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DWS Report No: P WMA 12/T30/00/5314/11

ENVIRONMENTAL IMPACT ASSESSMENT FOR THE MZIMVUBU WATER PROJECT

DEA REF. No 14/12/16/3/3/2/677 (Dam Construction)
14/12/16/3/3/2/678 (Electricity Generation)
14/12/16/3/3/1/1169 (Roads)

FAUNAL IMPACT ASSESSMENT

FINAL
January 2015

ENVIRONMENTAL IMPACT ASSESSMENT FOR THE MZIMVUBU WATER PROJECT

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ENVIRONMENTAL IMPACT ASSESSMENT FOR THE MZIMVUBU WATER PROJECT

LIST OF REPORTS

REPORT TITLE	DWS REPORT NUMBER
Inception Report	P WMA 12/T30/00/5314/1
Scoping Report	P WMA 12/T30/00/5314/2
Environmental Impact Assessment Report	P WMA 12/T30/00/5314/3
Environmental Management Programme	P WMA 12/T30/00/5314/14
Integrated Water Use License Application for the Mzimvubu Water Project: Technical Report	P WMA 12/T30/00/5314/4
Ntabelanga Dam borrow pits and quarry Environmental Management Plan	P WMA 12/T30/00/5314/5
Lalini Dam borrow pits and quarry Environmental Management Plan	P WMA 12/T30/00/5314/6
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Social Impact Assessment	P WMA 12/T30/00/5314/7
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Heritage Impact Assessment	P WMA 12/T30/00/5314/12
Water Quality Study	P WMA 12/T30/00/5314/13
Aquatic Ecology Assessment	P WMA 12/T30/00/5314/15
Wetland Assessment	P WMA 12/T30/00/5314/16
Rapid Reserve Determination: Tsitsa River at Lalini	P WMA 12/T30/00/5314/17

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14/12/16/3/3/1/1169 (Roads application)

This report is to be referred to in bibliographies as:

Department of Water and Sanitation, South Africa (2015). ***Environmental Impact Assessment for the Mzimvubu Water Project: Faunal Impact Assessment***

DWS Report No: P WMA 12/T30/00/5314/11

Prepared for: Directorate – Options Analysis

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DECLARATION OF INDEPENDENCE

I, Stephen van Staden, as authorised representative of Scientific Aquatic Services cc hereby confirm my independence as a specialist and declare that neither I nor Scientific Aquatic Services cc have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of which Scientific Aquatic Services cc was appointed as social impact assessment specialists in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), other than fair remuneration for work performed, specifically in connection with the Faunal Impact Assessment for the Mzimvubu Water Project Environmental Impact Assessment. I further declare that I am confident in the results of the studies undertaken and conclusions drawn as a result of it – as is described in my attached report.

Signed:  Date: January 2015

ENVIRONMENTAL IMPACT ASSESSMENT FOR THE MZIMVUBU WATER PROJECT

FAUNAL IMPACT ASSESSMENT

Executive summary

BACKGROUND

The Department of Water and Sanitation (DWS) commissioned the Mzimvubu Water Project, an integrated multi-purpose (domestic water supply, agriculture, power generation, transport, tourism, conservation and industry) project, with the intention of providing socio-economic development opportunities for the Eastern Cape region.

Scientific Aquatic Services (SAS) was appointed to conduct a faunal assessment as part of the Environmental Impact Assessment (EIA) and authorisation process for the proposed development of:

- *the Ntabelanga Dam;*
- *the Lalini Dam;*
- *road upgrades;*
- *primary and secondary pipelines, pump stations and reservoirs;*
- *hydro power generation and power lines; and*
- *irrigation infrastructure.*

Reference is made to the specific developments accordingly (hereinafter collectively referred to as the "study area").
The Lalini Dam, fed by the Tsitsa River, is situated approximately 17 km north east of the small town Tsolo and has three possible inundation levels. The Ntabelanga Dam is located approximately 25 km east of the town Maclear and north of the R396, and has an expected inundation extent of 2333.45 ha.
The road upgrades run along the northern and southern boundaries of Ntabelanga Dam, passing through the town Mpetsheni in the north and near the town Waca in the south (Figure 2).
The secondary and primary pipelines traverse the study area crossing the N2 and R396 at different points, with the northern most pipelines crossing the Thina River.

The inundation of the Tsitsa River by the Lalini and Ntabelanga Dams will cause direct impacts to the biological, chemical and physical properties of the river and riparian environments. Dam development will also result in the permanent loss of terrestrial faunal habitat.

ASSESSMENT OF IMPACTS ON FAUNA

The methods of assessment used in this study are considered adequate to determine the significance of impact associated with the dam development and associated infrastructure, and

the level of detail of assessment is deemed appropriate for the scale of this project. The key impacts are discussed below.

Specific outcomes required from this report include the following:

- *Faunal habitat and community classification, including a description of the study area;*
- *Faunal inventories for the study area;*
- *Determine the presence of any red data species (fauna) and the potential for such species to occur within the study area;*
- *Determine the presence and extent of sensitive faunal habitats which will be affected, with special mention of instream and wetland habitats as well as features such as rocky ridge areas; and*
- *Discuss the spatial significance of the property and provide recommendations if required.*

Faunal Impacts

- *Loss of faunal habitat will occur due to the flooding of floodplain, riparian and rocky outcrop areas, and affect threatened species such as Balearica regulorum (Grey Crowned Crane), Anthropoides paradise (Blue Crane), Grus carunculatus (Wattled Crane) and Hadogenes sp (Rock Scorpion).*
- *Decrease in food supply and faunal habitat will result in a lower carrying capacity and resultant decrease in faunal diversity, causing changes to faunal community assemblage.*
- *There is an increased poaching risk of potential species of conservational importance and fire hazards due to increased human activity as a result of the proposed projects to be undertaken.*

Faunal assessment

- *In terms of faunal habitat, primary issues are the impacts on rocky ridges, mountain bushveld, and riparian and wetlands present within the study area. These areas provide highly suitable habitat for several RDL faunal species. The rocky outcrops and mountain bushveld are ideal habitat zones for threatened scorpions. The wetland systems and associated grasslands provide suitable habitat for protected Crane species, as well as various small mammals.*
- *A number of small mammals as well as evidence of mammals was observed throughout the study area, namely Aonyx capensis (Cape Clawless Otter), Genetta maculata (Large Spotted Genet), Galerella sanguinea (Slender mongoose) and Hystrix africaeaustralis (South African Porcupine) amongst others. No threatened mammals were directly observed within the study area, nor are any threatened mammals expected to occur in the study area.*
- *A high diversity of avifaunal species was observed on site. This can be attributed to the fact that the study area has a variety of habitats suited to a diverse range of avifauna. The study area also provides suitable habitat to RDL bird species, most importantly communities of Balearica regulorum (Grey Crowned Crane), Anthropoides paradiseus (Blue Cranes) and Grus carunculatus (Wattled Crane) of which B. regulorum was directly observed in the study area. Sagittarius serpentarius (Secretary Bird) was also observed within the study area during the site assessment as well as a number of raptor species.*

- *Various reptile species was recorded during the site survey within the study area, amongst others Agama atra (Southern Rock Agama), Philothamnus hoplogaster (Green Water snake) and Causus rhombeatus (Rhombic Night Adder). These species have yet to be assessed by the IUCN and are not considered threatened. The rocky outcrop, mountain bushveld and riparian habitats are considered to be the most sensitive from a reptile conservation perspective.*
- *Only common amphibian species were encountered during the field assessment, including Afrana angolensis (Common River frog) and Strongylopus fasciatus (Striped Stream frog). The wetland habitat and river system is considered to be the most sensitive from an amphibian conservation perspective. However, the rising dam waters are unlikely to have a negative impact on amphibians in the study area.*
- *A large variety of invertebrate species were observed within the study area, but it must be noted that the field assessment was undertaken in autumn and early winter, and as such certain invertebrate species will have entered dormant phases in their life cycles. None of the invertebrate species identified are listed as threatened and as such the development of the dams and associated infrastructure will have no impact on invertebrate conservation within the area and region.*
- *Various common arachnid species were identified during the site assessments, including Olurunia ocellata (Grass funnel-web spider) and Nephila senegalensis (Banded-legged Golden Orb-web spider). No RDL or protected spiders were observed, or are expected to occur within the study area. One NEMBA listed and protected scorpion species, Hadogenes sp. was however observed in the mountain rocky outcrop/ bushveld habitat near the proposed Lalini Dam wall. This species will be impacted upon through loss of habitat due to the dam wall construction and subsequent rising water level.*

ENVIRONMENTAL IMPACT ASSESSMENT FOR THE MZIMVUBU WATER PROJECT – FAUNAL IMPACT ASSESSMENT

DEA REF No. 14/12/16/3/3/2/677 (Dam construction application)
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ACRONYMS AND ABBREVIATIONS

BID	Background Information Document
BLMC	Biodiversity Land Management Class
BGIS	Biodiversity Geographic Information System
CBA	Critical Biodiversity Areas
DMs	District Municipalities
DWA	Department Water Affairs (former DWS)
DWS	Department of Water and Sanitation
ECBCP	Eastern Cape Biodiversity Conservation Plan
EIA	Environmental Impact Assessment
EAP	Environmental Assessment Practitioner
EMPR	Environmental Management Programme
ESA	Ecological Supporting Areas
ESSA	Entomological Society of South Africa
GDACE	Gauteng Department of Agriculture, Conservation and Environment
GIS	Geographic Information System
GPS	Global Positioning System
IUCN	International Union for Conservation of Nature
MAP	Mean Annual Precipitation
MAPE	Mean Annual Potential for Evaporation
MASMS	Mean Annual Soil Moisture Stress
MAT	Mean Annual Temperature
NBA	National Biodiversity Act
NEMA	National Environmental Management Act
NEMBA	National Environmental Management Biodiversity Act
NFEPA	National Freshwater Ecosystem Priority Areas
NPAES	National Protected Area Expansion Strategy
PES	Present Ecological State
POC	Probability of Occurrence
PRECIS	Pretoria Computer Information Systems
RDL	Red Data Listed
RDSIS	Red Data Sensitivity Index Score
SABIO	South Africa Bee Industry Organization
SACNASP	South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute
SAS	Scientific Aquatic Services
SCC	Species of Conservational Concern
SASSO	South African Soil Surveyors Association
SA RHP	South African River Health Programme
SoER	State of the Environment Report
TSP	Threatened Species Programme
TSS	Total Species Score
WMA	Water Management Area
ZSSA	Zoological Society of Southern African

LIST OF UNITS

MW	Mega Watt
m	Meters
km^2	Square Kilometers
ha	Hectare
°C	Degrees Celsius
%	Percentage
m^3	Cubic meters

1. INTRODUCTION

1.1 BACKGROUND

The Department of Water and Sanitation (DWS) commissioned the Mzimvubu Water Project, an integrated multi-purpose (domestic water supply, agriculture, power generation, transport, tourism, conservation and industry) project, with the intention of providing a socio-economic development opportunity for the Eastern Cape region.

Environmental authorisation is required for the infrastructure components of the project. The purpose of the Environmental Impact Assessment (EIA) is to assess the components of the project that are listed activities by the National Environmental Management Act (NEMA) for which DWS has the mandate and intention to implement. The EIA process will provide the information that the environmental authorities require to decide whether the project should be authorised or not, and if so then under what conditions.
As part of this EIA process Scientific Aquatic Services (SAS) have been contracted to undertake a Faunal Impact Assessment for the proposed development of:

- the Ntabelanga Dam;
- the Lalini Dam;
- road upgrades;
- primary and secondary pipelines, pumpstations and reservoirs;
- hydro power generation and power lines; and
- irrigation infrastructure.

Reference will be made to the specific developments accordingly (hereinafter collectively referred to as the "study area").

The Lalini Dam, fed by the Tsitsa River, is situated approximately 17km north east of the small town Tsolo. The Ntabelanga Dam, located approximately 25 km east of the town Maclear and north of the R396, has an inundation extent of 2333.45ha (**Figure 1**). The road upgrades run along the northern and southern boundaries of Ntabelanga Dam, passing through the settlements of Mpetsheni in the north and near the town Waca in the south. The secondary and primary pipelines traverse the study area crossing the N2 and R396 at different points, with the northern most pipelines crossing the Thina River.

Land use in the study area includes agriculture, forestry and rural settlements. The ecological assessment was confined to the study area and did not include an ecological assessment of surrounding properties. The surrounding area was however considered as part of the desktop assessment of the area as well as during general movement through the area by road and on foot.

1.2 PURPOSE OF THIS REPORT

The purpose of this report is to define the faunal assemblages of the various habitat units that will be affected by the inundation of the dams and construction of other infrastructure.

Furthermore, this report will help guide the incumbent to better manage and mitigate impacts upon the faunal species within the study area to the best of their abilities.

1.3 DETAILS AND EXPERTISE OF THE SPECIALIST

Christopher Hooton

Chris obtained his National Diploma in Nature Conservation (2006-2008) and then proceeded to complete his BTech Nature Conservation degree (2011-2013), both at Tshwane University of Technology. Chris's BTech research thesis looked at successfully calculating Spotted Hyaena population size using infrared camera traps and the capture-recapture model for population calculation.

A year was spent working for the Special Investigations Unit of the then Gauteng Department of Agriculture, Conservation and Environment (GDACE), focusing on the enforcement of the Nature Conservation Ordinance of Gauteng, CITES and TOPS in the Gauteng and North West province. Here he focussed primarily on the control of illegal trade in endangered species, with special focus on Red Data List and CITES species and products thereof. Whilst working for GDACE Chris actively involved himself in the provincial game reserves, assisting with floral and faunal assessments.

As part of his BTech studies, Chris went to work for the Lowveld Wild Dog Project, based in Savé Valley Conservancy, Zimbabwe. Here he gained invaluable field experience in large carnivore work. Whilst in Zimbabwe, Chris assisted with the collaring, tracking and population management of the Wild Dogs, and also helped with a lion and leopard collaring project with his supervisor and the reserve ecologist. After leaving Zimbabwe, Chris moved to Phinda Private Game Reserve to start his research for his thesis project. This research involved using total species counts and call-up methods to gain benchmark population numbers in order to confirm population numbers calculated from the camera trap method, in order to show that hyaena populations can be successfully calculated through the use of camera traps and a capture recapture methodology.

Following his work on Spotted Hyaenas, Chris joined Scientific Aquatic Services in November 2013 as an ecologist, specialising in faunal studies.

Stephen van Staden

Stephen van Staden completed an undergraduate degree in Zoology, Geography and Environmental Management at Rand Afrikaans University. On completion of this degree, he undertook an honours course in Aquatic health through the Zoology department at RAU. In 2002 he began a Master's degree in environmental management, where he did his mini dissertation in the field of aquatic resource management, also undertaken at RAU. At the same time, Stephen began building a career by first working at an environmental consultancy specialising in town planning developments, after which he moved to a larger firm in late 2002. From 2002 to the end of 2003, he managed the monitoring division and acted as a specialist consultant on water resource management issues and other environmental processes and applications. In late 2003, Stephen started consulting as an

independent environmental scientist, specialising in water resource management under the banner of Scientific Aquatic Services. In addition to aquatic ecological assessments, clients started enquiring about terrestrial ecological assessments and biodiversity assessments. Stephen, in conjunction with other qualified ecologists, began facilitating these studies as well as highly specialised studies on specific endangered species, including grass owls, arachnids, invertebrates and various vegetation species. Scientific Aquatic Services soon became recognised as a company capable of producing high quality terrestrial ecological assessments. Stephen soon began diversifying into other fields, including the development of EIA process, EMP activities and mine closure and rehabilitation studies.

Stephen has experience on well over 1000 environmental assessment projects with specific mention of aquatic and wetland ecological studies as well as terrestrial ecological assessments and project management of environmental studies. Stephen has a professional career spanning more than 10 years, of which almost ten years have been as the owner and Managing member of Scientific Aquatic Services and the project manager on most projects undertaken by the company. Stephen has undertaken studies throughout Africa with work having been undertaken in South Africa; Lesotho; Angola; Botswana; Tanzania; Liberia; Guinea Bissau; Ghana; Democratic Republic of Congo and Mozambique.

Stephen is registered by the South African River Health Programme (SA RHP) as an accredited aquatic biomonitoring specialist and is also registered as a Professional Natural Scientist with the South African Council for Natural Scientific Professions (SACNASP) in the field of ecology. Stephen is also a member of the Gauteng Wetland Forum and South African Soil Surveyors Association (SASSO).

Marc Hanekom

Marc Hanekom completed his undergraduate BSc degree majoring in both Botany and Zoology (2000-2002) and then completed his Honours degree in Aquatic Health (2003) at RAU. Marc then completed his Master's degree in Zoology, specifically studying the social parasitic interaction of the southern African honeybees' at the University of Stellenbosch. Upon completion of these degrees, he started his career in the aquatic field, where he gained practical experience as an aquatic consultant, as well as mastering faunal field studies.

Marc has worked in England compiling and expanding on field work and data analysis techniques, where he became involved in the conducting and managing various data analysis processes. In addition, he has managed to bring expertise to the faunal field work assessments. Over the course of his career, Marc has completed several reports on aquatic and faunal impact studies, and has had the opportunity to apply his knowledge through rehabilitation design, planning, specification and implementation.

He is registered at the Zoological Society of Southern African (ZSSA), the Entomological Society of South Africa (ESSA), is an active beekeeper and is a member of the South Africa Bee Industry Organization (SABIO, TA number 1175) and is registered as an accredited aquatic biomonitoring specialist by the SA RHP standards of South Africa.

1.4 STRUCTURE OF THIS REPORT

This specialist study is undertaken in compliance with Regulation 32 of GN 543. **Table 1** below indicates how the requirements of Regulation 32 of GN 543 have been fulfilled in this report.

Table 1: Report content requirements in terms of Regulation 32 of GN 543

Regulatory Requirements in terms of Regulation 32 of GN 543	Section of Report
(a) The person who prepared the report; and the expertise of that person to carry out the specialist study or specialised process.	Chapter 1
(b) a declaration that the person is independent	Page iv
(c) an indication of the scope of, and the purpose for which, the report was prepared	Chapters 1 and 3
(d) a description of the methodology adopted in preparing the report or carrying out the specialised process	Chapter 3
(e) a description of any assumptions made and any uncertainties or gaps in knowledge	Chapter 4
(f) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Chapters 8 to 11
(g) recommendations in respect of any mitigation measures that should be considered by the applicant and the competent authority	Chapters 8 to 11
(h) a description of any consultation process that was undertaken during the course of carrying out the study	Chapter 13
(i) a summary and copies of any comments that were received during any consultation process	Chapter 13
(j) any other information requested by the competent authority.	Chapter 14

2. PROJECT BACKGROUND SUMMARY

2.1 LOCALITY

The project footprint spreads over three District Municipalities (DMs) namely the Joe Gqabi DM in the north west, the OR Tambo DM in the south west and the Alfred Nzo DM in the east and north east.

The proposed Ntabelanga Dam site is located approximately 25 km east of the town of Maclear and north of the R396 Road. The proposed Lalini Dam site is situated approximately 17 km north east of the small town Tsolo. Both are situated on the Tsitsa River.

2.2 MAIN PROJECT COMPONENTS

The project forms a large integrated project with several components. The proposed water resource infrastructure includes:

- A dam at the Ntabelanga site with a storage capacity of 490 million m^3;
- A dam at the Lalini site with a storage capacity of approximately 150 million m^3;
- A tunnel and power house at the Lalini Dam site for generating hydropower;
- Five new flow measuring weirs will be required in order to measure the flow that is entering and released from the dams. These flow gauging points will be important for monitoring the implementation of the Reserve and for operation of the dams.
- Wastewater treatment works at the dam sites;
- Accommodation for operations staff at the dam sites; and
- An information centre at each of the dam sites.

The Ntabelanga Dam will supply potable water to 539 000 people, which is estimated to rise to 730 000 people by year 2050. The domestic water supply infrastructure will include:

- A river intake structure and associated works;
- A regional water treatment works at Ntabelanga Dam;
- Potable bulk water distribution infrastructure for domestic and industrial water requirements (primary and secondary distribution lines);
- Bulk treated water storage reservoirs strategically located; and
- Pumping stations.

The Ntabelanga Dam will also provide water to irrigate approximately 2 900 ha of arable land. This project includes bulk water conveyance infrastructure for raw water supply to edge of field.

About 2 450 ha of the high potential land suitable for irrigated agriculture are in the Tsolo area and the rest near the proposed Ntabelanga Dam and along the river, close to the villages of Machibini, Nxotwe, Culunca, Ntshongweni, Caba, Kwatsha and Luxeni.

There will be a small hydropower plant at the Ntabelanga Dam to generate between 0.75 MW and 5 MW (average 2.1 MW). This will comprise a raw water pipeline from the dam to a building containing the hydropower turbines and associated equipment, and a discharge pipeline back to the river just below the dam wall. The impact is expected to be similar to that of a pumping station.

Another small hydropower plant will be constructed at the proposed Lalini Dam.

The larger hydropower plant at the Lalini Dam and tunnel (used conjunctively with the Ntabelanga Dam) will generate an average output of 30 MW if operated as a base load power station and up to 150 MW if operated as a peaking power station. The power plant will require a pipeline (approximately 4.6 km) and tunnel (approximately 3.2 km) linking the dam to the power plant downstream of the dam and below the gorge.

The power line to link the Lalini power station to the existing Eskom grid will be approximately 13 km. Power lines will be constructed to supply power for construction at the two dam sites and for operating five pumping and booster stations along the bulk distribution infrastructure.

The area to be inundated by the dams will submerge some roads. Approximately 80 km of local roads will therefore be re-aligned. Additional local roads will also be upgraded to support social and economic development in the area. The road design will be very similar to the existing roads as well as be constructed using similar materials.

The project is expected to cost R 12.45 billion and an annual income of R 5.9 billion is expected to be generated by or as a result of the project during construction and R 1.6 billion per annum during operation. It will create 3 880 new skilled employment opportunities and 2 930 un-skilled employment opportunities during construction.

2.3 ALTERNATIVES

The following project level alternatives will be assessed:

- Three hydro power tunnel positions and associated power lines;
- Peak versus Base load power generation;
- Three different dam sizes for the Lalini Dam; and
- The no project option.

For the construction camps, pipeline routes and new roads, the specialist will identify any sensitive areas and deviations to avoid these will be proposed in consultation with the technical team.

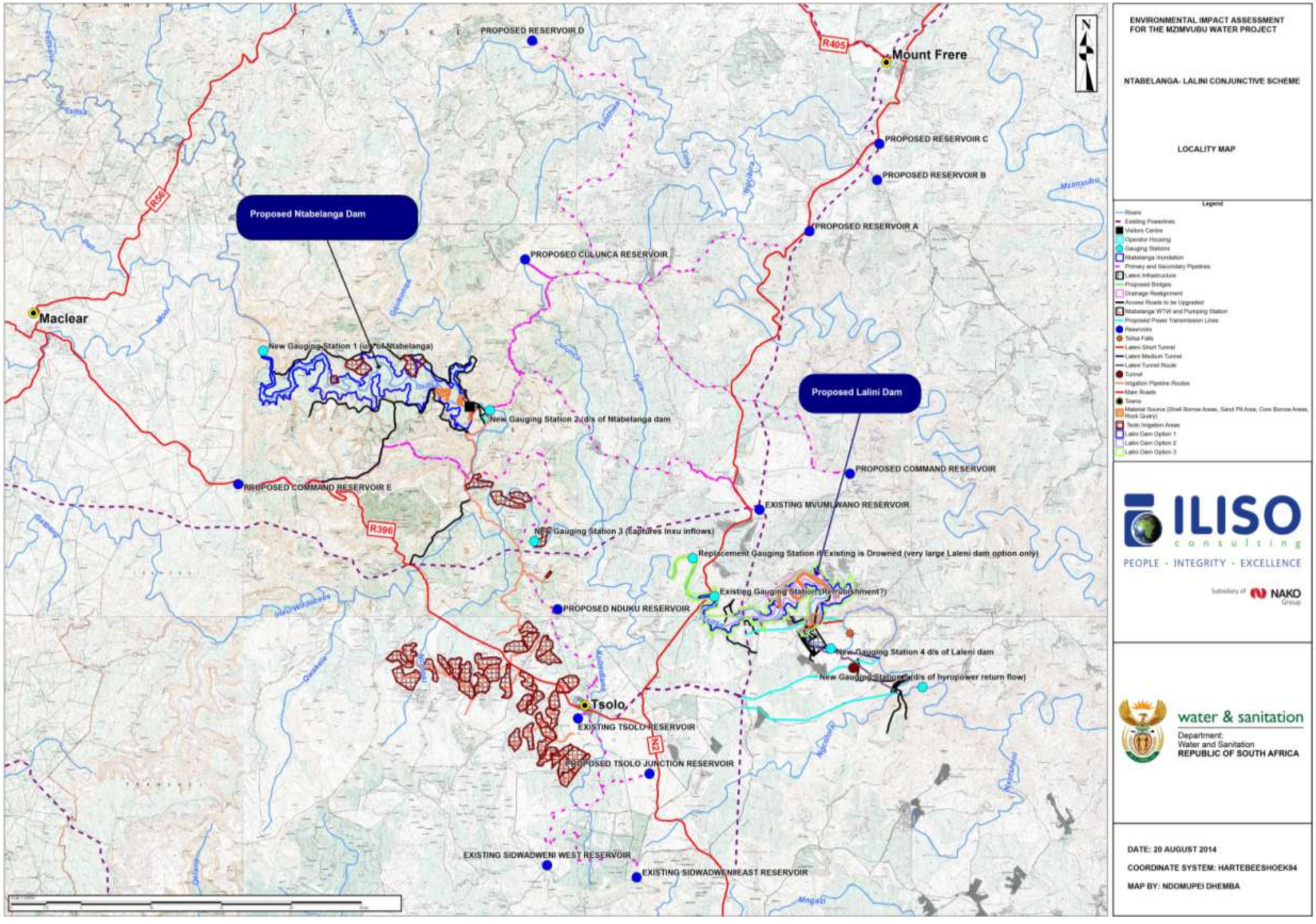

Figure 1: Locality map

2.4 LALINI DAM

Aspects applicable to the Lalini Dam and surroundings are discussed below:

- The subWMA is regarded as important with regards to fish corridors for movement of threatened fish between habitats and for the conservation of crane species (**Figure 2**).
- The subWMA is indicated as a fish corridor management area therefore effective management of activities near and between corridors are of upmost importance;
- The wetland vegetation groups is identified as Sub-escarpment Savanna;
- The wetland is classified as a channelled-valley bottom wetland in Category Z1 condition (critically modified); and
- According to the NFEPA Database (2011), the wetland is classified as a FEPA system, with a rank of 2 indicating that the majority of its area is within a sub-quaternary catchment that has sightings or breeding areas for threatened *Bugeranus carunculatus* (Wattle Crane), *Balearica regulorum* (Grey Crowned Crane) and *Anthropoides paradiseus* (Blue Crane).

2.5 NTABELANGA DAM AND ROAD UPGRADES

Aspects applicable to the Ntabelanga Dam and surroundings are discussed below:

- The subWMA is regarded as important in terms of the conservation of crane species (**Figure 3**).
- The subWMA is indicated as an upstream management area therefore effective management of activities near resources are of upmost importance.
- The subWMA is not considered to be a high groundwater recharge area nor a River FEPA.
- The wetland vegetation group is identified as Sub-escarpment Grassland Group 6.

2.6 PIPELINES

Aspects applicable to the pipelines and surroundings are discussed below:

- The northern pipelines cross the Thina River which is classified as being in Category C condition (moderately modified).
- The Thina River is regarded as an important fish sanctuary, translocation and relocation zone and is classified as being a fish support area according to the NFEPA Database (2011).

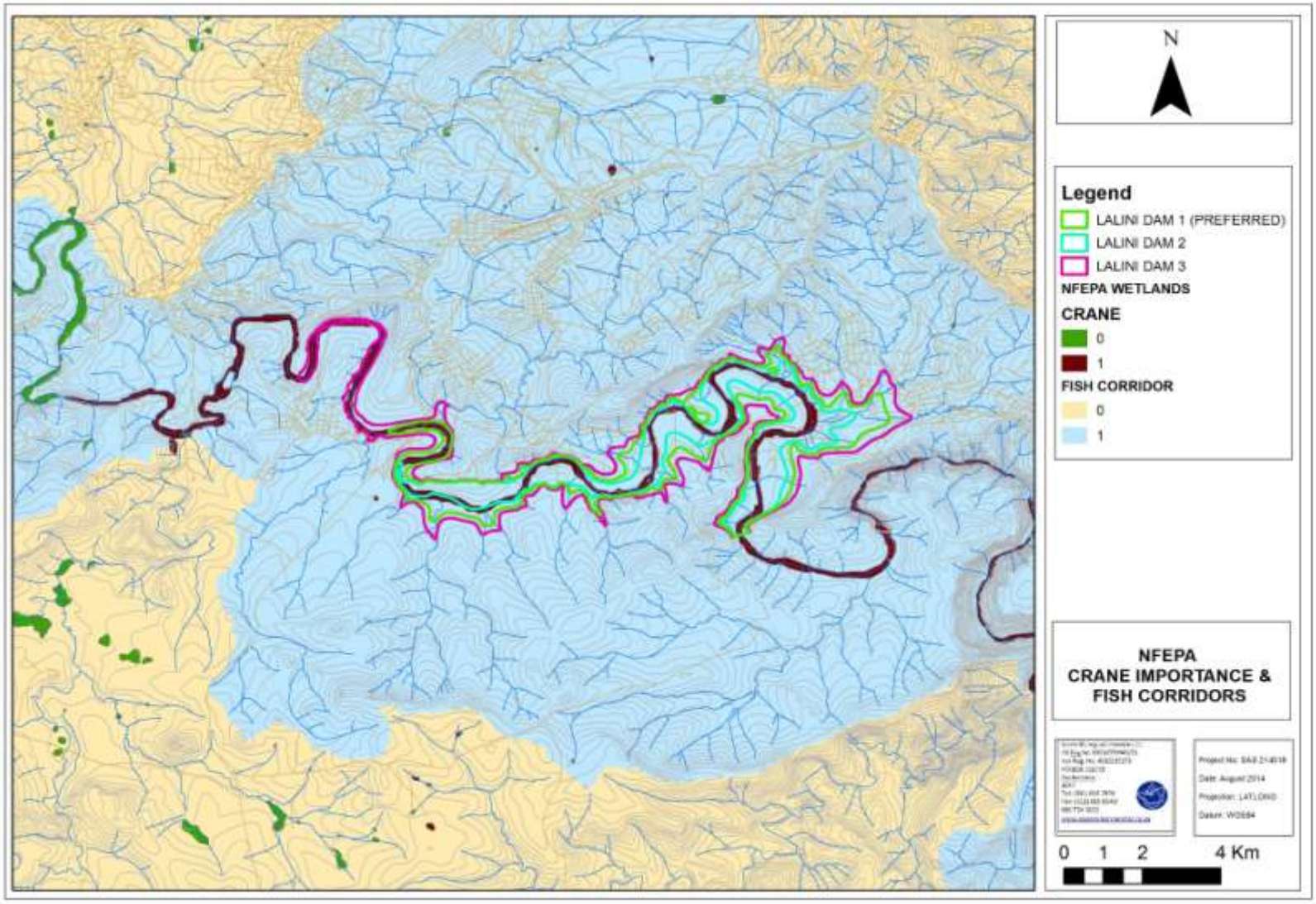

Figure 2: Important areas for the conservation of cranes and fish corridors in the iTsitsa River by Lalini Dam.

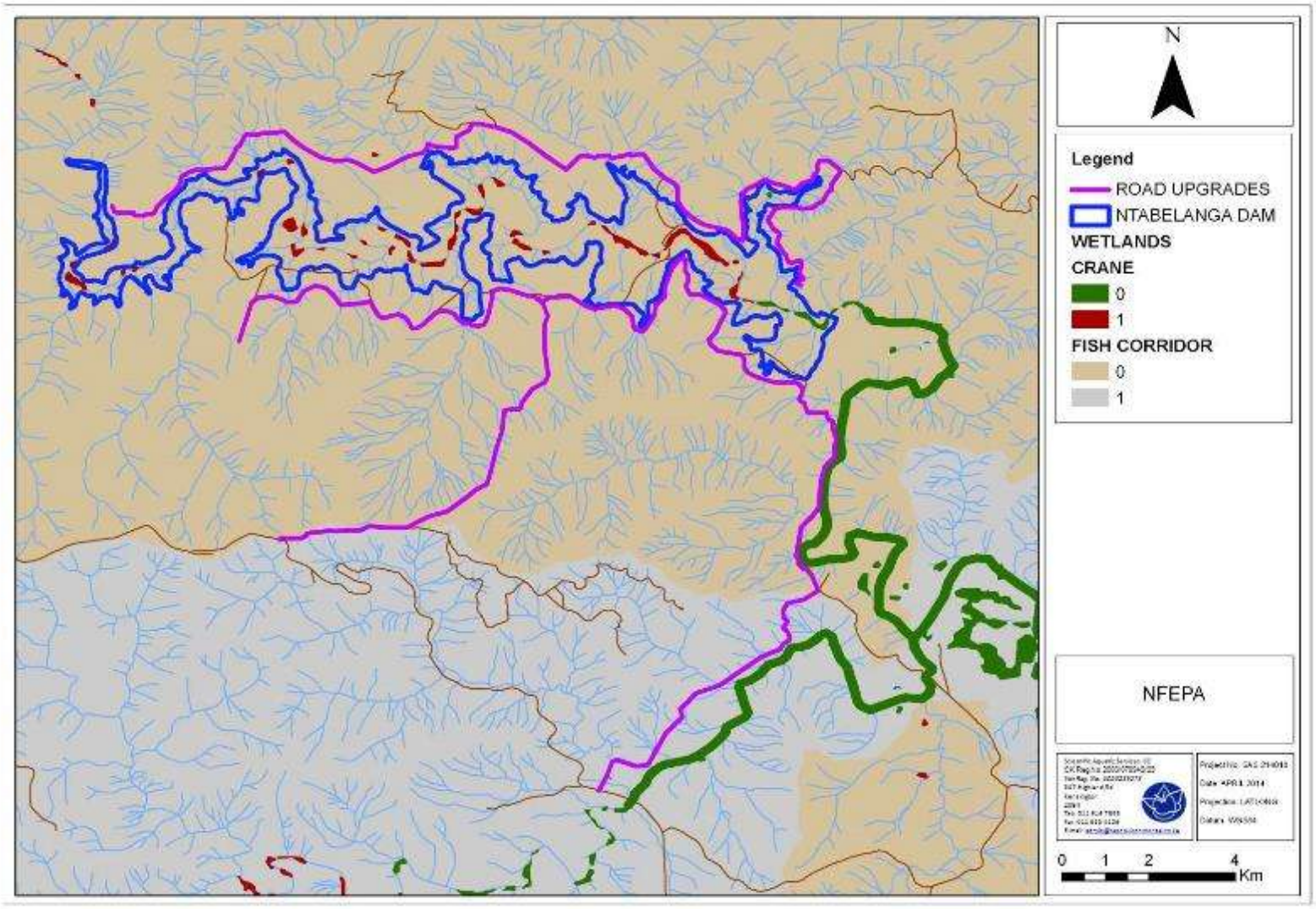

Figure 3: Important areas for the conservation of cranes in the iTsitsa River by Ntabelanga Dam.

2.7 NATIONAL LIST OF THREATENED TERRESTRIAL ECOSYSTEMS FOR SOUTH AFRICA (2011)

The National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA) provides for listing of threatened or protected ecosystems, in one of four categories: critically endangered, endangered, vulnerable or protected. Threatened ecosystems are listed in order to reduce the rate of ecosystem and species extinction by preventing further degradation and loss of structure, function and composition of threatened ecosystems. The purpose of listing protected ecosystems is primarily to conserve sites of exceptionally high conservation value (SANBI, BGIS).

According to the National List of Threatened Terrestrial Ecosystems (2011) sections of the proposed road upgrades, southern section of the pipelines and small portions of the Lalini Dam fall into a vulnerable ecosystem in terms of the original and remaining extent of the associated vegetation types (**Figures 4-6**). The Ntabelanga Dam and road upgrades fall into a least threatened ecosystem in terms of the original and remaining extent of the associated vegetation.

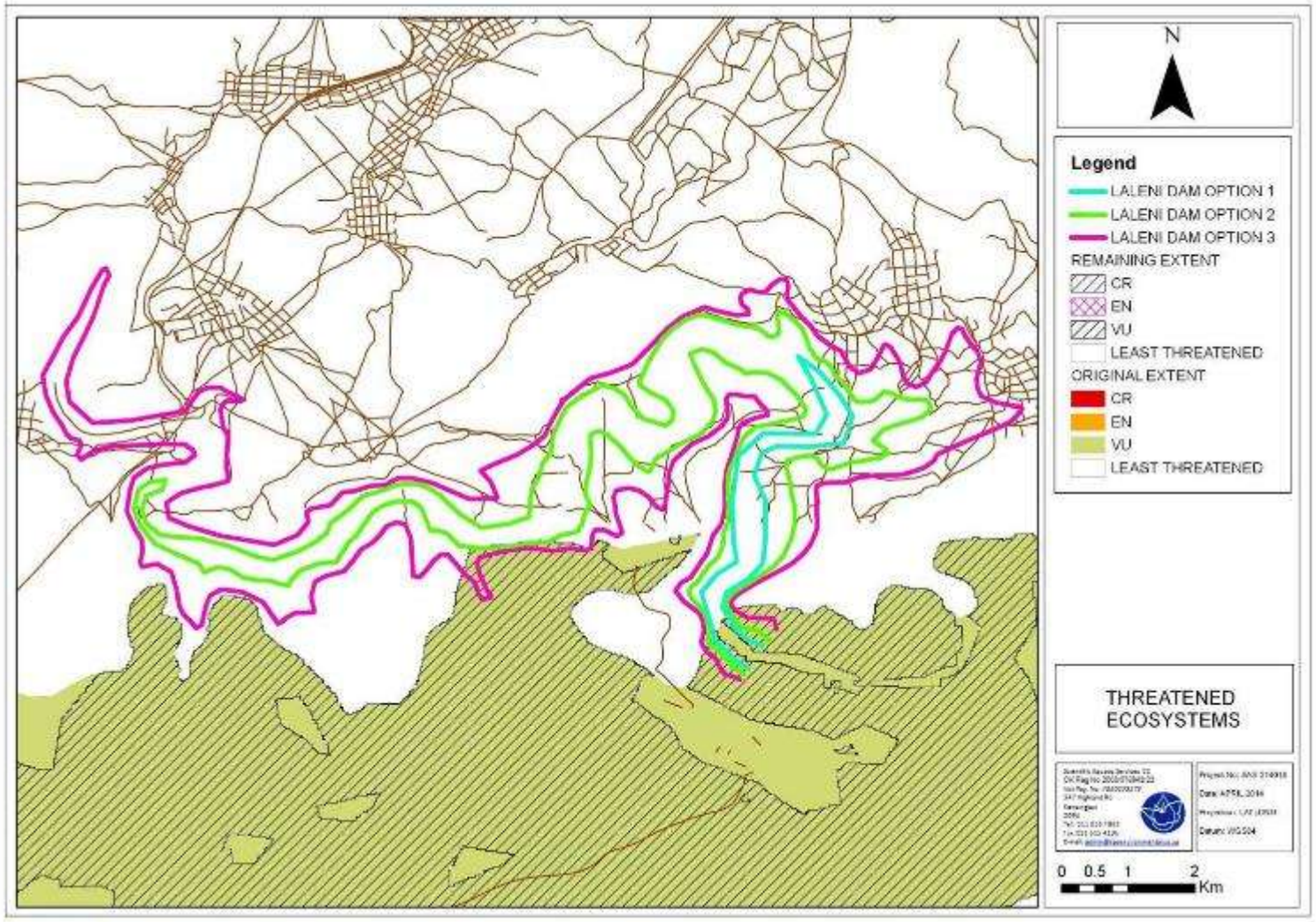

Figure 4: Threatened Ecosystems in terms of the original and remaining extent of the associated vegetation type distributed near Lalini Dam (National List of Threatened Terrestrial Ecosystems, 2011

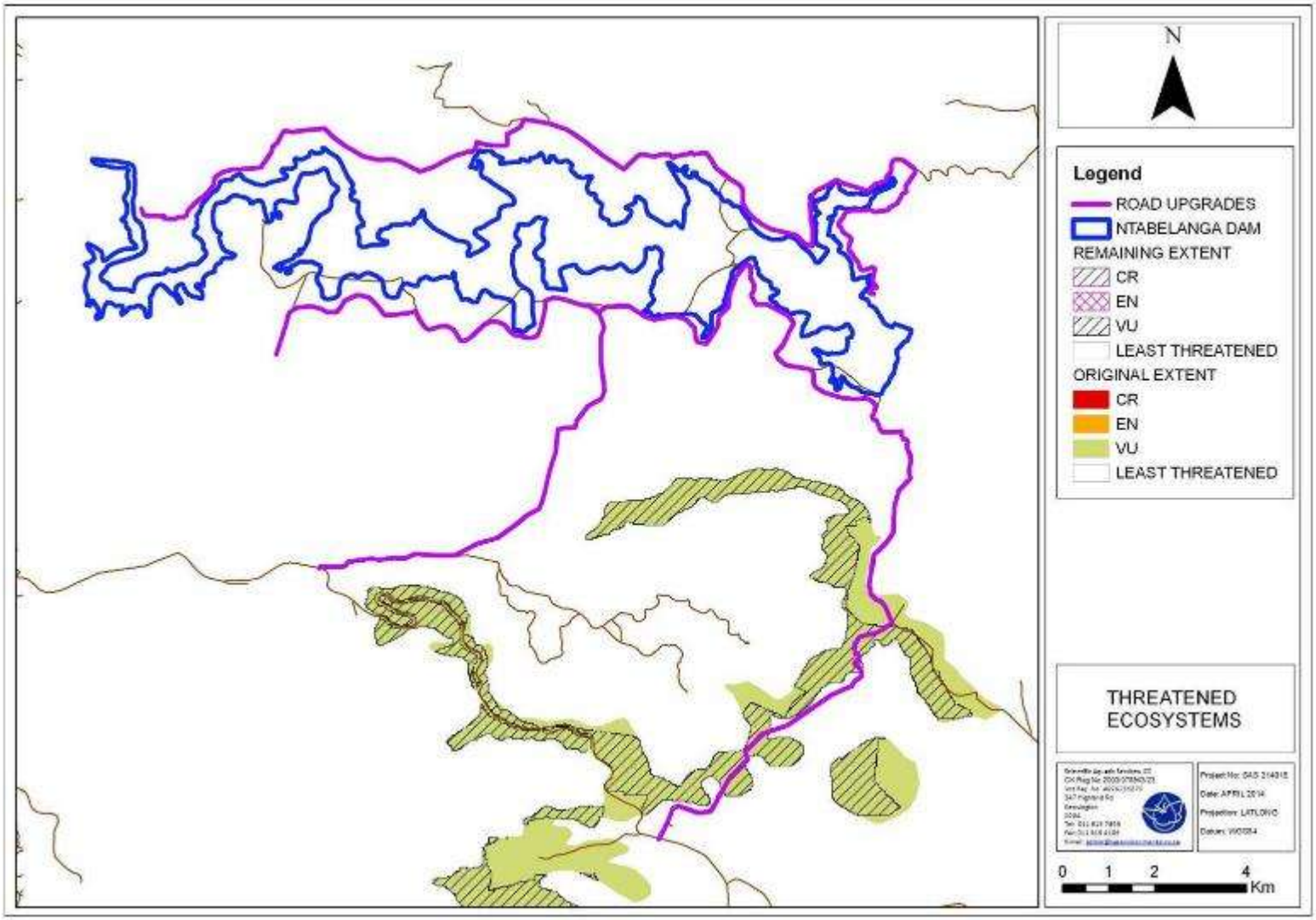

Figure 5: Threatened Ecosystems in terms of the original and remaining extent of the associated vegetation type distributed near Ntabelanga Dam and the road upgrades (National List of Threatened Terrestrial Ecosystems, 2011).

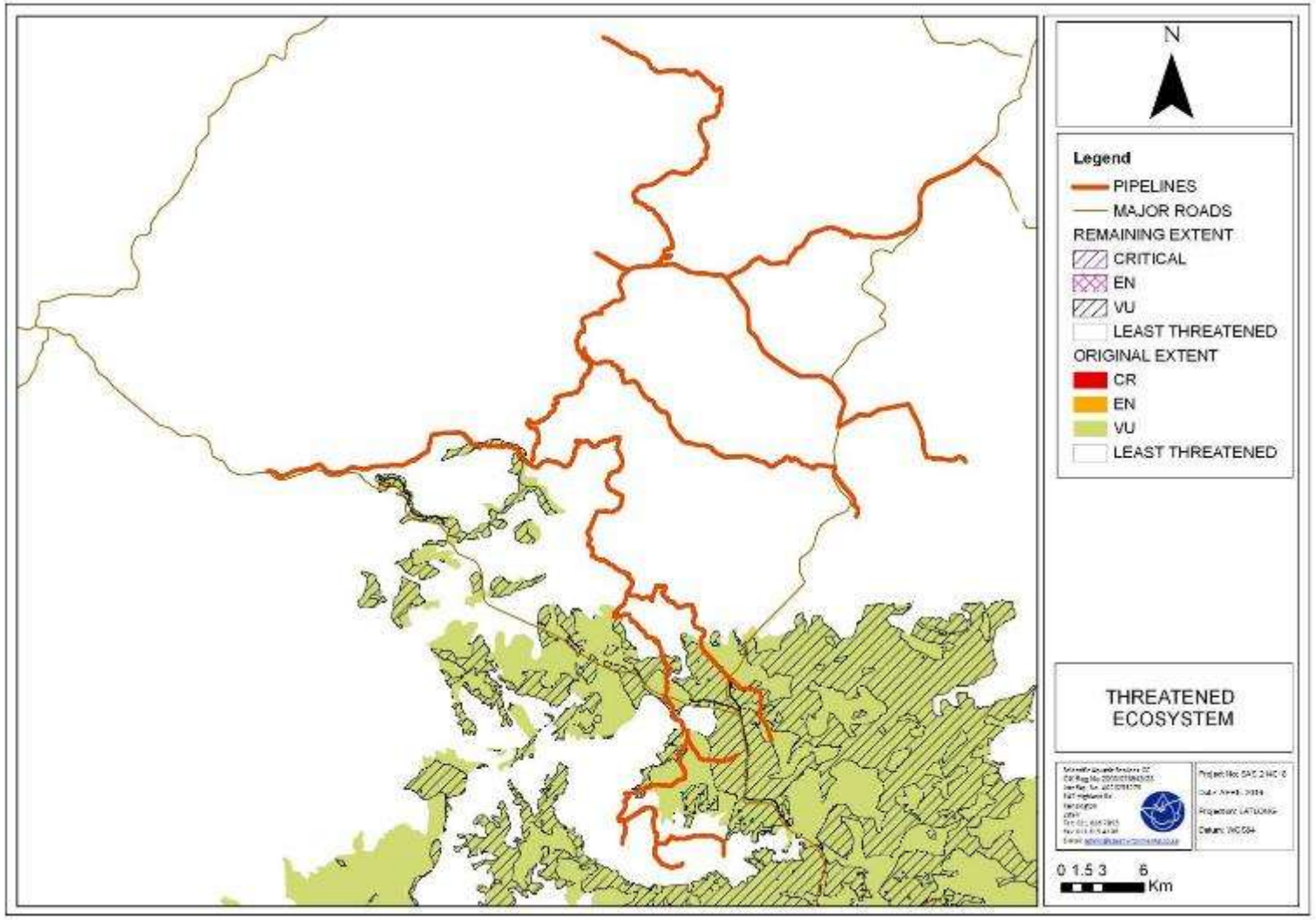

Figure 6: Threatened Ecosystems in terms of the original and remaining extent of the associated vegetation type associated with the pipelines (National List of Threatened Terrestrial Ecosystems, 2011).

3. TERMS OF REFERENCE

3.1 SCOPE OF THE STUDY

Specific outcomes in terms of the terrestrial assessment report are outlined below:

- A Red Data Listed (RDL) species assessment was conducted, including potential for species to occur on the study area and the Red Data Sensitivity Index Score (RDSIS) for the study area was implemented;
- Faunal inventories of species as encountered on site are provided;
- Habitat units were determined and described in terms of communities and ecological state;
- The spatial significance of the study area (including all alternatives) with regards to surrounding natural areas is described;
- All sensitive landscapes including rocky ridges, wetlands and/or any other special features have been identified and described;
- Environmental impacts of the proposed development activities and alternatives on the faunal ecology within the study area have been determined and assessed; and
- Management and mitigation measures which should be included in the Environmental Management Programme (EMPR) of the development to assist in minimising the impact on the receiving environment are presented.

3.2 METHODOLOGY

3.2.1 Field Surveys

Faunal habitat units will be identified and all faunal species will be recorded during the study area assessment. It is important to note that due to the nature and habits of fauna it is unlikely that all species will be recorded during the site assessment. In addition the levels of anthropogenic activity in the study area and surrounding area may determine whether species will be observed. The faunal categories that will be covered are: Overall faunal habitat units, mammals, avifaunal, reptiles; amphibians; invertebrates and araneae.

3.2.2 Mammals

Small mammals are unlikely to be directly observed in the field because of their nocturnal/crepuscular and cryptic nature. A simple and effective solution to this problem is to use Sherman traps. A Sherman trap is a small aluminium box with a spring-loaded door. Once the animal is inside the trap, it steps on a small plate that causes the door to snap shut, thereby capturing the individual. Trapping took place within relatively undisturbed small mammal habitat throughout the study area. In the event of capturing a small mammal during the night, the animal will be photographed and then set free unharmed early the following morning. Traps will be baited with a universal mixture of oats, peanut butter, and fish paste.

Infrared camera traps were placed in areas that show high faunal usage, or had the potential to be utilised by faunal species, most notably of the small to medium sized

mammals. These camera traps are ideal for recording species that are active at night, or are very secretive by nature and thus avoid direct human observation. Larger faunal species were also recorded during the assessment with the use of visual identification, spoor, call and dung.

Figure 7: Sherman trap and bait used to capture small mammal species.

Figure 8: Infrared camera trap used to observe illusive and nocturnal species.

3.2.3 Avifauna

The Southern African Bird Atlas Project 2 species list (http://sabap2.adu.org.za) for the quarter degree squares was compared with the field survey database of birds identified on the study area during the survey. Field surveys were undertaken utilising a pair of binoculars as well as birdcall identification techniques to accurately identify avifaunal species.

3.2.4 Reptiles

Reptiles observed were identified during the field survey. Abandoned termitaria were inspected for reptiles dwelling within them. Other areas where reptiles are likely to reside,

specifically wetland areas which were associated with rocky outcrop areas as well as exposed areas of rocky floodplain, were investigated where rock overturning took place. The data gathered during the assessment along with the habitat analysis provides an accurate indication of which reptile species are likely to occur within the varying habitats that can be found within and surrounding the study area.

Figure 9: Snake trap to capture and identify snakes and small reptiles.

3.2.5 Amphibians

All amphibian species encountered within the study area were recorded during the field assessment with the use of direct visual identification along with other identification aids such as call identification. Amphibian species flourish in and around wetland and riparian areas. It is in these areas that specific attention will be given to searching for amphibian species. It is unlikely that all amphibian species will be recorded during the site assessment, due to their cryptic nature and habits, varied stages of life cycles, seasonal and temporal fluctuations within the environment. However, the data gathered during the assessment along with a habitat analysis will provide an accurate indication of which amphibian species are likely to occur in the study area.

3.2.6 Invertebrates

Capture of invertebrate fauna took place by various methods including first hand visual identification, netting, pitfall traps, drift fences and dragging. In this regard special mention is made of the use of pitfall traps and sweep netting for invertebrates. A list of visually identified and observed invertebrate species will be compiled during the field surveys. However, due to their cryptic nature and habits, varied stages of life cycles, seasonal and temporal fluctuations within the environment, it is unlikely that all invertebrate species were recorded during the site assessment periods. Nevertheless, the data gathered during the

assessment along with a habitat analysis provided an accurate indication of which invertebrate species are likely to occur on the study area.

Figure 10: Drift fence used to capture small invertebrates on left; small pitfall trap placed under a rock to capture and identify secretive invertebrates on right.

3.2.7 Spiders and Scorpions

Within the study area there were suitable habitats, such as rocky outcrops and the mountain bushveld habitats, where spiders and scorpions were found to reside. Special attention was placed on the identification of spiders and scorpions within these areas. Rocks were overturned as well as drift fences and pitfall traps utilised in order to capture any spiders or scorpions for identification.

3.3 RED DATA SPECIES ASSESSMENT

Fauna and the Red Data Sensitivity Index

Given the restrictions of field assessments to identify all the faunal species that possibly occur in a particular area, the Red Data Sensitivity Index (RDSIS) has been developed by SAS Environmental to provide an indication of the potential red data faunal species that could reside in the area, while simultaneously providing a quantitative measure of the study area's value in terms of conserving faunal diversity. The RDSIS is based on the principles that when the knowledge of the specie's historical distribution is combined with a field assessment that identifies the degree to which the property supports a certain species habitat and food requirements, inferences can be made about the chances of that particular species residing on the property. Repeating this procedure for all the potential red data faunal species of the area and collating this information will then provide a sensitivity measure of the study area being investigated. The detailed methodology to be used to determine the RDSIS of the property is presented below:

- Probability of Occurrence (POC): Known distribution range (D), habitat suitability of the site (H) and availability of food sources (F) on site will be determined for each of the species. Each of these variables is expressed a percentage (where 100% is a perfect score). The average of these scores will provide a POC score for each species. The POC value is categorised as follows:
  - **0-20% = Low;**
  - **21-40% = Low to Medium;**
  - **41-60% = Medium;**
  - **61-80% = Medium to High and**
  - **81-100% = High**

  POC = (D+H+F)/3
- Total Species Score (TSS): Species with POC of more than 60% (High-medium) will be considered when applying the RDSIS. A weighting factor will be assigned to the different IUCN categories providing species with a higher conservation status, a higher score. This weighting factor will then be multiplied with the POC to calculate the total species score (TSS) for each species. The weighting as assigned to the various categories will be as follows:
  - **Data Deficient = 0.2;**
  - **Rare = 0.5;**
  - **Near Threatened = 0.7;**
  - **Vulnerable = 1.2;**
  - **Endangered = 1.7 and**
  - **Critically Endangered = 2.0**.

  TSS = (IUCN weighting*POC) where POC > 60%

- Average Total Species (Ave TSS) and Threatened Taxa Score (Ave TT): The average of all TSS potentially occurring on the site will be calculated. The average of all the Threatened taxa (TT) (*Near threatened*, *Vulnerable*, *Endangered* and *Critically Endangered)* TSS scores will also be calculated. The average of these two scores (Ave TSS and Ave TT) will then be calculated in order to add more weight to threatened taxa with POC higher than 60%.

  Ave = Ave TSS [TSS/No of Spp] + Ave TT [TT TSS/No of Spp]/2

- Red Data Sensitivity Index Score (RDSIS): The average score obtained above and the sum of the percentage of species with a POC of 60% or higher of the total number of RDL species listed for the area will then be calculated. The average of these two scores, expressed as a percentage, will give the RDSIS for the area investigated.

  RDSIS = Ave + [Spp with POC>60%/Total no Of Spp*100]/2

RDSIS interpretation:

Table 2: RDSIS value interpretation with regards to RDL faunal importance on the study area.

RDSIS Score	RDL faunal importance
0-20%	**Low**
21-40%	**Low-Medium**
41-60%	**Medium**
60-80%	**High-Medium**
81-100%	**High**

3.4 IMPACT CRITERIA AND RATING SCALE

The impacts are rated in accordance with the Environmental Impact Assessment Regulations, 2010 and the criteria drawn from the IEM Guidelines Series, Guideline 5: Assessment of Alternatives and Impacts, published by the (DEAT, 2006) as well as the Guideline Document on Impact Significance (DEAT, 2002).

The key issues identified during the Scoping Phase inform the terms of reference of this specialist study. Each issue consists of components that on their own or in combination with each other give rise to potential impacts, either positive or negative, from the project onto the environment or from the environment onto the project. The significance of the potential impacts is considered before and after identified mitigation is implemented, for direct, indirect, and cumulative impacts, in the short and long term.

A description of the nature of the impact, any specific legal requirements and the stage (construction/decommissioning or operation) is given. Impacts are considered to be the same during construction and decommissioning.
The following criteria has been used to evaluate significance:

- **Nature:** This is an appraisal of the type of effect the activity is likely to have on the affected environment. The description includes what is being affected and how. The nature of the impact will be classified as positive or negative, and direct or indirect.

- **Extent and location:** This indicates the spatial area that may be affected (**Table 3**Table 3:)

Table 3: Geographical extent of impact

Rating	Extent	Description
1	Site	Impacted area is only at the site – the actual extent of the activity.
2	Local	Impacted area is limited to the site and its immediate surrounding area
3	Regional	Impacted area extends to the surrounding area, the immediate and the neighbouring properties.
4	Provincial	Impact considered of provincial importance
5	National	Impact considered of national importance – will affect entire country.

- **Duration:** This measures the lifetime of the impact (**Table 4**).

Table 4: Duration of Impact

Rating	Duration	Description
1	Short term	0 – 3 years, or length of construction period
2	Medium term	3 – 10 years
3	Long term	> 10 years, or entire operational life of project.
4	Permanent – mitigated	Mitigation measures of natural process will reduce impact – impact will remain after operational life of project.
5	Permanent – no mitigation	No mitigation measures of natural process will reduce impact after implementation – impact will remain after operational life of project.

- **Intensity/severity:** This is the degree to which the project affects or changes the environment; it includes a measure of the reversibility of impacts (**Table 5**).

Table 5: Intensity of Impact

Rating	Intensity	Description
1	Negligible	Change is slight, often not noticeable, natural functioning of environment not affected.
2	Low	Natural functioning of environment is minimally affected. Natural, cultural and social functions and processes can be reversed to their original state.
3	Medium	Environment remarkably altered, still functions, if in modified way. Negative impacts cannot be fully reversed.
4	High	Cultural and social functions and processes disturbed – potentially ceasing to function temporarily.
5	Very high	Natural, cultural and social functions and processes permanently cease, and valued, important, sensitive or vulnerable systems or communities are substantially affected. Negative impacts cannot be reversed.

Potential for irreplaceable loss of resources: This is the degree to which the project will cause loss of resources that are irreplaceable (Table 6).

Table 6: Potential for irreplaceable loss of resources

Rating	Potential for irreplaceable loss of resources	Description
1	Low	No irreplaceable resources will be impacted.
3	Medium	Resources can be replaced, with effort.
5	High	There is no potential for replacing a particular vulnerable resource that will be impacted.

- **Probability:** This is the likelihood or the chances that the impact will occur (**Table 7**).

Table 7: Probability of Impact

Rating	Probability	Description
1	Improbable	Under normal conditions, no impacts expected.
2	Low	The probability of the impact to occur is low due to its design or historic experience.
3	Medium	There is a distinct probability of the impact occurring.

4	High	It is most likely that the impact will occur
5	Definite	The impact will occur regardless of any prevention measures.

- **Confidence:** This is the level of knowledge or information available, the environmental impact practitioner or a specialist had in his/her judgement (**Table 8**).

Table 8: Confidence in level of knowledge or information

Rating	Confidence	Description
	Low	Judgement based on intuition, not knowledge / information.
	Medium	Common sense and general knowledge informs decision.
	High	Scientific / proven information informs decision.

- **Consequence:** This is calculated as extent + duration + intensity + potential impact on irreplaceable resources.

- **Significance:** The significance will be rated by combining the consequence of the impact and the probability of occurrence (i.e. consequence x probability = significance). The maximum value which can be obtained is 100 significance points (**Table 9**).

Table 9: Significance of issues (based on parameters)

Rating	Significance	Description
1-14	Very low	No action required.
15-29	Low	Impacts are within the acceptable range.
30-44	Medium-low	Impacts are within the acceptable range but should be mitigated to lower significance levels wherever possible.
45-59	Medium-high	Impacts are important and require attention; mitigation is required to reduce the negative impacts to acceptable levels.
60-80	High	Impacts are of great importance, mitigation is crucial.
81-100	Very high	Impacts are unacceptable.

- **Cumulative Impacts:** This refers to the combined, incremental effects of the impact. The possible cumulative impacts will also be considered.

- **Mitigation:** Mitigation for significant issues will be incorporated into the EMPR.

3.5 LEGISLATION AND GUIDELINES CONSIDERED

3.5.1 National Environmental Management Act (NEMA) (Act No. 107 of 1998)

The Environmental Impact Assessment Regulations 2010: The NEMA EIA 2010 regulations and the listing notices thereto of Section 24 of the NEMA also allows the Minister of Environmental Affairs to identify and list or delist certain activities or particular areas, which require an environment authorisation prior to commencement of activities. Any person who wants to conduct such an activity is subject to completing an assessment of potential effects (positive and negative) of that activity on the environment and is subject to prosecution if he/she does not complete this assessment. EIA regulations 543 – 546 provide the processes to be undertaken to obtain environmental authorisation and lists the activities that the Minister has deemed necessary to require such a process.

3.5.2 National Environmental Management: Biodiversity Act (NEMBA) (Act No. 10 of 2004)

The objectives of this Act are (within the framework of NEMA) to provide for:

- the management and conservation of biological diversity within the Republic of South Africa and of the components of such diversity;
- the use of indigenous biological resources in a sustainable manner;
- the fair and equitable sharing among stakeholders of benefits arising from bio prospecting involving indigenous biological resources;
- to give effect to ratified international agreements relating to biodiversity which are binding to the Republic;
- to provide for co-operative governance in biodiversity management and conservation; and
- to provide for a South African National Biodiversity Institute (SANBI) to assist in achieving the objectives of this Act.

This act alludes to the fact that management of biodiversity must take place to ensure that the biodiversity of surrounding areas are not negatively impacted upon by any activity being undertaken, in order to ensure the fair and equitable sharing among stakeholders of benefits arising from indigenous biological resources.

3.5.3 The Protected Areas Act (Act No. 57 of 2003)

This act is to enable the provision for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes; for the establishment of a national register of all national, provincial and local protected areas; for the management of those areas in accordance with national norms and standards; for intergovernmental co-operation and public consultation in matters concerning protected areas; and for matters in connection therewith.

This Act as with the National Forestry Act alludes to the fact that the conservation status of all vegetation types needs to be considered when any development is taking place to ensure that the adequate conservation of all vegetation types is ensured.

4. ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations are applicable to this report:

- The ecological assessment is confined to the study area and does not include the neighbouring and adjacent properties; these were however considered as part of the desktop assessment.
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. It is, however, expected that most faunal species and their associated habitats have been sufficiently assessed and considered for a project of this scale. Two site assessments were conducted, one during April 2014 and the other during June 2014. A more reliable assessment would require seasonal assessments, which is not always feasible, with specific mention of a survey undertaken in the spring and/or summer growing season.
- Biodiversity can often be open and subjective, and as such fully quantifying such is not always possible.
- Due to the vast extent of the study area, sampling by its nature, means that not all individual floral species were assessed and identified. Some species and taxa on the study area may therefore been missed during the assessment.

5. DESCRIPTION OF THE AFFECTED ENVIRONMENT

Please note that section 5 has been divided into 2 sections. Section 5.1 refers to the Lalini Dam, the habitat zones and faunal species found there, 5.2 refers to the Ntabelanga Dam and the habitats and species found during the site visit and section 5.3 refers to the pipelines and powerlines.

For detailed discussion on the findings refer to section 6.

5.1 LALINI DAM

5.1.1 Faunal Habitat

There are varying faunal habitats that can be found at the site of the Lalini Dam. These habitats vary from being anthropogenically transformed open grassland areas to largely natural rocky ridge habitats and secluded riparian areas.

Rocky / Mountain Bushveld Habitat

This habitat is found in the vicinity of the dam wall, and has the highest biodiversity in terms of faunal species in comparison to the other habitat units. This unit can also be considered the most intact and natural habitat unit. It is characterised by a dense woody structure stretching from the water's edge up to the base of the cliffs located at higher altitudes. The central and higher sections of this habitat unit are interspersed with large Euphorbia trees which grow in a relatively dense forest, providing a unique ecological system for avifaunal and small mammal species. The rocky ledges and open outcrops also provide a variety of niche habitats for many reptile, spider and scorpion species. This habitat unit also proved to have the highest levels of poaching/ subsistence hunting by the local community members. On several occasions during the site visit local hunters were seen moving through this habitat unit with large packs of hunting dogs.

Figure 11: Mountain Bushveld located at the Lalini Dam.

Grassland / Acacia Thornveld Habitat

This habitat unit is found bordering the Rocky/ Mountain bushveld habitat, as well as being found in the central sections of the proposed Lalini Dam. *Acacia* sp's predominate this habitat unit and are regularly harvested by the local community members for firewood. This habitat unit proved to have a medium diversity of avifauna, most notably in the areas further away from the rural settlements as well as the sections that closely border the Rocky/ Mountain bushveld habitat units. There was very little sign of other faunal species occurring within this habitat unit, however local herds of goats and cattle were regularly observed within this unit, which would adversely impact the natural faunal species assemblage to increased human presence and resource competition.

Figure 12: Grassland/ Acacia thornveld located at the Lalini Dam.

Transformed Grassland Habitat

Found in sections along the river, this habitat unit was largely devoid of trees and often found on gentle slopes. This habitat unit is used by the local herders as grazing lands for their livestock, as well as historically for crop cultivation. The diversity and availability of habitat and cover within this habitat unit was very low, with only a low diversity of avifauna and invertebrates being observed.

Figure 13: Transformed grassland.

Riparian Habitat

This habitat unit is located along the river edge, and is characterized by its location as well as the dominant woody component. This habitat unit provides refugia and breeding sites for many avifaunal species, as well as reptile species associated with riparian areas and semi-aquatic mammals that inhabit the river system. In many places the riparian habitat was disturbed, but in a few key locations where either distance from human habitation or lack of accessibility exists, intact riparian habitat can be found. This habitat unit will be completely inundated with the rising waters of the proposed dams, and as such important faunal habitat for a diverse range of species, from invertebrates to avifauna, will be permanently lost.

Figure 14: Riparian habitat as found near the site of the Lalini Dam wall.

5.1.2 Mammals

All mammal species observed through visual confirmation or via signs thereof are listed in **Table 10**.

Table 10: Table listing mammal species observed

Scientific name	Common name	IUCN Status
Sylvicapra grimmia	Common Duiker	LC
Aonyx capensis	Cape Clawless Otter	LC
Atilax paludinosus	Water mongoose	LC
Procavia capensis	Rock Hyrax	LC
Lepus saxatilis	Scrub Hare	LC
Cynictis penicillata	Yellow mongoose	LC
Galerella sanguinea	Slender mongoose	LC
Hystrix africaeaustralis	South African Porcupine	LC
Mastomys natalensis	Natal multimammate mouse	LC
Genetta maculata	Large Spotted Genet	LC
Rhabdomys pumilio	Four-striped Grass Mouse	LC
Canis mesomelas	Black-backed Jackal	LC

VU = Vulnerable, NT = Near Threatened, LC = Least Concern NYBA = Not Yet Been

Figure 15: *Procavia capensis* (Rock hyrax) on the left with spoor of *Atilax paludinosus* (Water mongoose) on the right.

5.1.3 Avifauna

All avifaunal species identified through visual or call identification are listed in the **Table 11**.

Table 11: Table listing avifaunal species observed at the Lalini Dam study area.

Scientific name	Common name	IUCN Status
Stenostira scia	Fairy flycatcher	NYBA
Muscicapa adusta	African Dusky flycatcher	LC
Lanius collaris	Common fiscal shrike	LC
Stigmatopelia senegalensis	Laughing dove	LC
Scopus umbretta	Hammerkop	LC
Lamprotornis nitens	Cape starling	LC
Terpsiphone viridis	African Paradise Flycatcher	LC
Motacilla clara	Mountain Wagtail	LC
Motacila aguimp	African Pied Wagtail	NYBA
Tockus alboterminatus	Crowned Hornbill	LC
Phoeniculus purpureus	Green Wood Hoopoe	LC
Upupa africana	African Hoopoe	NYBA
Colius striatus	Speckled Mousebird	LC
Urocolius indicus	Red-faced Mousebird	LC
Centropus burchellii	Burchell's Coucal	NYBA
Saxicola torquatus	African Stonechat	LC
Buteo rufofuscus	Jackal Buzzard	LC
Laniarius ferrugineus	Southern Boubou	LC
Lybius torquatus	Black-collared Barbet	
Anas sparsa	African Black duck	
Numida meleagris	Helmeted Guinea fowl	
Buteo buteo	Steppe buzzard	
Fulica cristata	Red Knobbed Coot	
Vanellus armatus	Blacksmith Plover	
Motacilla capensis	Cape wagtail	
Hirundo albigularis	White throated swallow	
Elanus caeruleus	Black-Shouldered Kite	
Anthus cinnamomeus	African pipit	

Scientific name	Common name	IUCN Status
Bubulcus ibis	Cattle Egret	
Hirundo rustica	Barn swallow	
Pycononotus tricolor	Dark Capped BulBul	
Campicoloides bifasciatus	Buff-streaked chat	
Prinia flavicans	Black-chested Prinia	
Apus apus	Common swift	
Ripariacincta	Banded martin	
Myrmecocichla formicivora	Ant-eating chat	
Chalcomitra amethystina	Amethyst Sunbird	
Ardea melanocephala	Black headed heron	
Zosterops capensis	Cape White-eye	
Threskiornis aethiopicus	Sacred ibis	
Gyps coprotheres	Cape Vulture	VU
Ploceus subaureus	Spectacled Weaver	
Cossypha caffra	Robin-chat	
Alopochena egyptiaca	Egyptian Goose	
Pternistes afer	Red-necked Francolin	
Batis molitor	Chinspotbatis	
Falco amurensis	Amur falcon	
Uraeginthus angolensis	Blue Waxbill	LC
Quelea quelea	Red-billed Quelea	LC
Oenanthe monticola	Mountain Wheatear	LC
Cecropis cucullata	Greater Striped Swallow	NYBA
Lagonosticta rubricata	African Firefinch	LC

VU = Vulnerable, NT = Near Threatened, LC = Least Concern NYBA = Not Yet Been

Figure 16: On the left *Gyps coprotheres* (Cape Vulture) pair seen flying above the Lalini Dam study area; on the right *Lybius torquatus* (Black-collared Barbet) seen resting in the *Euphorbia sp.* forest.

Figure 17: On the left *Cossypha caffra* (Robin-chat) in riparian zone of Lalini Dam study area; and on the right *Zosterops capensis* (Cape White-eye).

5.1.4 Reptiles

Table 12 list all the reptile species observed during the site visit.

Table 12: Table listing reptile species observed

Scientific name	Common name	IUCN Status
Agama atra	Southern Rock Agama	NYBA
Trachylepis striata	Striped skink	NYBA
Gerrhosaurus flavigularis	Yellow throated plated lizard	NYBA

VU = Vulnerable, NT = Near Threatened, LC = Least Concern NYBA = Not Yet Been

Figure 18: *Agama atra* (Southern Rock Agama) observed in the mountain bushveld habitat

5.1.5 Amphibians

Table 13 contains the amphibian species observed during the site visit.

Table 13: Table listing amphibian species observed

Scientific name	Common name	IUCN Status
Afrana angolensis	Common river frog	LC
Cacosternum boettgeri	Boettger's Dainty frog	LC
Amietophrynus rangeri	Raucous toad	LC
Xenopus laevisi	Common Platanna	LC

VU = Vulnerable, NT = Near Threatened, LC = Least Concern NYBA = Not Yet Been

Figure 19: *Afrana angolensis* (Common river frog) observed throughout the study area. Note the two different colour morphs.

5.1.6 Invertebrates

Table 14 lists all the invertebrate species that were observed during the site visit.

Table 14: Table listing invertebrate species observed

Order	Family	Scientific name	Common name	IUCN Status
Coleoptera	Scarabaeidae	*Onthophagus taurus*	Dung beetle	NYBA
	Tenebrionidae	*Lagria vulnerata*	Hairy darkling beetle	NYBA
		Moluris pseudonitidae	Rounded Toktokkie	NYBA
	Coccinellidae	*Harmonia vigintiduomaculata*	Chequered ladybird	NYBA
	Meloidae	*Mylabris oculata*	CMR Bean beetle	
Lepidoptera	Pieridae	*Colotis danae*	Scarlet tip	NYBA
		Eurema hecabe	Common grass yellow	NYBA
		Eurema brigitta	Broad-bordered grass yellow	LC
		Colotis auxo	Sulphur orange tip	NYBA
		Junonia octavia	Gaudy Commodore	NYBA
		Byblia ilythia	Spotted Joker	NYBA
		Hypolimmas misippus	Diadem	NYBA
		Belenois creona	African Common White	NYBA
		Belenois aurota	Brown-veined white	NYBA
	Nymphalidae	*Junonia hierta*	Yellow Pansy	LC
		Pseudonympha magoides	False Silver-bottom Brown	

Order	Family	Scientific name	Common name	IUCN Status
	Lycaenidae	*Azanus jesous*	Topaz blue	NYBA
	Noctuidae	*Rhanidophora ridens*	Dice Moth	NYBA
Hemiptera	Cicadidae	*Sp.*		NYBA
	Miridae	*Daraeocoris sp.*	Plant bugs, capsids	NYBA
	Pentatomidae	*Nezara viridula*	Green Vegetable Bug	NYBA
Odonata	Libellulidae	*Trithemis furva*	Dark Dropwing	LC
		Orthetrum julia	Julia skimmer	LC
Ephemeroptera	Heptageniidae	*Sp.*	Flat-head Mayflies	NYBA
Orthoptera	Tetrigidae	*Sp.*	Groundhoppers, grouse locusts	NYBA
	Acrididae	*Paracinema tricolor*	Vlei grasshopper	NYBA
		Acanthacris ruficornis	Garden locust	NYBA
		Cannula gracilis	Grass mimicking Grasshopper	NYBA
		Acridaacuminata	Common stick grasshopper	NYBA
		Orthoctha sp.		NYBA
	Pyrgomorphidae	*Zonocerus elegans*	Elegant grasshopper	NYBA
Neuroptera	Myrmeleontidae	*Myrmeleon sp.*	Pit-building antlions	NYBA
Spirostreptida	Spirostreptidae	*Archispirostreptus sp*	African millipede	NYBA
Mantodea	Mantidae	*Sphodromantis lineola*	African Praying mantis	NYBA
Hymenoptera	Apidae	*Apis mellifera scutellata*	African honey bee	NYBA
Diptera	Calliphoridae	*Musca domestica*	House fly	NYBA
Thysanura	Lepismatidae	*Ctenolepisma longicaudata*	Fish moth	NYBA
Isoptera	Termitidae	*Odontotermes latericus*	Harvester Termites	NYBA
Other Invertebrates				
Achatina achatina	African giant land snail			NYBA

VU = Vulnerable, NT = Near Threatened, LC = Least Concern NYBA = Not Yet Been

Figure 20: *Mylabris oculata* (CMR Beetle) on the left; *Colotis danae* (Scarlet Tip) on the right.

Figure 21: *Onthophagus taurus* (Dung Beetle) on the left; *Zonocerus elegans* (Elegant Grasshopper) on the right.

5.1.7 Spiders and Scorpions

Listed in the tables below are the arachnid and scorpions species observed during the site visit.

Table 15: Table listing spider species observed

Scientific name	Common name	IUCN Status
Stegodyphus sp	Community web spiders	NYBA
Olorunia cellata.	Funnel web spider	NYBA
Selenopidae sp	Wall Spiders	NYBA

VU = Vulnerable, NT = Near Threatened, LC = Least Concern NYBA = Not Yet Been

Figure 22: *Olorunia cellata*. (Funnel web spider) on the left; *Stegodyphus sp* (Community web spiders) on the right.

Table 16: Table listing scorpion species observed

Scientific name	Common name	NEMBA (2004) Status
Hadogenes sp.	Rock scorpions	Protected

VU = Vulnerable, NT = Near Threatened, LC = Least Concern NYBA = Not Yet Been

Figure 23: *Hadogenes sp* (Rock scorpion) observed near the Lalini Dam wall

5.2 NTABELANGA DAM

5.2.1 Faunal Habitat

The habitats in at the proposed Ntabelanga Dam study area have been exposed to much higher levels of anthropogenic activities than those of the Lalini Dam study area. The greatest impact on the habitat zones has come from agriculture, mainly crop farming but also to a degree livestock grazing. The largest habitat zone found on the proposed Ntabelanga Dam study area is that of the transformed habitat. The remaining habitat types including the *Acacia* thornveld/ grassland, rocky outcrop and riparian habitat zones were spread throughout the study area in small pockets with very little connectivity being displayed amongst habitat zones of the same type.

***Acacia* Thornveld/ Grassland habitat**

This habitat zone appeared in patches in the southern sections of the Ntabelanga study area, amongst the transformed habitat unit. This habitat unit provided refugia to the more common avifaunal species that are known to occur in open bushveld and grasslands. Harvesting of wood as well as grazing/ browsing activities of goats and cattle was occurring at time of assessment in this habitat unit, slowly decreasing the woody component and converting this habitat unit to a more transformed grassland habitat unit. The faunal assemblage was not very high in this habitat unit, which can be attributed to the various levels of anthropogenic activities occurring within the habitat unit.

Figure 24: *Acacia* thornveld/ grassland habitat.

Rocky Outcrop habitat

This habitat unit is found in small sections towards the tail end of the dam as well as in the vicinity of the proposed dam wall. This habitat unit is most suited to reptile, scorpion and spider species, whilst also providing suitable habitat to a variety of avifaunal species. The remoteness in comparison to the other habitat units has provided a higher level of protection to this habitat unit and as such it is evident that this habitat has remained relatively undisturbed over time. Unfortunately, this habitat unit will be one of the most severely affected by the rising waters and the associated construction activities of the dam wall.

Figure 25: Rocky outcrop habitat.

Riparian habitat

Located along the course of the river system, only small sections of natural riparian habitat remain. Much of the existing riparian habitat has been removed, leaving grass covered banks or dense stands of alien trees. The undisturbed areas still provide suitable habitat to a limited number of faunal species, as the size constraints of the remaining suitable riparian habitat place a limit on the level of species support and numbers thereof. The sections that have been invaded by alien tree species provide very little habitat, and only the more hardy faunal species are found in these sections, most notably very common avian species.

Figure 26: Riparian habitat as found along the river system in the proposed Ntabelanga Dam study area.

Transformed habitat

This habitat unit represents the remnants of old agricultural lands that spread out along the river course and stretched far inland. Very few trees if any in areas exist in this unit, and it is predominated by hardy pioneer grasses. A few grassland bird species were observed in this unit, but it is mostly devoid of faunal species. This unit is used for grazing of the local herds of goats and cattle, and small scale crop production.

Figure 27: Transformed habitat as found along the river system in the proposed Ntabelanga Dam study area.

5.2.2 Mammals

Mammal species observed wither through visual confirmation or via signs thereof are listed in **Table 17**.

Table 17: Table listing mammal species observed

Scientific name	Common name	IUCN Status
Aonyx capensis	Cape Clawless Otter	LC
Atilax paludinosus	Water mongoose	LC
Lepus saxatilis	Scrub Hare	LC
Cynictis penicillata	Yellow mongoose	LC
Galerella sanguinea	Slender mongoose	LC
Mastomys natalensis	Natal multimammate mouse	LC
Rhabdomys pumilio	Four-striped Grass Mouse	LC
Canis mesomelas	Black-backed Jackal	LC

VU = Vulnerable, NT = Near Threatened, LC = Least Concern NYBA = Not Yet Been

5.2.3 Avifauna

All avifaunal species identified through visual or call identification are listed in **Table 18**.

Table 18: Table listing avifaunal species observed

Scientific name	Common name	IUCN Status
Stenostira scia	Fairy flycatcher	NYBA
Muscicapa adusta	African Dusky flycatcher	LC
Balearica regulorum	Grey Crowned Crane	EN
Gyps coprotheres	Cape Vulture	VU
Lophaetus occipitalis	Long-crested Eagle	LC
Lanius collaris	Common fiscal shrike	LC
Stigmatopelia senegalensis	Laughing dove	LC
Scopus umbretta	Hammerkop	LC
Lamprotornis nitens	Cape glossy starling	LC
Strurnus vulgaris	European straling	
Terpsiphone viridis	African Paradise Flycatcher	LC
Motacilla clara	Mountain Wagtail	LC
Motacila aguimp	African Pied Wagtail	NYBA
Cisticola fulvicapillus	Neddicky	
Upupa africana	African Hoopoe	LC
Colius striatus	Speckled Mousebird	LC
Urocolius indicus	Red-faced mousebird	LC
Centropus burchellii	Burchell's Coucal	LC
Saxicola torquata	African Stonechat	LC
Buteo rufofuscus	Jackal Buzzard	LC
Laniarius ferrugineus	Southern Boubou	LC
Pternistes afer	Red-necked Francolin	
Uraeginthus angolensis	Blue Waxbill	LC
Quelea quelea	Red-billed Quelea	LC
Oenanthe monticola	Mountain Wheatear	LC

Scientific name	Common name	IUCN Status
Cecropis cucullata	Greater Striped Swallow	NYBA
Cinnyris affer	Greater Double-collared Sunbird	NYBA
Pycnonotus nigricans	African Red-eyed Bulbul	LC
Macronyx capensis	Cape Longclaw	LC
Pyconotus tricolor	Dark-capped Bulbul	NYBA
Bubulcus ibis	Cattle Egret	LC
Cisticola ayresii	Wing-snapping Cisticola	LC
Ardea cinerea	Grey Heron	LC
Sagittarius serpentarius	Secretarybird	VU
Corvus albus	Pied Crow	LC
Corvus capensis	Cape Crow	LC
Corbus albicolis	White-necked Raven	NYBA
Serinus flaviventris	Yellow Canary	
Serinus mozambicus	Yellow-eyed Canary	
Batis molitor	Chinspotbatis	
Falco amurensis	Amur falcon	
Jynx ruficollis	Red-throated Wryneck	
Mirafra fasciolata	Eastern Clapper Lark	
Columba arquatrix	Rameron/ African Olive Pigeon	
Threskiornis aethiopicus	Sacred ibis	
Mirafra africana	Rufous-naped Lark	
Bostrychia hagedash	Hadeda Ibis	LC
Bubo africanus	Spotted Eagle Owl	LC

VU = Vulnerable, NT = Near Threatened, LC = Least Concern NYBA = Not Yet Been EN = Endangered

Figure 28: On the left *Balearica regulorum* (Grey Crowned Crane) flock seen in the vicinity of Ntabelanga Dam study area; on the right *Cinnyris affer* (Greater Double-collared Sunbird) seen resting in the riparian zone.

Figure 29: On the left *Columba arquatrix* (Rameron/ African Olive pigeon) resting in a tree; on the right *Oenanthe monticola* (Mountain Wheatear) resting on a power line.

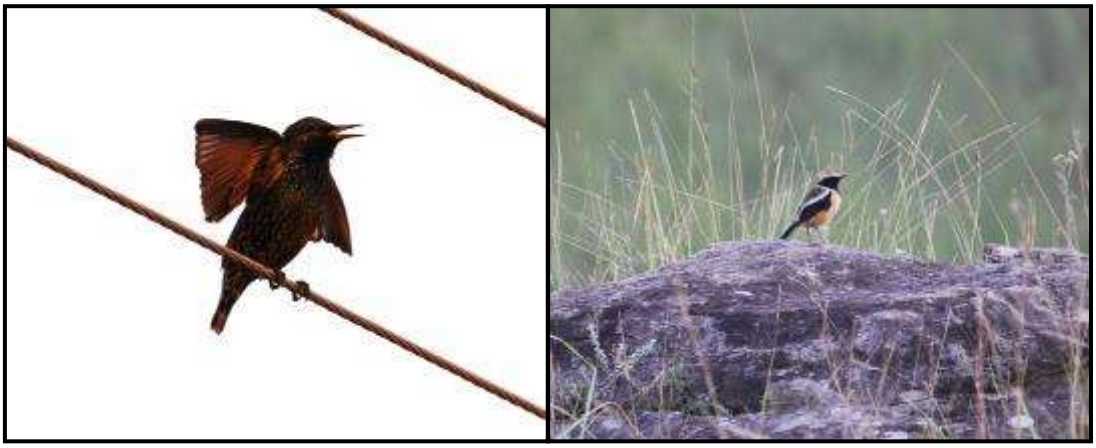

Figure 30: On the left *Strurnus vulgaris* (Common Starling) displaying on a power line; on the right *Saxicola torquata* (African Stonechat).

5.2.4 Reptiles

Table 19 list all the reptile species observed during the site visit.

Table 19: Table listing reptile species observed

Scientific name	Common name	IUCN Status
Trachylepis striata	Striped skink	NYBA
Gerrhosaurus flavigularis	Yellow throated plated lizard	NYBA
Philothamnus hoplogaster	Green water snake	NYBA
Causus rhombeatus	Rhombic Night Adder	NYBA

VU = Vulnerable, NT = Near Threatened, LC = Least Concern NYBA = Not Yet Been EN = Endangered

5.2.5 Amphibians

Table 20 contains the amphibian species observed during the site visit.

Table 20: Table listing amphibian species observed

Scientific name	Common name	IUCN Status
Afrana angolensis	Common River Frog	LC
Cacosternum boettgeri	Boettger's Dainty frog	LC
Amietophrynus rangeri	Raucous toad	LC
Xenopus muelleri	Platanna	LC
Strongylopus fasciatus	Striped Stream Frog	LC

VU = Vulnerable, NT = Near Threatened, LC = Least Concern NYBA = Not Yet Been EN = Endangered

Figure 31: *Afrana angolensis* (Common river frog) observed throughout the study area on the left; *Amietophrynus rangeri* (Raucous toad) on the right.

5.2.6 Invertebrates

Table 21 lists all the invertebrate species that were observed during the site visit.

Table 21: Table listing invertebrate species observed

Order	Family	Scientific name	Common name	IUCN Status
Coleoptera	Tenebrionidae	*Lagria vulnerata*	Hairy darkling beetle	NYBA
		Moluris pseudonitidae	Rounded Toktokkie	NYBA
	Coccinellidae	*Harmonia vigintiduomaculata*	Chequered ladybird	NYBA
Lepidoptera	Pieridae	*Colotis danae*	Scarlet tip	NYBA
		Eurema hecabe	Common grass yellow	NYBA
		Eurema brigitta	Broad-bordered grass yellow	LC
		Colotis auxo	Sulphur orange tip	NYBA
		Junonia octavia	Gaudy Commodore	NYBA
		Byblia ilythia	Spotted Joker	NYBA
		Hypolimmas misippus	Diadem	NYBA
		Belenois aurota	Brown-veined white	NYBA
		Belenois creona	African Common White	NYBA
	Nymphalidae	*Junonia hierta*	Yellow Pansy	LC
	Lycaenidae	*Azanus jesous*	Topaz blue	NYBA
	Noctuidae	*Rhanidophora ridens*	Dice Moth	NYBA
	Cicadidae	*Sp.*		NYBA
Hemiptera	Miridae	*Daraeocoris sp.*	Plant bugs, capsids	NYBA
	Libellulidae	*Trithemis furva*	Dark Dropwing	LC
Odonata		*Africallagma glaucum*	Swamp Bluet	LC
		Orthetrum julia	Julia skimmer	LC
	Platycnemidae	*Allocnemis sp.*	Featherlegs	
	Heptageniidae	*Sp.*	Flat-head Mayflies	NYBA
Ephemeroptera	Tetrigidae	*Sp.*	Groundhoppers, grouse locusts	NYBA
Orthoptera	Acrididae	*Paracinema tricolor*	Vlei grasshopper	NYBA

Order	Family	Scientific name	Common name	IUCN Status
		Acanthacris ruficornis	Garden locust	NYBA
		Gastrimargus sp.		
		Acrida acuminata	Common Stick Grasshopper	NYBA
		Eyprepocnemis plorans		NYBA
		Orthoctha sp.		NYBA
	Pyrgomorphidae	*Zonocerus elegans*	Elegant grasshopper	NYBA
Neuroptera	Myrmeleontidae	*Myrmeleon sp.*	Pit-building antlions	NYBA
Hymenoptera	Vespidae	*Belonogaster dubia*	Paper wasp	NYBA
Mantodea	Mantidae	*Sphodromantis lineola*	African Praying mantis	NYBA
Phasmatodea	Heteronemiidae	*Marans*is rufolineatus	Grass stick insect	NYBA
Diptera	Calliphoridae	*Musca domestica*	House fly	NYBA
Thysanura	Lepismatidae	*Ctenolepisma longicaudata*	Fish moth	NYBA
Isoptera	Termitidae	*Odontotermes latericus*	Harvester Termites	NYBA

VU = Vulnerable, NT = Near Threatened, LC = Least Concern NYBA = Not Yet Been EN = Endangered

Figure 32: On the left *Eyprepocnemis plorans* and *Junonia hierta* (Yellow Pansy) on the right.

Figure 33: On the left *Junonia Octavia* (Gaudy Commodore) and *Trithemis furva* (Dark Dropwing) on the right.

5.2.7 Spiders and Scorpions

Listed in the tables below are the arachnid species observed during the site visit.

Table 22: Table listing spider species observed

Scientific name	Common name	IUCN Status
Olorunia cellata.	Funnel web spider	NYBA
Nephila senegalensis	Banded-legged Golden Orb-web spider	
Nephila pilipes	Black-legged Golden Orb-web spider	NYBA
Leucauge sp	Silver Vlei Spiders	NYBA
Selenopidae sp	Wall Spiders	NYBA

VU = Vulnerable, NT = Near Threatened, LC = Least Concern NYBA = Not Yet Been EN = Endangered

Figure 34: *Nephila senegalensis* (Banded-legged Golden Orb-web spider) seen in the *Acaia* thornveld habitat at Ntabelanga Dam

No scorpions were identified in the Ntabelanga Dam area during the site assessment, however the rocky outcrops are suitable habitat for scorpion species and it is likely that they will occur there.

5.3 PIPELINES AND POWER LINES

The proposed pipelines and power lines that will expand into the neighbouring communities to supply water and power from the Dams and proposed hydroelectric scheme will have a very small impact of faunal species within the area. The affected areas are primarily located alongside the existing formal and informal road networks, which have a very low faunal diversity at the current point in time. No habitat units were identified that may contain any faunal species of conservation concern, nor were any RDL species identified along these proposed routes. Only the common faunal species associated with the area and habitats were observed.

No mammals were observed, but it can be expected that in certain areas small mammals will occur occasionally, however this occurrence is expected to be very low.

No reptiles were observed along the proposed routes. The possibility of any reptile species occurring along these routes is very low, due to the routes following alongside roads and through community areas, with high levels of habitat disturbance being present.

No amphibians were observed, however there does remain the possibility that the more common amphibian species, that are common in areas of human habitation may be found, such as *Amietophrynus rangeri* (Raucous toad), which is commonly found in and around human dwellings and gardens.

No spider or scorpions were observed along the proposed routes for the power and pipelines. It is expected that one or two common arachnid species may occur along these routes, such as those of the family Lycosidae (Wold spiders).

Table 23 is a list of the avifaunal species observed along the proposed routes. The species observed can be classified as common and are not of any conservational concern. All of the species observed will only use the proposed routes for foraging purposes occasionally, but not for breeding.

Table 23: Table listing avifaunal species observed along proposed power line and pipeline routes.

Scientific name	Common name	IUCN Status
Lanius collaris	Common fiscal shrike	LC
Stigmatopelia senegalensis	Laughing dove	LC
Strurnus vulgaris	European straling	
Motacilla clara	Mountain Wagtail	LC
Motacila aguimp	African Pied Wagtail	NYBA
Buteo rufofuscus	Jackal Buzzard	LC
Laniarius ferrugineus	Southern Boubou	LC
Pyconotus tricolor	Dark-capped Bulbul	NYBA
Bubulcus ibis	Cattle Egret	LC
Corvus albus	Pied Crow	LC
Corvus capensis	Cape Crow	LC
Corbus albicolis	White-necked Raven	NYBA
Threskiornis aethiopicus	Sacred ibis	
Bostrychia hagedash	Hadeda Ibis	LC

VU = Vulnerable, NT = Near Threatened, LC = Least Concern NYBA = Not Yet Been EN = Endangered

Table 24 lists the invertebrates that were observed during the site assessment of the proposed pipeline and power line routes. None of the observed invertebrate species are of conservational concern or listed as RDL species.

Table 24: Table listing invertebrate species observed along proposed power line and pipeline routes

Order	Family	Scientific name	Common name	IUCN Status
Lepidoptera	Pieridae	*Colotis danae*	Scarlet tip	NYBA
		Eurema hecabe	Common grass yellow	NYBA
		Eurema brigitta	Broad-bordered grass yellow	LC
		Byblia ilythia	Spotted Joker	NYBA
		Belenois aurota	Brown-veined white	NYBA
		Belenois creona	African Common White	NYBA
	Nymphalidae	*Junonia hierta*	Yellow Pansy	LC
Odonata		*Orthetrum julia*	Julia skimmer	LC
Ephemeroptera	Tetrigidae	*Sp.*	Groundhoppers, grouse locusts	NYBA
Orthoptera	Acrididae	*Paracinema tricolor*	Vlei grasshopper	NYBA
		Acanthacris ruficornis	Garden locust	NYBA
	Pyrgomorphidae	*Zonocerus elegans*	Elegant grasshopper	NYBA
Neuroptera	Myrmeleontidae	*Myrmeleon sp.*	Pit-building antlions	NYBA
Diptera	Calliphoridae	*Musca domestica*	House fly	NYBA
Isoptera	Termitidae	*Odontotermes latericus*	Harvester Termites	NYBA

VU = Vulnerable, NT = Near Threatened, LC = Least Concern NYBA = Not Yet Been EN = Endangered

6. FAUNAL DISCUSSION

6.1 MAMMALS

The mammal species observed within and surrounding the proposed Lalini and Ntabelanga Dams are considered to be mostly common species, found throughout South Africa, that are adaptable to changing and transformed habitats, as well as being known to occur around human settlements. None of the observed species are considered to be threatened on a national level or provincial level.

Currently mammal species within the study area are subjected to high levels of impact from subsistence hunting as well as habitat loss and transformation. Although the mammal species observed are known to have a greater tolerance to human presence and are better adapted to living in changing environments, the inundation of the dam basin will create a significant loss of current useable faunal habitat. The mountain bushveld and riparian zones will be the most severely affected by the inundation. All the current riparian habitat units within the dam basin will be totally submerged under the dam full supply level, whilst a large percentage of the mountain bushveld will suffer the same fate. With the decreased available faunal habitat, the remaining faunal species will be pushed into the small pockets of remaining habitat, where inter and intraspecific competition amongst the various faunal species for space and resources will cause a decline in overall faunal abundance and diversity. Furthermore, the continued hunting pressure from the local community will now be focussed on the remaining areas above the water line. With the decrease in habitat, faunal species will have less space to evade these hunters, resulting in higher losses to hunting, affecting overall population numbers and species composition.

The only mammals that are unlikely to be affected significantly by the inundation are those of *Aonyx capensis* (Cape Clawless Otter) and *Atilax paludinosus* (Water Mongoose), which are semi aquatic living mammals and as such will adapt to the rising waters fairly easy. However, due to the fluctuating water levels of the dams, there is the risk that these two species may not find ideal or suitable habitat along the dam edges for breeding and raising of young. It must be noted that further upstream towards the tail end of the Ntabelanga Dam, there will be a section of land that, once the water levels have risen, will effectively be transformed into an island. Any faunal species unable to fly or readily swim will be trapped on this island, with limited resources available to survive. As such, it is recommended that should any small mammals become trapped upon this newly created island as a result of inundation, that they must be captured and relocated to the mainland by a qualified and suitable specialist.

6.2 AVIFAUNA

A large diversity of avifaunal species was observed within the combined study areas, as was to be expected. Avifauna represents the largest faunal community observed within the study areas. The majority of avifauna observed was within the mountain bushveld, rocky outcrop and riparian habitat zones. This is of particular concern as it these habitat units

are going to be significantly impacted upon with the construction of the proposed dams. The inundation will result in the flooding of the current riparian habitat units, and to a large extent flood the majority of the rocky outcrop and mountain bushveld habitat units. The result will be a significant decrease in viable habitat for foraging and more importantly breeding of avifaunal species. The resultant habitat decrease within the area will force avifaunal species to leave the area in search of new suitable larger habitat areas. The mountain bushveld habitat unit located near the dam wall of the Lalini Dam is a unique habitat with a varying number of woody species, providing a large diversity of avifaunal species breeding habitat. The loss of this habitat unit will be irreplaceable as it is very limited within the study area itself. The flowering shrubs and aloes in these habitats provide a food source for many of the smaller specialized avifaunal feeders, notably the sunbirds as well as the small insectivorous birds such as the flycatchers. These birds to a large extent inhabit the habitat zones that will be inundated by the rising waters, and will either relocate to other suitable habitat (very little remaining will be available to them in the vicinity) or population densities will decrease due to a severe loss of food resources and breeding habitat.

One of the avifaunal species that is of concern is that of *Balearica regulorum* (Grey-Crowned Crane). This species was observed foraging in the grassland/ transformed habitat units alongside the river system in the vicinity of the Ntabelanga Dam. These habitat units will also disappear as the waters rise, resulting in a significant loss of foraging habitat for *B.regulorum* within the study area. Cranes throughout South Africa are already threatened with extinction due to habitat loss, and this will further exasperate conservation efforts to protect and increase this species numbers. *B.regulorum* is listed as endangered by the IUCN, and with a rapidly decreasing population. The main contributing factors to this decline are loss of wetland breeding areas, loss of grassland foraging areas and collision with high voltage power lines. The construction of the dams and new power lines will have a definitive negative impact on the *B.regulorum* population numbers in the study areas and surrounds. This population decrease will only add to the overall demise of *B.regulorum* throughout Southern Africa as key breeding populations are lost.

A second avifaunal species of concern within the study area and surrounds is *Gyps coprotheres* (Cape Vulture). This species is listed as Vulnerable by the IUCN, and also listed as an endangered and protected species by NEMBA (Act 10 of 2004), and is endemic to South Africa. Threats that affect *G.coprotheres* that are specific to the Ntabelanga and Lalini Dams would be loss of foraging habitat and a loss of foraging opportunities due to a reduced carrying capacity of food sources as well as a possible increase in persecution and poaching for the local muti trade. A loss in viable grazing lands for community pasture livestock will lead to a loss of income and stability for many families. They may turn to killing and selling vultures products for muti in order to supplement the loss of income incurred as a result of the rising waters affecting grazing lands.

Although none were observed during the time of assessment, NFEPA has indicated that the study area is a recognized breeding and foraging area for protected crane species, namely *Anthropoides paradisea* (Blue crane) and *Grus carunculatus* (Wattled crane). Both these species are listed as Vulnerable by the IUCN, and are listed protected species by NEMBA (Act 10 of 2004). *A. Paradisea* (Blue Crane) is of particular concern as it is indigenous to South Africa, as well as being South Africa's national bird. The flooding of the lowland grasslands and wetlands will have a detrimental impact on crane species populations within the area, as this will result in the loss of breeding and foraging habitat for all the above mentioned crane species. This will result in an overall population decrease of crane species in the immediate and surrounding areas.

6.3 REPTILES

Reptiles are notoriously hard to detect in the field due to the shy nature, and as such an intensive search was undertaken within suitable reptile habitat, specifically in the mountain bushveld and rocky outcrop habitat units. Due to the habitat availability and study areas location, a high diversity of reptiles was not expected to occur. The reptiles that were observed are commonly occurring species in the region. The rocky ridge outcrop and mountain bushveld habitat units are most suited to inhabitation by reptile species, and as such, with the rising dam waters these habitats will be lost. The rising waters will push the reptiles further up the slopes of the ridges; however there is suitable habitat for them in these areas. The construction of the dam walls however as well as the resultant edge effects of the construction do pose a secondary threat to reptiles that inhabit the areas around the proposed dam walls. A third threat that reptiles will be faced with, when the dams reach full supply level will be that of a reduced carrying capacity of the remaining suitable habitats for reptiles. Initially there will be overcrowding of species, but through increased mortality rates and emigration of certain species, the populations should stabilise, albeit at a lower number. A future risk that may surface over time is that of the remaining population number being reduced to such a point that the population loses its breeding potential. The lower carrying capacity and lower population numbers will result in a decreased food source for predators of many reptile species, thereby having a knock on effect further up the food chain.

6.4 AMPHIBIANS

A very low diversity of amphibians was observed at both the dams and surrounding areas. Although the dams presented a low diversity of amphibian species, the species that were observed were in fairly high numbers. The fairly isolated nature of the study areas from surrounding amphibian populations in other active rivers, as well as the iTsitsa waterfall presenting an unsurpassable obstacle may be contributing factors to the low species diversity in the rivers. The mountains surrounding the river system and the waterfall would have limited amphibian colonisation of the river systems, resulting in only a few of the hardier and more far ranging common species being present in the river systems. The inundation of the surrounding land as the dams fill up will not have a significant effect on

amphibian species within the two study areas, and will in all likelihood provide a greater expanse of habitat for the increase in amphibian numbers.

6.5 INVERTEBRATES

A wide variety of invertebrates was observed at both dam locations, and to a lesser extent along the proposed pipelines and power line routes as these predominantly followed existing roads. No NEMBA or Eastern Cape SoER (2004) listed invertebrates were observed during the site visit. As expected, the mountain bushveld, rocky outcrops and riparian zones provided the highest diversity of invertebrate species, with the transformed grassland areas providing habitat for common grasshoppers and locusts that are better suited to those habitats. Although the rising waters and associated construction activities will impact on the invertebrates in the area, it is not foreseen that this will be a significant negative impact on invertebrate conservation as a whole and the impact on invertebrate species of conservation concern is considered limited.

6.6 SPIDERS AND SCORPIONS

Only four species of spiders were observed during the site visit; however it is expected that more species do inhabit the study areas. Due to their reclusive nature when faced by a threat as well as their ability to camouflage themselves well, they are very hard to locate. None of the spider species observed are considered to be threatened or of conservation value, nor are any endangered species thought to persist within the study areas.

One scorpion was located in the mountain bushveld habitat near the dam wall of the Lalini Dam. The scorpion belongs to the Genus *Hadogenes* (Rock scorpion), of which all species in this genus are listed under NEMBA (Act10 of 2004). *Hadogenes* sp fall under the category of nationally protected species, and are an indigenous species of high conservation value or national importance that require national protection. The mountain bushveld habitat located by the Lalini Dam wall will invariably provide habitat for many of these scorpions, as well as other scorpion species. When the Lalini Dam reaches full supply level, and in the process of reaching such, the habitat availability for the scorpions will be greatly reduced. At full supply level, the scorpions would be restricted to the higher rocky areas on the mountainside. Although the higher mountainside does is of suitable habitat for the *Hadogenes* (Rock scorpion), the habitat size that remains may be a limiting factor, along with the increased rates of predation on the scorpions. Overall the rising water will have a negative impact on the *Hadogenes* population numbers in the study area.

7. RED DATA SPECIES ASSESSMENT

RDL species taken into consideration for calculation of the RDSIS are listed below:

- *Balearica regulorum* (Crowned Crane);
- *Hadogenes sp.*(Rock Scorpions);
- *Eupodotis caerulescense* (Blue Korhaan);
- *Anthropoides paradiseus* (Blue Crane);
- *Gyps africanus* (Cape Vulture);
- *Ciconia ciconia* (Black Stork);
- *Tyto capensis* (Grass Owl);and
- *Sagittarius serpentarius* (Secretarybird);

The species listed above were then used to calculate the RDSIS for the entire study area, the results of which are presented in **Table 25**.

Table 25: RDSIS score attained

Red Data Sensitivity Index Score	
Average Total Species Score	**84**
Average Threatened Taxa Score	**84**
Average (Ave TSS + Ave TT/2)	**84**
% Species greater than 60% POC	**8%**
RDSIS of Site	**46%**

Table 26: Species with a POC of >60%

Common name	Scientific Name	Threatened Status	POC
Black Stork	*Ciconia nigra*	NT	60.67
Secretary bird	*Sagittarius serpentarius*	NT	100.00
Blue Crane	*Anthropoides paradiseus*	VU	61.67
Blue Korhaan	*Eupodotis caerulescens*	NT	65.00
Grass Owl	*Tyto capensis*	VU	64.00
Cape Vulture	*Gyps coprotheres*	VU	100.00
Rock scorpion	*Hadogenes sp*	VU	100.00
Crowned crane	*Balearica regulorum*	VU	100.00

VU = Vulnerable, NT = Near Threatened, LC = Least Concern NYBA = Not Yet Been EN = Endangered

The RDSIS assessment of the study areas potential RDL fauna yielded a score of 46%, indicating a medium importance with regards to RDL faunal species conservation within the region. All species with a POC of 60% or more have an increased probability of either permanently or occasionally inhabiting the study area. The species that have a POC of

100% are those species that were directly observed at the time of the site visit. The species listed in **Table 26** are the only species that attained a POC of greater than 60%.

The majority of the above listed species would have a greater possibility of occurring at the Lalini Dam than the Ntabelanga Dam, as the Lalini Dam site provides more intact faunal habitats with lower levels of anthropogenic activities. In this regard, emphasis needs to be placed on the decision between the smaller Lalini dam alternative or possibly the no dam alternative, as the construction of this dam will lead to a definite impact on population size of endangered, vulnerable and protected indigenous species. The Ntabelanga Dam poses very little threat to the species listed in **Table 24**, as well as other occurring species. The power and pipeline routes do not pass through any sensitive faunal habitats, nor are any of the above listed species expected to occur along the proposed routes. The power and pipelines as they stand pose very little threat to any RDL species.

8. IMPACT ASSESSMENT FOR DAMS AND ASSOCIATED WATER INFRASTRUCTURE

This Chapter presents the findings of the environmental impact assessment for the dams and associated activities (DEA Ref no. 14/12/16/3/3/2/677).

The activities assessed under this chapter are listed below:

- The Ntabelanga and Lalini Dams;
- Five flow gauging weirs;
- Primary and secondary bulk potable water infrastructure:
  - Primary infrastructure: main water treatment works, including four major treated water pumping stations and three minor treated water pumping stations, main bulk treated water rising mains, and eight Command Reservoirs that will supply the whole region;
  - Secondary distribution lines: conveying bulk treated water from Command Reservoirs to existing and new District Reservoirs;
- Bulk raw water conveyance infrastructure (abstraction, pipelines, one raw water pumping station, one reservoir and two booster pumps) for irrigated agriculture (raw water supply up to field edge);
- Impact of commercial agriculture in earmarked irrigation areas;
- WWTWs at the Ntabelanga and Lalini Dam sites;
- Accommodation for operational staff at the Ntabelanga and Lalini Dam sites;
- Eight construction materials quarries and borrow pits;
- River intake structures and associated works;
- Information centres at the two dam sites; and
- Miscellaneous construction camps lay down areas, and storage sites.

General management and good housekeeping practices

Latent and general everyday impacts which may impact on the faunal ecosystem will include any activities which take place within the Lalini and Ntabelanga study areas that may impact on the receiving environment. These impacts are highlighted below and are relevant for all sensitive faunal related areas identified in this report.

- No areas falling outside of the study area may be cleared for construction purposes;
- Ensure that operational related activities are kept strictly within the development footprint;
- Do not allow dumping of refuse within the surrounding environment;
- The boundaries of the development footprint areas are to be clearly defined and it should be ensured that all activities remain within defined footprint areas;
- The proposed development footprint areas should remain as small as possible;
- All soils compacted as a result of construction activities falling outside development footprint areas should be ripped and profiled.
- Special attention should be paid to alien and invasive control within these areas. Alien and invasive vegetation control should take place throughout all phases of the development;

- In the event of a breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced to prevent the ingress of hydrocarbons into the topsoil;
- Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the proposed development activities;
- No trapping or hunting of fauna is to take place; and
- All informal fires in the vicinity of construction areas should be prohibited.

8.1 CONSTRUCTION AND FIRST FILLING PHASES

8.1.1 Impact on faunal habitat

Lalini Dam[1]

Lalini Dam provides ideal faunal habitat to a wide variety of faunal species. The most sensitive faunal habitat is that of the rocky outcrop areas and the mountain bushveld habitat. The dam wall is located within this mountain bushveld habitat, and will have a large impact on the faunal habitat here. The subsequent first filling, will submerge most of the rocky outcrop and mountain bushveld habitat, rendering it lost and unrecoverable. The first filling will also result in the inundation of all the wetlands in the Lalini Dam study area, resulting in a loss of faunal habitat for many endangered crane species. All three alternatives based on the various sizes of the dams will have large impacts on faunal habitat, as all will result in the inundation of large areas of habitat, with the smallest dam alternative having the least impact of the three.

Ntabelanga Dam[1]

Ntabelanga Dam presents no options in terms of varying full supply levels. At first filling the dam will result in total and irreversible loss in faunal habitat found below the indicated high level water line. This inundation will result in the flooding of the lowland grassland and wetland areas, key habitat for many crane species in the area. There are also substantial rocky outcrop areas located in the proposed location of the Ntabelanga Dam wall. The construction of the dam wall will result in the irreversible loss of a significant extent of this habitat.

Primary, secondary and irrigation pipelines

The primary and secondary pipelines will be constructed close to main or secondary existing roads, and as such will not have a high impact on faunal habitat or species. The irrigation pipelines are mostly located around the town of Tsolo, in an already disturbed area, and as such will have a low impact on faunal habitat and species thereof. Due to the sensitive nature of the habitat types found throughout the study area in terms of the floral sensitivity report and map, it is advised that areas of high sensitivity be avoided as far as

[1] All associated infrastructure (gauging weirs, construction camps, reservoirs etc), unless specifically addressed within the impact tables, has been included within the impact of the dam itself.

possible so as to minimise impacts on sensitive faunal habitat and faunal species within these areas.

Recommended mitigation (Also refer to general management and good housekeeping practices):

- Restrict vehicles to designated roadways to limit the ecological footprint of the proposed development activities as well as to reduce the possibility of collisions;
- Edge effects of all construction activities, such as erosion and alien plant species proliferation, which may affect faunal habitat within surrounding areas, need to be strictly managed in all areas of increased ecological sensitivity;
- Rehabilitate and naturalise areas beyond the development footprint, which have been affected by the construction activities, using indigenous grass species.

faunal habitat	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Ntabelanga Dam and associated infrastructure							
Without Mitigation	Local (2)	Medium term (2)	Very high (5)	High (5)	Definite (5)	High	High
With Mitigation	Site (1)	Medium term (2)	Very high (5)	High (5)	Definite (5)	High	High
Lalini Dam size 1 (preferred) and associated infrastructure							
Without Mitigation	Local (2)	Medium term (2)	Very high (5)	High (5)	Definite (5)	High	High
With Mitigation	Site (1)	Medium term (2)	Very high (5)	High (5)	Definite (5)	High	High
Lalini Dam size 2 (alternative) and associated infrastructure							
Without Mitigation	Local (2)	Medium term (2)	Very high (5)	High (5)	Definite (5)	High	High
With Mitigation	Site (1)	Medium term (2)	High (4)	Medium (3)	High (4)	High	Medium-low
Lalini Dam size 3 (alternative) and associated infrastructure							
Without Mitigation	Local (2)	Medium term (2)	Very high (5)	High (5)	Definite (5)	High	High
With Mitigation	Site (1)	Medium term (2)	Very high (5)	High (5)	Definite (5)	High	High
Primary pipelines							
Without Mitigation	Local (2)	Medium term (2)	Medium (3)	Medium (3)	Definite (5)	High	Medium-high
With Mitigation	Site (1)	Medium term (2)	Low (2)	Low (1)	High (4)	High	Low
Secondary pipelines							
Without Mitigation	Local (2)	Medium term (2)	Medium (3)	Medium (3)	Definite (5)	High	Medium-high
With Mitigation	Site (1)	Medium term (2)	Low (2)	Low (1)	High (4)	High	Low
Irrigation pipelines							
Without Mitigation	Local (2)	Medium term (2)	Medium (3)	Medium (3)	Definite (5)	High	Medium-high
With Mitigation	Site (1)	Medium term (2)	Low (2)	Low (1)	High (4)	High	Low
Cumulative Impact – Construction of the dam wall in sensitive faunal habitat will lead to a loss of sensitive habitat and associated sensitive faunal species. The first filling phase will inundate faunal habitat and displace a large number of terrestrial faunal species, leading to a significant decline in population sizes, most notably those located in the mountain bushveld and *Euphorbia* forest near the Lalini Dam wall.							

8.1.2 Impact on faunal diversity

Lalini and Ntabelanga Dams

There are various vegetation types in the study area providing a diverse range of habitat to faunal species. Most importantly are the rocky outcrop, wetland and mountain bushveld areas. The wetlands found along the river provide foraging and breeding habitat for endangered and important crane species, which will be lost when the first filling of the dam occurs. The rocky outcrops and mountain bushveld areas provide habitat for the indigenous *Hadogenes sp* of scorpions, which along with the cranes are a protected species in South Africa. The dam will result in a significant loss of habitat for these scorpions and subsequent decrease in population numbers. Due to the increase of human activities in the study area, the risk of informal fires as well as collision of vehicles with faunal species will also increase, and need to be addressed accordingly. All associated infrastructure (gauging weirs, construction camps, reservoirs etc), unless specifically addressed within the impact tables has been included within the impact of the dams themselves.

Primary, secondary and irrigation pipelines

The primary and secondary pipelines will be constructed close to main or secondary existing roads, and as such will not have a high impact on faunal habitat or species. The irrigation pipelines are mostly located around the town of Tsolo, in already disturbed areas, and as such will have a low impact on faunal habitat and species thereof.

Recommended mitigation:

- No areas falling outside of the study area may be cleared for construction purposes;
- Should any RDL or other common faunal species be found within the affected environment, these species must be relocated to similar habitat within the vicinity of the study area with the assistance of a suitably qualified specialist;
- Rescue and relocation of faunal species needs to be conducted by an appointed specialist where islands are formed as the water levels rise, that will be inundated when the service level of the dams is reached;
- Edge effects of all operational activities, such as erosion and alien plant species proliferation, which may affect faunal habitat within surrounding areas, need to be strictly managed in all areas of increased ecological sensitivity; and
- Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the proposed development activities.

faunal diversity	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Ntabelanga Dam and associated infrastructure							
Without Mitigation	Local (2)	Medium term (2)	Very high (5)	High (5)	Definite (5)	High	High
With Mitigation	Site (1)	Medium term (2)	Very high (5)	High (5)	Definite (5)	High	High
Lalini Dam size 1 (preferred) and associated infrastructure							
Without Mitigation	Local (2)	Medium term (2)	Very high (5)	High (5)	Definite (5)	High	High
With Mitigation	Site (1)	Medium term (2)	Very high (5)	High (5)	Definite (5)	High	High
Lalini Dam size 2 (alternative) and associated infrastructure							
Without Mitigation	Local (2)	Medium term (2)	Very high (5)	High (5)	Definite (5)	High	High
With Mitigation	Site (1)	Medium term (2)	High (4)	Medium (3)	High (4)	High	Medium-low
Lalini Dam size 3 (alternative) and associated infrastructure							
Without Mitigation	Local (2)	Medium term (2)	Very high (5)	High (5)	Definite (5)	High	High
With Mitigation	Site (1)	Medium term (2)	Very high (5)	High (5)	Definite (5)	High	High
Primary pipelines							
Without Mitigation	Local (2)	Medium term (2)	Medium (3)	Medium (3)	Definite (5)	High	Medium-high
With Mitigation	Site (1)	Medium term (2)	Low (2)	Low (1)	High (4)	High	Low
Secondary pipelines							
Without Mitigation	Local (2)	Medium term (2)	Medium (3)	Medium (3)	Definite (5)	High	Medium-high
With Mitigation	Site (1)	Medium term (2)	Low (2)	Low (1)	High (4)	High	Low
Irrigation pipelines							
Without Mitigation	Local (2)	Medium term (2)	Medium (3)	Medium (3)	Definite (5)	High	Medium-high
With Mitigation	Site (1)	Medium term (2)	Low (2)	Low (1)	High (4)	High	Low
Cumulative Impact – Overall loss of species diversity and numbers within the study area due to limited resources. Loss of population potential in the study area leading to a negative growth of species numbers, resulting in a decrease in species variety and numbers.							

8.1.3 Impact on faunal species of conservational concern and RDL species

Lalini Dam and Ntabelanga Dam and associated infrastructure

The study area is host to a number of RDL faunal species, most notably the various crane species as well as protected scorpions. The first filling of the dams and the construction of the dam walls will inevitably push these species out of the area as a result of large expanses of habitat loss sustained. This will lead to a decrease in overall population numbers of these species within the area and region. With the resultant new high water level, RDL species will be forced to utilise habitat that is closer to roads and local communities, and so will come under increased pressure from poaching and accidental mortalities from vehicle collisions. All associated infrastructure (gauging weirs, construction camps, reservoirs etc), unless specifically addressed within the impact tables has been included within the impact of the dams themselves.

Primary, secondary and irrigation pipelines

The primary and secondary pipeline will be constructed close to main or secondary existing roads, and as such will not have a high impact on faunal habitat or species.
The irrigation pipelines are mostly located around the town of Tsolo, in already disturbed areas, and as such will have a low impact on faunal habitat and species thereof.

Recommended mitigation:

- Should any RDL faunal species or species of conservational concern be found within the development footprint area, these species should be relocated to similar habitat within the vicinity of the study which will not be affected by the development activities with the assistance of a suitably qualified specialist;
- Edge effects of all construction activities, such as erosion and alien plant species proliferation, which may affect faunal habitat within surrounding areas, need to be strictly managed in all areas of increased ecological sensitivity; and
- Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the proposed development activities.

species of conservational concern	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Ntabelanga Dam and associated infrastructure							
Without Mitigation	Local (2)	Medium term (2)	Very high (5)	High (5)	Definite (5)	High	High
With Mitigation	Site (1)	Medium term (2)	High (4)	Medium (3)	High (4)	High	Medium-low
Lalini Dam size 1 (preferred) and associated infrastructure							
Without Mitigation	Local (2)	Medium term (2)	Very high (5)	High (5)	Definite (5)	High	High
With Mitigation	Site (1)	Medium term (2)	High (4)	Medium (3)	High (4)	High	Medium-low
Lalini Dam size 2 (alternative) and associated infrastructure							
Without Mitigation	Local (2)	Medium term (2)	Very high (5)	High (5)	Definite (5)	High	High
With Mitigation	Site (1)	Medium term (2)	High (4)	Medium (3)	High (4)	High	Medium-low
Lalini Dam size 3 (alternative) and associated infrastructure							
Without Mitigation	Local (2)	Medium term (2)	Very high (5)	High (5)	Definite (5)	High	High
With Mitigation	Site (1)	Medium term (2)	High (4)	Medium (3)	High (4)	High	Medium-low
Primary pipelines							
Without Mitigation	Local (2)	Short term (1)	Medium (3)	Medium (3)	Definite (5)	High	Medium-low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	High (4)	High	Low
Secondary pipelines							
Without Mitigation	Local (2)	Short term (1)	Medium (3)	Medium (3)	Definite (5)	High	Medium-low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	High (4)	High	Low
Irrigation pipelines							
Without Mitigation	Local (2)	Short term (1)	Medium (3)	Medium (3)	Definite (5)	High	Medium-low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	High (4)	High	Low
Cumulative Impact – Overall loss of RDL species diversity within the study area, with particular emphasis on the more niche species such as the cranes and *Hadogenes* scorpions which only occur in limited favourable habitat zones.							

8.2 OPERATION PHASE

8.2.1 Impact on faunal habitat

Minimal further impact will occur within the study area during the operational phase, as affected habitat from construction phase will be inundated by this point and lost. The fluctuating water levels of the Lalini Dam that are linked the hydroelectric power generation will however further affect faunal habitat, as the riparian zone will not be able to re-establish itself along the new water's edge. There will be an increased risk of alien vegetation establishing along the water's edge, outcompeting the natural riparian vegetation. The alien riparian vegetation will not provide suitable habitat for the faunal species within the study area. Vegetation where the pipelines were laid should recover once again and provide habitat to the species that were there beforehand, provided the mitigation measures are followed. All associated infrastructure (gauging weirs, reservoirs etc), unless specifically addressed within the impact tables has been included within the impact of the dams themselves.

Recommended mitigation:

- Restrict vehicles to designated roadways to limit the ecological footprint of the proposed development activities as well as to reduce the possibility of collisions;
- Edge effects of all construction activities, such as erosion and alien plant species proliferation, which may affect faunal habitat within surrounding areas, need to be strictly managed in all areas of increased ecological sensitivity; and
- Rehabilitate and naturalise areas beyond the development footprint, which have been affected by the construction activities, using indigenous grass species.

faunal habitat	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Ntabelanga Dam and associated infrastructure							
Without Mitigation	Site (1)	Permanent (5)	Medium (3)	Low (1)	Definite (5)	High	Medium-high
With Mitigation	Site (1)	Permanent (5)	Low (2)	Low (1)	Definite (5)	High	Medium-high
Lalini Dam size 1 (preferred) and associated infrastructure							
Without Mitigation	Site (1)	Permanent (5)	Medium (3)	Low(1)	Definite (5)	High	Medium-high
With Mitigation	Site (1)	Permanent (5)	Low (2)	Low(1)	Definite (5)	High	Medium-high
Lalini Dam size 2 (alternative) and associated infrastructure							
Without Mitigation	Site (1)	Permanent(5)	Medium (3)	Low (1)	Definite (5)	High	Medium-high
With Mitigation	Site (1)	Permanent (5)	Low (2)	Low (1)	Definite (5)	High	Medium-high
Lalini Dam size 3 (alternative) and associated infrastructure							
Without Mitigation	Site (1)	Permanent (5)	Medium (3)	Low (1)	Definite (5)	High	Medium-high
With Mitigation	Site (1)	Permanent (5)	Low (2)	Low (1)	Definite (5)	High	Medium-high
Primary pipelines							
Without Mitigation	Site (1)	Short term (1)	Medium (3)	Low (1)	High (4)	High	Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	Medium (3)	High	Low
Secondary pipelines							
Without Mitigation	Site (1)	Short term (1)	Medium (3)	Low (1)	High (4)	High	Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	Medium (3)	High	Low
Irrigation pipelines							
Without Mitigation	Site (1)	Short term (1)	Medium (3)	Low (1)	High (4)	High	Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	Medium (3)	High	Low
Cumulative Impact – Once the dams have been established the level of impacts on the faunal habitat will cease. However the fluctuating water level of the Lalini Dam will make it hard to re-establish a riparian habitat there.							

8.2.2 Impact on faunal diversity

Species that are better able to adapt and utilise the dams will continue to occur within the study area. However, species that rely on specific habitat zones that were flooded will have to migrate to new more suitable habitat zones within the region, or will slowly decrease in numbers until they no longer occur within the study area. The increased threat of poaching will also contribute to the diminished species numbers within the study area. Vegetation where the pipelines were laid should recover once again and provide habitat to the species that were there beforehand, provided the mitigation measures are followed.

Recommended mitigation:

- Edge effects of all operational activities, such as erosion and alien plant species proliferation, which may affect faunal habitat within surrounding areas, need to be strictly managed in all areas of increased ecological sensitivity;
- Should any RDL or other common faunal species be found within the development footprint area, these species should be relocated to similar habitat within the vicinity of the study area with the assistance of a suitably qualified specialist; and
- Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the proposed development activities.

All associated infrastructure (gauging weirs, reservoirs etc), unless specifically addressed within the impact tables has been included within the impact of the dams themselves.

faunal diversity	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Ntabelanga Dam and associated infrastructure							
Without Mitigation	Site (1)	Permanent (5)	Medium (3)	Low (1)	Definite (5)	High	Medium-high
With Mitigation	Site (1)	Permanent (5)	Low (2)	Low (1)	Definite (5)	High	Medium-high
Lalini Dam size 1 (preferred) and associated infrastructure							
Without Mitigation	Site (1)	Permanent (5)	Medium (3)	Low (1)	Definite (5)	High	Medium-high
With Mitigation	Site (1)	Permanent (5)	Low (2)	Low (1)	Definite (5)	High	Medium-high
Lalini Dam size 2 (alternative) and associated infrastructure							
Without Mitigation	Site (1)	Permanent (5)	Medium (3)	Low (1)	Definite (5)	High	Medium-high
With Mitigation	Site (1)	Permanent (5)	Low (2)	Low (1)	Definite (5)	High	Medium-high
Lalini Dam size 3 (alternative) and associated infrastructure							
Without Mitigation	Site (1)	Permanent (5)	Medium (3)	Low (1)	Definite (5)	High	Medium-high
With Mitigation	Site (1)	Permanent (5)	Low (2)	Low (1)	Definite (5)	High	Medium-high
Primary pipelines							
Without Mitigation	Site (1)	Short term (1)	Medium (3)	Low (1)	High (4)	High	Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	Medium (3)	High	Low
Secondary pipelines							
Without Mitigation	Site (1)	Short term (1)	Medium (3)	Low (1)	High (4)	High	Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	Medium (3)	High	Low
Irrigation pipelines							
Without Mitigation	Site (1)	Short term (1)	Medium (3)	Low (1)	High (4)	High	Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	Medium (3)	High	Low
Cumulative Impact – The remaining more hardy faunal species will adapt to the new decreased habitat zones and change in available resources. The niche and more sensitive species will either exist in small pockets or migrate to more favourable habitat if such is available in the surrounding area. However overall population abundances are deemed likely to decrease on a regional level.							

8.2.3 Impact on species of conservational concern

Balearica regulorum (Crowned Crane), *Anthropoides paradisea* (Blue crane), *Grus carunculatus* (Wattled crane) and protected scorpions will have been forced to migrate to more suitable habitats as the dams reach full capacity. The cranes will be forced to find more suitable breeding habitat in the surrounding area, so any further impacts that happen within the study area are less likely to have a direct impact on the. The protected scorpions will be pushed further up the cliffs and rocky outcrops as the water levels rise. If they find suitable habitat higher up the mountain they will continue to persist through the operational lifetime of the dam, provided that there are sufficient resources available to them in these new habitat areas, however overall population abundances are deemed likely to decrease on a regional level. The operation of the pipelines will have a very low impact on species of conservational concern as the pipelines they are not located in any areas were these species were observed, or are expected to readily occur.

Recommended mitigation:

- Edge effects of all operational activities, such as erosion and alien plant species proliferation, which may affect faunal habitat within surrounding areas, need to be strictly managed in all areas of increased ecological sensitivity;
- Should any RDL faunal species or species of conservational concern be found within the operational footprint area, these species should be relocated to similar habitat within the vicinity of the study area with the assistance of a suitably qualified specialist;
- Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the proposed development activities;
- Proliferation of alien and invasive species is expected within any disturbed areas. These species should be eradicated and controlled to prevent their spread beyond the power and pipeline. Alien plant seed dispersal within the top layers of the soil within footprint areas, that will have an impact on future rehabilitation, has to be controlled;
- Ensure that operational related activities are kept strictly within the development footprint.

All associated infrastructure (gauging weirs, reservoirs etc), unless specifically addressed within the impact tables has been included within the impact of the dams themselves.

species of conservational concern	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Proposed Project with Ntabelanga Dam size							
Without Mitigation	Site (1)	Permanent (5)	Negligible (1)	Low (1)	Definite (5)	High	Medium-low
With Mitigation	Site (1)	Permanent (5)	Negligible (1)	Low (1)	Definite (5)	High	Medium-low
Lalini Dam size 1 (preferred) and associated infrastructure							
Without Mitigation	Site (1)	Permanent (5)	Negligible (1)	Low (1)	Definite (5)	High	Medium-low
With Mitigation	Site (1)	Permanent (5)	Negligible (1)	Low (1)	Definite (5)	High	Medium-low
Lalini Dam size 2 (alternative) and associated infrastructure							
Without Mitigation	Site (1)	Permanent (5)	Negligible (1)	Low (1)	Definite (5)	High	Medium-low
With Mitigation	Site (1)	Permanent (5)	Negligible (1)	Low (1)	Definite (5)	High	Medium-low
Lalini Dam size 3 (alternative) and associated infrastructure							
Without Mitigation	Site (1)	Permanent (5)	Negligible (1)	Low (1)	Definite (5)	High	Medium-low
With Mitigation	Site (1)	Permanent (5)	Negligible (1)	Low (1)	Definite (5)	High	Medium-low
Proposed Project with primary pipelines							
Without Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	Medium (3)	High	Low
With Mitigation	Site (1)	Short term (1)	Negligible (1)	Low (1)	Low (2)	High	Very-low
Proposed Project with secondary pipelines							
Without Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	Medium (3)	High	Low
With Mitigation	Site (1)	Short term (1)	Negligible (1)	Low (1)	Low (2)	High	Very-low
Proposed Project with irrigation pipelines							
Without Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	Medium (3)	High	Low
With Mitigation	Site (1)	Short term (1)	Negligible (1)	Low (1)	Low (2)	High	Very-low
Cumulative Impact – Continued decrease in species of conservational concern. The few that remain will be found only in isolated pockets of the remaining habitats.							

9. IMPACT ASSESSMENT FOR ELECTRICITY GENERATION AND DISTRIBUTION INFRASTRUCTURE

This Chapter presents the findings of the environmental impact assessment for the electricity generation and distribution related activities (DEA Ref no. 14/12/16/3/3/2/678).

The assessed under this chapter are listed below:

- Power lines and tunnel (including tunnel alternatives) at the proposed Lalini Dam;
- Generation of hydro power and feeding of this power into the existing grid; and
- 18.5km power line from the Lalini Dam tunnel.

9.1 CONSTRUCTION PHASE

9.1.1 Impact on faunal habitat

The main impact on faunal habitat will occur during the construction phase. The hydropower tunnels, as they are located underground, pose a negligible threat to faunal habitat when compared to a surface pipe system. However, the entry and exit points of the tunnels will pose an increased threat to faunal habitat, most notably the short tunnel, as tunnel will impact heavily on sensitive faunal habitat, most notably the habitat located in the gorge below the Tsitsa falls. The medium and long tunnels do not pose a large threat to faunal habitat, as they are not impacting on any sensitive habitat areas. Likewise for the short hydropower tunnel, the associated power line will have a large impact on faunal habitat as it traverses through sensitive mountain habitat on both sides of the mountain, and down into the gorge. The remaining power line options do not pose serious threats to faunal habitat, as they traverse through previously disturbed habitat.

The fluctuating water levels of Lalini Dam with regard to providing peak or base power generation will further impact faunal habitat, more specifically the ability of the faunal habitat to recover, especially species associated with riparian zone habitats.

Recommended mitigation:

- The short hydropower tunnel and associated power line (alternative 1) should not be considered as an alternative. All possibilities that will further impact on the faunal habitat on the mountain and within the gorge should not be considered viable.
- The power line passing through the town of Lotana towards the Tsitsa River should if possible be rerouted slightly to follow down the crest of the mountain slope and not drop off through the sensitive mountain vegetation areas in the steep southern slopes.
- Edge effects of all construction activities, such as erosion and alien plant species proliferation, which may affect faunal habitat within surrounding areas, need to be strictly managed in all areas of increased ecological sensitivity;
- Restrict vehicles to designated roadways to limit the ecological footprint of the proposed development activities as well as to reduce the possibility of collisions; and
- Rehabilitate and naturalise areas beyond the development footprint, which have been affected by the construction activities, using indigenous grass species.

faunal habitat	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Peak power generation with hydropower short tunnel and power line alternative 1							
Without Mitigation	Local (2)	Medium term (2)	Very high (5)	Very high (5)	Definite (5)	High	High
With Mitigation	Site (1)	Medium term (2)	High (4)	Medium (3)	High (4)	High	Medium-low
Peak power generation with hydropower medium tunnel and power line alternative 2							
Without Mitigation	Local (2)	Medium term (2)	Medium (3)	Medium (2)	High (4)	High	Medium-low
With Mitigation	Site (1)	Medium term (2)	Low (2)	Low (2)	Medium (3)	High	Low
Peak power generation with hydropower long tunnel and power line alternative 3							
Without Mitigation	Local (2)	Medium term (2)	Medium (3)	Medium (2)	High (4)	High	Medium-low
With Mitigation	Site (1)	Medium term (2)	Low (2)	Low (2)	Medium (3)	High	Low
Base-load power generation and with hydropower short tunnel and power line alternative 1							
Without Mitigation	Local (2)	Medium term (2)	Very high (5)	Very high (5)	Definite (5)	High	High
With Mitigation	Site (1)	Medium term (2)	High (4)	Medium (3)	High (4)	High	Medium-low
Base-load power generation with hydropower medium tunnel and power line alternative 2							
Without Mitigation	Local (2)	Medium term (2)	Medium (3)	Medium (2)	High (4)	High	Medium-low
With Mitigation	Site (1)	Medium term (2)	Low (2)	Low (2)	Medium (3)	High	Low
Base-load power generation with hydropower long tunnel and power line alternative 3							
Without Mitigation	Local (2)	Medium term (2)	Medium (3)	Medium (2)	High (4)	High	Medium-low
With Mitigation	Site (1)	Medium term (2)	Low (2)	Low (2)	Medium (3)	High	Low
Residual Impact – Loss of faunal habitat in sensitive areas resulting in a lower carrying capacities and decrease in faunal species within the study area. Loss of forging grounds for far ranging species, forcing them to forage over greater distances.							

9.1.2 Impact on faunal diversity

The long and medium tunnels (alternatives 3 and 2 respectively) will have significantly less impact on faunal diversity when compared to the short tunnel and associated power line infrastructure due to their locations. The long and medium tunnels are positioned in disturbed habitat that has a fairly low faunal biodiversity already due to previous and current anthropogenic activities. The short tunnel and associated power line (alternative 1)

pass through a high biodiversity faunal prevalence area, and as such any infrastructure within this area will have a negative impact of faunal biodiversity, as well as have a high risk of avifaunal collisions and mortalities from the proposed power lines traversing the mountain down into the gorge immediately below the falls.

Recommended mitigation:

- The short hydropower tunnels and associated power line (alternative 1) should not be considered as an alternative. All possibilities that will further impact on the faunal diversity on the mountain and within the gorge below the falls should not be considered viable.
- No areas falling outside of the study area may be cleared for construction purposes;
- Should any RDL or other common faunal species be found within the development footprint area, these species should be relocated to similar habitat within the vicinity of the study area with the assistance of a suitably qualified specialist;
- Edge effects of all operational activities, such as erosion and alien plant species proliferation, which may affect faunal habitat within surrounding areas, need to be strictly managed in all areas of increased ecological sensitivity; and
- Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the proposed development activities.

faunal diversity	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Peak power generation with hydropower short tunnel and power line alternative 1							
Without Mitigation	Local (2)	Medium term (2)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Site (1)	Medium term (2)	Medium (3)	Medium (3)	Medium (3)	High	Low
Peak power generation with hydropower medium tunnel and power line alternative 2							
Without Mitigation	Local (2)	Medium term (2)	Medium (3)	Medium (3)	Medium (3)	High	Medium-low
With Mitigation	Site (1)	Medium term (2)	Low (2)	Low (1)	Low (2)	High	Very-low
Peak power generation with hydropower long tunnel and power line alternative 3							
Without Mitigation	Local (2)	Medium term (2)	Medium (3)	Medium (3)	Medium (3)	High	Medium-low
With Mitigation	Site (1)	Medium term (2)	Low (2)	Low (1)	Low (2)	High	Very-low
Base-load power generation and with hydropower short tunnel and power line alternative 1							
Without Mitigation	Local (2)	Medium term (2)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Site (1)	Medium term (2)	Medium (3)	Medium (3)	Medium (3)	High	Low
Base-load power generation with hydropower medium tunnel and power line alternative 2							
Without Mitigation	Local (2)	Medium term (2)	Medium (3)	Medium (3)	Medium (3)	High	Medium-low
With Mitigation	Site (1)	Medium term (2)	Low (2)	Low (1)	Low (2)	High	Very-low
Base-load power generation with hydropower long tunnel and power line alternative 3							
Without Mitigation	Local (2)	Medium term (2)	Medium (3)	Medium (3)	Medium (3)	High	Medium-low
With Mitigation	Site (1)	Medium term (2)	Low (2)	Low (1)	Low (2)	High	Very-low
Residual Impact – Infrastructure placed in areas of high diversity will result in negative impacts on faunal species within the study area, resulting in an overall decrease in faunal diversity.							

9.1.3 Impact on faunal species of conservational concern

The short hydropower tunnel and associated power line (alternative 1) are located within the sensitive habitat zones of the mountain bushveld and gorge below the Tsitsa falls. These areas contain a high diversity of faunal species, most notably the *Hadogenes* scorpions, a protected species. Placement of infrastructure within these sensitive areas should be avoided if possible, utilising the alternative hydropower tunnels and power lines.

Recommended mitigation:

- The short hydropower tunnels and associated power line (alternative 1) should not be considered as an alternative. All infrastructure that will further impact on the faunal diversity on the mountain and within the gorge below the falls should not be considered viable;
- Should any RDL faunal species or species of conservational concern be found within the development footprint area, these species should be relocated to similar habitat within the vicinity of the study area with the assistance of a suitably qualified specialist;
- Edge effects of all construction activities, such as erosion and alien plant species proliferation, which may affect faunal habitat within surrounding areas, need to be strictly managed in all areas of increased ecological sensitivity; and
- Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the proposed development activities.

species of conservational concern	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Peak power generation with hydropower short tunnel and power line alternative 1							
Without Mitigation	Site (1)	Medium term (2)	High (5)	High (5)	High (4)	High	Medium-high
With Mitigation	Site (1)	Short term (1)	Medium (3)	Medium (3)	Medium (3)	High	Low
Peak power generation with hydropower medium tunnel and power line alternative 2							
Without Mitigation	Site (1)	Medium term (2)	Medium (3)	Medium (3)	Medium (3)	High	Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	Low (2)	High	Very-low
Peak power generation with hydropower long tunnel and power line alternative 3							
Without Mitigation	Site (1)	Medium term (2)	Medium (3)	Medium (3)	Medium (3)	High	Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	Low (2)	High	Very-low
Base-load power generation and with hydropower short tunnel and power line alternative 1							
Without Mitigation	Site (1)	Medium term (2)	High (5)	High (5)	High (4)	High	Medium-high
With Mitigation	Site (1)	Short term (1)	Medium (3)	Medium (3)	Medium (3)	High	Low
Base-load power generation with hydropower medium tunnel and power line alternative 2							
Without Mitigation	Site (1)	Medium term (2)	Medium (3)	Medium (3)	Medium (3)	High	Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	Low (2)	High	Very-low
Base-load power generation with hydropower long tunnel and power line alternative 3							
Without Mitigation	Site (1)	Medium term (2)	Medium (3)	Medium (3)	Medium (3)	High	Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	Low (2)	High	Very-low
Residual Impact – A decrease in protected faunal species numbers within the study area contributes to a lower regional/ national population number. With regard to endangered species, the loss or decrease of even a small population places increased stress on species numbers on a regional scale.							

9.2 OPERATION PHASE

9.2.1 Impact on faunal habitat

The operational phase will have a marked decrease in impacts on the faunal habitat, more so if mitigation measures were implemented correctly during the construction phase. The functioning of the hydropower tunnel will have a very minimal effect on faunal habitat, and will the associated power lines. However impact will occur from the access roads to check and maintain the infrastructure, and this needs to be taken into consideration during this phase.

Recommended mitigation:

- Restrict vehicles to designated roadways to limit the ecological footprint of the proposed development activities as well as to reduce the possibility of collisions;
- Edge effects of all construction activities, such as erosion and alien plant species proliferation, which may affect faunal habitat within surrounding areas, need to be strictly managed in all areas of increased ecological sensitivity; and
- Rehabilitate and naturalize areas beyond the development footprint, which have been affected by the construction activities, using indigenous grass species.

faunal habitat	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Peak power generation with hydropower short tunnel and power line alternative 1							
Without Mitigation	Site (1)	Long term (3)	Medium (3)	Medium (3)	Medium (3)	High	Medium-low
With Mitigation	Site (1)	Long term (3)	Low (2)	Low (1)	Low (2)	High	Very-low
Peak power generation with hydropower medium tunnel and power line alternative 2							
Without Mitigation	Site (1)	Long term (3)	Medium (3)	Medium (3)	Medium (3)	High	Medium-low
With Mitigation	Site (1)	Long term (3)	Low (2)	Low (1)	Low (2)	High	Very-low
Peak power generation with hydropower long tunnel and power line alternative 3							
Without Mitigation	Site (1)	Long term (3)	Medium (3)	Medium (3)	Medium (3)	High	Medium-low
With Mitigation	Site (1)	Long term (3)	Low (2)	Low (1)	Low (2)	High	Very-low
Base-load power generation and with hydropower short tunnel and power line alternative 1							
Without Mitigation	Site (1)	Long term (3)	Medium (3)	Medium (3)	Medium (3)	High	Medium-low
With Mitigation	Site (1)	Long term (3)	Low (2)	Low (1)	Low (2)	High	Very-low
Base-load power generation with hydropower medium tunnel and power line alternative 2							
Without Mitigation	Site (1)	Long term (3)	Medium (3)	Medium (3)	Medium (3)	High	Medium-low
With Mitigation	Site (1)	Long term (3)	Low (2)	Low (1)	Low (2)	High	Very-low
Base-load power generation with hydropower long tunnel and power line alternative 3							
Without Mitigation	Site (1)	Long term (3)	Medium (3)	Medium (3)	Medium (3)	High	Medium-low
With Mitigation	Site (1)	Long term (3)	Low (2)	Low (1)	Low (2)	High	Very-low
Residual Impact – Placement of power lines and support structures within sensitive faunal habitat, with associated maintenance roads, will result in a further and possible continuous decrease in viable faunal habitat for faunal species, lower the carrying capacity of the area resulting in a reduction of species numbers.							

9.2.2 Impact on faunal diversity

If the mitigation measures are correctly implemented during the construction phase, there should be minimal long term impacts during the operational phase. It may however be necessary to place bird flappers/ diverters on the power lines to help mitigate avifaunal collisions with overhead transmission lines.

Recommended mitigation:

- All informal fires in the vicinity of operational areas should be prohibited;
- Edge effects of all operational activities, such as erosion and alien plant species proliferation, which may affect faunal habitat within surrounding areas, need to be strictly managed in all areas of increased ecological sensitivity;
- Should any RDL or other common faunal species be found within the development footprint area, these species should be relocated to similar habitat within the vicinity of the study area with the assistance of a suitably qualified specialist; and
- Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the proposed development activities.

faunal diversity	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Peak power generation with hydropower short tunnel and power line alternative 1							
Without Mitigation	Site (1)	Long term (3)	Low (2)	Medium (3)	Low (2)	High	Low
With Mitigation	Site (1)	Long term (3)	Negligible (1)	Low (1)	Low (2)	High	Very low
Peak power generation with hydropower medium tunnel and power line alternative 2							
Without Mitigation	Site (1)	Long term (3)	Low (2)	Medium (3)	Low (2)	High	Low
With Mitigation	Site (1)	Long term (3)	Negligible (1)	Low (1)	Low (2)	High	Very low
Peak power generation with hydropower long tunnel and power line alternative 3							
Without Mitigation	Site (1)	Long term (3)	Low (2)	Medium (3)	Low (2)	High	Low
With Mitigation	Site (1)	Long term (3)	Negligible (1)	Low (1)	Low (2)	High	Very low
Base-load power generation and with hydropower short tunnel and power line alternative 1							
Without Mitigation	Site (1)	Long term (3)	Low (2)	Medium (3)	Low (2)	High	Low
With Mitigation	Site (1)	Long term (3)	Negligible (1)	Low (1)	Low (2)	High	Very low
Base-load power generation with hydropower medium tunnel and power line alternative 2							
Without Mitigation	Site (1)	Long term (3)	Low (2)	Medium (3)	Low (2)	High	Low
With Mitigation	Site (1)	Long term (3)	Negligible (1)	Low (1)	Low (2)	High	Very low
Base-load power generation with hydropower long tunnel and power line alternative 3							
Without Mitigation	Site (1)	Long term (3)	Low (2)	Medium (3)	Low (2)	High	Low
With Mitigation	Site (1)	Long term (3)	Negligible (1)	Low (1)	Low (2)	High	Very low
Residual Impact – Overall decrease in species diversity due to faunal mortalities or resource competition. Avifaunal mortalities due to power line strikes are an ever present threat, and will result in a loss of avifaunal diversity, notably amongst the larger avifaunal species. Operational vehicle collisions with faunal species will result in a decrease of species numbers, possibly affecting the remaining breeding populations, which will have a knock on effect on species diversity.							

9.2.3 Impact on faunal species of conservational concern

Operational activities infringing into and impacting upon areas that are known to provide habitat to RDL and protected species must be limited to minimal levels. Access and maintenance roads passing through sensitive faunal habitat areas needs to be kept to a minimum, as these areas are utilised by RDL and protected species. Avifaunal species, (cranes and raptors) are prone to collision induced mortalities due to overhead cable. This needs to be taken into consideration to mitigate these impacts during the operational phase of the project.

Recommended mitigation:

- In the rocky outcrops and mountain bushveld habitat, bird flappers/ diverters must be installed on overhead power lines to help minimise bird strikes and subsequent mortalities;
- Power lines and maintenance roads should as afar as possible not be routed through sensitive habitat areas such as the rocky outcrops and mountain bushveld habitat zones, as these areas are habitat hot spots for RDL and protected species;
- Edge effects of all operational activities, such as erosion and alien plant species proliferation, which may affect faunal habitat within surrounding areas, need to be strictly managed in all areas of increased ecological sensitivity;
- Should any RDL faunal species or species of conservational concern be found within the operational footprint area, these species must be relocated to similar habitat within the vicinity of the study area with the assistance of a suitably qualified specialist;
- The proposed operational footprint areas should remain as small as possible and where possible be confined to already disturbed areas; and
- Vehicles must be restricted to travelling only on designated roadways to limit the ecological footprint of the proposed development activities.

species of conservational concern	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Peak power generation with hydropower short tunnel and power line alternative 1							
Without Mitigation	Site (1)	Long term (3)	Low (2)	Medium (3)	Low (2)	High	Low
With Mitigation	Site (1)	Long term (3)	Negligible (1)	Low (1)	Low (2)	High	Very low
Peak power generation with hydropower medium tunnel and power line alternative 2							
Without Mitigation	Site (1)	Long term (3)	Low (2)	Medium (3)	Low (2)	High	Low
With Mitigation	Site (1)	Long term (3)	Negligible (1)	Low (1)	Low (2)	High	Very low
Peak power generation with hydropower long tunnel and power line alternative 3							
Without Mitigation	Site (1)	Long term (3)	Low (2)	Medium (3)	Low (2)	High	Low
With Mitigation	Site (1)	Long term (3)	Negligible (1)	Low (1)	Low (2)	High	Very low
Base-load power generation and with hydropower short tunnel and power line alternative 1							
Without Mitigation	Site (1)	Long term (3)	Low (2)	Medium (3)	Low (2)	High	Low
With Mitigation	Site (1)	Long term (3)	Negligible (1)	Low (1)	Low (2)	High	Very low
Base-load power generation with hydropower medium tunnel and power line alternative 2							
Without Mitigation	Site (1)	Long term (3)	Low (2)	Medium (3)	Low (2)	High	Low
With Mitigation	Site (1)	Long term (3)	Negligible (1)	Low (1)	Low (2)	High	Very low
Base-load power generation with hydropower long tunnel and power line alternative 3							
Without Mitigation	Site (1)	Long term (3)	Low (2)	Medium (3)	Low (2)	High	Low
With Mitigation	Site (1)	Long term (3)	Negligible (1)	Low (1)	Low (2)	High	Very low
Residual Impact – Many of the species of conservational concern are endemic species to South Africa, and have small populations across the region, that is decreasing over time. The increased loss of individuals through habitat loss and human/ infrastructure induced mortalities will have a negative impact on the breeding metapopulation of the region.							

10. IMPACT ASSESSMENT FOR ROADS INFRASTRUCTURE

This Chapter presents the findings of the environmental impact assessment for the road infrastructure (DEA Ref no. 14/12/16/3/3/1/1169).

The activities included under this chapter are listed below:

- Upgrading and relocation of roads and bridges.

10.1 CONSTRUCTION PHASE

10.1.1 Impact on faunal habitat

The existing roads are not located within sensitive faunal habitat and as such, the upgrading of these roads will have minimal impacts on faunal habitats. Care must be taken to ensure excess water runoff and erosion are controlled, as the soils in the study area are susceptible to erosion. If left unchecked erosion gulleys may form, leading to a further loss of faunal habitat.

Other areas of the road upgrade are located within the higher altitude areas, where indigenous plant species are located, providing suitable habitat to a variety of faunal species. These areas are more sensitive than the transformed vegetation area, and as such mitigation measure must be implemented to ensure that the footprint area is kept as small as possible.

New access roads will be constructed in the Lalini Dam area. The majority of the newly proposed access roads traverse transformed vegetation types. These areas will not be highly impacted upon since vegetation transformation has already occurred. Access roads close to the Lalini Dam will have a very high impact on the overall loss of faunal habitat, since these mountain areas provide suitable habitat for indigenous and protected faunal species, as well as a large variety of other faunal species. Although most of the vegetation where the road upgrades or new roads will be constructed within the Lalini Dam basin have been transformed, the proposed road upgrade and new roads located within the Lalini Dam area, especially in the Mountain / afromontane forest sections close to the dam wall will have a highly negative impact on the faunal habitat and species located within the area.

It is also proposed that a road will be constructed to access the long hydropower tunnel and alternative power line 3. This road will be constructed within a highly sensitive habitat area, containing a high diversity of faunal species. These areas have the potential to provide habitat to the *Hadogenes* scorpions, a protected scorpion species. This increases the diversity and overall sensitivity of the area. The construction of this road is likely to result in the loss of a large portion of faunal habitat with a resultant decrease in species diversity. Thus the impact on the immediate and surrounding area will be very high. Thus the impact on the immediate and surrounding area will be very high. This route is thus not recommended due to the high impacts and loss of faunal habitat and faunal species.

Due to the sensitive nature of the habitat types found throughout the study area in terms of the floral sensitivity report and map, it is advised that areas of high sensitivity be avoided as far as possible so as to minimise impacts on sensitive faunal habitat and faunal species within these areas.

Recommended mitigation:

- Road must be sloped and berms constructed to deal with surface water runoff in an effective manner so as to mitigate any erosion issues alongside the roadways;
- Edge effects of all construction activities, such as erosion and alien plant species proliferation, which may affect faunal habitat within surrounding areas, need to be strictly managed in all areas of increased ecological sensitivity;
- Restrict vehicles to designated roadways to limit the ecological footprint of the proposed development activities as well as to reduce the possibility of collisions; and
- Rehabilitate and naturalise areas beyond the development footprint, which have been affected by the construction activities, using indigenous grass species.

faunal habitat	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Road upgrades and road realignments associated with the Ntabelanga Dam							
Without Mitigation	Site (1)	Medium term (2)	Low (2)	Medium (3)	Medium (3)	High	Low
With Mitigation	Site (1)	Short term (1)	Negligible (1)	Low (1)	Low (2)	High	Very low
Road upgrades associated with the Lalini Dam							
Without Mitigation	Local (2)	Medium term (2)	Medium (3)	Medium (3)	Definite (5)	High	Medium-high
With Mitigation	Site (1)	Medium term (2)	Medium (3)	Medium (3)	High (4)	High	Medium-low
Road construction associated with the power generated long tunnel (alternative 3)							
Without Mitigation	Regional (3)	Permanent (5)	Very high (5)	High (5)	Definite (5)	High	Very high
With Mitigation	Local (2)	Long term (3)	Very high (5)	Medium (3)	Definite (5)	High	High
Residual Impact –Extended habitat loss around the roads through non-management of the project footprint, erosional activities and an increase in alien plant species in the disturbed areas all resulting in a decrease in faunal habitat. Development of roads through sensitive habitat areas will result in a loss of vegetation and faunal habitat.							

10.1.2 Impact on faunal diversity

Due to the current roads not being routed through any sensitive faunal habitats, and that there is limited faunal habitat alongside the roads, it is not perceived that the upgrading of the roads will have a large impact on the faunal diversity of the study area.

Other areas of the road upgrade are located within the higher altitude areas, where indigenous plant species are located, providing suitable habitat to a large diversity of faunal species. These areas are more sensitive than the transformed vegetation area, and

as such mitigation measure must be implemented to ensure that the footprint area is kept as small as possible.

New access roads will be constructed in the Lalini Dam area. The majority of the newly proposed access roads traverse transformed vegetation types. These areas will not be highly impacted upon since vegetation transformation has already occurred. Access roads close to the Lalini Dam will have a high impact on the overall loss of faunal species, since these mountain areas provide suitable habitat for indigenous and common and protected faunal species. Although most of the vegetation where the road upgrades or new roads will be constructed within the Lalini Dam has been transformed, the proposed road upgrade and new roads located within the Lalini Dam area, especially in the Mountain / Afromontane forest sections close to the dam wall will have a highly negative impact on the faunal species located within the area.

It is also proposed that a road will be constructed to access the long hydropower tunnel and alternative power line 3. This road will be constructed within a highly sensitive habitat area, containing a high diversity of faunal species. These areas have the potential to provide habitat to the *Hadogenes* scorpions, a protected scorpion species. This increases the diversity and overall sensitivity of the area. The construction of this road is likely to result in the loss of a large portion of faunal habitat with a resultant decrease in species diversity. Thus the impact on the immediate and surrounding area will be very high. This route is thus not recommended due to the high impacts and loss of faunal habitat and faunal species

Recommended mitigation:

- Should any RDL or other common faunal species be found within the development footprint area, these species should be relocated to similar habitat within the vicinity of the study area with the assistance of a suitably qualified specialist;
- Road must be sloped and berms constructed to deal with surface water runoff in an effective manner so as to mitigate any erosion issues alongside the roadways;
- Restrict vehicles to designated roadways to limit the ecological footprint of the proposed development activities as well as to reduce the possibility of collisions;
- Rehabilitate and naturalise areas beyond the development footprint, which have been affected by the construction activities, using indigenous grass species; and
- No areas falling outside of the study area may be cleared for construction purposes.

faunal diversity	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Road upgrades and road realignments associated with the Ntabelanga Dam							
Without Mitigation	Site (1)	Medium term (2)	Medium (3)	Medium (3)	Medium (3)	High	Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	2 (Low)	High	Very low
Road upgrades associated with the Lalini Dam							
Without Mitigation	Local (2)	Medium term (2)	Medium (3)	High (5)	Definite (5)	High	High
With Mitigation	Site (1)	Medium term (2)	Medium (3)	Medium (3)	Definite (5)	High	Medium-high
Road construction associated with the power generated long tunnel							
Without Mitigation	3 (Regional)	Permanent (5)	Very high (5)	High (5)	Definite (5)	High	Very high
With Mitigation	Local (2)	Long term (3)	Very high (5)	Medium (3)	Definite (5)	High	High
Residual Impact – Erosion and edge effects leading to disturbance of faunal species within the vicinity of the roads being upgraded. Road placement by the Lalini Dam wall area and within the afromontane habitat will result in a high impact on faunal diversity, notably on protected species.							

10.1.3 Impact on faunal species of conservational concern (SCC)

Road infrastructure is not deemed to have any major impact on RDL and protected species within the Ntabelanga Dam study area. Roads to be upgraded are pre-existing roads and therefore any RDL or protected species will already show preference to avoiding these road areas. The roads to be upgraded and new roads to be developed within the Lalini Dam study area however do pose a greater threat to RDL and protected faunal species.

Some of the roads to be upgraded are located within the higher altitude areas, where indigenous plant species are located, providing suitable habitat to a large diversity of faunal species. These areas are more sensitive than the transformed vegetation area, and as such mitigation measure must be implemented to ensure that the footprint area is kept as small as possible. The majority of the newly proposed access roads traverse transformed vegetation types. These areas will not be highly impacted upon since vegetation transformation has already occurred. Access roads close to the Lalini Dam will have a high impact on the overall loss of faunal species, since these mountain areas provide suitable habitat for indigenous and common and protected faunal species. Although most of the vegetation where the road upgrades or new roads will be constructed within the Lalini Dam has been transformed, the proposed road upgrade and new roads located within the Lalini Dam area, especially in the Mountain / afromontane forest sections close to the dam wall will have a highly negative impact on the faunal species located within the area. Therefore the construction of these access roads is not recommended and alternative routes should be considered.

It is also proposed that a road will be constructed to access the long hydropower tunnel and alternative power line 3. This road will be constructed within a highly sensitive habitat area, containing a high diversity of faunal species. These areas have the potential to provide habitat to the *Hadogenes* scorpions, a protected scorpion species. This increases the diversity and overall sensitivity of the area. The construction of this road will result in a large portion of faunal habitat and species diversity will be lost. Thus the impact on the immediate and surrounding area will be very high. This route is thus not recommended due to the high impacts and loss of faunal habitat and faunal species

Recommended mitigation:

- Should any RDL or other common faunal species be found within the development footprint area, these species should be relocated to similar habitat within the vicinity of the study area with the assistance of a suitably qualified specialist;
- Road must be sloped and berms constructed to deal with surface water runoff in an effective manner so as to mitigate any erosion issues alongside the roadways;
- Restrict vehicles to designated roadways to limit the ecological footprint of the proposed development activities as well as to reduce the possibility of collisions;
- Rehabilitate and naturalise areas beyond the development footprint, which have been affected by the construction activities, using indigenous grass species; and
- No areas falling outside of the study area may be cleared for construction purposes.

faunal species of conservational concern	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Road upgrades and road realignments associated with the Ntabelanga Dam							
Without Mitigation	Site (1)	Medium term (2)	Medium (3)	Medium (3)	Medium (3)	High	Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	Medium (3)	High	Low
Road upgrades associated with the Lalini Dam							
Without Mitigation	Local (2)	Medium term (2)	Medium (3)	High (5)	Definite (5)	High	High
With Mitigation	Site (1)	Medium term (2)	Medium (3)	Medium (3)	Definite (5)	High	Medium-high
Road construction associated with the power generated long tunnel (alternative 3)							
Without Mitigation	3 (Regional)	Permanent (5)	Very high (5)	High (5)	Definite (5)	High	Very high
With Mitigation	Local (2)	Long term (3)	Very high (5)	Medium (3)	Definite (5)	High	High
Residual Impact – Minimal impact will occur to SCC's within the Ntabelanga Dam. Roads through the sensitive faunal habitat areas by the Lalini Dam wall and the proposed hydropower tunnel 3 will have a high impact of SCC's through direct species loss as well as loss of SCC habitat.							

10.2 OPERATION PHASE

10.2.1 Impact on faunal habitat

During the operational phase no major impacts for the roads around the Ntabelanga and Lalini Dams are expected, provided rehabilitation of the affected areas has been implemented correctly. It must be ensured that alien plant proliferation is controlled during the operation phase to ensure that further faunal habitat is not lost. During the maintenance of the access road, all vehicles should travel on the designated road to limit the ecological footprint and reduce further degradation or loss of faunal habitat. Impacts of the tunnel access road will still be high since edge effects from the road will still take place. Care must be taken to ensure excess water runoff and erosion is controlled, as the soils in the study area are very sandy and susceptible to erosion. If left unchecked erosion gulley's may form, leading to a loss of faunal habitat in the vicinity of the roads.

Recommended mitigation:

- Road must be sloped and berms constructed to deal with surface water runoff in an effective manner so as to mitigate any erosion issues alongside the roadways;
- Restrict vehicles to designated roadways to limit the ecological footprint of the proposed development activities as well as to reduce the possibility of collisions;
- Rehabilitate and naturalize areas beyond the development footprint, which have been affected by the construction activities, using indigenous grass species; and
- Alien and invasive vegetation control should take place throughout the operational phase of the development.

faunal habitat	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Road upgrades and road realignments associated with the Ntabelanga Dam							
Without Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	Low (2)	High	Very low
With Mitigation	1 (Site)	Short term (1)	Negligible (1)	Low (1)	Improbable (1)	High	Very low
Road upgrades associated with the Lalini Dam							
Without Mitigation	Local (2)	Medium term (2)	Medium (3)	Medium (3)	High (4)	High	Medium-low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	Medium (3)	High	Low
Road construction associated with the power generated long tunnel (alternative 3)							
Without Mitigation	Local (2)	Permanent (5)	Medium (3)	Medium (3)	High (4)	High	Medium-high
With Mitigation	Local (2)	Long term (3)	Low (2)	Medium (3)	Medium (3)	High	Medium-low
Residual Impact – Erosional activities result in loss of surface vegetation (faunal habitat). Reduction in habitat lowers carrying capacity and so affects faunal specie numbers in the study area.							

10.2.2 Impact on faunal diversity

Operational activities of the road infrastructure will have a minimal impact on faunal species. As the majority of the roads are pre-existing, and new ones located in less sensitive areas, the road impact will be significantly lessoned. However the upgraded road will allow for more vehicle traffic and higher traveling speeds, and may result in an increase of operational vehicle collisions with faunal species. Impacts of the tunnel access road will still be high since edge effects from the road will still take place. Faunal species within the areas surrounding the tunnel access roads and new access roads close to the Lalini Dam wall will still be affected during the operational phase due to edge effects from the road and potential mitigation measures that were not fully implemented during the construction and operation phases.

Recommended mitigation:

- Edge effects of all operational activities, such as erosion and alien plant species proliferation, which may affect faunal habitat within surrounding areas, must to be strictly managed in all areas of increased ecological sensitivity;
- Vehicles must be restricted to travelling only on designated roadways to limit the ecological footprint of the proposed development activities; and
- Where high speed traveling is possible, speed bumps/ berms must be placed across the road to slow moving vehicles and also help control surface water runoff.

Impact on habitat for faunal species	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Road upgrades and road realignments associated with the Ntabelanga Dam							
Without Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	Low (2)	High	Very low
With Mitigation	Site (1)	Short term (1)	Negligible (1)	Low (1)	Improbable (1)	High	Very low)
Road upgrades associated with the Lalini Dam							
Without Mitigation	Local (2)	Medium term (2)	Medium (3)	Medium (3)	High (4)	High	Medium-low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	Medium (3)	High	Low
Road construction associated with the power generated long tunnel (alternative 3)							
Without Mitigation	Local (2)	Permanent (5)	Medium (3)	Medium (3)	High (4)	High	Medium-high
With Mitigation	Local (2)	Long term (3)	Low (2)	Medium (3)	Medium (3)	High	Medium-low
Residual Impact: Minimal faunal species loss is expected to occur within the transformed habitat areas, however the sensitive habitat areas that have a high faunal diversity there is still an increased risk of species loss due to habitat transformation or collision with operational vehicles.							

10.2.3 Impact on faunal species of conservational concern

Road infrastructure and associated operational activities are not deemed to have any major impact on RDL and protected species within the Ntabelanga Dam area, or within the transformed habitat areas of Lalini Dam. The roads near the Lalini Dam wall and the long hydropower tunnel access road will still have a negative impact on SCC's within the study area.

Recommended mitigation:

- Edge effects of all operational activities, such as erosion and alien plant species proliferation, which may affect faunal habitat within surrounding areas, need to be strictly managed in all areas of increased ecological sensitivity;
- Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the proposed development activities; and
- Where high speed traveling is possible, speed bumps/ berms must be placed across the road to slow moving vehicles and also help control surface water runoff.

faunal species of conservational concern	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Road upgrades and road realignments associated with the Ntabelanga Dam							
Without Mitigation	Site (1)	Medium term (2)	Low (2)	Low (1)	Low (2)	High	Very low
With Mitigation	Site (1)	Medium term (2)	Negligible (1)	Low (1)	Improbable (1)	High	Very low
Road upgrades associated with the Lalini Dam							
Without Mitigation	Local (2)	Medium term (2)	Medium (3)	Medium (3)	High (4)	High	Medium-low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	Medium (3)	High	Low
Road construction associated with the power generated long tunnel (alternative 3)							
Without Mitigation	Local (2)	Permanent (5)	Medium (3)	Medium (3)	High (4)	High	Medium-high
With Mitigation	Local (2)	Long term (3)	Low (2)	Medium (3)	Medium (3)	High	Medium-low
Residual Impact: Minimal impact to SCC's are expected within the Ntabelanga Dam area and transformed habitat areas. The access roads by the Lalini Dam wall and the long hydropower tunnel will still negatively impact SCC's through edge effects and vehicle collisions, resulting in a decrease of species.							

11. IMPACT STATEMENT FOR IRRIGATION AREAS

The irrigation fields were briefly assessed and selected areas were investigated as examples of the condition of these areas. The proposed agricultural fields are located within old farming lands, historically used since they have the highest agricultural potential and yield the highest harvests. Field assessments indicated that these fields have been uniformly heavily disturbed due to prior farming activities, and as such provide very limited habitat to faunal species within the area and region and the decommissioning of these areas as irrigated croplands is considered an insignificant impact to the regional faunal ecology.

12. IMPACT ASSESSMENT FOR THE NO PROJECT ALTERNATIVE

Faunal habitat remains intact across the entire study area, with special emphasis on habitat units by the dam walls. The Lalini Dam wall is situated in a unique and sensitive habitat unit, comprising of a *Euphorbia forest*, numerous *Cussonia paniculata*, a variety of *Aloe* species and a diverse woody component. This habitat zone is not seen to occur within any other areas of the study area, and is unique to the study area. Due to the intact state of the vegetation there is a large diversity of avifauna in comparison to the surrounding habitat units, which are mostly transformed. The habitat in this area provides habitat to a variety of faunal taxa, from scorpions to avifauna. Small and medium sized mammals also occur here, and due to the dense vegetation are provided with a more protective habitat in comparison the surrounding areas. This habitat will remain intact if no construction proceeds, and no loss of faunal habitat and RDL and protected species will occur. The Ntabelanga Dam area provides significantly less faunal habitat and as such has a lower faunal diversity than the Lalini dam study area. However, the wetlands and grasslands like those in in vicinity of the Lalini Dam provide breeding and foraging habitat to crane species, as well as a variety of raptors. The grasslands also provide grazing lands for the local community's cattle, the loss of which will force them to graze and over utilise the remaining grassland areas, resulting in a loss of habitat and possible increase in erosion as the herbaceous layer is lost. In addition the regional carrying capacity of species relying on these habitats may be reduced.

13. MITIGATION HIERARCHY AND OFFSET DISCUSSION

'Mitigation' is a broad term that covers all components of the 'mitigation hierarchy' defined hereunder. It involves selecting and implementing measures – amongst others – to conserve biodiversity and to protect, the users of biodiversity and other affected stakeholders from potentially adverse impacts as a result of development. The aim is to prevent adverse impacts from occurring or, where this is unavoidable, to limit their significance to an acceptable level. Offsetting of impacts is considered to be the last option in the mitigation hierarchy for any project.

The mitigation hierarchy in general consists of the following in order of which impacts should be mitigated (DEA *at al.* 2013):

1. **Avoid/prevent impact:** can be done through utilising alternative sites, technology and scale of projects to prevent impacts. In some cases if impacts are expected to be too high the "no project" option should also be considered, especially where it is expected that the lower levels of mitigation will not be adequate to limit environmental damage and eco-service provision to suitable levels;
2. **Minimise impact:** can be done through utilisation of alternatives that will ensure that impacts on biodiversity and ecoservices provision are reduced. Impact minimisation is considered an essential part of any development project;
3. **Rehabilitate impact** is applicable to areas where impact avoidance and minimisation are unavoidable where an attempt to re-instate impacted areas and return them to conditions which are ecologically similar to the pre-project condition or an agreed post project land use, for example arable land. Rehabilitation often only restores ecological function to some degree to avoid ongoing negative impacts and to minimise aesthetic damage to the setting of a project.
4. **Offset impact:** refers to compensating for latent or unavoidable negative impacts on biodiversity. Offsetting should take place to address any impacts deemed to be unacceptable which cannot be mitigated through the other mechanisms in the mitigation hierarchy. The objective of biodiversity offsets should be to ensure no net loss of biodiversity. Biodiversity offsets can be considered to be a last resort to compensate for residual negative impacts on biodiversity.

Following the assessment of the resources within the study area, impacts associated with the project, with specific mention of the construction of the Ntabelanga and Lalini Dams and their associated infrastructure, are deemed high largely due to the impact assessment method. Nevertheless, the impacts are considered acceptable when taking into account the socio-economic value of the dams compared to the residual impacts on faunal biodiversity. Whilst sections of faunal habitat within the study area are considered to be ecologically important and sensitive on a localised and provincial scale, these habitats have already undergone varying degrees of transformation due to ongoing anthropogenic activities within the area, thus the integrity and overall value of these areas has been compromised to some extent. Residual impacts such as the locality of protected scorpion

and crane habitats are deemed unlikely to be mitigated by offsetting these habitats thus limiting the significance of an offset programme. Although it is in our opinion that a formal offset is not required, “green” initiatives could possibly contribute to the overall success and value of the project, including initiatives with NGO’s to further Crane conservation within the region. The mitigation hierarchy as defined above should nonetheless be implemented accordingly in order to minimise the significance of the impact of the proposed development to ensure that regional conservation targets and objectives are met while still ensuring sustainable development. No need for biodiversity or faunal species habitat offsetting is however deemed necessary.

14. CONSULTATION PROCESS

14.1 CONSULTATION PROCESS FOLLOWED

PUBLIC PARTICIPATION

Engagement with Interested and Affected Parties (I&APs) forms an integral component of the EIA process. I&APs have an opportunity at various stages throughout the EIA process to gain more knowledge about the proposed project, to provide input into the process and to verify that their issues and concerns have been addressed.

The proposed project was announced in April 2014 to elicit comment from and register I&APs from as broad a spectrum of public as possible. The announcement was done by the following means:

- The distribution of Background Information Documents (BIDs) in English and IsiXhosa;
- Placement of site notices in the project area and Municipal offices (Tsolo and Qumbu);
- Placement of advertisements in one regional (The Herald) and two local (Daily Dispatch and the Mthatha Fever) newspapers; and
- Publication of all available information on the DWS web site (www.dwa.gov.za/mzimvubu).

The Draft Scoping Report (DSR) was made available for a 30 day public comment period in May 2014. All documents were uploaded to the web, notification letters were sent out, the summary of the DSR was translated into isiXhosa, distributed to all registered stakeholders and hardcopies of the full report and translated summary report were available at public places. Additionally, three public meetings were held in the affected areas, Siqhungqwini, Tsolo and Lalini respectively. An Authorities Forum Meeting with all relevant authorities was held in the Eastern Cape on the 28 May 2014. This was to assist the authorities with commenting on the relevant documentation.

Comments received from stakeholders were captured in the Issues and Response Report (IRR) which formed part of the Final Scoping Report (FSR). The FSR was made available to the public for a 21 day comment period on 13 June 2014 and was submitted to the Department of Environmental Affairs (DEA). Comments received during the Final Scoping public comment period were compiled and an updated IRR was submitted to DEA on 8 July 204 and uploaded to the website. The FSR was accepted by DEA with certain conditions on 15 July 2014. Following this, a newsletter was compiled and translated to isiXhosa, explaining everything that has happened to date as well as what is to come. Both the English and isiXhosa versions were electronically distributed to all registered stakeholders and hardcopies were distributed by the local facilitators in the affected areas.

The Draft Environmental Impact Assessment Report (DEIR), its summary (translated into isiXhosa), the various specialist studies, the Environmental Management Programmes

(one for the construction and operation of the project, and one for the borrow areas and quarries) as well as the Water Use Licence Application will be made available for a period of thirty (30 days) for stakeholders to comment. Hardcopies will be made available at the same venues as the DSR and all documents will be uploaded to the website. The availability of these documents as well as the announcement of the upcoming public meetings in Siqhungqwini, Tsolo and Lalini will be advertised on the Eastern Cape SABC radio station, Umhlobo Wenene FM, which has a listenership of over 4 million people. Another Authorities Forum Meeting is scheduled for October 2014.

Stakeholder comments will be taken into consideration with the preparation of the final documents. The availability of the final documents will be announced prior to submission to the decision-making authority. Once a decision has been made by the DEA, all stakeholders will again be notified.

The following issues were sourced from the Issue and Response Report (Final Version 1) as submitted to the Department of Environmental Affairs with the Final Scoping Report.

14.2 SUMMARY OF COMMENTS RECEIVED

Table 27: Issues related to the Flora, Fauna and Erosion

ISSUE/COMMENT/QUESTION	Date received	Origin	Response
Stakeholder stated that soil erosion may be a potential problem.	09.06.2014 via fax	Sivuyise Mange (Resident)	Soil erosion is indeed a big issue in this catchment. The Department of Environmental Affairs has therefore initiated a Catchment Rehabilitation and Management Programme aimed at addressing this and related issues. This project includes the removal of alien invasive species, rehabilitation of eroded areas and other land management exercises. The project has already commenced. Should any activities of the Catchment Rehabilitation and Management Programme (e.g. the construction of soil erosion abatement structures) require environmental authorisation or a water use licence these are not included in the applications that we have submitted for the dams, and separate EIAs will have to be undertaken for them. There is close liaison between the catchment management and Mzimvubu Water Project teams to focus their initial activities on areas that will most benefit the dams.
Many dams in the Transkei have been silted up how do you take care of this?	01.07.2014 via email	Sizekele Gabula (Department of Environmental Affairs)	
In previous cases, alien vegetation growth that was flooded caused a lot of unhappiness with communities, as the plants were being used by people and because people derived an income from removing the vegetation through, for example, *Working for Water*. He asked how this aspect was being dealt with in the EIA.	28.05.2014 AFM	Andrew Lucas (Department of Water and Sanitation)	If such plants qualified as a resource that is currently being used, and they are lost, this will be captured in the RAP.
With regards to additional authorization, please consider National Environmental Biodiversity Act (NEMBA) Threatened or Protected Species (TOPS) Regulations in respect of protected plants other than tress covered by National Forest Act.	01.07.2014 via email	Sizekele Gabula (Department of Environmental Affairs)	Protected *Hadogenes* scorpions were found in the rocky mountain areas near the Lalini dam wall. Depending on which dam alternative is selected, if feasible, consideration needs to be given to the relocation of these species by a specialist to a similar habitat in the surrounding area.

15. OTHER INFORMATION REQUESTED BY THE AUTHORITY

No specific information was requested by DEA in respect of the faunal impact assessment.

16. IMPACT STATEMENT

Impact	Construction and first filling		Operational phase	
Mitigation status	**Unmitigated**	**Mitigated**	**Unmitigated**	**Mitigated**
Roads and Pipelines impact on habitat	High	Medium high	Medium high	Low
Roads and Pipelines impact on species diversity	High	Medium high	Medium high	Low
Roads and Pipelines impact on SCC	High	Medium high	Medium high	Low
Electricity Generation and distribution impact on habitat	Medium Low	Low	Medium Low	Very low
Electricity Generation and distribution impact on species diversity	Medium Low	Very low	Low	Very low
Electricity Generation and distribution impact on SCC	Low	Very low	Low	Very low
Lalini and Ntabelanga Dams impact on habitat	High	High	Medium high	Medium high
Lalini and Ntabelanga Dams impact on species diversity	High	High	Medium high	Medium high
Lalini and Ntabelanga Dams impact on SCC	High	Medium low	Medium low	Medium low

Lalini Dam

Dam size 1 (preferred) and alternative dam size 3 pose the greatest threat to faunal habitat, faunal diversity and RDL species as they both exhibit very high water levels and will result in large portions of the surrounding land being submerged. Alternative dam size 2 () has the lowest full supply level, and as such spares sections of faunal habitat from being submerged. All three options will result in large scale loss of faunal habitat, with a resultant impact on carrying capacity of faunal species. Less available resources and space will result in great species competition, lower carrying capacities and emigration of faunal species. All these factors result in the loss of species numbers and diversity as species leave the area, adapt to new environment at lower numbers or are lost in totality within the study area. RDL and protected species are of concern in the region, as the loss of the wetlands and the lower grassland areas, as well as the mountain bushveld and rocky outcrops will directly impact on the populations of these species. The construction of the dam wall and other associated infrastructure will also have a large impact on the remaining vegetation, notably the habitat around the proposed dam wall. Once full service level of the dam is achieved, a large island will exist within the dam. This island will be temporarily connected to the main land as water levels fluctuate, negating the need for and rescue and relocation of species here. Furthermore, this island may provide a safe haven to many faunal species, especially from anthropogenic impacts such as hunting. The island is deemed to be large enough to be self-sustaining, and in the event that faunal species are trapped here they will more than likely be able to survive on the island. However, rescue and relocation is deemed necessary as small islands form as the dam fills up and will become covered as it fills further.

Ntabelanga Dam

The study area of Ntabelanga dam did not contain the same levels of faunal habitat and species as Lalini Dam. However, the wetlands and grasslands are used by *Balearica regulorum* (Crowned Crane), *Anthropoides paradisea* (Blue crane) and *Grus carunculatus* (Wattled crane) for breeding and foraging. The loss of these habitats will negatively impact crane species within the area and region, forcing them to find new breeding grounds. The construction of the dam wall and the associated infrastructure will result in a significant loss in faunal habitat within the study area, with a resultant knock on effect of a decrease in faunal diversity. Once full service level of the dam is achieved, a large island will exist within the dam. The island is deemed to be large enough to be self-sustaining, and in the event that faunal species are trapped here they will more than likely be able to survive on the island. Furthermore, this island may provide a safe haven to many faunal species, especially from anthropogenic impacts such as hunting. However, rescue and relocation is deemed necessary as small islands form as the dam fills up and will become covered as it fills further.

Primary, secondary and irrigation pipelines

The primary and secondary pipelines will be constructed close to main or existing roads. Vegetation that is within the pipeline route will be lost, however, in terms of vegetation habitat, the edge effects of the existing roads, overgrazed veld and surrounding community villages has transformed the vegetation to the extent that only grass species, which are associated with more disturbed areas, occur alongside the current access roads. In areas that are associated with disturbance and vegetation clearance, the impact on further transformation of faunal habitat of the pipelines will be low, provided all mitigation measures are implemented.

Electricity generation and distribution

The hydropower tunnels only pose threats to faunal species at the entry and exit points of these tunnels, as these are the areas where faunal habitat and species will be subjected to construction and operational activities, the rest of the tunnel will be underground and pose minimal threat. The short hydropower tunnel (alternative 1) poses the greatest threat as it exits into the gorge below the Tsitsa falls, which is a unique habitat area. The power line associated with the short hydropower tunnel will also have a significant impact on faunal habitat and species. The short hydropower tunnel and associated power line (alternative 1) should not be considered as an alternative. The two alternative hydropower tunnels (alternatives 2 and 3) and associated power lines have a significantly lower impact risk to faunal habitat and species.

Road infrastructure

Upgrading of the existing road infrastructure poses minimal threat to faunal habitat and species through habitat loss or modification. However the upgrading of the roads may result in an increase in vehicle traffic and faunal species collisions. In light of this, it is recommended that speed control measures be put in place to help mitigate this impact.

Access roads by the Lalini Dam wall and the long hydropower tunnel (alternative 3) will have a significant impact on both faunal habitat and faunal species within the area. It is recommended that alternative routes are identified so as to minimise these impacts.

Key mitigation measures

- Should any RDL faunal species or species of conservational concern be found within the operational footprint area, these species must be relocated to similar habitat within the vicinity of the study area with the assistance of a suitably qualified specialist;
- No hunting or trapping of faunal species is to occur;
- The construction footprint needs to remain as small as possible, especially in the sensitive habitats;
- Bird flappers/ diverters should be placed on the power lines to mitigate bird strikes;
- In the event that islands are created during the filling phase of the dams, that will later be flooded when full service levels are achieved, rescue and relocation of faunal species by a qualified specialist must occur;
- Proliferation of alien and invasive species is expected within any disturbed areas. These species should be eradicated and controlled to prevent their spread beyond the footprint areas resulting in a further loss of faunal habitat; and
- Restrict vehicles as far as possible to travel on designated roadways to limit the ecological footprint.

17. CONCLUSION AND RECOMMENDATIONS

Faunal assessment:

- In terms of faunal habitat, primary issues are the impacts on rocky ridges, mountain bushveld, riparian and wetlands present within the study area. These areas provide highly suitable habitat for several RDL faunal species. The rocky outcrops and mountain bushveld are ideal habitat zones for threatened scorpions. The wetland systems and associated grasslands provide suitable habitat for protected Crane species, as well as various small mammals.
- A number of small mammals, as well as evidence of mammals, was observed throughout the study area, namely *Aonyx capensis* (Cape Clawless Otter), *Genetta maculata* (Large Spotted Genet), *Galerella sanguinea* (Slender mongoose) and *Hystrix africaeaustralis* (South African Porcupine) amongst others. No threatened mammals were directly observed within the study area, nor are any threatened mammals expected to occur in the study area.
- A high diversity of avifaunal species was observed on site. This can be attributed to the fact that the study area has a variety of habitats suited to a diverse range of avifauna. The study area also provides suitable habitat to RDL bird species, most importantly communities of *Balearica regulorum* (Grey Crowned Crane)*, Anthropoides paradiseus* (Blue Cranes) and *Grus carunculatus* (Wattled Crane) of which *B. regulorum* was directly observed in the study area. *Sagittarius serpentarius* (Secretary Bird) was also observed within the study area during the site assessment as well as a number of raptor species.
- Various reptile species were recorded during the site survey within the study area amongst others *Agama atra* (Southern Rock Agama), *Philothamnus hoplogaster* (Green Water snake) and *Causus rhombeatus* (Rhombic Night Adder). These species have yet to be assessed by the IUCN and are not considered threatened. The rocky outcrop, mountain bushveld and riparian habitats are considered to be the most sensitive from a reptile conservation perspective.
- Only common amphibian species were encountered during the field assessment including *Afrana angolensis* (Common River frog) and *Strongylopus fasciatus* (Striped Stream frog). The wetland habitat and river system is considered to be the most sensitive from an amphibian conservation perspective. However, the inundation in the dam basins is unlikely to have a negative impact on amphibians in the study area.
- A large variety of invertebrate species was observed within the study area but it must be noted that the field assessments were undertaken in autumn and early winter, and as such certain invertebrate species would have entered dormant phases in their life cycles. None of the invertebrate species identified are listed as threatened and as such the development of the dams and associated infrastructure will have no impact on invertebrate conservation within the area and region.
- Various common arachnid species were identified during the site assessments including *Olurunia ocellata* (Grass funnel-web spider) and *Nephila senegalensis* (Banded-legged Golden Orb-web spider). No RDL or protected spiders were observed, or are expected to occur within the study area. One NEMBA listed and

protected scorpion species, *Hadogenes sp.* was however observed in the mountain rocky outcrop/ bushveld habitat near the proposed Lalini Dam wall. This species will be impacted upon through loss of habitat due to the dam wall construction and subsequent rising water level.

Faunal Impacts:

- Loss of faunal habitat will occur due to the flooding of floodplain, riparian and rocky outcrop areas and affect threatened species such as *Balearica regulorum (*Grey Crowned Crane), *Anthropoides paradise* (Blue Crane), *Grus carunculatus* (Wattled Crane) and *Hadogenes sp* (Rock Scorpion).
- Decrease in food supply due to habitat loss will result in a decrease in faunal diversity and cause changes to faunal community assemblage.
- Loss of faunal habitat will result in lower carrying capacity for faunal species, resulting in knock on effects within the food chain and on populations of various species in the local area.
- There is an increased poaching risk of potential species of conservational importance and fire hazards due to increased human activity as a result of the proposed projects to be undertaken.

As far as possible impacts must be mitigated, and if need be faunal species need to be relocated by a professional to suitable habitat in the area that isn't affected by the proposed dams. Alternatives need to be carefully considered with respect to their impacts on the environment, and changed further if required, in order to minimise impacts.

18. REFERENCES

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