a limited area over a limited time period, but the following two measures can be implemented. The first of these will be crucial.

3. The construction phase (and therefore the disturbance) must be entirely complete before the advent of summer and the arrival of the migrant species, particularly the Blue Swallows which will arrive in mid-August.
4. The pushed out trees and bush should be burned inside the dam before inundation to prevent further impacts and disturbances away from the dam site.

#### 9.2.7.3 Impact on Endangered Species

**Critically Endangered Species (CR):**
***Blue Swallow (Hirundo atrocaerulea)***
*Justification for Red list classification: This species satisfies the population size criteria for Regionally Critically Endangered (population numbers <250 individuals and a decline of at least 25% is predicted in the next three years).*

In the early stages of the Environmental Impact Assessment (EIA) process concerned with the development of this new "Bruintjieslaagte" Dam, Blue Swallows *(Hirundo atrocaerulea)* had unexpectedly been recorded in the area of the proposed dam site. This was a new locality for this species, as it was previously not known to occur there. This species is Red Data listed as Critically Endangered (Taylor, Peacock & Wanless 2015). This initiated a visit to the site to confirm their presence at the site which was achieved. We were able to establish that Blue Swallows were definitely present at the site. A single bird was seen higher up the valley, and a pair was seen from where we were standing at the proposed dam site. It was possible that the single bird was one of the pair seen later. The conclusion drawn from this visit (Whyte 2017) was that the vegetation communities that will be inundated by a dam constructed at either of the proposed sites, only represent marginal foraging areas for the swallows, and in an ecological context, would represent only a small fraction of the birds' total foraging range. I do not believe that the shrub-lands offer the swallows any suitable habitat for nesting sites, as they prefer climax, mist-belt grasslands, large areas of which still exist at higher altitudes above and adjacent to the dam sites. While we watched these birds at the site, it was these higher level grassland which they were favouring for their foraging. During a later visit by others, four birds were seen - probably two adults and two juveniles (Kammeyer *pers. comm*.).

This has now become an extremely important site for this species, as the birds have showed a steady decline wherever they have occurred in Mpumalanga. From my personal observations, it would seem that the problem is not a local one, as most pairs in the area regularly raised two broods to the fledgling stage per year. Each year however, fewer birds returned from their migration to the Central African "great lakes" area. It is therefore not suspected that local conditions, or the management of the grasslands, play any part in the decline, but that some factor elsewhere on their migratory travels has reduced the numbers of these birds.

Hopefully this "Bruintjieslaagte" area will prove to be crucial to the survival of this species in Mpumalanga, and as it seems that there are still fairly large areas of what appears to be suitable habitat, more pairs of the species may be found to occur there.

**Eagle, Martial, (*Polemaetus bellicosus)*.**
*Justification for Red list classification: The regional population of the Martial Eagle is estimated at c. 800 mature individuals and is believed to be undergoing continuous population decline of >20% over a period of two generations. In addition, there appears to have been a suspected population size reduction of >30% over the last three generations where the reduction or its causes may not have ceased or may not be understood or may not be reversible. For these reasons it is listed as regionally Endangered.*

An adult (probably a male) was seen upstream of the dam on 24th January 2017. It had recently fed as its crop was full. May be a breeding resident, but would likely have a much wider home range, so might not nest on Bruintjieslaagte. Given the wide ranging habits of this species, the proposed new dam site would represent only a tiny fraction of its home range, so it is unlikely that the dam will have any negative consequences for this species. Indeed, as Monitor lizards (Varanus spp.) make up a large proportion of their prey, it is likely that the dam may prove beneficial.

**Vulnerable Species (V):**
No species on the "Vulnerable" list were recorded during the survey, though it is probable that the following two species will be found to occur there:

**Crowned Eagle (*Stephanoaetus coronatus*).**
*Justification for Red list classification: The regional population of this species meets the criterion for regionally Vulnerable (population size estimated to number <1 000 mature individuals). In addition, the regional population is projected to undergo a continuous decline that may exceed 10% over the next three generations.*

Crowned Eagles are known (from SABAP data) to occur in the wider QDGC, but they were not recorded in these surveys. Their nesting biology in the Lowveld is currently under study by the Crowned Eagle Working Group which is based in Nelspruit. This is a forest species, and though a small patch of riparian forest would be lost to the proposed dam, this species prefers to breed in tall trees higher up the slopes and not in river valley bottoms. Given the wide ranging habits of this species, the proposed new dam site would represent only a tiny fraction of its home range, so it is unlikely that the dam will have any negative consequences for this species.

***Secretary Bird*** *(Sagittarius serpentarius).*
Justification for Red List classification: *The regional population of this species satisfies the criteria for regionally Vulnerable, having undergone a population size reduction of >30% over the past ten years; this reduction and its causes may not have ceased, is not fully understood and may not be reversible. Trends are based are based on data from direct observation, a decline in area of occupancy, extent of occurrence and/or quality of habitat, and levels of exploitation. In addition, the population size is estimated to number <10 000 individuals and is projected to undergo a continuing decline of at least 10% within the next three generations.*

This species is a Highveld grassland species which will almost certainly visit this area from time to time, but has not been recorded during these surveys. Riparian or other forest patches do not form part of their normal habitat, so it is unlikely that the dam will have any negative consequences for this species.

**Near-Threatened Species (NT):**
***Half-collared Kingfisher*** *(Alcedo semitorquata).*
Justification for Red List classification: *As is the case for several other river specialists, this species is suspected to have undergone population declines due to a reduction in the extent and quality of its sensitive riverine habitat. Declines appear to have approached 30% over*

*the last ten years, and the regional population is suspected to be fewer than 10 000 mature individuals, occupying a range that maybe .2 000km2, qualifying the species as Near Threatened.*

Half-collared Kingfishers were not recorded during these surveys, but it has been recorded in SABAP's database for the larger QDGC. As its habitat usually is on quiet, flowing streams and rivers, is very likely to occur here. As with the Giant Kingfisher, it is a fish eater, so will probably benefit from the development of the proposed new dam. Many small Tilapia were seen in the existing dam downstream, so the food supply should be ensured, and seepage and releases from the dam will ensure a more consistent flow in the stream below the dam wall.

**9.2.7.4 Status and impact on birds recorded in the Bruintjieslaagte dam area:**

**Unless specifically stated, the dam is expected to have no, or negligible impact on the species below.**

| |
|---|
| Apalis, Bar-throated, *Apalis thoracica.* Common breeding resident occurring especially in the indigenous forest patches and riparian vegetation. Replaces the next species at higher altitudes. |
| Apalis, Yellow-breasted, *Apalis flavida.* Common breeding resident throughout especially in the indigenous forest patches and riparian vegetation. Replaces the next species at lower altitudes. |
| Barbet, Black-collared, *Lybius torquatus.* Common breeding resident found in a wide variety of habitats. |
| Barbet, Crested, *Trachyphonus vaillantii.* Common breeding resident, found in a wide variety of habitats. |
| Batis, Cape, *Batis capensis.* Common breeding resident found in the forest patches and riparian areas, but due to the general availability of sufficient similar habitats close by, is unlikely to be affected by the development of the proposed dam. |
| Bee-eater, European, *Merops apiaster.* Common non-breeding Palearctic migrant present in summer. An aerial forager and so is not dependent upon BLG's habitats |
| Boubou, Southern, *Laniarius ferrugineus.* Common breeding resident. Favouring riparian zones and forest patches, but due to the general availability of sufficient similar habitats close by, is unlikely to be affected by the development of the proposed dam. |
| Brownbul, Terrestrial, *Phyllastrephus terrestris.* Fairly common breeding resident. Favours riparian zones and forest patches, but due to the general availability of sufficient similar habitats close by, is unlikely to be affected by the development of the proposed dam. |
| Bulbul, Dark-capped, *Pycnonotus tricolor.* A very common breeding resident occurring in all habitats. |
| Bush-shrike, Olive, *Telophorus olivaceus.* Rather uncommon breeding resident. Favours riparian and forest patches, but due to the general availability of sufficient similar habitats close by, is unlikely to be affected by the development of the proposed dam. |
| Bush-shrike, Orange-breasted, *Telophorus sulfureopectus.* Common breeding resident. Favours forest patches and savanna. |
| Buzzard, Jackal, *Buteo rufofuscus.* Uncommon breeding resident. Favours high altitude grasslands and savanna. |
| Camaroptera, Green-backed, *Camaroptera brachyuran.* Very common breeding resident. Favours forest and riparian patches and savanna. Unlikely to be affected by the development of the proposed dam. |
| Canary, Cape, *Serinus canicollis.* Common breeding resident. Favours savanna and |

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| grassland. |
| Probably at the edge of its range here as it is usually found at higher altitudes. |
| Canary, Yellow-fronted, *Crithagra mozambicus.* A very common breeding resident. Favours savanna and grassland. |
| Cisticola, Lazy, *Cisticola aberrans.* Rather uncommon breeding resident. Favours rocky slopes in savanna and grassland. |
| Cuckoo, African Emerald, *Chrysococcyx cupreus.* Fairly common breeding intra-African migrant occurring in the indigenous forest patches and riparian vegetation. A brood parasite of Camaropteras. |
| Cuckoo, Black, *Cuculus clamosus.* An uncommon breeding intra-African migrant occurring in the indigenous forest patches and riparian vegetation. A brood parasite of the Boubou shrikes. |
| Cuckoo, Red-chested, *Cuculus solitaries.* Common and conspicuous breeding intra-African migrant. Primarily a brood parasite of the Cape Robin. |
| Cuckooshrike, Grey, *Coracina caesia.* Probably a rather rare breeding resident occurring especially in the indigenous forest patches with tall trees. Probably at the edge of its range here as it is usually found at higher altitudes. |
| Dove, Cape Turtle-, *Streptopelia capicola.* Common and widespread breeding resident. |
| Dove, Emerald-spotted Wood-, *Turtur chalcospilos.* Common and widespread breeding resident. |
| Dove, Laughing, *Spilopelia senegalensis.* Common and widespread breeding resident. |
| Dove, Red-eyed, *Streptopelia semitorquata.* Common breeding resident, usually associated with tall trees |
| Drongo, Fork-tailed, *Dicrurus adsimilis*. Common breeding resident. Favours forest and riparian patches and savanna. |
| Duck, African Black, *Anas sparsa.* A rather uncommon breeding resident species. Usually found on quiet rivers and occasionally also on dams. Suitable habitat for this species exists on Bruintjieslaagte, but it may benefit from the construction of the new dam which would in all likelihood ensure a constant flow of water down to the existing dam. |
| Eagle, Martial, *Polemaetus bellicosus* (EN). A rare and endangered raptor (see the "Red Data" section below.). An adult (probably a male) was seen upstream of the dam on 24th January 2017. May be a breeding resident, but would have a wide home range, so might not nest on Bruintjieslaagte. |
| Firefinch, African, *Lagonosticta rubricata.* Common breeding resident. Favours rank grass at forest fringes, riparian patches and savanna. |
| Flycatcher, Ashy, *Muscicapa caerulescens.* An uncommon breeding resident. Favours forest and riparian patches, but due to the general availability of sufficient similar habitats close by, is unlikely to be affected by the development of the proposed dam. |
| Goshawk, African, *Accipiter tachiro*. An uncommon but widespread breeding resident. Favours forest and riparian patches. |
| Grassbird, Cape, *Sphenoeacus afer.* A fairly common breeding resident. Favours grassland and vlei areas. |
| Greenbul, Sombre, *Andropadus importunes*. A very common breeding resident occurring in all habitats. |
| Honeyguide, Scaly-throated, *Indicator variegatus.* Heard in one of the forest patches away from the riparian zone. A rather rare breeding resident species. A brood parasite of the Woodpeckers and Barbets. Will not be affected by the development of the proposed dam. |
| Ibis, Hadeda, *Bostrychia hagedash*. A common and conspicuous breeding resident. Recorded at the existing dam further downstream so will probably benefit from the establishment of the proposed new dam. |
| Kingfisher, Brown-hooded, *Halcyon albiventris.* A common breeding resident favouring savanna and forest fringes. An insectivorous species favouring savanna and forest fringes. Will not be affected by the development of the proposed dam. |

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| Kingfisher, Giant, *Megaceryle maximus*. A common breeding resident favouring rivers and dams. A fish eater, so will probably benefit from the development of the proposed new dam. Many small *Tilapia spp*. were seen in the existing dam, so the food supply should be ensured. |
| Martin, Common House, *Delichon urbicum*. A very common non-breeding Palearctic migrant present in summer. An aerial forager and so is not dependent upon BLG's habitats. |
| Mousebird, Red-faced, *Urocolius indicus.* Probably a rare breeding resident which is probably at the edge of its range at this altitude. Mainly a frugivore so favours riparian, forest and savanna habitats. Due to the general availability of sufficient similar habitats close by, will not likely be affected by the development of the proposed dam. |
| Mousebird, Speckled, *Colius striatus.* A fairly common breeding resident. Also mainly a frugivore so favours riparian, forest and savanna habitats. Will not be affected by the development of the proposed dam. |
| Neddicky, *Cisticola fulvicapilla.* A fairly common breeding resident species favouring savannas. Will not be affected by the development of the proposed dam. |
| Oriole, Black-headed, *Oriolus larvatus.* Fairly common breeding resident. |
| Pigeon, African Olive-, *Columba arquatrix.* Fairly common breeding resident. Mainly a frugivore, utilising the fruit of alien invasives such as Bugweed which has led to population increases and range expansion. |
| Pipit, African, *Anthus cinnamomeus.* A fairly common breeding resident preferring short grass and overgrazed areas. |
| Prinia, Tawny-flanked, *Prinia subflava.* A common breeding resident in rank grass in riparian and grasslands. |
| Puffback, Black-backed, *Dryoscopus cubla.* A very common breeding resident species found in most habitats. |
| Robin, White-browed, Scrub-, *Cercotrichas leucophrys.* A common breeding resident species in bushveld, but less common in the BLG area. |
| Robin-chat, Cape, *Cossypha caffra*. A rather rare species in the BLG area. Probably at the edge of its range, preferring higher altitudes. A breeding resident. |
| Robin-chat, Red-capped, *Cossypha natalensis*. A rather rare species in the BLG area. Probably at the edge of its range, preferring lower altitudes. A breeding resident. |
| Saw-wing, Black (Southern race), *Psalidoprocne holomelaena*. A fairly common breeding intra- African migrant present from August to May. Favours riparian areas around rivers and streams. Breeds in burrows excavated into sandbanks, river banks or erosion gullies, so may benefit from construction of the dam wall. |
| Scimitarbill, Common, *Rhinopomastus cyanomelas*. Fairly common breeding resident favouring savannas and forest fringes. |
| Spurfowl, Natal, *Pternistis natalensis.* Common breeding resident in bushveld, savanna and grassland. |
| Spurfowl, Swainson's, *Pternistis swainsonii.* A common ground bird usually found in grasslands. A breeding resident. |
| Starling, Red-winged, *Onychognathus morio.* A fairly common species in areas where cliffs (and sometimes buildings) offer nesting ledges. A breeding resident. |
| Sunbird, Amethyst, *Chalcomitra amethystine.* Common breeding resident occurring especially in the indigenous forest patches, riparian vegetation and urban gardens. |
| Sunbird, Malachite, *Nectarinia famosa.* A fairly common species which may breed locally. A vagrant species dependent upon flowering Proteas, its movements dictated by the flowering of these plants. Probably occurs mainly at higher altitudes in the mist belt grasslands where Proteas are more common. |
| Swallow, Barn, *Hirundo rustica.* A very common non-breeding Palearctic migrant present in summer. An aerial forager and so is not dependent upon BLG's habitats. |
| Swallow, Blue, *Hirundo atrocaerulea* (CR). A very rare and Critically Endangered species (Taylor, Peacock & Wanless 2015) recorded on Bruintjieslaagte for the first time in January |

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| 2017 by Anthony Emery. (See the section on Red Data species below). |
| Swallow, Lesser Striped, *Hirundo abyssinica.* A common intra-African breeding migrant present in summer. Is often associated with man-made structures such as buildings and bridges which it uses for breeding. |
| Swallow, White-throated, *Hirundo albigularis.* A rather rare breeding intra-African migrant present in summer months. Favours riverine habitats, often breeding on buildings and bridges close to water. |
| Swift, African Black, Apus barbatus. A fairly common species in areas where cliffs (and sometimes buildings) offer nesting ledges. A breeding resident. |
| Swift, African Palm, *Cypsiurus parvus.* Fairly common breeding resident. Dependant on palm trees for breeding, but also known to nest on buildings and bridges. Spends most of the time on the wing. |
| Tchagra, Black-crowned, *Tchagra senegalus.* Fairly common savanna species which occurring also in grassy/woodland ecotones. A breeding resident. |
| Tinkerbird, Yellow-fronted, *Pogoniulus chrysoconus.* A fairly common breeding resident species whose range is apparently expanding. |
| Turaco, Knysna, *Tauraco corythaix.* A rather rare species in the BLG area. Heard in the riparian habitats below the proposed new dam wall. Probably at the edge of its range, preferring higher altitudes. A breeding resident. |
| Turaco, Purple-crested, *Gallirex porphyreolophus.* A more common species in the BLG area than the previous one. Probably also at the edge of its range, preferring lower altitudes. A breeding resident. |
| Wagtail, African Pied, *Motacilla aguimp.* A species favouring water in the form of rivers and dams. Recorded only at the existing dam further downstream. The proposed new dam would probably benefit this species. A breeding resident. |
| Wagtail, Cape, *Motacilla capensis.* Recorded only around anthropogenic (areas altered by man, particularly by the construction of buildings) areas. A breeding resident. |
| Waxbill, Common, *Estrilda astrild.* A very common breeding resident species found sometimes in large parties in rank grasslands wherever these may occur. |
| Waxbill, Swee, *Estrilda melanotis.* A common but secretive breeding resident species found in rank grasslands. |
| Weaver, Golden, *Ploceus xanthops.* An uncommon breeding resident species |
| Weaver, Southern Masked-, *Ploceus velatus.* A common and widespread breeding resident, usually found in savanna habitats. |
| White-eye, Cape, *Zosterops viren,* A common and widespread breeding resident, usually found in small parties in a wide variety of habitats. |
| Whydah, Pin-tailed, *Vidua macroura.* A fairly common breeding resident species, inconspicuous when not in breeding plumage. A brood parasite of firefinches. |
| Widowbird, Red-collared, *Euplectes arden.* Another fairly common breeding resident species, inconspicuous when not in breeding plumage. Favours rank grasslands |
| Woodpecker, Olive, *Dendropicos griseocephalus.* A rather rare species in the BLG area. Heard in the riparian habitats below the proposed new dam wall. Probably at the edge of its range, preferring higher altitudes. A breeding resident. |

**Mitigation measures:**

- Construction period must be during the winter month period when the Blue Swallows are not present in the area. This means that construction should be scheduled for during April – August and construction must be completed by mid-August.
- The pushed out trees and bush should be burned inside the dam before inundation to prevent further impacts and disturbances away from the dam site on avifauna.
- Support a project to determine the population size, number of breeding pairs, foraging areas and nesting and breeding sites of the Blue Swallows in the area in

conjunction with the Endangered Wildlife Trust (EWT) and the Blue Swallow Working Group.

- Establish a monitoring program for the Blue Swallows in conjunction with the EWT and Blue Swallows Working Group.
- Investigate the viability in conjunction with the Blue Swallow Working Group to create artificial nesting sites in suitable areas (Dr Garth Batcher's suggestion).
- Investigate the inclusion of the Bruintjieslaagte farm into the National Protected Area Expansion Strategy. Enter into a contractual agreement with the protected area agency.

**Socio and Socio-economic impacts**

### 9.2.8 Heritage and Archaeology

| Nature of Impact | Period | Extent | Duration | Intensity | Probability | Significance before mitigation | Significance after mitigation |
|---|---|---|---|---|---|---|---|
| Loss of archaeological site | | | | | | | |
| BL 1 | Construction | Site | Short | Low | Unlikely | Low | Low |
| BL 2 | Construction | Site | Long term | High | Definite | High | Medium |
| BL 3 | Construction | Site | Short | Low | Unlikely | Low | Low |
| BL 4 &BL 4B | Construction | Site | Long term | High | Definite | High | Medium |
| BL 5 | Construction | Site | Short | Low | Unlikely | Low | Low |
| BL 6 | Construction | Site | Short | Low | Unlikely | Low | Low |
| BL 7 | Construction | Site | Short | Low | Unlikely | Low | Low |
| | | | | | | | |

In terms of the archaeological component of the Act (25 of 1999, section 35) seven sites were located and documented and management and mitigation measures were recommended in the Archaeology and Heritage Impact Assessment Report.

As part of mitigation measures, it is recommended that the affected/ impacted archaeological sites be mapped and recorded by archaeological excavation, pending a successful permit application from SAHRA. In terms of the built environment in the area (section 34 of the Act) no significant buildings were identified.

| Field Rating | Grade | Significance | Recommended Mitigation |
|---|---|---|---|
| National Significance (NS) | Grade 1 | High Significance | Conservation, nomination as national site |
| Provincial Significance (PS) | Grade 2 | High Significance | Conservation; Provincial site nomination |
| Local significance (LS 3A) | Grade 3A | High Significance | Conservation, No mitigation advised |
| Local Significance (LS 3B) | Grade 3B | High Significance | Mitigation but at least part of site should be retained |
| Generally Protected A (GPA) | GPA | High/ Medium Significance | Mitigation before destruction |

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|---|---|---|---|
| Generally Protected B (GPB) | GPB | Medium Significance | Recording before destruction |
| Generally Protected C (GPC) | GPC | Low Significance | Destruction |

**Table 9.2.1. Significance rating guidelines for sites**

| Site No. | Description | Type of significance | Degree of significance | NHRA heritage resource & rating |
|---|---|---|---|---|
| BL 1 | Historic stone-walled dwelling | Historic architecture | Archaeological: Medium<br>Historic: Low | Structures (Sect. 34). Medium. **GPB.** |
| BL 2 | LIA stone-walled enclosures | Archaeological | Archaeological: High<br>Historic: High | Archaeological (Sect. 35). High. **GPA.** |
| BL 3 | LIA stone-walled enclosure | Archaeological | Archaeological: Medium<br>Historic: Medium | Archaeological (Sect. 35). Medium. **GPB.** |
| BL 4 &BL 4B | LIA stone-walled enclosures | Archaeological | Archaeological: High<br>Historic: High | Archaeological (Sect. 35). High. **GPA.** |
| BL 5 | LIA stone-walled enclosures | Archaeological | Archaeological: High<br>Historic: High | Archaeological (Sect. 35). High. **GPA.** |
| BL 6 | LIA stone-walled enclosures & terraces | Archaeological | Archaeological: High<br>Historic: High | Archaeological (Sect. 35). High. **GPA.** |
| BL 7 | LIA site perimeter | Archaeological | Archaeological: High<br>Historic: High | Archaeological (Sect. 35). High. **GPA.** |

**Table 9.2.2. General description of located sites and field rating**

| Site no. | Type of Heritage resource | Integrity of cultural material | Preservation condition of site | Quality of archaeological/ historic material | Quantity of site features | Recommended conservation management |
|---|---|---|---|---|---|---|
| BL 1 | Historic Architecture | Fair | Fair | Archaeology: Not known Historically: Poor | 1 | None. Not located near project area. |
| BL 2 | LIA stone-walled enclosures | Fair | Fair-Good | Archaeology: Fair Historically: Fair | 2 | Older than 60 years, mitigation before destruction |
| BL 3 | LIA stone-walled enclosure | Poor | Poor | Archaeology: Poor Historically: Poor | 1 | None. Not located in the project area. |
| BL 4 & BL 4B | LIA stone-walled enclosures | Fair | Fair-Good | Archaeology: Fair Historically: Fair | 2 | Older than 60 years, mitigation before |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | destruction |
| BL 5 | LIA stone-walled enclosure | Fair | Fair | Archaeology: Fair<br>Historically: Fair | 1 | None. Not located in the project area. |
| BL 6 | LIA stone-walled enclosures & terraces | Fair | Fair-Poor | Archaeology: Fair<br>Historically: Fair | 4 | None. Not located in the project area. |
| BL 7 | LIA site perimeter | Poor | Poor | Archaeology: Poor<br>Historically: Poor | 1 | None. Not located near project area. |

**Table 9.2.3. Site condition assessment and management recommendations**

Mitigation measures:

**Site BL 2**

Mitigation measures include the detailed mapping of the site and archaeological excavation of the two enclosures pending a successful permit application to SAHRA. Provisionally a 1x1m square is recommended to be excavated at the western-most enclosure in an effort to determine the depth of cultural deposit and confirm cultural identity. Similarly a 2x4m excavation is recommended in the larger eastern enclosure. The precise location of both excavations to be determined when site clearing has been done.

**Site BL 4**

Mitigation measures include the detailed mapping of the site and archaeological excavation of the enclosure pending a successful permit application to SAHRA. Provisionally a shovel test at the western wall of the enclosure (down-slope) is recommended to determine the depth of cultural deposit after which 1x1m square may be excavated if necessary. The precise location of the excavation to be determined when site clearing has been done.

**Site BL 4B**

Mitigation measures include the detailed mapping of the site and archaeological excavation of the enclosures pending a successful permit application to SAHRA. Provisionally a shovel tests at both enclosures is recommended to determine the depth of cultural deposit after which 1x1m squares may be excavated if necessary. The precise location of both excavations to be determined when site clearing has been done.

The bulk of archaeological remains are normally located beneath the soil surface. It is therefore possible that some significant cultural material or remains were not located during the survey and will only be revealed when the soil is disturbed. Should excavation or large scale earth moving activities reveal any human skeletal remains, broken pieces of ceramic pottery, large quantities of sub-surface charcoal or any material that can be associated with previous occupation, a qualified archaeologist should be notified immediately. This will also temporarily halt such activities until an archaeologist has assessed the situation. It should be noted that if such a situation occurs it may have further financial implications.

General mitigation measures:

- The contractors and workers should be notified that archaeological sites might be exposed during the construction work.
- Should any heritage artefacts be exposed during excavation, work on the area where the artefacts were discovered, shall cease immediately and the Environmental Control Officer shall be notified as soon as possible;
- All discoveries shall be reported immediately to a museum, preferably one at which an archaeologist is available, so that an investigation and evaluation of the finds can be made. Acting upon advice from these specialists, the Environmental Control Officer will advise the necessary actions to be taken;
- Under no circumstances shall any artefacts be removed, destroyed or interfered with by anyone on the site; and
- Contractors and workers shall be advised of the penalties associated with the unlawful removal of cultural, historical, archaeological or palaeontological artefacts, as set out in the National Heritage Resources Act Section 51.(1).

### 9.2.9 Palaeontology

| Nature of Impact | Period | Extent | Duration | Intensity | Probability | Significance before mitigation | Significance after mitigation |
|---|---|---|---|---|---|---|---|
| Palaeontology impact | Construction | Local | Long term | Low | Unlikely | Low | Low |

Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the basement rocks, dolomites, sandstones, shales, quartzites, basalts and gabbros are typical for the country and do not contain any fossil material. The sediments of the Silverton Formation could contain trace fossils of algal mats and ripple marks in sandstones, however, they have yet to be recorded from the Timeball Hill Formation on which the dam wall will be built.

It is extremely unlikely that any fossils occur in the sites for the proposed dam wall because mostly the rocks are much too old and volcanic in origin. Although there are rare reports of microbial mats from similar aged rocks, none has been reported from this particular Formation.

As far as the palaeontology is concerned the proposed development can go ahead. Any further palaeontological assessment would be unnecessary.

### 9.2.10 Aesthetics

The dam construction site is remote from public and other landowners and located in the Devil's Creek valley more than 5 km from the Crocodile River. Due to the topography it is not visible from the N4 or landowners adjacent the Crocodile River. The construction site will only be visible from the Sappi plantations located east from the dam site and the visual impact is of no significance to Sappi.

### 9.2.11 Traffic

The dam construction site is remote from public and public transportation roads on the Bruintjieslaagte farm which is only accessible to the Applicant.

There is therefore no traffic impact on any other party.

### 9.2.12 Noise and vibration

The dam construction site is remote from public, farmers and other landowners.

There is therefore no noise or vibration impact on any other landowner.

### 9.2.13 Health and Safety

Due to the location of the dam there is no access for public or any other landowner other than the applicant and the appointed contractor to the dam building site. There is therefore no health and safety risk for other parties or landowners.

The contractor workers will be exposed to the normal health and safety risk of a construction project of this nature. The Health and Safety Act is applicable and the compliance with this Act is outside the scope of this assessment and report. The Applicant and his appointed Contractors must however comply with the Health and Safety Act.

### 9.2.14 Socio- economic impact

| Nature of Impact | Period | Extent | Duration | Intensity | Probability | Significance before mitigation | Significance after mitigation |
|---|---|---|---|---|---|---|---|
| Water quality – suspended solids | Construction | Regional | Short | Low | Unlikely | Low | Low |
| Water quantity in Crocodile River | Operations | Regional | Long term | Low | Probable | Medium | Low |

If the water quality (suspended solids, turbidity) is affected during the construction period, it should extend only to the existing dam downstream of the proposed dam and not into the Crocodile River. Mitigation measures will anyway be implemented to reduce the suspended solids in the Devil's Creek water for aquatic reasons. There should therefore be no impact on downstream water users.

It was proven (refer to hydrology section and water use rights) that there is sufficient water in the Devil's Creek catchment to sustain the dam and that a yield of 1.2 million cubic metres per annum of water, after allowing for the Ecological Water Requirement (EWR), is available. The volume of water available for downstream water users will therefore not be affected by the dam.

Water abstraction from the dam will not exceed the allocated water use rights available from the Crocodile River.

**Mitigation measures:**

- Implement measures as earlier defined to limit the carry-over of suspended solids into the water of the Devil's Creek.
- Monitor water quality (turbidity) downstream from the construction site and below the existing dam and implement further mitigation measures if suspended solids in water are high.

- The operational plan for the dam must allow for on-going release (monthly EWR profile) of the EWR volume of water.
- Cumulative water abstraction from the Bruintjieslaagte dam and directly from the Crocodile River must not exceed the annual total licenced irrigation water use rights.

## 10. Environmental Statement and Findings

Various potential environmental impacts were identified and considered in the EIA Report.

### 10.1 The key environmental impacts identified

- Water resources and aquatic ecology;
- Wetlands and riverine habitat;
- Avifauna and specifically the Blue Swallows;
- Terrestrial ecology;
- Archaeology and Heritage.

### 10.2 Primary positive and negative impacts

Positive aspects of the proposed dam project:

- A new area for the Blue Swallows (*Hirundo atrocaerulea*) was discovered during the site investigations and further work will be done to study and protect the Blue Swallows:
  - Support a project to determine the population size, number of breeding pairs, foraging areas and nesting and breeding sites of the Blue Swallows in the area in conjunction with the Endangered Wildlife Trust (EWT) and the Blue Swallow Working Group.
  - Establish a monitoring program for the Blue Swallows in conjunction with the EWT and Blue Swallows Working Group.
  - Investigate the viability in conjunction with the Blue Swallow Working Group to create artificial nesting sites in suitable areas (Dr Garth Batcher's suggestion).
- Additional storage capacity for irrigation water is created in the Crocodile River catchment and it will make water available for use during drought or low-flow periods.
- The footprint area of the dam is small relative to the large natural area and the ecological impact of the dam is small after mitigation.
- No fish was found in the Devil's Creek upstream from the waterfall and the upper catchment where the dam would be located.
- Mitigation measures area available to mitigate the impact on aquatic species during the construction and operational periods.
- Investigations for the inclusion of the Bruintjieslaagte farm into the National Protected Area Expansion Strategy have started. Protection status of the farm and critical biodiversity area would be increased.

Negative aspects of the proposed dam project:

- The dam is located in an area that is classified as "critical biodiversity" in terms of the MBSP.
- The construction of the dam could impact on the Blue Swallows if construction is not done during the period May to mid-August. (This will be a conditions in the EMPr and Authorisation)
- A section of an Archaeological site will be lost due to the dam construction.

### 10.3 Assumptions and uncertainties

The environmental assessment practitioner accepts that the information contained in this report as provided by the applicant and professional consultants is true and accurate.

To make an assessment of the potential impacts the EAP took into account the findings of the specialists. The EAP also depends on the opinions and feedback from the Interested and Affected Parties and State Departments during the commenting periods provided.

There are no major gaps in knowledge regarding the description of the current state of the environment including the potential impacts on water resources and other environmental aspects. All sensitive environments were identified by a specialist and appropriate mitigation measures were identified. The recommendations of the specialist study were incorporated into the assessment where applicable.

There is a high level of confidence that the most significant potential negative impacts can be appropriately minimised with the implementation of mitigation measures as proposed.

### 10.4 Indication of management and monitoring

An Environmental Management Programme (EMPr) has been compiled to ensure that the biophysical and social environments receive due consideration (Refer to Appendix 11 for the EMPr).

The Environmental Management Programme (EMPr) was compiled to ensure that the biophysical and social environments receive due consideration and that it is protected during the undertaking of the activities.

Blue Swallows:

- Support a project to determine the population size, number of breeding pairs, foraging areas and nesting and breeding sites of the Blue Swallows in the area in conjunction with the Endangered Wildlife Trust (EWT) and the Blue Swallow Working Group.
- Establish a monitoring program for the Blue Swallows in conjunction with the EWT and Blue Swallows Working Group.
- Investigate the viability in conjunction with the Blue Swallow Working Group to create artificial nesting sites in suitable areas (Dr Garth Batcher's suggestion).

Protected Area Status of the Bruintjieslaagte farm:

Subject to finalisation of the Protected Area status of the farm an environmental management plan for the protected area would form part of the contractual agreement entered into between the landowner and the relevant regulating authority. There will therefore be on-going environmental management and monitoring in conjunction with the regulating authority.

The EMPr is a guideline document that will provide detailed specifications for the management and mitigation of activities that have the potential to impact negatively on the environment. The measures prescribed must aim to result in a cautious approach being applied to on-site environmental management to ensure prevention, minimising and remediation of potential impacts.

## 11. Conclusion and Recommendations

The "critical biodiversity" in terms of the Mpumalanga Biodiversity Plan was taken into account and several specialist assessments were done to assess the application site.

The footprint area of the dam is small relative to similar habitat in the Devil's Creek catchment as well as adjacent farms.

The potential impact on Blue Swallows would be small and appropriate mitigation measures were identified to lower the risk of impact on the Blue Swallows more.

No fish were found in the upper reaches of the Devil's Creek above the waterfall. Mitigation measures were defined to lower the risk on fish downstream from the dam during the construction period.

Conservation important plant species that may occur on site are listed in the Emross Consulting and Taylor Environmental Report. Of all these plant species only *Eucomis autumnalis* (Common Pineapple Lily) was identified on the site. ECO (ecologist) will survey site and identify, rescue and relocate conservation important plant species prior to start of construction.

In order to mitigate against the loss of plants of conservation- importance that are present on the footprint, it is essential that a conservation-important plant (*Eucomis autumnalis* and *Encephalartos humulis*, amongst others) walk-through and rescue plan be established and implemented prior to construction.

The hydrology study confirmed that sufficient water is available in the Devil's Creek and that a yield of approximately 1.2 million cubic meters per annum, after allowance for the Ecological Water Requirement (EWR) is available from the dam.

Controlled discharge of water from the dam will maintain the Ecological Water Requirement (EWR) during the operational period.

There are sufficient irrigation water use rights available and there will not be any new abstraction water use rights for the new dam. The dam is an alternative abstraction point for water other than directly from the Crocodile River.

Water abstraction from the dam and the utilisation of the gravitational head would bring about larger electricity savings as it would save pumping costs from the Crocodile River. This is environmentally preferred as electricity generation from coal is known to have a very high negative environmental impact.

Water use licence application for the dam (storage of water) will be submitted to the IUCMA (Department of Water and Sanitation).

The dam will only impact on some of the similar stonewall archaeological sites found on the Bruintjieslaagte farm. A permit will be obtained from SAHRA and the affected sites will be surveyed, excavated and documented.

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Enpact Environmental Consultants CC

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