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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)

WETLAND 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

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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
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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 Wetland 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

WETLAND 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 region.

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.

The purpose of this report is to provide a summary of the wetland resource delineation, Present Ecological State (PES), Ecological Importance and Sensitivity (EIS) and function, as well as to conduct an impact assessment and develop mitigation measures, as part of the Environmental Assessment and authorisation process for the Mzimvubu Water Project. This is in order to inform the Environmental Assessment Practitioners (EAP) as well as the proponent and relevant authorities as to the best use of the resources in the area, and in order to ensure that adequate impact mitigation is implemented into the project plan, should the proposed development proceed.

<u>Outcomes</u>

Specific outcomes required from this report in terms of the wetland assessment include the following:

- *Identify and map Management Units within the study area according to Hydrogeomorphic (HGM) units following the guidelines in the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems (Ollis et al., 2013);*
- *Delineate wetland resources and riparian zones within the focus study area. Due to the scale of the project, delineation was undertaken using desktop methods and digital satellite imagery. In the field, verification of the wetland delineation took place according to the guidelines as defined by (DWA, 2005);*
- *Determine function and service provision of wetland systems according to the method supplied by Kotze et al (2009);*
- *Define the wetland health of the systems within the study area according to the resource directed measures guideline described by Macfarlane et al. (2008) or the WET-IHI method described by the DWA (2007) (as applicable) and thereby define PES of the wetland resources to be affected by the proposed Mzimvubu Water Project;*
- *Define the wetland EIS and Recommended Ecological Category (REC) for the wetland systems (DWA, 1999);*
- *Consider potential impacts on the wetland habitat and the ecological communities likely as a result of the proposed development; and*

- *Present management and mitigation measures in order to minimise the impacts that the proposed expansion will have on the wetland resources in line with the mitigation Hierarchy, as defined by the DMR (2013), followed by an assessment of the significance of the impacts after mitigation, assuming that they are fully implemented.*

Conclusions from literature review

The following background conclusions were drawn upon completion of the literature review:
The study area falls within the South Eastern Uplands Aquatic Ecoregion and the Mzimvubu to Kieskamma Water Management Area (WMA). The subWMA indicated for the study area is Mzimvubu. The Tsitsa River is a tributary of the Mzimvubu River and will be partially inundated by both proposed dams. The Tsitsa River is a large perennial river that is classified in Category C condition (Moderately modified) according to Kleynhans (2007) and NFEPA (2011).

The Lalini Dam is located within the T35L and T35K Quaternary Catchments, whilst the Ntabelanga Dam and road upgrades are located within the T35E quaternary catchment, and the particular river resource in the area is the Upper Ntata, Mzimvubu River.

The pipelines traverse over several quaternary catchments, namely T20B, T34H, T34 J, T35E, T35H and T35K. The PES Category of the various river systems in these quaternary catchments varies between PES B and PES C. Specifically, the Tsitsa River is classified as a PES Category B river, whilst the Inxu is considered to be in a PES Category C. All systems are considered to have a 'moderate' Ecological Importance (EI) whilst the Ecological Sensitivity (ES) varies between High to Medium sensitivity. The Tsitsa River is considered to be of moderate sensitivity whilst the Inxu River is deemed to be highly sensitive. The default Ecological Class (EC) of the river systems in these quaternary catchments, based on the median PES and highest of EI or ES means is considered to be either a Class B or a Class C. The Tsitsa River is deemed to be a Class C, and the Inxu is deemed to be a Class B system.

The Freshwater Ecosystem Priority Areas (FEPAs) database was consulted to define the aquatic ecology of the wetland systems close to or within the study area that may be of ecological importance.

Lalini Dam

Aspects applicable to the Lalini Dam 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. However it must be noted that the specific section of the Tsitsa river is considered less important based on the findings of the aquatic assessment and the migratory barriers created by the waterfalls on the system;*
- *The subWMA is indicated as a fish corridor management area therefore effective management of activities near and between corridors are of upmost importance. The Tsitsa River can however be considered of less importance due to the reasons presented above although the system is still considered important in terms of eel migration;*

- *The wetland vegetation group is identified as Sub-escarpment Savanna; and*
- *According to the NFEPA Database (2011), the wetlands in the region of the proposed Lalini Dam are classified as FEPA wetlands, 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 Balearica regulorum (Grey Crowned Crane) and Anthropoides paradiseus (Blue Crane).*

Ntabelanga Dam

Aspects of the results from the FEPA (2011) database applicable to the Ntabelanga Dam include:

- *The subWMA is regarded as important in terms of the conservation of crane species;*
- *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; and*
- *The wetland vegetation group is identified as Sub-escarpment Grassland Group 6.*

Pipelines

Aspects concerning the pipelines according to the NFEPA (2011) database are as follows:

- *The northern pipelines cross the Thina River which is classified as being in Category C condition (moderately modified); and*
- *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).*

CONCLUSIONS OF WETLAND AND RIPARIAN ASSESSMENT

The following general conclusions were drawn upon the completion of the wetland and riparian assessment:

Features within the study area were categorised with the use of the Classification System for Wetlands and other Aquatic Ecosystems in South Africa (Ollis, 2013). After the field assessment it can be concluded that five main feature groups are present within the study area, namely rivers, channelled valley bottom wetlands, seeps, depressions and drainage lines. The features identified during the assessment were further divided into either wetland or riparian habitat based on the characteristics as defined by the NWA No 36 of 1998. Riparian habitat was assessed with use of the VEGRAI, Wetland Function Assessment, and Wetland IHI, whilst wetland habitat was assessed with the use of Wet-Health and the Wetland Function Assessment.

Riparian Habitat

- *The results of the VEGRAI assessment indicate that the riparian vegetation of the Tsitsa River and several of its unnamed tributaries, as well as the Inxu River, can be considered to be in a Present Ecological State (PES) Category C. One unnamed tributary, which passes through the town of Tsolo, has undergone marginally higher levels of transformation and can be considered to be in a PES Category D;*

- *The results of the wetland function assessment indicate that the Tsitsa River and the various tributaries provide moderately high levels of ecological and socio-cultural services;*
- *The WET-IHI method as described by DWA (2005) was applied to the Tsitsa River and the various tributaries in order to ascertain the PES of the riparian resources. The results of these assessments indicate that the riparian resources are in a PES Category C;*
- *The ecological importance and sensitivity (EIS) assessment of the riparian features indicates that they are considered to be highly sensitive. However, although all riparian features assessed were placed within the same EIS category, it should be noted that each feature obtained different scores indicating that some – such as the Tsitsa River – may be deemed more ecologically important and sensitive to modifications than the others; and*
- *A Recommended Ecological Category (REC) B/C was assigned to the riparian features based on the outcomes of the wetland functionality, PES and EIS assessments.*

Wetland Habitat

Each group of wetland HGM units were assessed to ascertain levels of ecological functioning and service provision, present ecological state, and ecological importance and sensitivity. The results of these assessments are summarised below:

Numerous drainage lines were identified within the study area, particularly in the regions associated with the proposed Ntabelanga and Lalini dam sites.

- *The results of the wetland function assessment applied to these drainage lines indicate intermediate levels of ecological and socio-cultural service provision;*
- *The PES of the drainage lines was assessed using the WET-IHI method (DWA, 2005) and was found to fall within a PES Category C (moderately modified);*
- *The drainage line features were found to fall within an EIS Category C (ecologically important and sensitive on a localised scale); and*
- *After consideration of the above results, an REC C was assigned to the drainage line features.*

<u>Channelled Valley Bottom Wetlands</u>

Several channelled valley bottom wetland features were noted during the site assessment. The results of the assessments applied to these features are as follows:

- *The channelled valley bottom wetland features were found to have moderately high levels of ecological and socio-cultural service provision;*
- *The PES of these wetland features was calculated using the Wet-Health method as described by Macfarlane et al. (2008) and were found to fall within a PES Category C (moderately modified);*
- *The results of the EIS assessment indicate that the channelled valley bottom wetlands are considered highly ecologically important and sensitive, and were placed in an EIS Category B; and*
- *Following consideration of the results of the assessments the channelled valley bottom wetlands were assigned an REC C.*

<u>Seep Wetlands</u>

A few small seep wetlands were identified. The results of these assessments are as follows:

- *The wetland functionality assessment indicated intermediate levels of ecological and socio-cultural service provision and functionality;*
- *Using Wet-Health, the PES of the seep wetland features was calculated, and found to fall within a PES Category C (moderately modified);*
- *The seep wetlands are considered to be ecologically important and sensitive on a local or provincial scale, although biodiversity is unlikely to be sensitive to habitat and flow modifications, and the results of the EIS assessment indicate that these wetlands fall within an EIS Category C; and*
- *An REC C was assigned to the seep wetlands based on the results of the various assessments applied to the features.*

Depression Wetlands

No depression wetlands were identified during the site assessment, however, a few small depression wetlands were identified using digital satellite imagery. The assessments of these features was therefore based on available background information relevant to the study area and catchment as well as wetland-specific information obtained for the other wetland features evaluated. The results of the assessments are summarised below:

- *The depression wetland features obtained a score in the wetland functionality assessment which indicates that they provide intermediate levels of ecological and socio-cultural services;*
- *The PES of the features was calculated using Wet-Health and was found to be in a PES Category C (moderately modified);*
- *As with the seep wetland features, these wetlands may be considered ecologically important and sensitive on a local or provincial scale, however the biodiversity is unlikely to be sensitive to habitat and flow modifications. The depression wetlands obtained a score placing them in an EIS Category C; and*
- *Based on the above, an REC C was assigned to the depression wetlands.*

Summary

*In summary, the results of the wetland and riparian assessments indicate that overall, the various riparian and wetland resources can be considered to be in **moderately modified** condition, indicating that loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.*

Impacts on the resources include:

- *Altered hydrology due to changing catchment uses such as subsistence agriculture (abstraction, increased run-off due to vegetation losses), small-scale and localised abstraction of water for domestic purposes, and localised increased on-site water usage by alien invasive vegetation such as Acacia mearnsii and Eucalyptus cameldulensis;*
- *Increased sediment inputs as a result of extensive and often severe erosion within the study area and greater catchment are anticipated, thus altering the sediment loads within riparian and wetland features;*
- *Incision and erosion of stream banks is considered severe in some sections of the tributaries of the Tsitsa; and*
- *Wetland and riparian floral communities have undergone varying degrees of transformation due to removal for small-scale agriculture, overgrazing and trampling by domestic livestock, and alien vegetation encroachment.*

DELINEATION AND SENSITIVITY MAPPING

All features were delineated on a desktop level with the use of aerial photographs, digital satellite imagery and topographical maps. As described in Section 3.2.1 of this report, points of interest were identified prior to the site assessments in order to guide the field assessment. Where wetland features were identified during the field survey at these points of interest, portions of the features were verified according to the guidelines advocated by DWA (2005) utilising terrain units, soil form indicators and vegetation indicators.

The use of buffer zones for wetlands is alluded to in: Environmental Best Practice Guidelines: Planning (Water supply and water resource infrastructure) as published by DWA in 2005, and the legislative principles as enshrined in the National Environmental Management Act (NEMA) (Activity 9 and 11 listing 1 of Government Notice R544 and Activity 16 Listing 3 of Government Notice R546 of 2010) prescribe a minimum 32m buffer around the wetland and riparian resource. Any activities proposed within the wetland or riparian boundaries, including rehabilitation, must be authorised by the DWS in terms of Section 21 (c) & (i) of the National Water Act (Act 36 of 1998). Since a Section 21 c & i WUL will be applied for, and due to the vast extent of the various components of the project, detailed mapping of unaffected wetlands within 500m of the proposed infrastructure did not take place in the field but were delineated with the aid of digital satellite imagery.

It is recognised however that due to the nature of the Mzimvubu Water Project, avoidance of construction or impact within a wetland or riverine resource is not possible for all riparian and wetland features identified within the study area, as the construction of the dams will entail *inundating several wetland features. Additionally, roads and pipelines may be planned to traverse wetland features; thus it will not be feasible to implement a buffer zone around all wetland features affected by the project. Effective mitigation must be implemented in order to reduce the level of impacts on the wetland features which will be negatively impacted by the construction of the proposed Ntabelanga and Lalini Dams in particular, as it is anticipated that this will result in the loss of wetland habitat and service provision in those areas. Furthermore, due to the linear nature of roads and pipelines, it is acknowledged that a buffer zone cannot be effectively implemented around the wetland features which will be crossed by such infrastructure. Nevertheless, mitigation measures must be implemented in order to, where possible, avoid and minimise impacts on such features.*

Based on the results of the study, it is clear that the wetlands which will be directly impacted by the project provide important ecological services in the way of sediment trapping, nutrient cycling and toxicant assimilation, flood attenuation and biodiversity maintenance. In view of the extensive, and often severe, erosion within the study area and greater catchment, sediment trapping is especially important. The proposed Mzimvubu Water Project has the potential to lead to loss of niche habitat for wetland-dependent faunal and floral taxa and/or alteration of the aquatic and riparian resources on the study area, with particular mention of the impacts that the two dams will have on the Tsitsa River and its tributaries, as well as the associated wetland and riparian resources.

The anticipated cumulative loss of riparian and wetland habitat arising from the construction of the dams is estimated to be 1034.30 hectares; overall this is deemed to be a relatively insignificant fraction of the wetland resources within the Mzimvubu subWMA. The approximate loss of wetlands as a result of the construction of each dam is presented in the table below:

Anticipated approximate loss of riparian and wetland habitat as a result of the construction of the dams.

Ntabelanga Dam		Lalini Dam	
Resource	**Hectares lost**	**Resource**	**Hectares lost**
Tsita River	246.09	Tsitsa River	550.91
Tributaries	23.20	Tributaries	0
Seeps	15.11	Seeps	0
Channelled Valley Bottom	37.20	Channelled Valley Bottom	0
Drainage Lines	89.93	Drainage Lines	71.85
TOTAL	**411.53**	**TOTAL**	**622.76**

IMPACT ASSESSMENT

The following table summarises the perceived impacts before and after the implementation of mitigation measures. The Ntabelanga and Lalini Dams will have the greatest impact on wetland and riparian habitat, as wetland habitat will be permanently lost during the first filling.

Summary of perceived impacts of the construction and operation of the two dams and their associated infrastructure on wetland and riparian ecology.

Impact	Construction and First Filling		Operational Phase	
Mitigation Status	**Unmitigated**	**Mitigated**	**Unmitigated**	**Mitigated**
Roads and pipelines: impact on habitat	Low	Very Low	Low	Very Low
Roads and pipelines: impact on ecoservices	Low	Very Low	Low	Very Low
Roads and pipelines: impact on hydrology and sediment balance	Low	Very Low	Low	Very Low
Electricity generation and distribution: impact on habitat	Low	Very Low	Medium Low	Very Low
Electricity generation and distribution: impact on ecoservices	Low	Very Low	Medium Low	Very Low
Electricity generation and distribution: impact on hydrology and sediment balance	Low	Very Low	Medium Low	Very Low
Ntabelanga and Lalini Dams: impact on habitat	High	High	Medium High	Medium High
Ntabelanga and Lalini Dams: impact on ecoservices	High	High	Medium High	Medium High
Ntabelanga and Lalini Dams: impact on hydrology and sediment balance	High	High	Medium High	Medium High

Key Mitigation Measures

The essential mitigation measures referred to in Section 6: General Management and Good Housekeeping Practices must be adhered to, in addition to the key mitigation measures presented in Sections 7 to 9. These key mitigation measures are:

- *Areas of increased sensitivity as shown in the sensitivity and buffer zone maps developed (**Figures 22-23 and 30-31**) should ideally be avoided in terms of the placement of infrastructure in order to minimise the footprints within wetland features. However, it is acknowledged that due to the scale of this project and the mountainous terrain within which much of the infrastructure is planned, it will not always be possible to completely avoid all wetland or riparian habitat. In such instances, mitigation measures to limit the impacts (such as ensuring the design of crossings allows for the retention of wetland soil conditions as discussed in Section 9 of this report) must be implemented;*
- *Quarries and borrow pits should ideally be placed within the dam footprints in order to preserve wetland and riparian habitat outside of the dam footprints, and to reduce sedimentation of the riparian resources. According to the EAP this has been achieved;*
- *Minimise the construction footprints and implement strict controls of edge effects;*
- *Erosion management and sediment controls such as the use of gabions or reno mattresses, revegetation of profiled slopes, erosion berms, drift fences with hessian and silt traps must be strictly implemented from the outset of construction activities;*
- *It is critical that an alien vegetation control programme is implemented, as encroachment of alien vegetation is already apparent in the study area and is expected to increase as a result of the disturbances resulting during the construction process. Rehabilitation of disturbed areas, utilising indigenous wetland vegetation species, will assist in retaining essential wetland ecological services, particularly flood attenuation, sediment trapping and*

erosion control, and assimilation of nutrients and toxicants, thus reducing the impacts of construction related activities;

- *Implement measures such as sediment control, and prevention of pollution (solid wastes, oil spills, discharge of sewage) to minimise impacts on the water quality of nearby adjacent rivers;*
- *Support structures for pipelines must be placed outside of riparian features, channelled valley bottom wetlands and drainage lines. Should it be essential to place such support structures within these features, the designs of such structures must ensure that the creation of turbulent flow in the system is minimised, in order to prevent downstream erosion. No support pillars should be constructed within the active channels. In order to achieve this all crossings of wetlands should take place at right angles wherever possible;*
- *The Ecological Water Requirements (EWR) as set out in the Reserve Determination Volume 1: River (Report P WMA 12/T30/00/5212/7) for the Ntabelanga Dam, and the EWR determined for the Lalini Dam, must be adhered to;*
- *During operations and maintenance of infrastructure, vehicles must remain on designated roads and not be permitted to drive through sensitive wetland / riparian habitat, particularly on the edges of the dams where loss of wetland habitat and therefore ability of the wetlands to provide ecological services, is already compromised.*
- *Maintenance personnel must ensure that any tools and/or waste products resulting from maintenance activities are removed from the site following completion of maintenance.*
- *Wherever possible, it is preferable that existing roads be upgraded, rather than constructing new roads, in order to minimise the impact of construction on wetland / riparian habitat;*
- *Where it is necessary to traverse features such as drainage lines, channelled valley bottom wetlands and riparian habitat, the crossing designs of bridges must ensure that the creation of turbulent flow in the system is minimised, in order to prevent downstream erosion. No support pillars should be constructed within the active channels. In order to achieve this all crossings of wetlands should take place at right angles wherever possible;*
- *If it is absolutely unavoidable that wetland / riparian habitat is affected during the construction of new roads, especially during bridge or culvert construction, disturbance to any wetland crossings must be minimised and suitably rehabilitated. The design of such culverts / bridges should allow for wetland soil conditions to be maintained both upstream and downstream of the crossing to such a degree that wetland vegetation community structures upstream and downstream of the crossing are maintained. In this regard, special mention is made of:*
    - *The design of such culverts and/or bridges should ensure that the permanent wetland zone should have inundated soil conditions throughout the year extending to the soil surface;*
    - *The design of such culverts and/or bridges should ensure that the seasonal wetland zone should have water-logged soils within 500mm of the soil surface during the summer rainfall period;*
    - *Temporary wetland zone areas should have waterlogged soil conditions occurring to within 300m of the land surface during the summer rainfall period;*

- *Ensure that no incision and canalisation of the wetland system takes place as a result of the construction of the culverts;*
- *It must be ensured that flow connectivity along the wetland features is maintained;*
- *Reinforce banks and drainage features where necessary with gabions, reno mattresses and geotextiles;*
- *Monitor all systems for incision and sedimentation;*
- *As much vegetation growth as possible should be promoted within the wetland areas in order to protect soils. In this regard, special mention is made of the need to use indigenous vegetation species where hydroseeding, wetland and rehabilitation planting (where applicable) are to be implemented;*
- *Regular maintenance of all roads, with specific mention of wetland / riparian crossings, must take place in order to minimise the risk of further degradation to wetland / riparian habitat.*

The first filling of the dams will result in the permanent loss of wetland habitat; due to the nature of the development, this cannot be avoided. It is therefore imperative that measures are taken in order to minimise the impact on those portions of the ***affected wetland features which will not be inundated with special mention of areas downstream of the proposed dams.***

ENVIRONMENTAL IMPACT ASSESSMENT FOR THE MZIMVUBU WATER PROJECT – WETLAND ASSESSMENT

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

BGIS	Biodiversity Geographic Information System
DEAT	Department of Environmental Affairs and Tourism
DEMC	Desired Ecological Management Class
DMs	District Municipalities
DWA	Department of Water Affairs (former DWS)
DWS	**Department of Water and Sanitation**
EAP	Environmental Assessment Practitioner
EC	Ecological Class
EI	Ecological Importance
EIA	Environment Impact Assessment
EIS	Ecological Importance and Sensitivity
EMC	Ecological Management Class
EMPR	Environmental Management Programme
ES	Ecological Sensitivity
FEPA	Freshwater Ecosystem Priority Areas
GIS	Geographic Information System
GPS	Global Positioning System
HGM	Hydrogeomorphic
IHI	Index of Habitat Integrity
IAIA	International Affiliation for Impact Assessments
MPRDA	Mineral and Petroleum Resources Development Act
NAEHMP	National Aquatic Ecosystem Health Monitoring Programme
NEMA	National Environmental Management Act
NEMBA	National Environmental Management: Biodiversity Act
NFEPA	National Freshwater Ecosystem Priority Areas
NWA	National Water Act
PES	Present Ecological State
PEMC	Present Ecological Management Class
PES	Present Ecological State
QDS	Quarter Degree Square
REC	Recommended Ecological Category
RHP	River Health Program
SACNASP	South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute
SAS	Scientific Aquatic Services
WMA	Water Management Area

LIST OF UNITS

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

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 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 the 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 have been contracted to undertake a Wetland Assessment for the proposed development of:

- the Ntabelanga Dam;
- the Lalini Dam;
- associated infrastructure, including gauging weirs, reservoirs, Waste Water Treatment Works (WWTWs), accommodation for operational staff, borrow pits and construction materials quarries, information centres, river intake structures, hydro tunnels and pipelines;
- miscellaneous construction camps, lay down areas and storage sites;
- road and bridge upgrades, construction and relocation; and
- irrigation, primary and secondary bulk potable water 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 25km 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.

The study area is surrounded by land used for agricultural, 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

This report, after consideration of the ecological integrity of the study area, must guide the Environmental Assessment Practitioner (EAP) and regulatory authorities, by means of the presentation of results and recommendations, as to the ecological viability of the proposed development activities.

1.3 DETAILS AND EXPERTISE OF THE SPECIALISTS

Stephen van Staden

Stephen van Staden completed an undergraduate degree in Zoology, Geography and Environmental Management at RAU. 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 and arachnids and 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, EMPR activities and mine closure ad 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 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).

Amanda Mileson

Born and raised in Zimbabwe, Amanda's fascination with, and love for the natural world was ignited at an early age, with a particular interest in zoology. After completing secondary school in 1994, Amanda participated in an exchange year in Australia, sponsored by Rotary International. Upon her return to Zimbabwe, Amanda's professional career commenced in retail photography before moving on to a two year stint as an Account Executive with a well-known advertising agency. The ever deteriorating situation in Zimbabwe led Amanda to seek opportunities overseas, and she spent two years in Birmingham, England, during which time Amanda made the decision to return to Africa.
Upon her relocation to South Africa in 2007, Amanda volunteered part-time at FreeMe Wildlife Rehabilitation Centre in Johannesburg (2007-2009), gaining experience in the general husbandry, nutrition and basic veterinary treatment of avian and mammal species. This strengthened her resolve to study further, and in 2010 she enrolled with UNISA to study a National Diploma in Nature Conservation. In order to align her career with her studies, Amanda took up the position of PA to the CEO of the Johannesburg Zoo in October 2011, rapidly learning the ins and outs of one of the most unique businesses in the world. Driven to gain as much relevant experience as possible, Amanda job shadowed curatorial staff and veterinarians in her spare time, organised a volunteer programme for other Nature Conservation students to gain practical experience, and even spent a few icy winter nights at the Zoo feeding Wattled Crane chicks throughout the night.

Additionally, Amanda has participated in field work on projects which seek to ascertain the effect of wind farms on bats in South Africa, and provided administrative support to the Jane Goodall Institute South Africa and the African Association of Zoos and Aquaria on a volunteer basis.

Amanda joined Scientific Aquatic Services in September 2013 as a Junior Field Ecologist focusing on wetland ecology and zoology, building a career as a scientist.

Amanda is a member of the Gauteng Wetland Forum and the South African Wetland Society.

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

Regulatory Requirements in terms of Regulation 32 of GN 543	Section of Report
(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 6 to 9
(g) recommendations in respect of any mitigation measures that should be considered by the applicant and the competent authority	Chapters 6 to 9
(h) a description of any consultation process that was undertaken during the course of carrying out the study	Chapter 11
(i) a summary and copies of any comments that were received during any consultation process	Chapter 11
(j) any other information requested by the competent authority.	Chapter 12

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 pipeline and tunnel, and a 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
- Two information centres at the dam sites.

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

- A river intake structure and associated works;
- Water treatment works;
- 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.

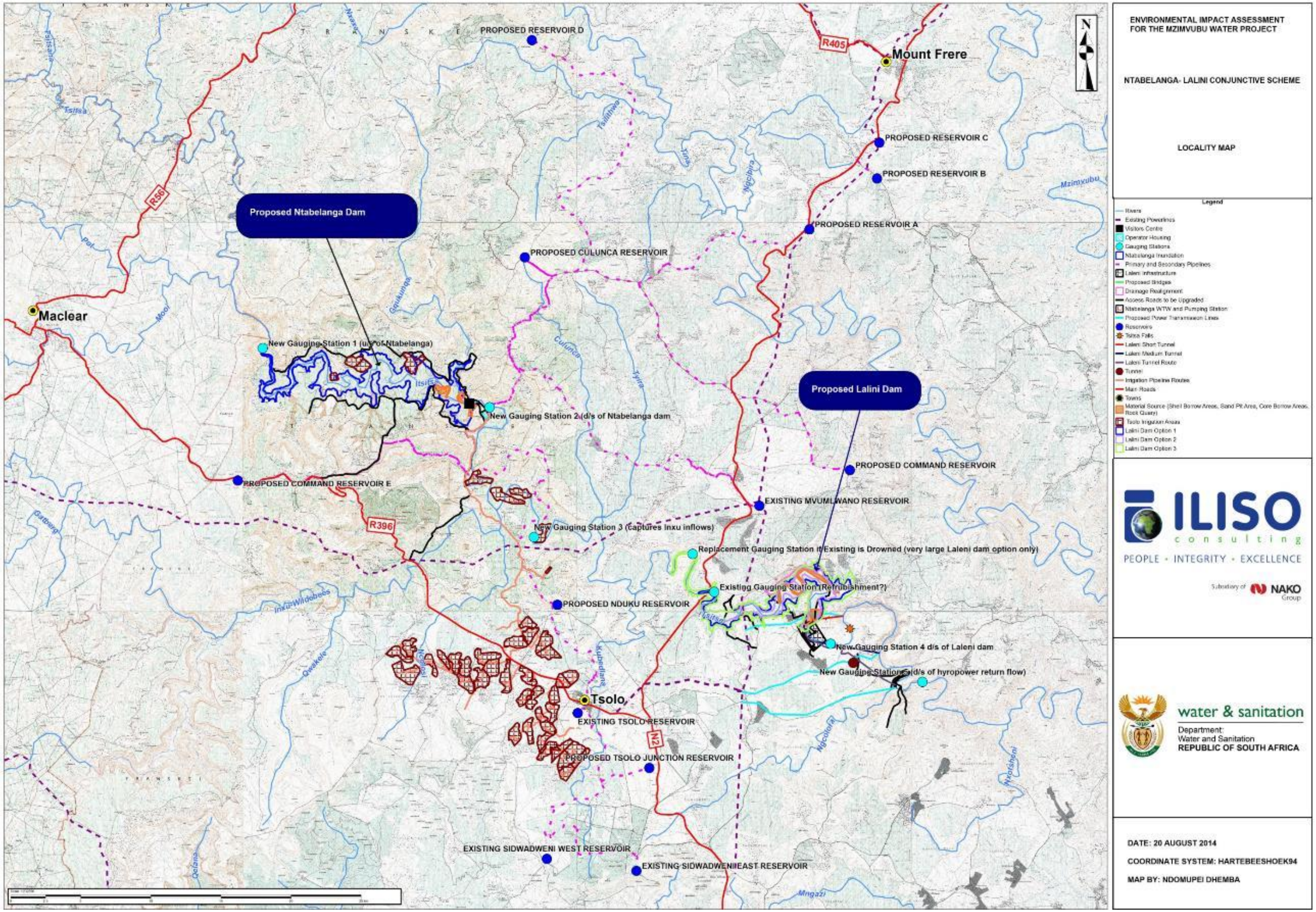

Figure 1: Locality map

3 TERMS OF REFERENCE

3.1 SCOPE OF THE STUDY

The purpose of this report is to provide a summary of the wetland resource delineation, Present Ecological State (PES) and function, as well as to conduct an impact assessment and develop mitigation measures, as part of the Environmental Assessment and authorisation process for the Mzimvubu Water Project in order to inform the Environmental Assessment Practitioners (EAP) as well as the proponent and relevant authorities as to the best use of the resources in the area, and in order to ensure that adequate impact mitigation is implemented into the project plan, should the proposed development proceed.

Specific outcomes required from this report in terms of the wetland assessment include the following:

- Identify and map Management Units within the study area according to Hydrogeomorphic (HGM) units following the guidelines in the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems (Ollis *et al*., 2013);
- Delineate wetland resources and riparian zones within the focus study area. Due to the scale of the project, delineation was undertaken using desktop methods and digital satellite imagery. In the field, verification of the wetland delineation took place according to the guidelines as defined by (DWA, 2005);
- Determine function and service provision of wetland systems according to the method supplied by Kotze *et al* (2009);
- Define the wetland health of the systems within the study area according to the resource directed measures guideline described by Macfarlane *et al.* (2008) or the WET-IHI method described by the DWA (2007) (as applicable) and thereby define the PES of the wetland resources to be affected by the proposed Mzimvubu Dam Project;
- Define the wetland Ecological Importance and Sensitivity (EIS) and Recommended Ecological Category (REC) for the wetland systems (DWA, 1999);
- Consider potential impacts on the wetland habitat and the ecological communities likely as a result of the proposed development; and
- Present management and mitigation measures in order to minimise the impacts that the proposed expansion will have on the wetland resources in line with the mitigation Hierarchy, as defined by the DMR (2013), followed by an assessment of the significance of the impacts after mitigation, assuming that they are fully implemented.

3.2 METHODOLOGY

3.2.1 Wetland Site Selection and Field Verification

Use was made of digital satellite imagery as well as provincial and national wetland databases to identify points of interest prior to the field survey. Points of interest were defined taking the following into consideration:

- Ensuring that detailed assessments took place in the vicinity of the Ntabelanga and Lalini dams footprints;
- As far as possible assessing crossings where proposed road infrastructure and pipelines will cross wetland resources;
- Ensuring a geographic spread of points to ensure that conditions in all areas were addressed; and
- Ensuring that features displaying a diversity of digital signatures were identified in order to allow for field verification. In this regard specific mention is made of the following:
  - Riparian vegetation: a distinct increase in density as well as tree size near drainage lines;
  - Hue: with drainage lines and outcrops displaying soils of varying chroma created by varying vegetation cover and soil conditions identified;
  - Surface water: to aid with the identification of artificial impoundments that may sustain wetland habitat the presence of surface water were considered informative; and
  - Texture: with areas displaying various textures, created by varying vegetation cover and soil conditions being identified.

Two site visits were undertaken during April and June 2014 to assess points of interest which were identified during the desktop assessment phase. The presence of any wetland characteristics as defined by the DWA (2005) or riparian habitat as defined by the NWA (Act 36 of 1998) was noted at each river, drainage line, and seepage area to determine if features can be considered to contain areas displaying wetland or riparian characteristics. Any additional wetland areas encountered during the site visit were noted and mapped. Factors influencing the habitat integrity of each feature group identified during the field survey was noted, and the functioning and the ecological and socio-cultural services provided by the various features was determined.

3.2.2 Literature Review

A desktop study was compiled with all relevant information as presented by the South African National Biodiversity Institutes (SANBI's) Biodiversity Geographic Information Systems (BGIS) website (http://bgis.sanbi.org). Wetland specific information resources taken into consideration during the desktop assessment of the study area included:

- National Freshwater Ecosystem Priority Areas (NFEPAs, 2011)
  - NFEPA water management area (WMA)
  - NFEPA wetlands/National wetlands map
  - Wetland and estuary FEPA
  - FEPA (sub)WMA % area
  - Sub water catchment area FEPAs
  - Water management area FEPAs
  - Fish sanctuaries

- Wetland ecosystem types
- Threatened Terrestrial Ecosystems for South Africa, 2009
- National Protected Area Expansion Strategy, 2011

3.2.3 Classification System for Wetlands and other Aquatic Ecosystems in South Africa (2013)

All wetland or riparian features encountered within the study area were assessed using the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland systems, hereafter referred to as the "classification system" (Ollis *et al*., 2013). A summary of Levels 1 to 4 of the classification system are presented in **Table 2 and 3**, below.

Table 2: Classification structure for Inland Systems, up to Level 3.

WETLAND / AQUATIC ECOSYSTEM CONTEXT		
LEVEL 1: SYSTEM	LEVEL 2: REGIONAL SETTING	LEVEL 3: LANDSCAPE UNIT
Inland Systems	DWS Level 1 Ecoregions OR NFEPA WetVeg Groups OR Other special framework	Valley Floor
		Slope
		Plain
		Bench (Hilltop / Saddle / Shelf)

Table 3: Hydrogeomorphic (HGM) Units for the Inland System, showing the primary HGM Types at Level 4A and the subcategories at Level 4B to 4C.

FUNCTIONAL UNIT		
LEVEL 4: HYDROGEOMORPHIC (HGM) UNIT		
HGM type	Longitudinal zonation/ Landform / Outflow drainage	Landform / Inflow drainage
A	**B**	**C**
River	Mountain headwater stream	Active channel
		Riparian zone
	Mountain stream	Active channel
		Riparian zone
	Transitional	Active channel
		Riparian zone
	Upper foothills	Active channel
		Riparian zone
	Lower foothills	Active channel
		Riparian zone
	Lowland river	Active channel
		Riparian zone
	Rejuvenated bedrock fall	Active channel
		Riparian zone
	Rejuvenated foothills	Active channel
		Riparian zone
	Upland floodplain	Active channel
		Riparian zone
Channelled valley-bottom wetland	(not applicable)	(not applicable)
Unchannelled valley-bottom wetland	(not applicable)	(not applicable)
Floodplain wetland	Floodplain depression	(not applicable)
	Floodplain flat	(not applicable)
Depression	Exorheic	With channelled inflow
		Without channelled inflow
	Endorheic	With channelled inflow
		Without channelled inflow
	Dammed	With channelled inflow
		Without channelled inflow
Seep	With channelled outflow	(not applicable)
	Without channelled outflow	(not applicable)
Wetland flat	(not applicable)	(not applicable)

3.2.3.1 Level 1: Inland systems

From the classification system, Inland Systems are defined as **an aquatic ecosystem that have no existing connection to the ocean**[1] (i.e. characterised by the complete absence of marine exchange and/or tidal influence) but **which are inundated or saturated with water, either permanently or periodically.** It is important to bear in mind, however, that certain Inland Systems may have had an historical connection to the ocean, which in some cases may have been relatively recent.

[1] Most rivers are indirectly connected to the ocean via an estuary at the downstream end, but where marine exchange (i.e. the presence of seawater) or tidal fluctuations are detectable in a river channel that is permanently or periodically connected to the ocean, it is defined as part of the estuary.

3.2.3.2 Level 2: Ecoregions & NFEPA Wetland Vegetation Groups

For Inland Systems, the regional spatial framework that will be included at Level 2 of the classification system is that of DWS's Level 1 Ecoregions for aquatic ecosystems (Kleynhans *et al.,* 2005). There are a total of 31 Ecoregions across South Africa, including Lesotho and Swaziland (**Figure 2** below). DWS Ecoregions have most commonly been used to categorise the regional setting for national and regional water resource management applications, especially in relation to rivers.

The Vegetation Map of South Africa, Swaziland and Lesotho (Mucina & Rutherford, 2006) groups vegetation types across the country according to Biomes, which are then divided into Bioregions. To categorise the regional setting for the wetland component of the NFEPA project, wetland vegetation groups (referred to as WetVeg Groups) will be derived by further splitting Bioregions into smaller groups through expert input (Nel *et al*., 2011). There are currently 133 NFEPA WetVeg Groups. It is envisaged that these groups could be used as a special framework for the classification of wetlands in national- and regional-scale conservation planning and wetland management initiatives.

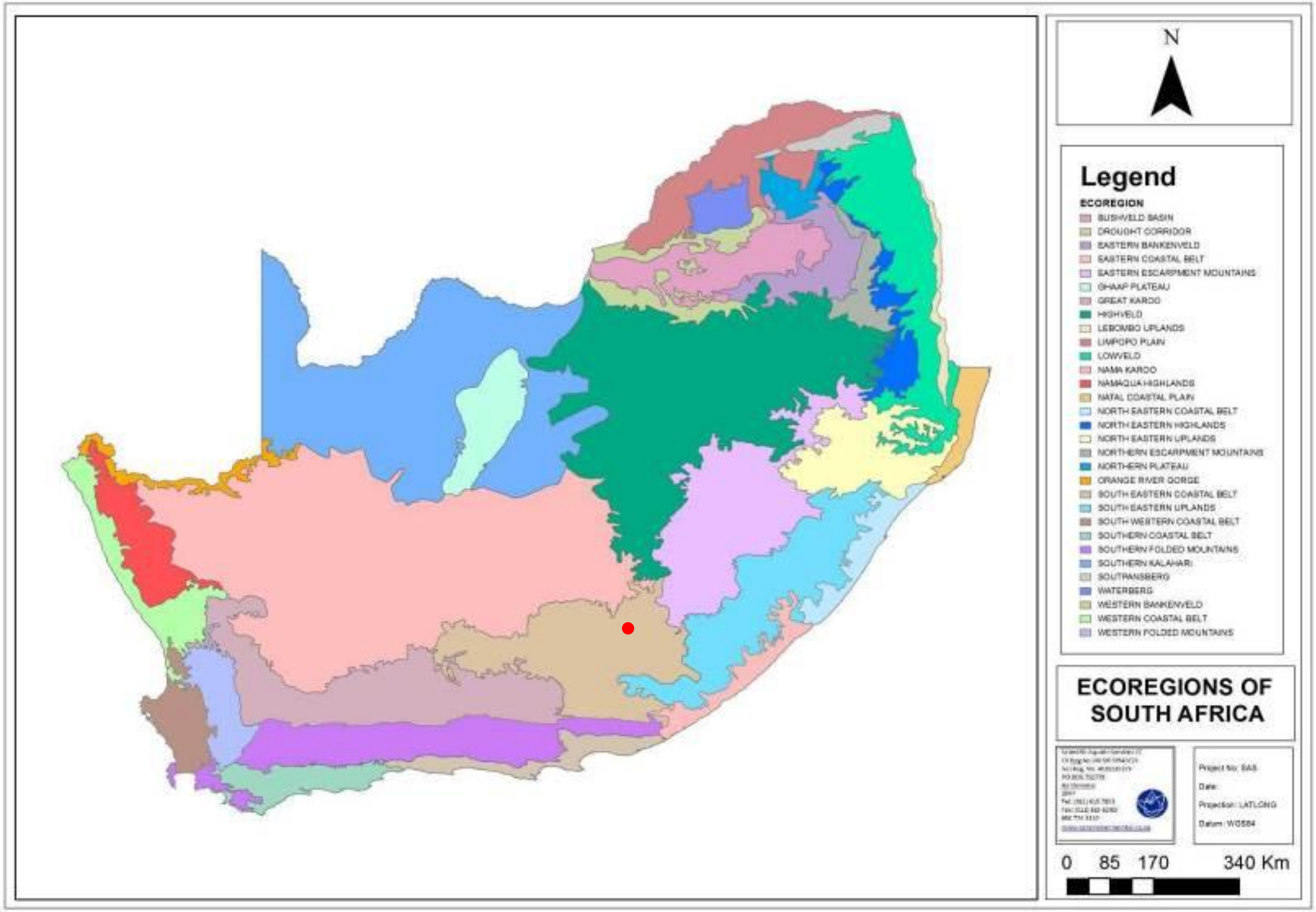

Figure 2: Map of Level 1 Ecoregions of South Africa, with the approximate position of the study area indicated in red.

3.2.3.3 Level 3: Landscape Setting

At Level 3 of the proposed classification System, for Inland Systems, a distinction will be made between four Landscape Units on the basis of the landscape setting (i.e. topographical position) within which an HGM Unit is situated, as follows (Ollis *et al.,* 2013):

- **Slope:** an included stretch of ground that is not part of a valley floor, which is typically located on the side of a mountain, hill or valley;
- **Valley floor:** The base of a valley, situated between two distinct valley side-slopes;
- **Plain:** an extensive area of low relief characterised by relatively level, gently undulating or uniformly sloping land; and
- **Bench (hilltop/saddle/shelf):** an area of mostly level or nearly level high ground (relative to the broad surroundings), including hilltops/crests (areas at the top of a mountain or hill flanked by down-slopes in all directions), saddles (relatively high-lying areas flanked by down-slopes on two sides in one direction and up-slopes on two sides in an approximately perpendicular direction), and shelves/terraces/ledges (relatively high-lying, localised flat areas along a slope, representing a break in slope with an up-slope one side and a down-slope on the other side in the same direction).

3.2.3.4 Level 4: Hydrogeomorphic Units

Eight primary HGM Types are recognised for Inland Systems at Level 4A of the classification system, on the basis of hydrology and geomorphology (Ollis *et al*., 2013), namely:

- **River:** a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water;
- **Channelled valley-bottom wetland:** a valley-bottom wetland with a river channel running through it;
- **Unchannelled valley-bottom wetland:** a valley-bottom wetland without a river channel running through it;
- **Floodplain wetland:** the mostly flat or gently sloping land adjacent to and formed by an alluvial river channel, under its present climate and sediment load, which is subject to periodic inundation by over-topping of the channel bank; and
- **Depression:** a landform with closed elevation contours that increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates.
- **Wetland Flat:** a level or near-level wetland area that is not fed by water from a river channel, and which is typically situated on a plain or a bench. Closed elevation contours are not evident around the edge of a wetland flat
- **Seep:** a wetland area located on (gently to steeply) sloping land, which is dominated by the colluvial (i.e. gravity-driven), unidirectional movement of material down-slope. Seeps are often located on the side-slopes of a valley but they do not, typically, extend into a valley floor.

The above terms will be used for the primary HGM Units in the classification system to try and ensure consistency with the wetland classification terms currently in common usage in

South Africa. Similar terminology (but excluding categories for "channel", "flat" and "valleyhead seep") is used, for example, in the recently developed tools produced as part of the Wetland Management Series including WET-Health (Macfarlane *et al*., 2008), WET-IHI (DWAF, 2007) and WET-EcoServices (Kotze *et al*., 2008).

3.2.4 Wet-Ecoservices (2008)

"The importance of a water resource, in ecological social or economic terms, acts as a modifying or motivating determinant in the selection of the management class".[2] The assessment of the ecosystem services supplied by the identified wetlands will be conducted according to the guidelines as described by Kotze *et al* (2008). An assessment will be undertaken to examine and rate the following services according to their degree of importance and the degree to which the service is provided:

- Flood attenuation;
- Stream flow regulation;
- Sediment trapping;
- Phosphate trapping;
- Nitrate removal;
- Toxicant removal;
- Erosion control;
- Carbon storage;
- Maintenance of biodiversity;
- Water supply for human use;
- Natural resources;
- Cultivated foods;
- Cultural significance;
- Tourism and recreation; and
- Education and research.

The characteristics will be used to quantitatively determine the value, and by extension sensitivity, of the wetlands. Each characteristic will be scored to give the likelihood that the service is being provided. The scores for each service will then be averaged to give an overall score to the wetland.

Table 4: Classes for determining the likely extent to which a benefit is being supplied.

Score	Rating of the likely extent to which the benefit is being supplied
<0.5	Low
0.6-1.2	Moderately low
1.3-2	Intermediate
2.1-3	Moderately high
>3	High

[2] Department of Water Affairs and Forestry, South Africa *Version 1.0 of Resource Directed Measures for Protection of Water Resources, 1999*

Table 5: Descriptions of the A-F ecological categories (after Kleynhans, 1996, 1999).

Ecological Category	PES % Score	Description
A	90-100%	Unmodified, natural.
B	80-90%	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.
C	60-80%	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.
D	40-60%	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred. 20-40% Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.
E	20-40%	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.
F	0-20%	Critically/Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances, the basic ecosystem functions have been destroyed and the changes are irreversible.

3.2.5 Index of Habitat Integrity (IHI)

To assess the Present Ecological State (PES) of the drainage feature the Index of Habitat Integrity (IHI) for South African floodplain, channelled and channelled valley bottom wetland types (DWAF Resource Quality Services, 2007) will be used.

The WETLAND-IHI is a tool developed for use in the National Aquatic Ecosystem Health Monitoring Programme (NAEHMP), formerly known as the River Health Programme (RHP). The WETLAND-IHI has been developed to allow the NAEHMP to include floodplain and channelled valley bottom wetland types to be assessed. The output scores from the WETLAND-IHI model are presented in A – F ecological categories (**Table 6** below), and provide a score of the PES of the habitat integrity of the wetland system being examined.

Table 6: Descriptions of the A – F ecological categories (after Kleynhans, 1996, 1999).

Ecological Category	PES % Score	Description
A	90-100%	Unmodified, natural.
B	80-90%	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.
C	60-80%	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.
D	40-60%	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred. E 20-40% Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.
E	20-40%	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.
F	0-20%	Critically / Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.

3.2.6 WET-Health

Healthy wetlands are known to provide important habitats for wildlife and to deliver a range of important goods and services to society. Management of these systems is therefore essential if these attributes are to be retained within an ever changing landscape. The primary purpose of this assessment[3] is to evaluate the ecophysical health of wetlands, and in so doing promote their conservation and wise management.

Level of Evaluation

Two levels of assessment are provided by WET-Health:

- Level 1: Desktop evaluation, with limited field verification. This is generally applicable to situations where a large number of wetlands need to be assessed at a very low resolution; and
- Level 2: On-site evaluation. This involves structured sampling and data collection in a single wetland and its surrounding catchment.

Framework for the Assessment

A set of three modules has been synthesised from the set of processes, interactions and interventions that take place in wetland systems and their catchments: hydrology (water inputs, distribution and retention, and outputs), geomorphology (sediment inputs, retention and outputs) and vegetation (transformation and presence of introduced alien species).

[3] Kleynhans et al., 2007

Units of Assessment

Central to WET-Health is the characterisation of HGM units, which have been defined based on geomorphic setting (e.g. hillslope or valley-bottom; whether drainage is open or closed), water source (surface water dominated or sub-surface water dominated) and pattern of water flow through the wetland unit (diffusely or channelled) as described under the *Classification System for Wetlands and other Aquatic Ecosystems*.

Quantification of Present State of a wetland

The overall approach will be to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present State score. This will take the form of assessing the spatial *extent* of impact of individual activities and then separately assessing the *intensity* of impact of each activity in the affected area. The extent and intensity will then be combined to determine an overall *magnitude* of impact. The impact scores and Present State categories are provided in **Table 7.**

Table 7: Impact scores and categories of present State used by WET-Health for describing the integrity of wetlands.

Impact category	Description	Impact score range	Present State category
None	Unmodified, natural	0-0.9	A
Small	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1-1.9	B
Moderate	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact.	2-3.9	C
Large	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4-5.9	D
Serious	The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6-7.9	E
Critical	Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8-10	F

Assessing the Anticipated Trajectory of Change

As is the case with the Present State, future threats to the state of the wetland may arise from activities in the catchment upstream of the unit or from within the wetland itself or from processes downstream of the wetland. In each of the individual sections for hydrology, geomorphology and vegetation, five potential situations exist depending upon the direction and likely extent of change (**Table 8**).

Table 8: Trajectory of Change classes and scores used to evaluate likely future changes to the present state of the wetland.

Change Class	Description	HGM change score	Symbol
Substantial improvement	State is likely to improve substantially over the next 5 years	2	↑↑
Slight improvement	State is likely to improve slightly over the next 5 years	1	↑
Remain stable	State is likely to remain stable over the next 5 years	0	→
Slight deterioration	State is likely to deteriorate slightly over the next 5 years	-1	↓
Substantial deterioration	State is expected to deteriorate substantially over the next 5 years	-2	↓↓

Overall health of the wetland

Once all HGM units have been assessed, a summary of health for the wetland as a whole will be calculated. This is achieved by calculating a combined score for each component by area-weighting the scores calculated for each HGM unit. Recording the health assessments for the hydrology, geomorphology and vegetation components will provide a summary of impacts, Present State, Trajectory of Change and Health for individual HGM units and for the entire wetland.

3.2.7 Ecological Importance and Sensitivity (EIS)

The method that will be used for the EIS determination was adapted from the method as provided by DWA (1999) for wetlands. The method takes into consideration PES scores obtained for WET-Health as well as function and service provision to enable the assessor to determine the most representative EIS category for the wetland feature or group being assessed.

A series of determinants for EIS will be assessed on a scale of 0 to 4, where 0 indicates no importance and 4 indicates very high importance. The median of the determinants will then be used to assign the EIS category as listed in **Table 9** below.

Table 9: Descriptions of the EIS Categories.

EIS Category	Range of Mean	Recommended Ecological Management Class[4]
Very high Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications.	>3 and <=4	A
High Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications.	>2 and <=3	B
Moderate Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications.	>1 and <=2	C
Low/marginal Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications.	>0 and <=1	D

3.2.8 Riparian Vegetation Response Assessment Index (VEGRAI; 2007)

Riparian vegetation is described in the NWA (Act No 36 of 1998) as follows: 'riparian habitat' includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.

VEGRAI is designed for qualitative assessment of the response of riparian vegetation to impacts in such a way that qualitative ratings translate into quantitative and defensible results[5]. Results are defensible because their generation can be traced through an outlined process (a suite of rules that convert assessor estimates into ratings and convert multiple ratings into an Ecological Category).

[4] Ed's note: Author to confirm exact wording for version 1.1
[5] Kleynhans *et al*, 2007

Table 10: Descriptions of the A-F ecological categories.

Ecological category	Description	Score (% of total)
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitat and biota may have taken place but the ecosystem functions are essentially unchanged.	80-89
C	Moderately modified. Loss and change of natural habitat have occurred, but the basic ecosystem functions are still predominately unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Critically modified. Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible	0-19

3.3 IMPACT CRITERIA AND RATING SCALE

The wetland 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 11**:)

Table 11: 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 12**).

Table 12: 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 13**).

Table 13: 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 14**).

Table 14: 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 15**).

Table 15: 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 16**).

Table 16: 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 17**).

Table 17: 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 residual impacts will also be considered.

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

3.4 LEGISLATION AND GUIDELINES CONSIDERED

3.4.1 National Environmental Management Act (ACT 107 OF 1998)

The National Environmental Management Act (Act 107 of 1998) and the associated Regulations (Listing No R. 544, No R. 545 and R. 546) as amended, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation needs to be obtained. This could follow either the Basic Assessment process or the Environmental Impact Assessment (EIA) process depending on the nature of the activity and scale of the impact. In the case of this project, the EIA process has been followed.

3.4.2 National Water Act (NWA; ACT 36 OF 1998)

The NWA; Act 36 of 1998 recognises that the entire ecosystem and not just the water itself in any given water resource, constitutes the resource and as such needs to be conserved. No activity may therefore take place within a watercourse unless it is authorised by the Department of Water and Sanitation (DWS).

Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from DWS in terms of Section 21 of the NWA.

3.4.3 General Notice (GN) 1199 as Published in the Government Gazette 32805 of 2009 as it relates to the NWA, 1998 (Act 36 Of 1998)

Wetlands are extremely sensitive environments and as such, the Section 21 (c) and (i) water use General Authorisation does not apply to any wetland or any water resource within a distance of 500 meters upstream or downstream from the boundary of any wetland.

3.4.4 GN 704 – Regulations on use of water for mining and related activities aimed at the protection of water resources, 1999

These Regulations, promulgated in terms of the NWA, were put in place in order to prevent the pollution of water resources and protect water resources in areas where mining activity is taking place.

It is recommended that the proposed project complies with Regulation GN 704 of the NWA which contains regulations on use of water for mining, including borrowing activities and related activities aimed at the protection of water resources. GN 704 states that:
No person in control of a mine or activity may:

- locate or place any residue deposit, dam, reservoir, together with any associated structure or any other facility within the 1:100 year flood line or within a horizontal distance of 100 metres, whichever is the greatest, from any watercourse or estuary, borehole or well, excluding boreholes or wells drilled specifically to monitor the pollution of groundwater, or on waterlogged ground, or on ground likely to become waterlogged, undermined, unstable or cracked.

According to the above, the borrow areas must fall outside of the 1:100 year flood line of the drainage feature or 100m from the edge of the feature, whichever distance is the greatest. Therefore an exemption will be required from DWS since the borrow areas will be located within the 1:100 year flood line.

3.5 RESULTS OF ECOREGIONS LITERATURE REVIEW

The study area falls within the South Eastern Uplands Aquatic Ecoregion and the Mzimvubu to Kieskamma Management Area (WMA). The Present Ecological State, Ecological Importance and Ecological Sensitivity database[6] as developed by the Resource Quality Services (RQS) department of the Department of Water and Sanitation (DWS) (formerly the DWA) was used as reference for the catchment of concern in order to define the EIS, PEMC and DEMC. **Figures 3 to 5** indicate the aquatic ecoregion and quaternary catchments of the different developments of the study area.

The Lalini Dam is located within the T35L and T35K Quaternary Catchments (**Figure 3**), whilst the Ntabelanga Dam and road upgrades are located within the T35E quaternary catchment and the particular river resource in the area is the Upper Ntata, Mzimvubu River (**Figure 4**). The pipelines traverse over several quaternary catchments, namely T20B, T34H, T34 J, T35E, T35H and T35K (**Figure 5**).

The ecological status of these quaternary catchments are summarised in **Table 18**.

[6]Present Ecological State, Ecological Importance and Ecological Sensitivity database for Primary Drainage Region T as developed by the RQS Department of the DWS. Available at http://www.dwa.gov.za/iwqs/rhp/eco/peseismodel.aspx retrieved 28th July 2014.

Table 18: Summary of the Ecological Status of the quaternary catchments associated with the study area (DWS, 2012).

SQ* REACH	SQR** NAME	PES ASSESSED BY EXPERTS? (IF TRUE="Y")	PES CATEGORY MEDIAN	MEAN EI CLASS	MEAN ES CLASS	STREAM ORDER	DEFAULT EC (BASED ON MEDIAN PES AND HIGHEST OF EI OR ES MEANS)
T34H-05598	Thina	Y	C	MODERATE	MODERATE	3,0	C
T34H-05699	Mvuzi	Y	C	MODERATE	MODERATE	1,0	C
T34H-05714	Qhanqu	Y	C	MODERATE	MODERATE	1,0	C
T34H-05738	Ngcibira	Y	B	MODERATE	MODERATE	2,0	C
T34H-05769	Tsilithwa	Y	B	MODERATE	MODERATE	2,0	C
T34H-05772	Thina	Y	B	MODERATE	MODERATE	3,0	C
T34H-05791	Tsilithwa	Y	B	MODERATE	MODERATE	1,0	C
T34H-05809	Mvumvu	Y	B	MODERATE	HIGH	1,0	B
T34H-05826	Ngcothi	Y	B	MODERATE	MODERATE	1,0	C
T34H-05838	Thina	Y	C	MODERATE	MODERATE	3,0	C
T35E-05780	Gqukunqa	Y	B	MODERATE	MODERATE	1,0	C
T35E-05908	Tsitsa	Y	B	MODERATE	MODERATE	3,0	C
T35E-05977	Tsitsa	Y	B	MODERATE	MODERATE	3,0	C
T35H-06024	Inxu	Y	C	MODERATE	HIGH	3,0	B
T35H-06053	Inxu	Y	C	MODERATE	HIGH	3,0	B
T35H-06158	Qwakele	Y	C	MODERATE	HIGH	1,0	B
T35H-06186	Umnga	Y	C	MODERATE	MODERATE	2,0	C
T35H-06240	KuNgindi	Y	B	MODERATE	MODERATE	1,0	C
T35H-06282	Umnga	Y	B	MODERATE	MODERATE	1,0	C
T35J-06088	Inxu	Y	C	MODERATE	HIGH	3,0	B
T35J-06106	Ncolosi	Y	C	MODERATE	HIGH	1,0	B
T35K-05897	Culunca	Y	B	MODERATE	HIGH	1,0	B
T35K-05904	Tyira	Y	C	MODERATE	MODERATE	1,0	C
T35K-06037	Tsitsa	Y	B	MODERATE	MODERATE	4,0	C
T35K-06098	Tsitsa	Y	B	MODERATE	MODERATE	4,0	C
T35K-06167	Xokonxa	Y	C	MODERATE	MODERATE	1,0	C
T35L-05976	Tsitsa	Y	B	MODERATE	MODERATE	4,0	C
T35L-06190	Tsitsa	Y	B	MODERATE	MODERATE	4,0	C
T35L-06226	Ngcolora	Y	C	MODERATE	MODERATE	1,0	C

*SQ = Sub-quaternary

**SQR = Sub-Quaternary Reach

From **Table 18**, it is apparent that the PES Category of the various river systems varies between PES B and PES C. Specifically, the Tsitsa River is classified as a PES Category B river, whilst the Inxu is considered to be in a PES Category C. All systems are considered to have a 'moderate' Ecological Importance (EI) whilst the Ecological Sensitivity (ES) varies between High to Medium sensitivity. The Tsitsa River is considered to be of moderate sensitivity whilst the Inxu River is deemed to be highly sensitive. The default Ecological Class (EC) of the river systems in these quaternary catchments, based on the median PES and highest of EI or ES means is considered to be either a Class B or a Class C. The Tsitsa River is deemed to be a Class C, and the Inxu is deemed to be a Class B system.

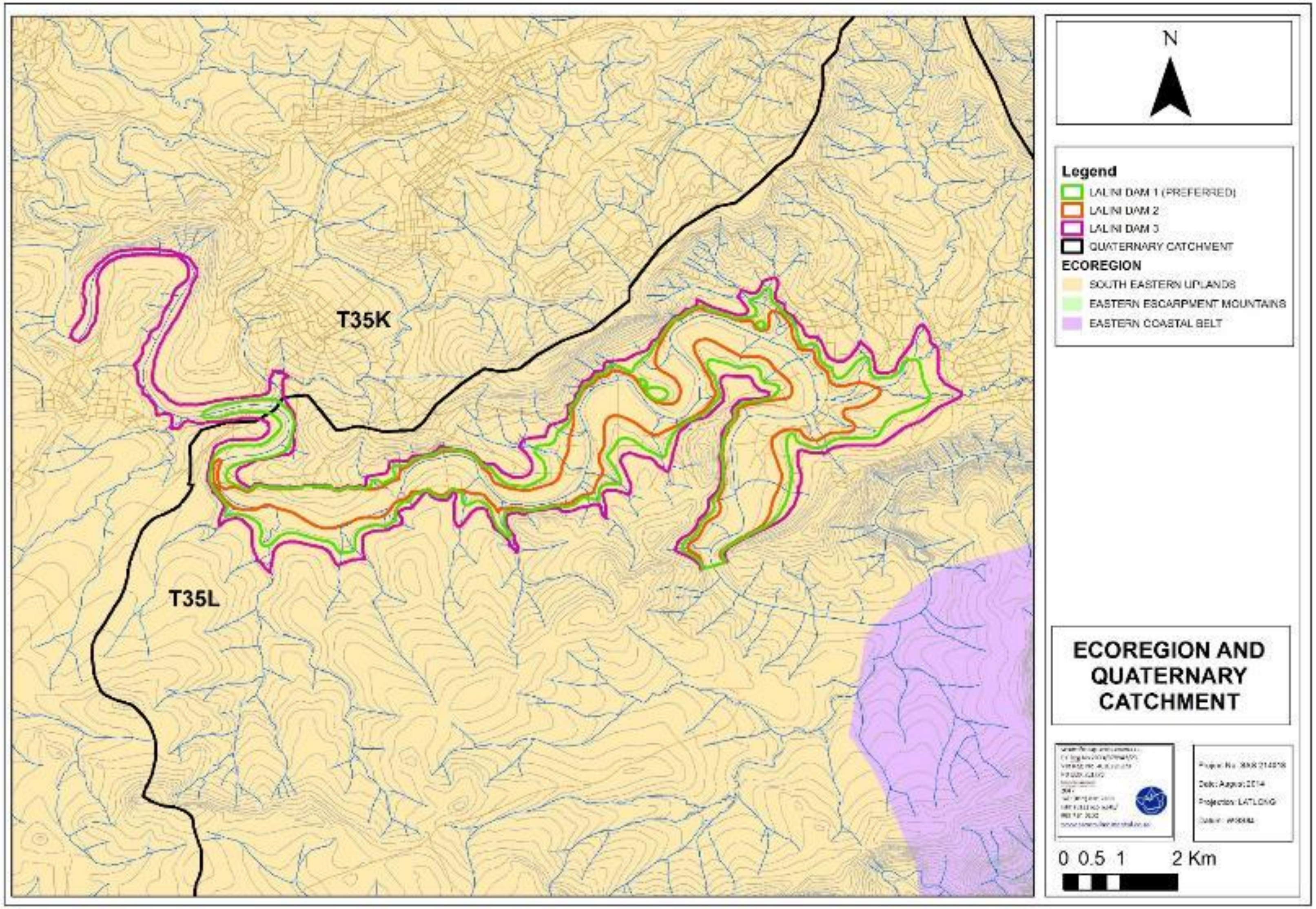

Figure 3: Ecoregion and quaternary catchment associated with the Lalini Dam.

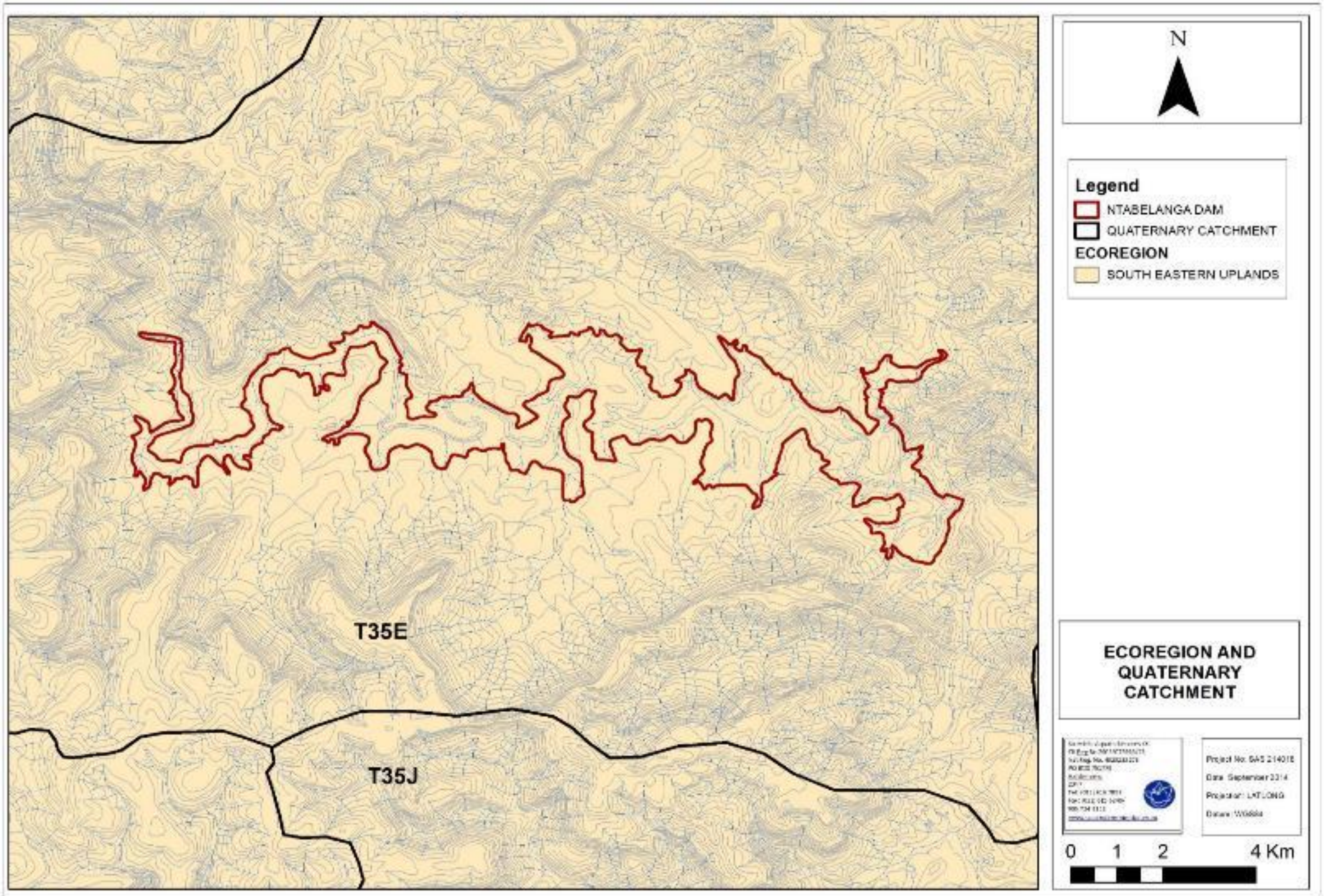

Figure 4: Ecoregion and quaternary catchment associated with the Ntabelanga Dam.

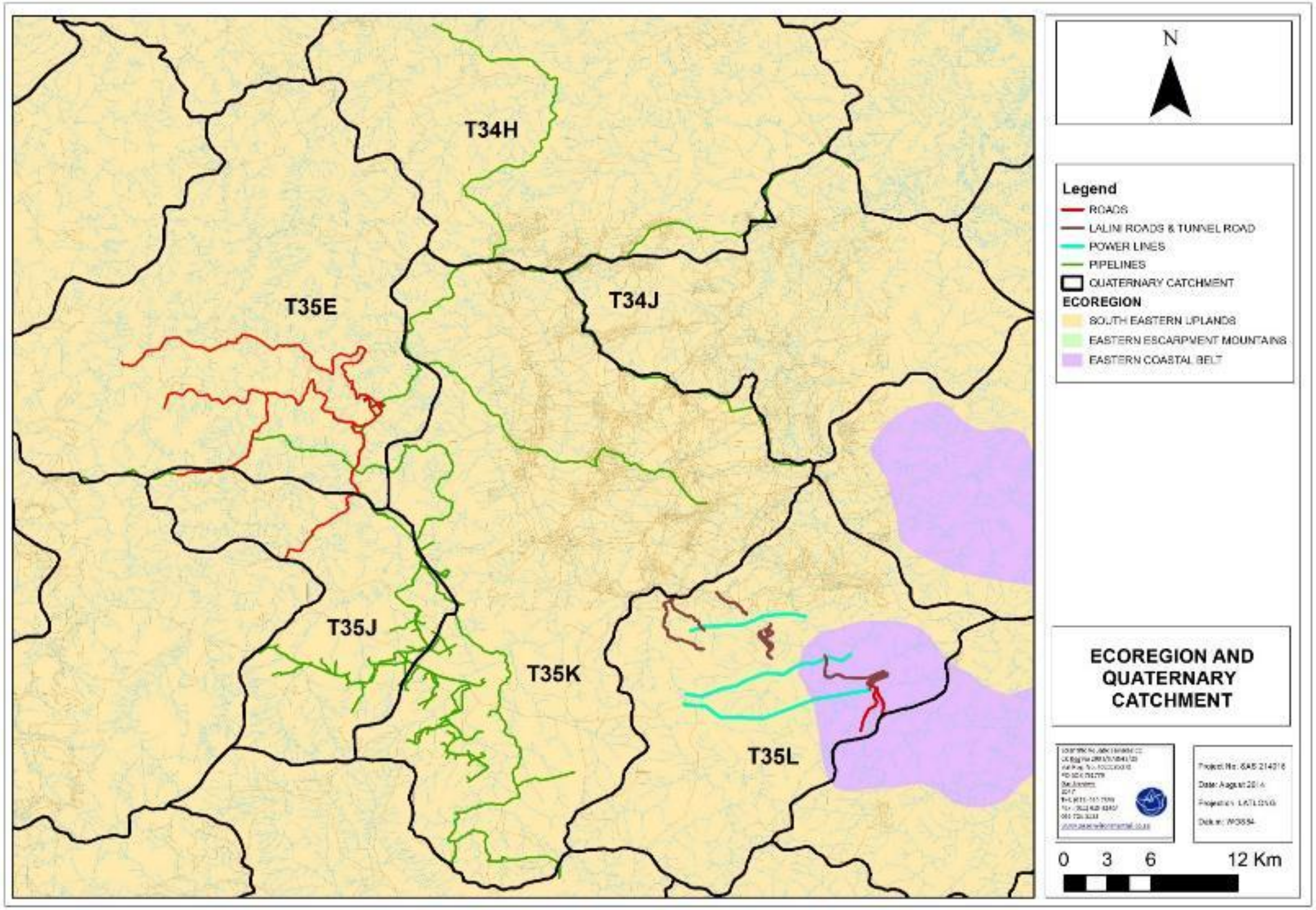

Figure 5: Ecoregion and quaternary catchments associated with the roads, pipelines and power lines.

4 ASSUMPTIONS AND LIMITATIONS

- The wetland assessment is confined to the study area as well as the immediate adjacent areas of relevance and does not include the neighbouring and adjacent properties;
- Due to the extent of the area that forms part of the total Mzimvubu Water Project area as well as the inaccessibility of some portions of the project area it was not practical to delineate the entire extent of the total project area in the field according to the DWA (2005) methodology. For this reason the study took a two tiered approach as follows:
  - The wetland resources in the vicinity of the proposed Ntabelanga and Lalini dam footprints were assessed in detail and delineated according to the DWA (2005) methodology;
  - The wetland areas affected by the proposed roads and pipelines were delineated in less detail with more accessible areas being assessed and delineated in the field while less accessible areas, especially in the remote areas at high altitude assessed at a desktop level; and
  - The level of detail undertaken in this study is deemed adequate to ensure that informed planning and decision making pertaining to the wetland resources within the study area can be made and no further detailed field delineation is deemed necessary.
- Due to the extent of the area that forms part of the total Mzimvubu Water Project area, use was made of aerial photographs and digital satellite imagery as well as provincial and national wetland databases to identify areas of interest prior to the field survey. Any additional wetland areas and drainage lines noted during the field survey were also assessed and added to the number of survey points. Although all possible measures were undertaken to ensure all wetland features, riparian zones and drainage lines were assessed and delineated by either desktop techniques with field verification or field delineated, some smaller ephemeral drainage lines as well as areas of hillslope seepage wetlands may have been overlooked, especially in the remote areas at elevated altitude. However, if the sensitivity map as presented in this report is consulted during the planning phases of the project, the majority of wetland habitat considered to be of increased EIS will be safeguarded, and no further detailed field delineation is deemed necessary.
- Due to the scale of the remote imagery used, the accuracy of the handheld GPS unit used to delineate the wetland boundary cannot be definitively defined. The mapping presented reflects the delineated wetland and riparian zones with reasonable accuracy;
- Therefore, the wetland delineation as presented in this report is regarded as a best estimate of the wetland boundary based on the site conditions present at the time of assessment and based on the level of detail applied to each specific area;
- Wetlands and terrestrial areas form transitional areas where an ecotone is formed as vegetation species change from terrestrial species to facultative wetland species. Within this transition zone some variation of opinion on the wetland or riparian zone

boundary and the occurrence of a true riparian zone may occur. However, if the DWA 2005 method is followed, all assessors should get largely similar results; and

- Aquatic, wetland and riparian ecosystems are dynamic and complex. The studies undertaken by SAS in April and June 2014 took place during low flow (dry) periods, limiting the use of vegetation indicators for the assessment. Furthermore, some aspects of the ecology of these systems, some of which may be important, may have been overlooked as a result of the season in which the field surveys were conducted. A more reliable assessment would have required that at least one assessment of the greater proposed development area be undertaken during the high flow (rainy) season, when certain aspects of hydrology and vegetation communities may be more accurately assessed.