



water & sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

Mzimvubu Water Project

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

14/12/16/3/3/2/678 (Electricity generation application)

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

ENVIRONMENTAL MANAGEMENT PROGRAMME

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Compiled by: ILISO Consulting (Pty) Ltd

P.O. Box 68735

Highveld

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012 685 0900

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CONSULTANTS: ILISO CONSULTING (PTY) LTD

Approved for ILISO Consulting (Pty) Ltd by:

Dr M van Veelen
Director

DEPARTMENT OF WATER AND SANITATION – DIRECTORATE: OPTIONS ANALYSIS

Approved for DWS:

M Mugumo
Chief Engineer: Options Analysis (South)

L S Mabuda
Chief Director: Integrated Water Resource Planning

DEVELOPER

Approved by the Department of Water and Sanitation: National Water Resources Infrastructure Branch

Chief Director: Infrastructure Development

Date

ENGINEER

Approved by the Department of Water and Sanitation: Engineering Services:

Chief Director: Engineering Services

Date

CONTRACTOR

Accepted by: _____

Name: _____

Date

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
SUPPORTING REPORTS	
Social Impact Assessment	P WMA 12/T30/00/5314/7
Economic Impact Assessment	P WMA 12/T30/00/5314/8
Visual Impact Assessment	P WMA 12/T30/00/5314/9
Floral Impact Assessment	P WMA 12/T30/00/5314/10
Faunal Impact Assessment	P WMA 12/T30/00/5314/11
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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Prepared for: Directorate – Options Analysis

Prepared by: ILISO Consulting (Pty) Ltd, P O Box 68735, Highveld, 0169

Tel: (012) 685 0900, Fax: (012) 655 1886

Contact: Ms T Calmeyer

Email: terry@iliso.com



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- Appendix B: Example of Emergency Incident Report
- Appendix C: Environmental Management Plans for the borrow areas and quarries
- Appendix D: Ecological Sensitivity maps
- Appendix E: Key search and rescue locations

ABBREVIATIONS

CER	Contractor's Environmental Representative
DEA	Department of Environmental Affairs
DWS	Department of Water Affairs
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EER	Engineer's Environmental Representative
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMPR	Environmental Management Programme
GN	Government Notice
MSDS	Material Strategy Data sheets
MAR	Mean Annual Runoff
NEMA	National Environmental Management Act (No.107 of 1998)
NEMWA	National Environmental Management: Waste Act (Act 59 of 2008) .
OHSA	Occupation Health and Safety Act (Act 85 of 1993)
UIF	Unemployment Insurance Fund
SANCOLD	South African National Committee on Large Dams
IAIA	International Association for Impact Assessment
IAIAsa	International Association for Impact Assessment South African affiliate
DM	District Municipality
DAFF	Department of Agriculture Forestry and Fisheries

1. INTRODUCTION

1.1 BACKGROUND

The Mzimvubu River catchment in the Eastern Cape of South Africa is within one of the poorest and least developed regions of the country. Development of the area to accelerate the social and economic upliftment of the people was therefore identified as one of the priority initiatives of the Eastern Cape Provincial Government.

Harnessing the water resources of the Mzimvubu River, the only major river in the country which is still largely unutilised, is considered by the Eastern Cape Provincial Government, as offering one of the best opportunities in the Province to achieve such development.

The five pillars on which the Eastern Cape Provincial Government proposed to model the Mzimvubu River water resources development are:

- Forestry;
- Irrigation;
- Hydropower;
- Water transfer; and
- Tourism.

As a result of this the Department of Water and Sanitation (DWS) commissioned the Mzimvubu Water Project, which consists of two multi-purpose dams on the Tsitsa River, a major tributary to the Mzimvubu River. Socio-economic upliftment is expected to be achieved through bulk potable water supply schemes for domestic and industrial water supply, bulk raw water supply schemes for irrigated agriculture, hydropower generation, the creation of temporary and permanent jobs, and associated development (**Figure 1**).

Environmental authorisation is required for the infrastructure components of the proposed Ntabelanga-Lalini Conjunctive Scheme. An Environmental Impact Assessment (EIA) process has been conducted as part of the application for environmental authorisation.

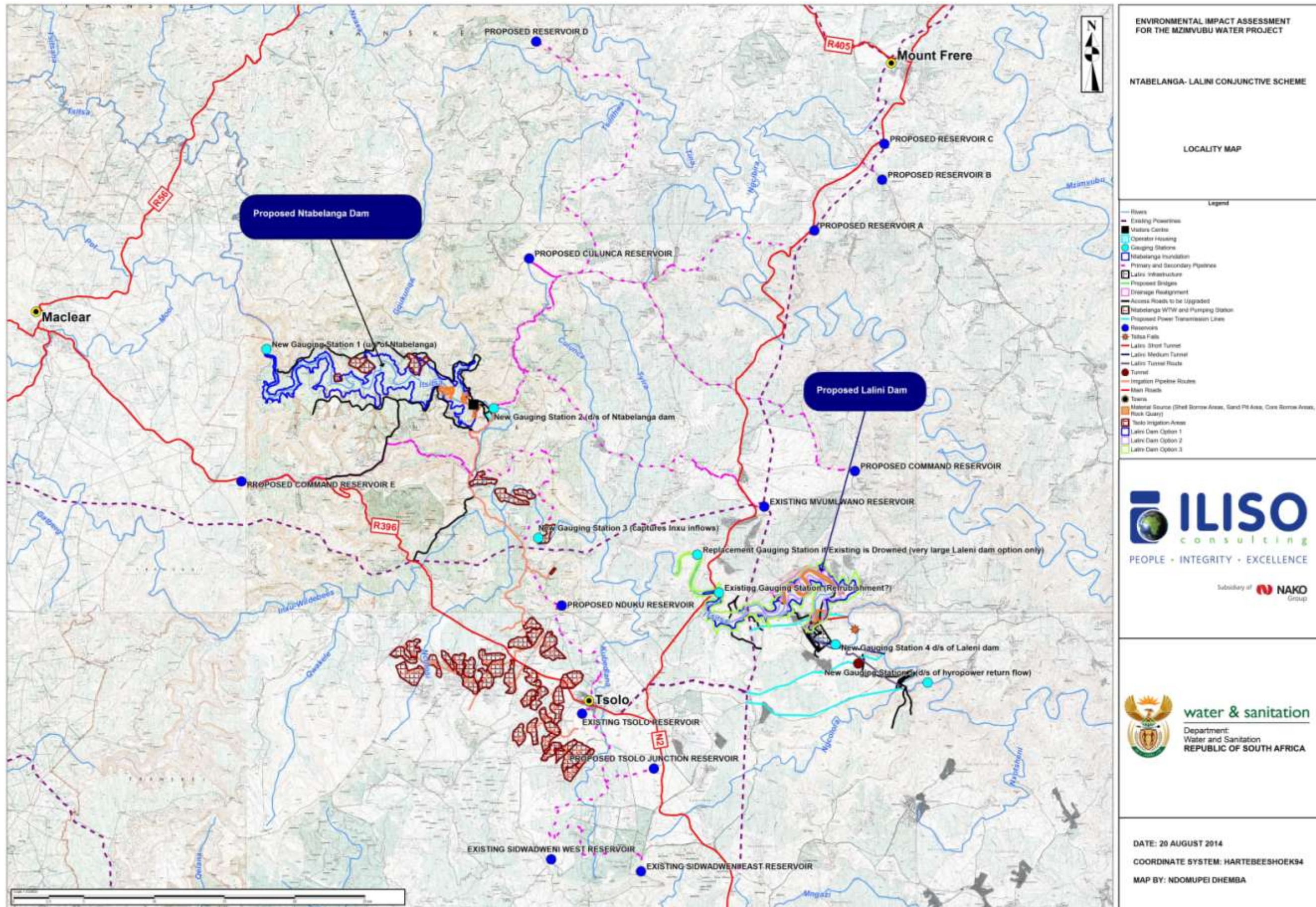


Figure 1-1: Locality map

1.2 PURPOSE OF THE EMPR

This document is an Environmental Management Programme (EMPR), compiled as part of the EIA for the Mzimvubu Water Project. The EMPR is aimed at ensuring that optimal environmental protection is achieved during the pre-construction, construction and operational phases of the project and covers the principles, responsibilities and requirements applicable.

Mitigation measures in the form of environmental management and mitigation plans are specified for purposes of minimising environmental impacts likely to be incurred during pre-construction and construction activities, as well as during operation.

The EMPR also provides a practical implementation framework for monitoring, auditing and taking corrective actions during implementation.

The EMPR is a dynamic document, which will be reviewed, revised and updated during the life span of the project.

Separate Environmental Management Plans have been compiled for the borrow areas and quarries, these are attached in **Appendix C**.

N.B.: Three applications for environmental authorisation have been submitted to Department of Environmental Affairs (DEA) for the dams and associated infrastructure, electrical generation and distribution infrastructure and road infrastructure respectively. This is because the responsibility for the implementation of these project components will likely be divided between three different entities. Institutional arrangements have however not been finalised and once DEA has made a decision in respect of the environmental authorisations, they will all be issued to Department of Water and Sanitation (DWS). Should the authorisation(s) be transferred to other parties at a later stage, this EMPR will still apply but will have to be revised accordingly.

1.3 APPROACH

Nine specialist studies were undertaken during the environmental assessment for the Mzimvubu Water Project, which considered the potential impacts of the Ntabelanga-Lalini conjunctive scheme and associated infrastructure on the receiving environment.

The findings of all the specialist studies were distilled, examined and captured in the Environmental Impact Report (EIR). All mitigation measures recommended by the specialists were assessed for relevance and summarised in the EIR. The proposed mitigation measures have been incorporated into the relevant sections of the EMPR

(for pre-construction, construction and operation) through the development of management and mitigation plans.

1.4 PROJECT TEAM

ILISO Consulting (Pty) Ltd was appointed as the independent Environmental Assessment Practitioner (EAP) to undertake the EIA and compile the EMPR with input from the specialists. The EIA project team consisted of:

Lea Muruven is an EAP with Masters degrees in Environmental Management and Political Science. She has over five years experience in impact assessment and environmental management and has been responsible for drafting impact assessment reports and Environmental Management Programmes, and conducting public participation processes, as well as high level environmental screenings for a variety of projects in the water, energy, transport and industrial sectors. Lea has an excellent understanding of the laws and regulations relating to air quality, water, biodiversity, heritage, and waste management in South Africa. She is a member of the South African Affiliate of the International Association for Impact Assessment.

Dr Martin van Veelen is a Professional Engineer with a PhD in aquatic health. He is a Fellow of the South African Institution of Civil Engineers, a member of the South African Society of Aquatic Scientists, of the Environmental Scientific Association, of the International Water Association, of the Water Institute of South Africa, and of the Vaal River Catchment Association. He is a certified Environmental Assessment Practitioner with over 30 years experience who specialises in project management, environmental impact assessments and water resource planning. He specifically has extensive experience in water quality, especially water quality management, water quality monitoring and water quality assessment. Martin has experience in managing projects that involve multi-disciplinary teams, and projects that involve public consultation and participation.

Terry Calmeyer is a certified Environmental Assessment Practitioner. She has a Masters degree in Environmental Management and specialises in Environmental Impact Assessments, the environmental components of project implementation and Project Management. Terry serves on the International Association of Impact Assessment (IAIA) Council, is the past President of the South African Affiliation of the International Association of Impact Assessment (IAIAsa) and an active member of the South African Committee on Large Dams (SANCOLD), the Environmental Law Association and the International Association for Public Participation. She has been involved in a variety of different types of EIAs including for transmission lines, water supply projects, dams, roads, railways, waste water treatment works and airports, in South Africa, Uganda, Lesotho, Botswana, Namibia and Mozambique. Terry was the EAP for the Groot Letaba Water Project (GLeWaP) and the Kobong pumped storage

scheme. She is the specialist environmental advisor on the Mooi Mgeni Transfer Scheme Phase 2.

Kim Dalhuijsen has an Honours degree in Zoology and Environmental Sciences from the University of the Witwatersrand and 1.5 years of work experience. She has been responsible for drafting impact assessment reports and Environmental Management Programmes, and assisting with public participation processes on a variety of projects. She is a member of the South African Affiliate of the International Association for Impact Assessment.

Joseph Masilela has a Diploma in Finance and Accounting and eight years experience in office administration and community liaison work that includes arranging meetings, facilitating community workshops, meetings with traditional authorities and assisting on all project related work. Joseph assists with secretarial functions for projects including maintaining attendance registers and databases for projects.

Ndomupe Dhemba is a Geographic Information Systems (GIS) and Remote Sensing specialist with a Masters degree in GIS and Remote Sensing for Environmental Management. She has 7 years experience in natural resources management including resource inventorying and auditing, biodiversity assessment, and has been involved in a number of EIA programmes as a biodiversity and GIS & Remote Sensing Specialist in Zimbabwe, Tanzania and South Africa. She has worked with rural communities in the promotion of rural development through the sustainable utilization of Natural Resources through group projects, capacity building and EIAs of these projects. She also has experience in public participation and research particularly in the promotion of the use of remote sensing for biodiversity assessment. She is conversant with ArcGIS, ERDAS, ILWIS, Planet GIS and ENVI.

Nadine Duncan has an Honours Degree in Geography with 7 years experience in Planning and Environmental Impact Assessment related projects including for roads, storm water infrastructure, dams and power stations in South Africa. She has been involved in S24G Rectification Applications, Environmental auditing, project management and implementation. Nadine has also been involved in GIS, data management and Visual Impact Assessments. She has gained experience in Open Space Planning and Environmental Management Frameworks and is conversant in ArcGIS, AutoCAD, CorelDRAW, Google SketchUP, Photoshop, InDesign, and Illustrator.

Sandhisha Jay Narain is an Environmental Consultant with an Honours degree in Environmental Management. She has over 6 years onsite Environmental Management and Environmental Compliance Auditing and Monitoring experience. Sandhisha has been involved in the implementation of the Environmental Management Plan for the Moses Mabhida Stadium, served as the Environmental

Control Officer (ECO) for Transnet's Multi Purpose Pipeline Project and was project based as the Environmental Monitor at the Spring Grove Dam. Sandhisha is also an accredited Green Star SA Professional and is knowledgeable in the functioning of ISO 14001 Environmental Management Systems.

Dr Neville Bews is a senior social scientist and human resource professional with a PhD in Sociology and 36 years experience. He consults in the fields of Social Impact Assessments and research, and human resource management. He has worked on a number of large infrastructure, mining and water resource projects. He at times lectures at both the Universities of Pretoria and Johannesburg and is a Senior Fellow in the Centre for Sociological Research, Department of Sociology at the University of Johannesburg.

Stephen van Staden has a Masters degree from the University of Johannesburg in Environmental Management. Stephen has experience on over 1 000 environmental assessment projects specifically with aquatic and wetland ecological studies as well as terrestrial ecological assessments and project management. Stephen has a professional career spanning more than 10 years, most of which have been as the owner and managing member of Scientific Aquatic Services. He is registered by the South African River Health Project as an accredited aquatic biomonitoring specialist and as a Professional Natural Scientist with the South African Council for Natural Scientific Professions in the field of ecology. Stephen is also a member of the Gauteng Wetland Forum and South African Soil Surveyors Association.

Menno Klapwijk obtained a B.Sc. degree in Landscape Architecture at Texas A&M University. Menno is a registered Landscape Architect (South African Council for Landscape Architectural Professionals). He has 32 years experience in integrated environmental assessment and planning for existing and future land uses, visual impact assessment, mining and quarry reclamation and development planning and design. He's been involved in Landscape design for corporate headquarters, office and industrial parks, housing developments, hotels, plazas and pedestrian malls as well as recreation planning and planning and design for conservation areas, natural resource areas, nature reserves and game farms.

William Mullins has a BSc degree and 38 years experience in the agricultural and economic field. He has been involved in economic growth and development strategies for regions and sub-regions in South Africa; sectoral economic analyses; various cost-benefit analysis studies; environmental impact studies and policy analysis including irrigation projects; constructing a Building Construction Model for South Africa with specific reference to the impact of Government Capital Expenditure and the Construction of National and Regional Input Output Tables as well as the compilation of National, Regional or Multi-Regional SAM. William has also worked in specialist fields like the SKA Telescope study, and impact studies for Eskom.

Bob Pullen obtained BSc(Eng), MSc(Eng) and MBL degrees. He played a major role in the conception of the Thukela-Vaal Project, and was responsible for much of the construction phase. His interest in and experience with environmental management issues led to his significant roles in managing various Reserve determination assignments and Environmental Impact Assessments (Groot Letaba, Levhuvhu and Thukela Rivers in Limpopo and KwaZulu-Natal) and to the implementation of social components of Environmental Management Plans. Important examples of the last-mentioned are the Relocation Policy Framework for Nandoni Dam near Thohoyandou (465 households, 1 000 graves, four archaeological sites and 2 100 subsistence farmers) and the relocation of about 130 graves and ten archaeological sites at De Hoop Dam in the Steelpoort River, both in Limpopo. He was also responsible for managing implementation of the Environmental Management aspects associated with construction of Spring Grove Dam in the Mooi River, KwaZulu-Natal.

Len van Schalkwyk has an MA in Archaeology and 25 years of professional experience as a practising archaeologist and heritage resource manager in South Africa, Botswana and Mozambique. His research interests have focussed on the Iron Age of southern Africa, while his management specialisations are heritage impact assessments, community liaison and ancestral grave management.

James Cross obtained BA, LLB and LLM (Constitutional and Environmental Law) degrees from the University of Stellenbosch. He subsequently obtained a Diploma in Corporate Law from the Rand Afrikaans University (now University of Johannesburg). During 1997, James was admitted as an attorney and commenced practising law at Blakes Maphanga Incorporated. James has 18 years experience consulting with clients in the environmental consulting, engineering, heavy industrial, mining and property development sectors. His environmental law practice includes legal interpretation of environmental legislation and the drafting of legal opinions, administrative appeals, and preparation of legal requirements assessments, legal auditing, drafting and review of commercial agreements, advice on legal authorisation processes as well as legal training. He is regularly requested to assist with environmental, health and safety due diligence investigations within the context of mergers and acquisition transactions. James has been consulting to the public sector (government and parastatals) on statutory development projects. He has acted as external legal advisor and drafter of regulations under the Protected Areas Act 57 of 2003 and consults to government on the transfer of environmental impact assessment requirements from mining to environmental legislation. James has written numerous articles on aspects of environmental law, has lectured to students at the University of Pretoria and University of Stellenbosch and presented papers at various Cameron Cross and other sponsored seminars and events. He is presently the course leader for the Certificate in Environmental Law presented by the University of Pretoria.

Table 1-1: Specialist Project Team summary

Consultant Name	Company Name	Field of speciality
Dr Neville Bews	Dr Neville Bews and Associates	Social Impact Assessment
Stephen van Staden	Scientific Aquatic Services	Ecology and wetlands
Menno Klapwijk	Bapela Cave Klapwijk	Visual Impact Assessment
William Mullins	Mosaka Economic Consultants cc. t/a Conningarth Economists	Economics and Agricultural economics
Bob Pullen	Independent Consultant	Relocation Policy Framework
Len van Schalkwyk	eThembeni Cultural Heritage	Heritage
James Cross	Mervyn Tabacks Incorporated	Legal Advisor

1.5 STRUCTURE OF THE REPORT

The report is structured as follows:

Chapter 1 of the EMPR serves to outline the background to the project.

Chapter 2 provides a project description.

Chapter 3 provides an organisational structure and the roles and responsibilities of the various departments and construction team.

Chapter 4 specifies compliance monitoring requirements.

Chapter 5 highlights all relevant legislative requirements and principles.

Chapter 6 provides the measures applicable to the Pre-construction Phase.

Chapter 7 presents the Relocation Policy Framework.

Chapter 8 provides mitigation and management plans for the construction phase. It is divided according to the following sub-sections:

- **Chapter 8.1** Socio-economic management and mitigation plan.
- **Chapter 8.2** Public Consultation and disclosure management and mitigation plan.
- **Chapter 8.3** Construction site management and mitigation plan.
- **Chapter 8.4** Solid Waste management and mitigation plan.
- **Chapter 8.5** Visual Aesthetics management and mitigation plan.
- **Chapter 8.6** Air quality management and mitigation plan.
- **Chapter 8.7** Noise Control management and mitigation plan.
- **Chapter 8.8** Traffic management and mitigation plan.
- **Chapter 8.9** Water management and mitigation plan.
- **Chapter 8.10** Aquatic Ecosystem management and mitigation plan.
- **Chapter 8.11** Material Sourcing and Earthfill Stockpiles management and mitigation plan.
- **Chapter 8.12** Topsoil management and mitigation plan.
- **Chapter 8.13** Spoil management and mitigation plan.

- **Chapter 8.14** Fauna and Flora management and mitigation plan.
- **Chapter 8.15** Heritage management and mitigation plan.
- **Chapter 8.16** Health and Safety management and mitigation plan.
- **Chapter 8.17** Rehabilitation management and mitigation plan.
- **Chapter 8.18** Monitoring requirements.
- **Chapter 8.19** Site Closure requirement

Chapter 9 provides mitigation and management plans for the operation phase.

2. PROJECT OVERVIEW

2.1 PROJECT LOCATION

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

Water Resource Infrastructure includes:

- A dam at the Ntabelanga site with a storage capacity of 490 million m³;
- A dam at the Lalini site with a storage capacity of approximately 150 million m³;
- A pipeline and tunnel/conduit and power house at 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 increase 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. 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 is 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 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.

The hydropower plant at the proposed Lalini Dam and tunnel (used conjunctively with the Ntabelanga Dam) will generate an average output of 30 MW when operated as a base load power station and up to 150 MW when operated as a peaking power station. The power plant will require a tunnel/conduit of approximately 7 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 .

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 were 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 specialists identified sensitive areas, and deviations to avoid these areas were proposed.

2.4 SUMMARY OF THE EIA FINDINGS

While the project was assessed holistically, it is acknowledged that the impacts associated with the various infrastructure components have different degrees of

significance. Impacts are summarised below for the dams and associated infrastructure, electricity generation and distribution infrastructure, and road infrastructure.

2.4.1 Dams and associated infrastructure

The construction of the dams, and to a lesser extent the associated infrastructure (including construction offices, potable and raw water distribution infrastructure, borrow pits and quarries etc.) will have significant negative impacts on the terrestrial and aquatic ecology, as well as on the wetlands. To a large extent these impacts will be permanent.

The riparian and wetland areas, as well as the mountain/rocky outcrop areas and Euphorbia Forest near the Lalini dam wall that provide habitat for sensitive indigenous vegetation as well as fauna, including possible red data list and protected species, will be lost and the habitat within the river will be permanently altered. This impact is considered to be of high significance.

In addition, wetlands in the project area provide important ecological services in the way of sediment trapping, nutrient cycling and toxicant assimilation, flood attenuation and biodiversity maintenance. Considering the extensive, and often severe, erosion within the study area and greater catchment, sediment trapping is especially important. In view of this, the permanent loss of wetland habitat due to inundation is regarded as being of high significance. The anticipated cumulative loss of riparian and wetland habitat arising from the construction of the dams is estimated to be 1034.30 hectares. Overall however, the loss of riparian and wetland habitat is deemed to constitute a relatively insignificant fraction of the wetland resources within the Mzimvubu sub Water Management Area.

At Lalini Dam, large scale loss of habitat for animals will result in a loss of animal species numbers and diversity, as species leave the area, adapt to the new environment in lower numbers, or are lost in totality within the study area. In particular, the loss of wetlands, lower grassland areas, mountain bushveld and rocky outcrops will directly impact on the population of red data list and protected species.

At Ntabelanga Dam, the main concern relates to the loss of key breeding crane populations. Wetlands and grasslands within the Ntabelanga Dam basin are used by cranes (Crowned Cranes, Blue Cranes and Wattled Cranes) for breeding and foraging. Cranes are red data list species, threatened with extinction throughout South Africa; Crowned Cranes in particular are listed as endangered by IUCN with rapidly declining populations. Loss of wetlands and grasslands has been identified as one of the main contributing factors. This impact is considered to be of high significance.

Most of the above-mentioned impacts are permanent and thus extend into the operation phase.

The EAP recommends, as indicated by DEA, that any Environmental Authorisation is subject to the Water Use Licence (WUL) being obtained and complied with. The WUL takes the Reserve, which includes the Ecological Water Requirements (EWR), into account. The EWR are determined to protect the in-stream aquatic and riparian ecology of the river by setting the limits of deviation from the natural flow beyond which the impact would be unacceptable.

For this assessment, the specialists and EAP have assumed that the EWR, as defined in the Reserve determinations will be adhered to during the construction and operational phases. Adhering to the EWR will ensure that sufficient water goes over the Tsitsa Falls to prevent the endemic cremnohytes identified at the Falls from being negatively affected, and that the river downstream of the hydropower plant outlet works can also be maintained in an acceptable ecological state.

The most critical socio-economic impacts associated with the construction of the dams relate to relocation and resettlement, the influx of construction workers, and risks and nuisances associated with construction activities. These impacts can be highly disruptive to communities and need to be carefully managed and mitigated.

In terms of affected households and assets, 62 structures and 19.9 km² of cultivated land are located within the Ntabelanga Dam basin and will have to be relocated or compensated. At the Lalini Dam site, 12 structures and 7.6 km² of cultivated land are located within the dam basin (alternative 1).

Regarding the proposed potable and raw water pipeline routes, 124 structures are located within the pipeline servitudes (feasibility level pipeline routes). This is a large number but it is possible to realign the pipelines during the detailed design stage to avoid most of these structures and minimise, or altogether eliminate, the need for relocation and associated negative social impacts.

The proposed pipelines are largely located within transformed habitat and construction will have a low to very low impact on terrestrial and aquatic ecology and wetlands, provided the mitigation measures contained in the EMPR are adhered to. These include, inter alia, minor realignments to avoid protected trees, and realignments to avoid wetlands where possible.

The Tsitsa River contributes a small percentage of the flow in the Mzimvubu River that reaches the estuary. The Ntabelanga/Lalini system will always be operated in a manner that fulfills the EWR downstream of the hydropower plant outfall, both in terms of minimum and maximum flows. The project is also not expected to impact on the water quality. The sizes of the Ntabelanga and Lalini Dams are such that they

will support the EWR and the Best Attainable State for the estuary, as set out in the estuarine Reserve determination. The impact on the estuary is therefore predicted to be negligible.

The Macro-Economic Impact Analysis found that during the peak of the construction period, the Ntabelanga Dam will result in 2 299 direct employment opportunities created in the Province, with another 843 indirect and 1 036 induced jobs. Of the direct jobs an estimated 1 057 will be semi-skilled and 771 low-skilled and should be recruited from the local community. There is a positive impact on the GDP to the value of R282.7 million. Low income households will also receive a total of R82.42 million out of a total of R528.11 million.

Although only for a short period, the construction activity of the Ntabelanga Dam will contribute considerably to the economy of the region and the province.

The proposed construction of the Lalini Dam and accompanying hydropower plant will also contribute considerably to the economy. At the peak of construction of the dam 815 direct jobs will be created with another 491 indirect and 604 induced jobs in the provincial economy. Of the direct jobs an estimated 375 will be semi-skilled and 273 low-skilled, most of which should be recruited from the local community. There is a positive impact on the Gross Domestic Product to the value of R164.6 million. Low income households are expected to receive a total of R52.38 million out of a total of R335.64 million of the total impact on households.

During operation, both dams will indirectly provide important social and economic benefits at a local, provincial and national level, as the water they supply will enable:

- The provision of potable water to many households in the project area and beyond, which will have a direct positive impact on the quality of life of the recipients;
- The emergence of an agricultural sector which will be able to actively contribute to the economy of the area and of the province; and
- The provision of electricity to alleviate pressures on the national grid and cross-subsidise the cost of the other components of the project.

The irrigation component of the project will contribute an estimated R129.3 million per year to the GDP and a total household income at R146.6 million with R38.6 million for low-income households. The total fulltime employment opportunities is estimated at 1 976 of which 1 301 is direct on the farms.

The agricultural component of the project may, however, place an additional work burden on women who may have to undertake such tasks as weeding.

2.4.2 Electricity generation and distribution

During construction, the main impact of the electricity generation and distribution infrastructure relates to the construction of the tunnel/conduit and hydropower plant. For the construction of the power line linking the Lalini hydropower plant to the grid, three alternatives were considered and are discussed in more detail below.

During operation, the primary concern relates to the alteration of the natural flow rate and water levels in the Tsitsa River due to releases of water through the tunnel/conduit for hydropower generation. This constitutes a risk for the riparian habitat and the ability of the riparian zone to support biodiversity, with secondary impacts on flow sensitive species, species of conservation concern and aquatic biodiversity in general. The EWR should be adhered to at all times in order to manage this risk. After mitigation, the impact is rated as very low to medium low.

The impact on health of electromagnetic fields associated with power lines has not been determined. From a social point of view, the risk, or perceived risk, is considered to be the main impact of the power line during operation. The precautionary principle will be applied and human settlements and activities within the power line servitude will be restricted.

As far as the electricity generation and distribution component of the project is concerned, the main benefit will be the substantial income generated from the sale of renewable energy, and feeding this power into the national grid.

2.4.3 Roads

In general, road upgrades, and to a lesser extent new access roads and road realignments will have a low to very low impact on terrestrial and aquatic ecology and wetlands, provided effective mitigation is implemented.

However, the construction of new roads in the vicinity of the Lalini Dam wall (i.e. haul roads), as well as the access road to the Lalini hydropower plant are located within highly sensitive areas with regard to fauna and flora, and will have a very high negative impact. However, there are no alternative access routes to the hydropower plant that could avoid the impact on this sensitive area. It is therefore recommended that a walk down to undertake search and rescue be done by a qualified specialist before construction of the haul road and access road commences.

During operation, roads will result in a risk of collisions with animals, which is likely not to be fully mitigated.

From a social perspective, 26 structures are within the footprint of proposed roads and road servitudes and may require relocation. The preferred mitigation is to realign

the roads to avoid structures as much as possible in order to minimise or altogether eliminate the need for relocation and associated negative social impacts.

Road alignments, the new and upgraded roads will facilitate easier access to the areas served which may indirectly stimulate economic development. On the other hand, this could hasten effects of globalisation and changes to local norms and culture.

2.4.4 Comparative assessment of alternatives

- **Preferred power generation mode**

The EWR have been determined to protect the in-stream aquatic and riparian ecology of the river by setting the limits of deviation from the natural flow beyond which the impact would be unacceptable. Whichever option of hydropower generation results in the greatest financial income while still fully meeting the EWR is therefore recommended. This still needs to be confirmed.

- **Preferred tunnel/power line alternative**

The aquatic assessment found that in order to reduce the area of impact in terms of silting, sedimentation, decrease in water quality and excessive vegetation growth, the shortest possible section between the dam wall and discharge point should be preferred (i.e. Alternative 1: short hydropower tunnel and associated power line). However, fatal flaws have been identified for Alternative 1 in terms of faunal, floral, and visual impacts. In particular, the power line crosses large sections of indigenous and possible protected trees, and the impact on the faunal habitat on the mountain and within the gorge was not considered viable.

After the environmental assessment had been conducted Alternatives 1 and 2 (associated with the short and medium length tunnels respectively) were eliminated by the technical team due to the presence of deep steep gorges which provide no access to where the tunnel daylights and the hydropower plant would be located. In addition Alternatives 1 and 2 would have significantly less head to generate power, leaving only Alternative 3.

Alternative 3 (associated with the longest pipeline/tunnel and power line) as it is currently proposed has a very high visual impact and also crosses more sensitive floral habitats. It was recommended that this power line be realigned in order to avoid sensitive areas in terms of ecology and visual aspects. The power line route recommended by the EAP is shown in **Figure 6-1**.

- **Preferred dam size for Lalini Dam**

With regard to the Lalini Dam, three dam sizes were considered.

The smallest dam size (Alternative 2) is preferred from a number of perspectives. Firstly, it involves the least loss of cultivated land and structures (i.e. one dwelling

and 4.9km² of cultivated land, compared to 12 structures and 7.6km² of cultivated land for technically preferred Alternative 1) and is therefore the socially preferred option. Secondly, it will result in the lowest direct loss of wetland habitat, and is thus considered to be the most viable option in terms of wetland conservation. Thirdly, it will result in the inundation of the least amount of floral and especially sensitive floral vegetation and habitat and is therefore the preferred alternative in terms of floral impacts. Finally, while all 3 alternative dam sizes will lead to a definite impact on population size of endangered, vulnerable and protected indigenous faunal species. Alternative 2 is regarded as impacting the least on faunal RDL species.

Notwithstanding this, no major red flags or fatal flaws were found with technically preferred Alternative 1 (i.e. medium dam size). The technically preferred option is therefore acceptable with the careful application of mitigation measures aimed at reducing the social impact on displaced and host communities, as well as the impacts on ecology and wetlands.

As detailed designs have not yet been finalised for the Lalini Dam, the EAP's recommendation is that the final dam size be within the range of proposed Alternatives 1 and 2 (i.e. a Full Supply Level of between 752.42 mamsl and 763.61 mamsl).

- **No project alternative**

By and large, the no project alternative will result in the status quo being maintained.

The following points can however be noted:

- Although no loss or decrease in sensitive species and habitats is expected, the current impacts such as overgrazed veld and alien proliferation along the riparian features will continue. Thus the ecological state of these areas will not improve if the no project alternative is implemented.
- No loss of faunal habitat and RDL and protected species is expected. This should be seen in contrast to the definite impact on population size of endangered, vulnerable and protected indigenous faunal species resulting from the construction of the Lalini Dam.
- In terms of aquatic ecology, the no project alternative will best ensure maintenance of ecological integrity within the system with the current rocky habitat in fast flowing clear water being maintained.
- It is expected that wetland habitats will still undergo alterations as a result of the continued impacts of anthropogenic activities such as vegetation clearing, sediment winning, crop cultivation within wetland habitats, etc. Additionally, due to the extensive erosion within the study area and the catchment, sediment inputs to wetland and riparian habitats are anticipated, thus potentially altering flow patterns within wetlands and riparian zones, as well as smothering vegetation and aquatic macro-invertebrates.

- No negative impacts will accrue to heritage resources. In particular, residents will not be subject to the high emotional cost associated with ancestral grave relocation. Conversely, the scientific knowledge inherent in resources such as archaeological sites will remain unrecovered until and unless funding for research is obtained from another source.
- There is an obligation on the State to advance the interests of the poor and, in accordance with the Bill of Rights, take adequate measures in ensuring that all citizens have access to basic housing, health care, food, water, social security, education and a healthy environment (South African Human Rights Commission, 2004). In addition to this South Africa has a policy of recognising the human right to water at both the Constitutional and policy levels (Mehta, 2005). A no project alternative would contradict these obligations as the Department of Water and Sanitation and the Eastern Cape Province would lose an opportunity to supplement the water resources in the area and consequently to deliver both domestic water and water for irrigation. Together with this lost opportunity would be the loss of a number of job opportunities, not only associated with the construction of the dams and infrastructure, but also associated with the productive potential of the irrigation scheme. With the area being one of the least developed and poorest in the country these losses will have severe social consequences. With the Mzimvubu River being the largest undeveloped water resource in the country any loss of benefits associated with the use of this river will be of national significance.

3. ORGANISATIONAL STRUCTURE

Effective environmental management during the planning, design and construction phases of the project will be dependent on a number of project personnel. The purpose of this section is to define roles for personnel and allocate responsibilities in the execution of the EMPR. The diagram below indicates the organisational structure (figure 3.1).

This organisational structure assumes DWS is the authorisation holder.

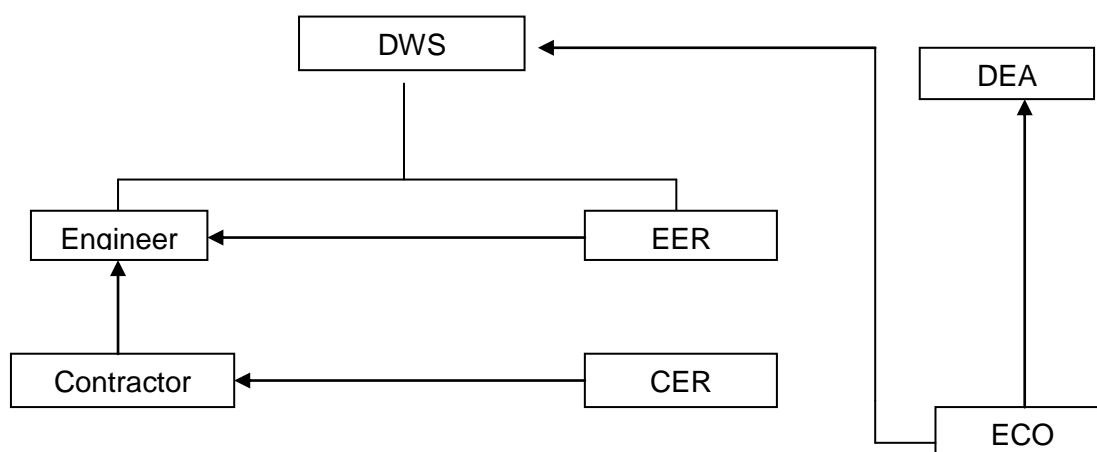


Figure 3.1: Reporting structure

3.1 DEPARTMENT OF ENVIRONMENTAL AFFAIRS (DEA)

The DEA, on behalf of the Minister, plays a lead role in the implementation of national environmental policies, legislation and regulations. Their role is to ensure that the Mzimvubu Water Project is implemented in a sustainable manner, in compliance to the relevant environmental legislation. DEA is responsible for approving the EMPR for the Mzimvubu Water Project and any revisions and amendments thereto.

3.2 DEPARTMENT OF WATER AND SANITATION (DWS)

DWS is the applicant of the authorisation, the developer of the project and the Contractor's and Engineer's Client. Under the South African environmental law, applicants are accountable for the potential impacts of activities being undertaken as well as managing these impacts. DWS, therefore, has the overall environmental responsibility to ensure that the implementation of the EMPR complies with national and provincial legislation as well as with the conditions of the Environmental Authorisation (EA).

DWS must compile a project communication strategy that includes directly affected persons and anybody with rights to any immediately adjacent properties that must be submitted to the DEA prior to the commencement of construction.

DWS may delegate environmental compliance / responsibility to nominated agents such as the Engineer.

The holder of the authorisation must submit an environmental audit report upon completion of the construction and rehabilitation activities.

The environmental audit report must indicate the date of the audit, the name of the auditor and the outcome of the audit in terms of compliance with the environmental authorisation conditions as well as the requirements of the EMPR.

3.3 ENGINEER

The Engineer is responsible for design of the works and supervision of the contract. The Engineer is DWS' representative onsite and is ultimately responsible for:

- Compliance with legal environmental requirements;
- Confirming that the EMPR forms part of the contract documents;
- Placing the EMPR on the site meeting agenda;
- Directing on site teams implementation and compliance with the EMPR;
- Consulting and co-operating with the Environmental Control Officer (ECO) appointed by the DWS on environmental matters;
- Reporting to DWS; and
- The Engineer may appoint an Engineer's Environmental Representative (EER) to plan and direct the implementation of the EMPR and provide advice on environmental matters.

The EER will:

- Provide support and advice, via the Engineer regarding environmental matters during the entire project lifecycle;
- Distribute all statutory requirements, including permits, authorisations and licences;
- Keep a copy of the Environmental Authorisation and EMPR on site;
- Provide Environmental Awareness training for the Engineers staff;
- Ensure that the Code of Conduct is signed by all personnel responsible for activities that could have a negative impact on the environment;
- Report at site construction meetings;
- Manage a schedule of Internal Audits. Internal audit reports are submitted to the Engineer;
- Maintain and manage a complaints register;
- Maintain and manage an incidents and non-conformance register;

-
- Keep a record of proof of all training undertaken on site; and
 - Keep records relating to monitoring and auditing on site and make these available for inspection to any relevant and competent authority in respect of this development.

3.4 ENVIRONMENTAL CONTROL OFFICER (ECO)

An Independent Environmental Control Officer (ECO) will be appointed by DWS to monitor and audit compliance and report environmental compliance to DEA. Once appointed, the name and contact details of the ECO must be submitted to the Director: Compliance Monitoring of the DEA. The ECO will:

- Keep records of all activities on site, problems identified, transgressions noted and a task schedule of tasks undertaken by the ECO;
- Confirm that the requirements of the EMPR are communicated, understood, and implemented by personnel on site;
- Manage scheduled audits and inspections on contractors' performance on site.
- Monitor EMPR compliance through regular site visits and inspections during the pre-construction, construction and rehabilitation phases;
- Submit compliance reports to DEA;
- Submit emergency incident reports (example in **Appendix B**) to DEA for all Level 3 to 5 incidents (as defined in **Table 4.1**); and
- All documentation e.g. audit/monitoring/compliance reports and notifications, required to be submitted to the Department in terms of this authorisation, must be submitted to the *Director: Compliance Monitoring* at the DEA.

3.5 CONTRACTOR

The Contractor implements the EMPR specifications on site. The Contractor may appoint an environmental representative (the Contractor's Environmental Representative (CER)) to assist with the implementation of the EMPR.

The Contractor's Environmental Representative (CER) will:

- Provide Environmental Awareness training for Contractors Engineers, foremen, site staff and any visitors to the site. A record of all training and visitors induction must be kept on site;
- Ensure that the Code of Conduct is signed by all personnel responsible for activities that could have a negative impact on the environment;
- Undertake monitoring and analysing of data, and reporting to Engineer and the ECO on a monthly basis; and
- Maintain and manage an incidents and non-conformance register.

3.6 CONTRACTOR MANAGEMENT

Contractor management will be affected through specific activities as listed below:

- At the tender briefing meeting environmental management expectations during the project shall be highlighted;
- The EMPR shall be included with the tender documents;
- Once the Contractor is appointed they should be instructed to develop a document that should indicate how they plan to ensure compliance with the EMPR; and
- Fines and penalties shall be managed in accordance with the Public Management Finance Act.

3.7 PENALTIES AND FINES

A penalties and fines system shall be developed and implemented by the Contractor.

A guideline of minimum fine values is provided for minor, moderate and serious offences in the table below.

Table 3-1: Table depicting guidelines for fines and offences

Offences	Fine
<u>Minor offences</u> Littering Possession of intoxication substances on site. Failure to use ablutions. Moving on areas recently landscaped. Disturbing grassed areas. Not parking in demarcated areas. Not using safety equipment Wasting of water and electricity. Not removing domestic waste off site. Not stockpiling topsoil adequately.	R 1500 - 00
<u>Moderate offences</u> Oil spills Persistent oil leaks on vehicles. Generation of excessive dust and noise. Transgression of the speed limit. Illegal fires. Burying of waste. Use of intoxicate substances on site. Lack of erosion control. Entering non-demarcated areas. Hunting and snaring. Damaging of pre- identified trees.	R 5000-00
<u>Serious offences</u> Large oil/ hazardous waste spill.	

Removal of pre-identified trees. Damage of pre- identified heritage sites or objects. Continually exceed noise limits. Transgression of legal requirements. Sanitation facilities not adequate. Pollution of groundwater. Removal of any protected plant or other species. Damage or pollution of wetlands.	R15 000.00
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These fines should be issued in addition to any remedial costs included as a result of the non-compliance, as well as any statutory penalty or fine (if applicable) which will also be for the offender's expense.

4. COMPLIANCE MONITORING

4.1 CODE OF CONDUCT

The Engineer must compile a Code of Conduct that all of the Engineer's and Contractor's personnel responsible for activities that have potential impacts on the environment must sign.

4.2 METHOD STATEMENTS

A Method Statement must be compiled for every activity undertaken by the Contractor. The Method Statements must include the following information:

- Responsible person (name and ID number) and an alternative (name and ID number);
- Legal Requirements;
- Training Requirements;
- PPE required;
- Method by which the activity will be undertaken;
- Emergency Procedures;
- Response in the case of a non-compliance; and
- All Method Statements must be signed by the Engineer.

An example of a Method Statement is included in **Appendix A**.

Method Statements for the following activities are required by this EMPR:

- Training;
- Fencing;
- Waste Management;
- Water (including Storm water) Management;
- Erosion control;
- Air Quality Management;
- Noise Management
- Traffic Management;
- Emergency response plan; and
- Rehabilitation.

The EER or ECO may require additional Method Statements for any aspects or activities that are identified as problematic or not complying with targets in the EMPR.

4.3 INCIDENTS AND NON-CONFORMANCES

According to Section 30 of the National Environmental Management Act (NEMA):
"Incident" means an unexpected sudden occurrence including a major emission, fire

or explosion leading to serious danger to the public or potential serious pollution of or detriment to the environment, whether immediate or delayed.

In terms of the above definition:

The Emergency response plan/method statement should be initiated in response to an incident. The incident must be reported to the ECO and DEA as per Section 30 (3) of NEMA. An emergency incident report required in terms of Section 30(5) of NEMA (example attached as **Appendix B**) must be submitted to DEA's Environmental Management Inspectorate for processing. A close out certificate will be issued by the Inspectorate indicating that measures undertaken were to the department's satisfaction.

A chemical spill is defined as a potential liquid hydrocarbon or chemical spill or other release which can create a hazard to life or property or create environmental damage. Examples include liquid hydrocarbons, compressor or other equipment lube oil, evaporative cooler acid water, liquid odorant, or other substances that contain controlled or hazardous substances. Spills and other environmental incidents have been classified according to the risk to the environment and appropriate responses are indicated in **Table 4-1**.

Table 4-1: Classification of Environmental Incidents

Level	Definition	Response Required
Level 1	A Minor Emergency which can be controlled entirely by the personnel and facilities located within the immediate vicinity of the accident/incident site. These include events which cause minor property or equipment damage that are non-disruptive to operations, and do not pose a safety risk to personnel or property outside of the boundaries of Clients's property.	Recorded in the incidents register and managed accordingly
Level 2	A Level 2 Incident is defined as a Moderate Emergency which is disruptive, but not extensive, and forces <u>a portion</u> of the employer operation to be temporarily suspended or shut down. A Level 2 Incident is a spill or hazardous product release which has the potential to cause harm to personnel, the public, or the environment and includes a chemical spill of more than 35 l to land; or any chemical spill to water resources.	Recorded in the incidents register and managed accordingly
Level 3 to 5 Incidents	A Level 3 to 5 Incident is defined as a Serious (3), Major (4) to Catastrophic (5) alert requiring the intervention of external support services and that can have serious impacts on ecology, humans and on the	Report the incident to the ECO immediately. The ECO will submit an emergency incident report

Level	Definition	Response Required
	overall Project.	to DEA. The incident must also be recorded in the incidents register

In the above cases, it will be the decision of the site management and Engineer as to whether work stoppage must be implemented. In most cases, work in the area where the incident occurred will be stopped until all safety clearances have been given. Unless, there is a fatal accident, then the whole site will stop.

The holder of the authorisation must notify DEA, in writing and within 48 (forty eight) hours, if any condition of the Environmental Authorisation cannot be or is not adhered to. The notification must be accompanied by reasons for the non-compliance. Non-compliance with a condition of the Environmental Authorisation may result in criminal prosecution or other actions provided for in NEMA and the regulations.

4.4 CHECKING AND CORRECTIVE ACTION

4.4.1 Monitoring

A series of environmental variables that are to be monitored during the pre-construction and construction phases should be developed for identified aspects, such as surface water monitoring, noise monitoring, air quality monitoring etc. Monitoring results should be presented monthly. Where the target values are not met, further mitigation action (development of detailed method statements) should be considered.

4.4.2 Inspections

Some potential impacts are difficult to monitor quantitatively such as soil erosion and waste management. Daily visual inspections of all construction sites should be undertaken.

4.4.3 Internal Audits

Where monitoring data and the inspection reports highlight problems, an internal audit could be initiated. The EER is responsible for undertaking Internal Compliance Audits that cover the EA, EMPR, Method Statements and Tender Specification. The purpose of the audit is to ascertain the source of the problem and define what action must be taken to prevent its re-occurrence. Detailed method statements could be the outcome of the internal audit.

4.4.4 ECO audits

The ECO will undertake quarterly audits and submit audit reports to DEA, after client review.

4.4.5 Corrective action

There are several levels at which corrective action can be affected, namely verbal instructions, written instructions and contract notices.

5. LEGISLATIVE REQUIREMENTS AND PRINCIPLES

5.1 ENVIRONMENTAL PRINCIPLES

The following principles should be considered at all times during the pre-construction and construction phase activities.

- The environment is considered to be composed of both biophysical and social components.
- Construction is a disruptive activity and due consideration must be given to the environment, including the social environment, during the execution of a project to minimise the impact on affected parties.
- Minimisation of areas disturbed by construction activities (i.e. the footprint of the construction area) should minimise many of the construction related environmental impacts of the project and reduce rehabilitation requirements and costs.
- As minimum requirements, all relevant standards relating to international, national, provincial and local legislation, as applicable, shall be adhered to. This includes requirements relating to waste emissions (e.g. hazardous, airborne, liquid and solid), waste disposal practices, noise regulations, road traffic ordinances, etc.
- Every effort should be made to minimise, reclaim and/or recycle “waste” material.

5.2 ENVIRONMENTAL PERMITS, LICENCES AND AUTHORISATIONS

Commencement of the project is subject to obtaining all necessary permits, licences and/or authorisations required in terms of South African environmental legislation. A number of activities were applied for as part of the EIA process. Should the project trigger any other activities not included in the applications submitted, a separate application process must be followed and these activities authorised before the project can commence.

Such activities may include:

- **Blasting** - Blasting permits are required from the Department of Mineral Resources in accordance with the Explosives Act (Act No 26 of 1956).
- **Waste management** - The management of waste is regulated by the National Environmental Management: Waste Act (Act 59 of 2008) (NEMWA) and associated Regulations.
GN 921 lists Waste Management Activities in respect of which a Waste Management Licence (WML) is required; these include various activities associated with the storage of waste, reuse, recycling and recovery of waste, treatment of waste (which includes the remediation of contaminated land) and disposal of waste. The Schedule to the Notice distinguishes between two

categories of waste management activities which require licensing and for which a basic assessment process (for Category A Waste Management Activities) or an Environmental Impact Assessment process (for Category B Waste Management Activities) must be conducted. A third category (Category C) refers to activities for which norms and standards have been set.

Construction activities usually result in general as well as hazardous waste.

WMLs are required for, amongst others:

- The storage of general or hazardous waste in lagoons;
- The disposal of inert waste to land in excess of 25 tons;
- The disposal of any hazardous waste to land;
- The disposal of general waste to land covering an area of more than 50m² and
- The disposal of domestic waste generated on premises in areas not serviced by the municipal service where the waste disposed exceeds 500 kg per month.

Schedule 3 of the NEMWA, as amended, defines "general waste" as waste that does not pose an immediate hazard or threat to health or to the environment, and includes—

- (a) domestic waste;
- (b) building and demolition waste;
- (c) business waste; and
- (d) Inert waste; or
- (e) any waste classified as non-hazardous waste in terms of the regulations made under section 69, and includes non-hazardous substances, materials or objects within business, domestic, inert, building and demolition wastes as outlined in Schedule 3 of the Act.

Where

"building and demolition waste" means waste, excluding hazardous waste, produced during the construction, alteration, repair or demolition of any structure, and includes rubble, earth, rock and wood displaced during that construction, alteration, repair or demolition; and includes discarded concrete, bricks, tiles and ceramics, discarded wood, glass and plastic, discarded metals, discarded soil, stones and dredging spoil and "other" discarded building or demolition wastes.

"inert waste" means waste that—

- (a) does not undergo any significant physical, chemical or biological transformation after disposal;
- (b) does not burn, react physically or chemically biodegrade or otherwise adversely affect any other matter or environment with which it may come into contact; and

(c) does not impact negatively on the environment, because of its pollutant content and because the toxicity of its leachate is insignificant and which include discarded concrete, bricks, tiles and ceramics, discarded glass and discarded soil, stones and dredging spoil, as listed in Schedule 3 of the Act.

Sludge will be dewatered/pressed/dried (depending upon the actual process selected at detailed design stage) and the treated sludge will be disposed to farmland or at a licensed approved solid waste disposal site. The sludge will be classified before it is disposed of in order to prove that it is not hazardous. A Waste Management Licence may be required if it is disposed to land and covers more than 50 m².

A WML may be required for the settling ponds that will be used to capture runoff from the batching and crusher plants (Activity (1) of Category A: Storage of general waste in lagoons).

The construction of the tunnel at the Lalini Dam for the generation of hydro power will result in spoil (inert general waste) that needs to be disposed of, if it cannot be utilised as aggregate or fill material, and may require a WML.

No WML Applications are included in this EIA process and if applications are required, they will have to be applied for separately. It is recommended that all activities that may require a WML are considered during the design stage so that assessments and applications can be made, and a licence received, before the activity is undertaken.

NEMWA GN 926 presents the norms and standards for the storage of waste. The requirements of waste storage facilities; management of waste storage facilities; and general provisions required, are outlined therein.

- **Storage of hazardous substances** - Hazardous substances must be stored and handled in accordance with the appropriate legislation and standards, which may include the Hazardous Substances Act, the Occupational Health and Safety Act, and relevant associated Regulations. No more than 500 m³ of hazardous substances may be stored on site without an environmental authorisation.
- **Health and safety of work teams** - Construction Regulations (2003) published under the Occupational Health and Safety Act (Act No 85 of 1993) apply to construction activities including “the moving of earth, clearing of land, the making of an excavation, piling, or any similar type of work”. A “health and safety plan” which addresses hazards, and includes safe working procedures to mitigate, reduce or control the hazards identified, is required under this Act. A risk assessment must also be undertaken by an appropriately qualified person(s) and the Contractor shall ensure that all employees under his or her control are

informed, instructed and trained by a competent person regarding any hazard and the related work procedures before any work commences, and thereafter at such times as may be determined in the risk assessment.

- **Heritage resources** – Before any heritage resources are demolished or damaged a permit must be obtained. Permit applications must be submitted to the relevant Heritage Resources Authority (i.e. the South African Heritage Resources Agency and/or the Eastern Cape Provincial Heritage Resources Authority).
- **Removal of graves** - Permits are required for the removal of graves in terms of the National Heritage Resources Act (No 25 of 1999) section 36.
- **Removal of trees** – The removal of trees protected in terms of the National Forests Act (No 84 of 1998) requires a licence from the Department of Agriculture, Forestry and Fisheries (DAFF).
- **Removal and transportation of endangered fauna and flora** - A permit must be obtained from the provincial nature conservation agency for the removal or destruction of indigenous protected and endangered plant and animal species. Copies of permits required must be submitted to the DEA for record keeping purposes.
- **Water abstractions** – Water abstracted from any sources for construction purposes requires authorisation from DWS.
- **Asphalt Plants** - GN 893 of 2013 in GG 37054 dated 22 November 2013 provides a list of activities which result in atmospheric emissions which have or may have a significant detrimental effect on the environment, including health, social conditions, economic conditions, ecological conditions or cultural heritage. Activities include Macadam preparation (the mixing of aggregate and tar or bitumen to produce road surfacing in permanent facilities and mobile plants). These activities require an Atmospheric Emissions Licence in terms of Section 37 of the Act.
- **Borrow areas and Quarries** - Government Gazette No 26501 dated July 2004 states that the Minister of the Mineral Resources, acting in terms of section 106 (1) of the Mineral and Petroleum Resources Development Act, 2002 (Act No 28 of 2002) (MPRDA) exempts the Department of Water and Sanitation, amongst other institutions, from the provisions of sections 16, 20, 22 and 27 of said Act in respect of any activity to remove any mineral for the construction and maintenance of dams, harbours, roads and railway lines and for purposes incidental thereto. Section 106 (2) of the MPRDA says that in such cases the DWS must still compile an Environmental Management Programme (EMPR) for

approval in terms of Section 39 (4) of the Act. Any new borrow areas and quarries not authorised as part of the EIA process must be authorised separately.

5.3 CONSTRUCTION INDUSTRY DEVELOPMENT BOARD

The Construction Industry Development Board (CIDB) is a Schedule 3A public entity established by Act of Parliament (Act 38 of 2000) to promote a regulatory and developmental framework that builds the construction delivery capability for South Africa's social and economic growth.

The Construction Registers Service of the CIDB comprises the Register of Contractors and the Register of Projects which have been established in terms of the CIDB Act (Act 38 of 2000). The Register of Contractors grades and categorises contractors according to financial and works capability. It is mandatory for public sector clients to apply the Register of Contractors when considering construction works tenders. The Register of Contractors facilitates public sector procurement and serves as a framework for contractor development.

6. PRE-CONSTRUCTION SPECIFICATIONS

6.1 GENERAL

This section of the EMPR provides a framework for environmental protection during the planning and design phases of the project, leading up to, but not including, the establishment on site by the appointed contractor. This period will typically include relocation and compensation of affected communities (discussed in **Chapter 7**), land acquisition, as well as investigative activities such as confirmation of materials availability, archaeological site protection and rescue and fencing.

The pre-construction activities are the responsibility of DWS as the authorisation holder. Should the authorisation be transferred to another party, that party would be responsible as per the relevant organisational structure.

6.2 DECISIONS REGISTER

A Decisions Register must be established and maintained, and must be available to any member of the public who wishes to access it. The register should include, *inter alia*, all commitments made to stakeholders during the public participation process, which are recorded in the Issues and Responses Report (see **Appendix B** of the EIR).

6.3 LAND ACQUISITION

The proposed project is located on state-owned land which is administered by traditional authorities. The land is therefore currently subject to communal land tenure arrangements.

DWS, in consultation with the Department of Rural Development and Agrarian Reform will formally acquire the land that will be directly affected by the project (e.g. footprint of the dams and pipeline servitudes) once the project has been officially promulgated as a Government Waterworks.

6.4 PROTECTION OF VEGETATION

- a) Search and rescue of all indigenous vegetation (e.g. *Aloe* species, *Euphorbia* species, *Cussonia* species) must be undertaken by a suitably qualified specialist. The search, rescue and relocation operation should take place prior to clearing any areas affected by construction. The dam basins, the areas impacted by the access road to the hydropower plant and haul roads at Lalini Dam, areas of the footprint that have been identified as sensitive (see **Appendix D**), as well as the areas identified by the floral specialist for rescue and relocation (see **Appendix E**) must be subjected to search and rescue. Floral species must be

relocated to similar habitat types, outside of infrastructure footprint areas. All the required permits must be obtained.

- b) Linear infrastructure should be re-aligned to avoid protected trees. Where this is not possible, permits for the moving or destruction of these trees must be obtained in terms of the National Forests Act.
- c) Planning of temporary roads and access routes should take place within areas of lower sensitivity or where historic vegetation transformation has occurred (refer to sensitivity maps in **Appendix D**).
- d) An investigation must be undertaken by a qualified specialist to determine whether any waterfall dependent plants in the gorge and on the cliff could be significantly impacted and whether they require relocation; and findings of the investigation must be implemented.

6.5 PROTECTION OF FAUNA

- a) Should any RDL faunal species, species of conservational concern 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.
- b) Rescue and relocation of faunal species needs to be conducted by an appointed specialist where islands are formed by the flooding of the valley.
- c) No wild, domesticated or farm animals may, under any circumstances, be fed, hunted, snared, captured, injured or killed. Personnel must report any animal found dead or injured in traps or snares to the Engineer who will take appropriate action.

6.6 PROTECTION OF CULTURAL HISTORICAL ASPECTS AND GRAVES

- a) Thorough identification of abandoned homesteads affected by the project is required.
- b) No associated infrastructure may be located within 100 m of graves outside the full supply levels, and if unavoidable, these graves should also be relocated.
- c) The archaeological site identified in the proposed Ntabelanga Dam basin (**Table 6-1**) should be mapped in detail, with judicious sampling, authorised by a permit from ECPHRA. Thereafter the site may be destroyed once a destruction permit has been issued by ECPHRA.
- d) The archaeological site identified in the proposed Lalini Dam basin (**Table 6-1**) basin should be mapped and excavated/sampled, authorised by a permit from ECPHRA. Thereafter the site may be destroyed once a destruction permit has been issued by ECPHRA.
- e) A detailed survey of potential Early Iron Age sites should be undertaken once crops have been harvested and vegetation clearance has occurred.
- f) Fieldwork to identify heritage resources affected by new roads, pipelines, and electrical infrastructure must be undertaken, and mitigation measures

recommended, once final infrastructure locations and routes have been surveyed and pegged.

- g) The personnel and consultants may not disturb, deface, destroy or remove protected heritage resource features, whether fenced or not. If any archaeological features, graves or skeletal remains are found, work must cease and the Engineer must be informed immediately. Work may proceed only once the site has been investigated by a person nominated by the Engineer and has been signed off as being cleared.

Table 6-1: Archaeological sites identified within the dam basins

Ntabelanga Dam Basin	Location relative to FSL	Coordinates	
LSA knapping floor	948 m asl. Within FSL	31 06.550 S	28 30.746 E
Laleni Dam Basin			
EIA smelting site c. 900AD	732 m asl. Within FSL	31 15.030 S	28 55.555 E

6.7 PROTECTION OF AQUATIC ECOSYSTEMS

Ongoing aquatic biomonitoring on a minimum of a quarterly basis must take place from 6 months prior to construction until one year after construction to determine trends in ecology and define any impacts requiring mitigation. All aquatic biomonitoring should be undertaken by a suitably qualified and South African River Health Program (SA RHP) accredited assessor.

6.8 DISASTER MANAGEMENT

Develop a disaster management plan that includes a well-developed public communication process and evacuation plan, for implementation during the construction phase.

6.9 SITE LAYOUT PLANNING

- a) Minimise construction footprints during the design of the project components, prior to commencement of construction.
- b) In determining the site layout for the site office, cognisance must be taken of sensitive and no-go areas, which are defined by the botanist, zoologist, wetland specialist and archaeologist prior to impacting the area, as well as protecting and maintaining existing private/communal property, fences and gates.
- c) Ensure that contractor lay-down areas are included in the initial areas demarcated for clearing in order to minimise vegetation loss, and ensure as far as possible, that they do not encroach into wetland / riparian zones or their respective buffer zones.
- d) Clearly demarcate sensitive areas into which no construction activities should encroach.

- e) Where construction will obstruct existing access, be sure to allow for alternative temporary access routes.

6.10 ACCESS ROADS, ROAD REALIGNMENTS AND ROAD UPGRADES

- a) Adjust road alignments so as to avoid as many structures as is feasible.
- b) Adjust road alignments to avoid cutting and destroying protected tree species as much as possible.
- c) The haul road linking the borrow areas to the Lalini Dam construction site must be realigned to avoid going through the town of Lalini.
- d) The proposed access road for construction vehicles through Lotana village must be realigned to avoid the village.
- e) In determining the final route and extent of access/haul roads, cognisance must be taken of sensitive and no-go areas, which are defined by the botanist, zoologist, wetland specialist and archaeologist prior to impacting the area, as well as protecting and maintaining existing private/communal property, fences and gates.
- f) 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:
 - o The crossing designs of bridges must ensure that the creation of turbulent flow in the system is minimised, in order to prevent downstream erosion.;
 - o 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;
 - o The design of such culverts and/or bridges should ensure that the seasonal wetland zone should have water-logged soils within 300 mm of the soil surface at all times;
 - o Temporary wetland zone areas should have waterlogged soil conditions occurring within 300 mm of the land surface during the summer season;
 - o In order to achieve this all crossings of wetlands should take place at right angles wherever possible.
- g) Specific components which require the provision of drainage facilities are:
 - o Abutments, retaining walls and culvert barrels, behind which drainage filters and pipes are required to collect ground water and dispose of this through weepholes;
 - o Abutment girder beds which require the provision of collector channels and outlet pipes to remove water which has leaked through expansion joints or has arisen from driving rain or condensation;

- Deck roadway surface subject to direct rainfall, which must be disposed of via drainage scuppers, supplemented in certain instances by grid inlets and concealed drainage pipes
 - Deck concrete surface on the uphill side of concrete nosings, asphalt plug joints or proprietary joints, which cause the entrapment of water which has percolated through the asphalt surfacing and must be disposed of through small drainage pipes;
 - Deck concrete surface on the uphill side of the transverse concrete housings for the expansion joints which seal off the area beneath the sidewalks and entrap water which has percolated through the sand fill and must be disposed of through drainage pipes; and
 - Drip notches in the underside of deck cantilevers, strictly in compliance with the configuration and positions shown on the drawings. The careless omission of drip notches can lead to the defacement of the soffits and sides of bridge decks through runoff water laden with silt and other contaminants even before construction of the balustrades.
- h) Surface water runoff from access roads and the final road structure needs to be curtailed and slowed down by the strategic placement of energy dissipation structures.
- i) Where high speed travelling is possible, speed bumps/ berms must be placed across the road to slow moving vehicles. This is particularly important near villages, schools, clinics, etc.
- j) Adequate stormwater management must be incorporated into the design of the proposed structure in order to prevent erosion and the associated sedimentation of the system for the life of the structure. Particular attention must be given to the area adjacent to the road reserve to ensure that stormwater energy is dissipated and does not cause erosion in these areas.
- k) All crossing construction should be undertaken in the low flow season and must be completed within 6 months.
- l) Clearly demarcate sensitive areas into which no construction activities should encroach.

6.11 PRE-CONSTRUCTION DESIGN REQUIREMENTS AND PROJECT PLANNING

These specifications are intended to guide the engineers, scientists, surveyors, Contractors and other parties that will be involved in detailed planning for the project and act as a reference during the planning and design of the scheme. The objective is to operationalise the recommendations in the EIA that are to be addressed at the design phase of the project:

- a) No associated infrastructure may be located within 100 m of graves outside the full supply levels, and if unavoidable, these graves should be relocated.
- b) Sections of the power line that require bird diverters must be identified and bird diverters must be placed accordingly.

- c) The discharge point from the hydropower plant and discharge structure must be designed and positioned in a way that would minimise incision, erosion and changes to instream habitat structures.
- d) Stratification is predicted to occur in the proposed new dams, and the release of cold, anoxic bottom water will have a detrimental effect on water quality and aquatic life up to a distance of about 15 km downstream of the dam wall. To overcome this effect a multiple level outlet structure must be installed, with outlets at approximately 4 m intervals starting 6 m below the full supply level of the dam. Valves must be designed to ensure the immediate aeration of released water.
- e) An investigation on the necessity and design specifications for an eel-way should be undertaken and findings implemented.
- f) A noise baseline must be undertaken to establish existing ambient noise levels where sensitive receptors will be affected by construction. The baseline study should include recommended monitoring points for noise monitoring during the construction phase.
- g) Strategically placed sections of earth berm or equivalent noise attenuation barrier may be necessary along the edges of the respective road reserves to adequately protect noise sensitive areas as identified in the noise baseline study.
- h) Acoustic design should ensure that the overall generated noise level from the new hydropower plants does not exceed the limits specified for rural districts in SANS 10103:2008.
- i) An air quality baseline must be undertaken to establish existing PM10 and dust fallout levels where there are sensitive receptors. The baseline study should include recommended monitoring points for air quality monitoring and set limits for dust levels during the construction phase.
- j) A water quality baseline must be undertaken.
- k) Restrict disruptive construction activities to the drier months wherever feasible, in order to avoid sedimentation and erosion of wetland / riparian features associated with the activities due to the soils of the area being highly susceptible to erosion.
- l) Determine the locality of the registered landfill site and hazardous waste disposal facilities nearest to the construction site as well as the capacity and condition of these sites. If the landfill site(s) near the construction site is not registered, consider assistance to upgrade the site as part of the project.

6.11.1 Pipeline route realignments

- a) Pipelines should be realigned as far as possible to avoid any structures, graves, and to a lesser extent, assets (such as cultivated fields). It seems that there may be some scope to move the hydro pipeline and tunnel junction further west or south, where there are no dwellings, which is the socially preferred option.
- b) Pipelines should be realigned as far as possible to avoid cutting and destroying protected trees.

- c) The final alignment of pipeline routes must also take into consideration the sensitivity maps developed by the wetland and flora specialists (see **Appendix D**) in order to minimise footprints in sensitive areas.
- d) 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 and infrastructure should cross wetlands at right angles.

6.11.2 Power line route realignments

- a) It is recommended that Alternative 3 (furthest from the Falls) be selected but re-aligned to drop below the ridge line into the adjacent valley where it will have the valley sides to provide a backdrop and reduce the silhouette image against the skyline (see **Figure 2**).
- b) The final power line route should as far as possible avoid any structures, graves, and to a lesser extent, assets (such as cultivated fields); and must also take into consideration the sensitivity maps developed by the wetland and flora specialists (e.g. rocky outcrops and mountain bushveld habitat zones) (see **Appendix D**) in order to minimise footprints in sensitive areas. Support structures for power lines should not be placed within sensitive wetland / riparian and floral habitats.

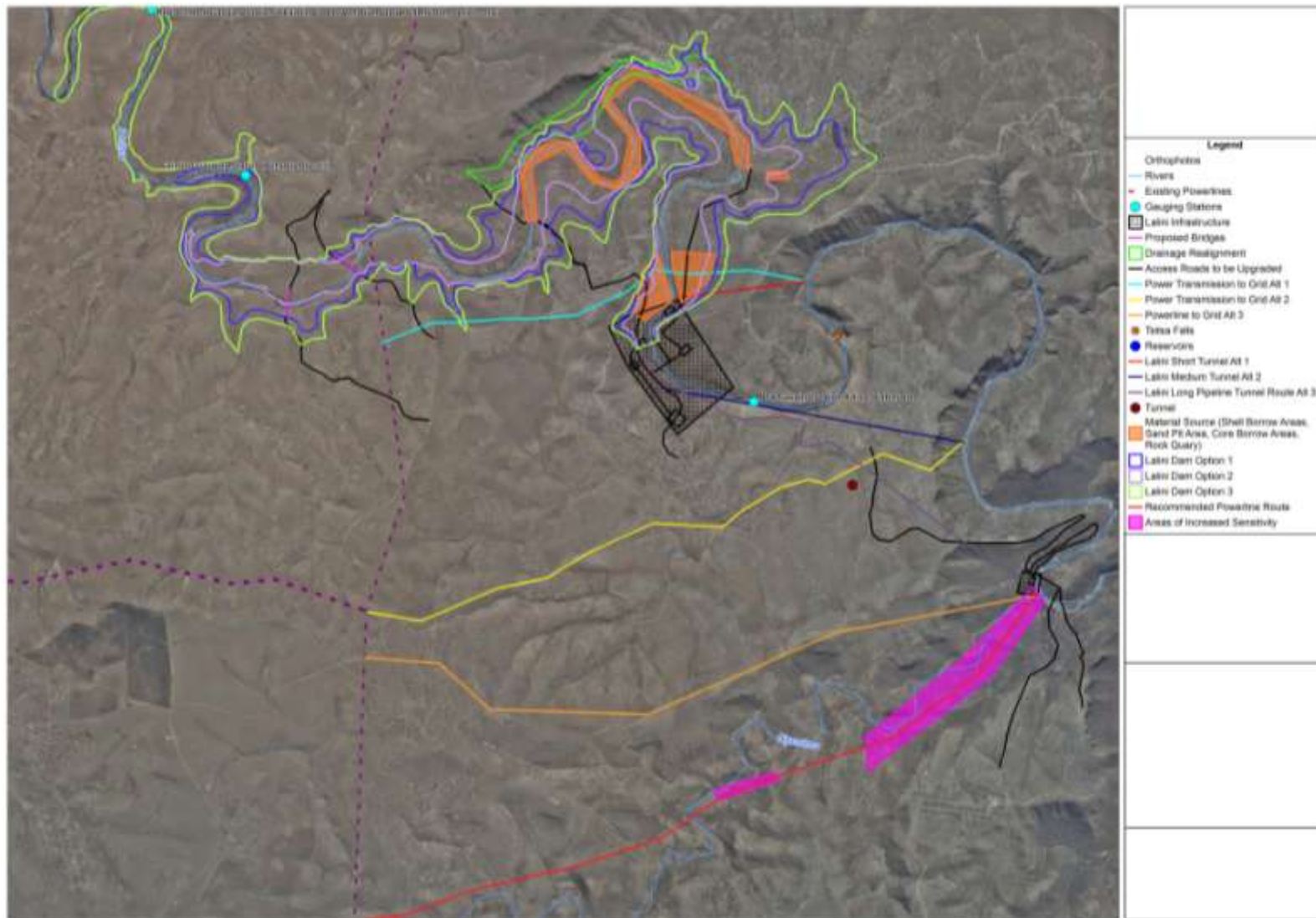


Figure 6-1: Recommended power line route alignment

6.12 AUTHORISATION OF LISTED ACTIVITIES

Any activity that requires authorisation in terms of the NEMA or any Specific National Environmental Management Act that is not included in the EIA must be authorised through a separate process (e.g. amendment application). This may for instance be required for project components which were not yet finalised at the time of undertaking fieldwork and compiling the EIA report, such as power lines to supply power during construction at Ntabelanga and Lalini Dam sites, as well as access roads to the borrow areas and quarries within the Ntabelanga Dam basin.

6.13 INVESTIGATIVE ACTIVITIES

Investigative activities include geotechnical and other pre-construction activities on site.

6.13.1 Arrangements for access on site

The DWS must establish a protocol for liaising with traditional authorities and for responding to all queries from occupiers of the land. A liaison officer must be nominated to be the direct contact with the traditional authorities during the pre-construction period.

The DWS Liaison Officer will be responsible for interacting with and obtaining consent from traditional authorities and occupiers of the land (where relevant) to access the project site. The period and conditions for access to the site(s) will be agreed formally with the traditional authorities and occupiers of the land (where relevant).

6.13.2 Identification of accredited site personnel

Each person required to be on site as a member of the investigating personnel must be issued with an identification card and will be required to carry this card on their person at all times as an identification document.

6.13.3 Access roads and access points

All personnel must make use of existing roads and tracks as far as possible.

6.13.4 Record-keeping

The DWS Liaison Officer will keep a record of all field visits and contacts with traditional authorities and occupiers of the land by investigating personnel.

6.13.5 Accommodation

Personnel accommodation must as far as possible be placed in an urban area or registered lodges.

6.13.6 Requirements for managing environmental impacts on site

Hydrocarbon wastes, accidental spills and hazardous wastes

Compliance with all national, regional and local legislation with regard to the disposal of hydrocarbons, chemicals, solvents and any other harmful and hazardous substances and materials must be ensured. All hazardous waste must be collected in receptacles located on a drip tray on site for disposal at a registered hazardous waste disposal site. Accidental chemical spills must be contained for cleanup and control by the supplier, or by a professional pollution control service provider. Fuel spill absorption kits must be available on site.

Vehicles and equipment must undergo regular inspection and maintenance to avoid fuel and oil leaks, as well as to remove combustible material that may be the cause of accidental fires. All areas from which surface water runoff could possibly be contaminated by oils, grease and fuel must be identified and made safe.

Water pollution control

No substance which may cause water pollution may be stored within the 1:100 year flood line, or within a horizontal distance of 100m (whichever is greater) of a watercourse, drainage line or identified wetland. No waste of any nature may be dumped into any watercourse, drainage line or wetland. Swimming, bathing, and the cleaning of clothing, tools or equipment in all watercourses, drainage lines and wetlands is prohibited.

Access to water for geotechnical drilling purposes

No water use, as per Section 21 of the National Water Act (Act No. 36 of 1998) (including any activities in wetlands), is permitted without the necessary authorisation. This authorization must be obtained by DWS.

Water for human consumption

Water for human consumption will be brought to site by the Contractor in a water tank and the water will be obtained from a potable source.

Fire prevention and management

No open fire is permitted in works areas or in camping areas and the collection on site of firewood or other fuel is strictly prohibited. Fires may only be lit in designated areas. Fire suppression equipment must be located at specific points in work areas, storage sites and field camps, as designated by DWS. The Contractor will ensure that specific staff undergo basic fire fighting training and place on record copies of certificates to this effect. The Contractor will ensure that all staff working on site have gone through fire danger awareness training before work on site can commence. The fire fighting equipment required on site is:

- Fire extinguishers (dry powder canisters) placed at storage, field camps and accommodation sites;

- A 500 litre water tanker with pump on a dedicated fire fighting bakkie; and
- Hand held equipment (fire beaters and Raco).

Protection of fauna

See **section 6.4**.

Protection of vegetation

See **section 6.3**.

Topsoil conservation

Topsoil is defined as the A Horizon which is the upper soil profile approximately 200 mm deep. The topsoil cleared for purposes of an investigation must be stock-piled separately from the sub-soils and replaced from where it was removed once investigations have been completed. After completion of drilling and excavation of trail pits the Contractor must rehabilitate the disturbed sites by replacing the topsoil and landscaping the area to control storm runoff.

Protection of cultural and heritage resources

See **section 6.5**.

Solid waste management

No dumping or littering must be allowed. Domestic and all other waste from any temporary accommodation area, from any storage area and from all work areas and drilling activities must be collected and disposed of at the nearest registered solid waste disposal facility. No solid waste may be burned on site. The Contractor must provide proof of landfill acceptance and waste receipt to DWS.

Toilet facilities

Contractors must provide at least one portable chemical toilet at each work area for every 30 workers at that site. Site toilets may not be located within the 1:100 year flood line, or within a horizontal distance of 100m (whichever is greater) of a watercourse, drainage line or identified wetland. Site toilets must be regularly maintained and cleaned so as to keep them in good, functional working order and in an acceptable state of hygiene. Drinking water facilities and hand washing facilities must be located conveniently near to site toilets. Toilets must be screened from view by means of shade cloth.

Infilling in river

Contractors may not make infillings by soil or any other material in a river or wetland for crossing or drilling purposes without prior authorisation.

Landscaping and rehabilitation

All test pits dug for investigation purposes must be properly filled in, compacted and covered with topsoil. 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.

Damage to property

Any damage caused to property must be reported immediately to the DWS Liaison Officer who will report it to the landowner and arrange for repairs to be done or for a claim for compensation to be lodged with the DWS. The cost of repairs or compensation for accidental damage will be for the account of the Contractor.

Health and safety specifications

The DWS Health and Safety Requirements shall apply to all Contractors. Informal fires should be prohibited.

7. RELOCATION POLICY FRAMEWORK

7.1 PURPOSE

The Relocation Policy Framework (RPF) directs attention to all of the aspects which must be considered when mitigating the impact of project implementation on people who are physically and directly affected by construction of the project. Project impacts include the need to relocate the following to make way for the new development:

- homes of individuals, families or communities;
- graves associated with families that must be relocated;
- religious and other sites used for cultural ceremonies and rituals;
- shops and other business premises;
- social services such as schools, clinics, hospitals and public buildings;
- access roads and streets;
- water sources and pipelines for domestic use and stock
- watering;
- power lines and electrical sub-stations;
- hazardous material such as cattle dips, stores for chemicals such as fertilizer; and soil contaminated by diesel and motor oil.

7.2 LEGISLATION AND POLICY

All relocation activities and other matters associated therewith must be planned and implemented strictly in accordance with the laws of the land. These activities must also comply with policies of the Department of Water and Sanitation in regards to at least the following:

- fairness and equity;
- transparency; and
- inclusiveness.

Best practice in relocating people who are displaced, either voluntarily or involuntarily, by an infrastructure project is to follow, where appropriate, the guidelines offered by bodies such as the World Bank and its affiliate the International Finance Corporation (IFC). As a minimum requirement, the people who are affected by having to be relocated must not be worse off than before the project was implemented.

7.3 FORMS OF MITIGATION

Various aspects of personal and community life are affected by project-related relocations and the most appropriate mitigation in each case can take different forms. In the first instance mitigation should be in the form of like-for-like. Only when this is not possible should other forms of mitigation be implemented. So for instance, a dwelling and all its facilities that has to be vacated should be replaced by an equivalent dwelling on an alternative piece of land. Where crops on the land are lost

this could be replaced with food or compensated in cash. The use of cash payments to mitigate the loss of physical and enduring assets should be avoided wherever possible.

All mitigation measures associated with the relocation of people and their activities from the project area must be implemented before the physical works comprising the project are commissioned. This implies that annuities are not tenable.

7.4 RELOCATION ACTION PLAN (RAP)

A RAP must be compiled according to this Policy Framework and be ready for implementation at the start of construction activities. Compilation of the RAP must follow the DWS policies noted in paragraph 7.2 and for this purpose stakeholder participation in detailed planning is imperative. The structures created for facilitating meaningful participation should comprise at least the following:

- Department of Water and Sanitation
- District and Local Municipalities
- Ward Councillor
- Traditional Authorities
- Headman

Responsibility for the administration of consultative structures lies with the Developer through the Implementing Agent and full records of all proceedings must be prepared and maintained. The outcome of consultations with the affected parties should be in the form of Social Compacts or “Project Policies”, signed off by representatives of the affected parties and by the Developer, in respect of the following:

(a) Relocation areas

Provision must be made for households, families, groups of families and perhaps communities to be relocated to areas which are socially and physically acceptable. Areas selected for relocation, the host communities, must be acceptable in the Integrated Development Plan (IDP) of the Municipality and be supported by the Traditional Authority.

Provision must be made for all the necessary municipal services such as roads, streets, storm water drainage, water supply and sanitation in the relocation areas.

(b) Dwellings and other Buildings

This component, conveniently referred to as the “Housing Policy”, must be supported by a comprehensive inventory of all dwellings and buildings that are affected. The inventory must include at least the following details: number of living rooms, total floor area under roof, type of roof covering, floor finishes, ceilings, water and electricity supply, out buildings, cooking facilities, storage facilities, animal enclosures and fencing.

Provision must be made to replace like-for-like and all replacement buildings and facilities must be professionally designed. Affected individuals must be offered maximum opportunity to exercise personal choice in matters such as floor plan, roof and floor coverings, and wall finishes (painting).

Similar arrangements must be made for replacing other buildings and facilities such as businesses, churches and clinics.

(c) Lands

Households who are relocated will most likely be reliant on a plot of land, some distance from their homestead, for the production of maize and other food crops. Provision must be made for the loss of crops on the land when relocation takes place and for the allocation by the Tribal Authority of an alternative piece of land to the household for its future use. This may be documented in the form of a Permission to Occupy (PTO).

Provision must be made for the alternative plot of land to be prepared for planting and food production.

(d) Graves

A Phase 1 Cultural Resource Impact Assessment was completed as part of the HIA Specialist Study. This information forms the basis of a Grave Relocation component of the RAP for which an accredited Principal Investigator (PI), normally a Professional Archaeologist, must be appointed. The PI will be responsible for obtaining all permits and authorizations to exhume graves and for their re-internment. The SAHRA must authorise the PI to undertake the work and will expect a full report at the completion of the project. The PI must obtain a permit for exhuming and reburial from the relevant Provincial Government authority, and consent from the relevant municipality and Traditional Authority for exhumations and reburials in their areas of jurisdiction.

The Graves Register compiled in the HIA must be used as the basis for detailed social consultations with the next of kin to obtain all the details necessary to obtain permission to relocate the graves. During such consultations the preferred site for re-internment of the grave contents will be determined by the next of kin. Care must be taken to confirm the locality of all graves in the Register and to ensure that all affected graves are on record.

Once grave relocation activities commence the Implementing Agent must procure the services of certificated Funeral Undertakers to make all funeral arrangements with the next of kin, obtain grave plots for reburials in a cemetery and attend to all other traditional and ritual ceremonies required by the next of kin.

Graves that are associated with households that have to be relocated must be given special attention. Some such graves will be within the footprint of the project and be included in the Heritage Impact Assessment. Other graves may be outside the footprint and will have to be given the same attention as those that are directly affected. The timing of mitigating the impact on all graves associated with households that have to be relocated must be scheduled together with the physical moving of the family, and be subject to close social consultation.

7.5 DECISIONS REGISTER

A Decisions Register must be established and maintained, and must be available to any member of the public who wishes to access it. The register should include all commitments made to stakeholders during the public participation process, which are recorded in the Issues and Responses Report.

8. MANAGEMENT AND MITIGATION PLANS FOR CONSTRUCTION

This Chapter provides specific and detailed management and mitigation plans for the construction phase of the project. Each management and mitigation plan deals with a specific construction or environmental aspect. The management and mitigations plans structure provides for a section that describes the purpose of the aspect, the specific components of the aspect, objectives and targets for each component and specific management and mitigation requirements.

Table 8-1 provides a summary of the identified management and mitigation plans and relevant components per management and mitigation plan.

Table 8-1: Management and Mitigation Plans

Management and Mitigation Plans
CHAPTER 8.1
Socio-economic management plan
Influx of job seekers
Formal employment opportunities to local individuals
Temporary loss of cultivated land
Temporary loss of grazing land
Access to resources
Integration with local communities
Physical splintering
Employment and skills development policy
Procurement policy
Exit Strategy
CHAPTER 8.2
Community Consultation and Disclosure
Community consultation and participation
Complaints management
CHAPTER 8.3
Construction site
Establishment of site office
Signage on site
Ablution facilities
Eating areas
Training and induction of construction staff
Handling and disposal of contaminated water
Hazardous materials storage
Vehicle and equipment refuelling and maintenance
Water conservation and recycling
Trench excavations and dewatering
Site clearance
Contractors camp and lay-down areas
Batching Plants
Roads and Access

Gates and fences
Site Closure
CHAPTER 8.4
Solid Waste Management
Domestic waste
Construction waste
Hazardous waste
CHAPTER 8.5
Visual Aesthetics
Visual impact of new dams, power lines and access roads
CHAPTER 8.6
Air Quality
Truck transport and road dust entrainment
Excavation and earthworks
Stockpiles and spoil dumps
Vehicle and machinery emissions
CHAPTER 8.7
Noise Control
General noise mitigation
Noise from plant and machinery
Noise from blasting
Noise from vehicles
CHAPTER 8.8
Traffic
Construction signage
Traffic movement of construction vehicles
CHAPTER 8.9
Water Management
General
Storm water runoff and discharge
Erosion protection
Floodlines
Proximity to rivers, streams and/or wetlands
Water abstracted from rivers/streams
River crossings/alteration of water courses
Crossing of aquifers
Pollution control
CHAPTER 8.10
Aquatic Ecosystem
Removal of riparian vegetation
Reinforcement and protection of downstream banks and streambed
Dam basin clearing
Maintenance of baseflows
CHAPTER 8.11
Natural Materials Sourcing and Earthworks/Stockpiles
Materials sourcing
Earthworks/stockpiles

CHAPTER 8.12
Topsoil management
Topsoil stripping
Topsoil stockpiling
Topsoil storage
CHAPTER 8.13
Spoil Management
Locating spoil disposal sites
Transporting spoil
CHAPTER 8.14
Fauna and flora
Protection of ecologically sensitive areas/ habitats and endangered fauna and flora
Weeds and alien vegetation
Animal and plant rescue and relocation
CHAPTER 8.15
Heritage
Protected heritage sites
Chance heritage finds
CHAPTER 8.16
Health and Safety
Safety of construction workers
Construction related illnesses
Disaster management
CHAPTER 8.17
Site Rehabilitation
Disturbed areas to be rehabilitated
Re-vegetation of disturbed areas
Rehabilitation and reinstatement of borrow pits, quarries and blasting areas
Rehabilitation of wetland and riparian areas
CHAPTER 8.18
Monitoring
Noise monitoring
Air quality monitoring
Water quality monitoring
Aquatic life monitoring
Rehabilitation monitoring
CHAPTER 8.19
Site Closure

Each management and mitigation plan includes objectives, targets and mitigation requirements. If the mitigation requirements are found to be insufficient to effectively mitigate potential negative impacts the Contractor may be instructed to prepare a detailed method statement to effectively mitigate potential negative impacts.

8.1 SOCIO - ECONOMIC MANAGEMENT PLAN

8.1.1 Purpose

Construction activities have the potential to impact on the social environment to a fairly large extent. This social management and mitigation plan ensures that construction activities are managed in such a manner that the positive impacts may be enhanced and the negative impacts are minimised as far as possible.

8.1.2 Components

The following components have been addressed in this social mitigation plan:

- a) Influx of job seekers.
- b) Formal employment opportunities to local individuals.
- c) Temporary loss of cultivated land.
- d) Temporary loss of grazing land.
- e) Access to resources.
- f) Integration with local communities.
- g) Physical splintering.
- h) Employment and skills development policy.
- i) Procurement policy.
- j) Exit Strategy.

a. Influx of job seekers

Objective

Manage the impact that the influx of job seekers might have on composition and functioning of the local community, with particular concern for the impact that these job seekers might have on the local residents' sense of safety and security.

Targets

- Establish an employment strategy that is known and communicated to potential job seekers.
- Prevent loitering and the construction of informal dwellings in the vicinity of the construction camp and sites.
- No construction personnel accommodation will be allowed on site.

Management and mitigation requirements

- Draw up a recruitment policy (see **sub-section h.**) in conjunction with the Traditional Authorities and Ward Councillors of the area and ensure compliance with this policy.
- The recruitment policy and employment procedures must be communicated to local stakeholders and potential job seekers.
- No onsite staff accommodation. Accommodation for construction workers must be in existing towns and villages. This should be done by recruiting a large number of

construction workers from communities within close proximity of the project site and transporting these workers to and from site on a daily basis.

- Ensure that construction workers are clearly identifiable. All workers should carry identification cards and wear identifiable clothing.
- Put procedures and regulations in place to control loitering and the construction of informal dwellings in the vicinity of the construction camp and sites.
- Provide communication channels and mechanisms through which local communities and construction workers can address their expectations and concerns.

b. Formal employment opportunities to local individuals

Objective

- Facilitate local employment opportunities.
- Ensure that formal employment opportunities benefit local residents and/or service providers.

Targets

- Employ people from the local communities as far as possible.
- Offer training opportunities to ensure sustainable skills development within the community.
- Provide for alternative employment opportunities through the development of portable and other skills;
- Ensure a more sustainable economic injection into the local community that can be sustained over the longer term.

Management and mitigation requirements

See **sub-sections h. and i.**

c. Temporary loss of cultivated land

Objective

Minimise the loss of cultivated land, thereby minimising the potential economic loss.

Targets

- Curb losses of cultivated land as a result of the physical space required for construction.
- Rehabilitation of impacted cultivated land to its original standard as it was before the commencement of the construction phase or to an acceptable condition, as defined in the rehabilitation specifications (see **section 8.17**).

Management and mitigation requirements

- The temporary loss of cultivated land should be included in the negotiation process with the landowner/occupier of the land.

- The area outside of the dam basin, as well as all pipeline construction servitudes should be rehabilitated to the same condition as prior to the construction activities or to an acceptable condition, as defined in the rehabilitation specifications (see **section 8.17**).

d. Temporary loss of grazing land

Objective

Minimise the loss of grazing land and other resources, thereby minimising the potential economic loss for communities.

Targets

- Rehabilitate impacted grazing land outside the dam basin to its original or to an acceptable condition, as defined in the rehabilitation specifications (see **section 8.17**).

Management and mitigation requirements

- Grazing areas outside the dam basin should be rehabilitated to their original or to an acceptable grazing condition (as defined in the rehabilitation specifications, see **section 8.17**) to ensure that cattle can continue to graze in the area once they are returned to the area.
- Where land cannot be rehabilitated within a reasonable period of time ensure that stock feed or an acceptable alternative is provided in consultation with the relevant consultative structures.

e. Access to resources

Objective

Minimise disturbance to communities livelihoods by ensuring communal resources are accessible.

Targets

Ensure continued access to resources such as water and medicinal plants.

Management and mitigation requirements

- Investigate and consult local communities on the need to provide suitable hard access points around the dam basin for people and animals.
- Consult traditional healers, herbalists, traditional doctors and elderly people of the area to ensure that any lost access to natural resources is restored to former levels.

f. Integration with local communities

Objective

Minimise potential conflict and possible health risks between the local residents and the construction workers.

Targets

- Controlled access at the construction site.
- Empowering local females to reduce their vulnerability.
- Ensure that, at all times, people have access to their properties as well as to social facilities such as schools, churches, transport and shops. Where construction will obstruct existing access, be sure to allow for alternative temporary access routes.

Management and mitigation requirements

See **section 8.2**.

g. Physical splintering

Objective

Ensuring the safety of community members.

Targets

- Providing a safe passageway for community members through or around the site.
- Fencing of areas deemed necessary by the Contractor to be addressed by means of a **Method Statement** approved by the Engineer.

Management and mitigation requirements

- Clearly mark any hazardous areas and regularly monitor these areas to ensure that people and animals avoid these areas.
- Fence off all construction sites and control access to these sites.

h. Employment and skills development policy

Objective

Maximise employment opportunities and skills development for local communities.

Targets

- Align employment opportunities to the unemployed.
- Promote gender inclusivity and equity.

Management and mitigation requirements

- Draw up a recruitment policy in conjunction with the Traditional Authorities and Ward Councillors of the area and ensure compliance with this policy.
- Communicate employment procedures / policy to local stakeholders, especially community representative organisations
- Communicate the limitations of opportunities created by the project through the Traditional Authorities and Ward Councillors.
- Local residents should be recruited to fill semi and unskilled jobs.
- Women should be given equal employment opportunities and encouraged to apply for positions.

- A skills transfer plan should be put in place at an early stage and workers should be provided the opportunity to develop their skills which they can use to secure jobs elsewhere post-construction.
- Ensure that strategies are put in place to monitor and prevent child labour from emerging in the area.

i. Procurement policy

Objective

Implement fair procurement policies.

Targets

- Comply with procurement policies.
- Promote business opportunities for local communities.

Management and mitigation requirements

- Ensure that the appropriate procurement policies are put in place and closely followed.
- Procurement policies should promote the use of local business, where applicable.
- Any contravention of the procurement policies must be swiftly, transparently and appropriately dealt with.

j. Exit Strategy

Objective

- To ensure that the withdrawal of workers and the Contractors from the project site is adequately planned and managed.
- To identify potential impacts (both negative and positive) resulting from the exit of workers and the contractor and develop appropriate mitigation measures.
- To ensure that all the post-construction impacts are adequately addressed.

Target

- Drafting of an Exit Policy document
- Implementation of strategies.

Management and mitigation requirements

The Contractor should prepare an Exit Policy document.

8.2 COMMUNITY CONSULTATION AND DISCLOSURE

8.2.1 Purpose

The community consultation process should ensure an ongoing process of community participation that should run in parallel with the activities during the pre-construction and construction phases. This could be achieved by the formation of a committee to inform and monitor the planning and implementation process.

8.2.2 Components

- a) Community consultation and participation.
- b) Complaints management.

a. Community consultation and participation.

DWS will identify and maintain open liaison channels throughout the construction phase to disseminate information about the project and ensure that all queries and/or complaints from affected parties are addressed with the shortest possible delay.

Objectives

- Maintain open communication channels between local communities, DWS, Contractors and construction workers.
- Promote good relations.
- Ensure community participation is gender inclusive.

Targets

Establish formal communication channels (e.g. through a committee(s)) to disseminate all relevant information to affected parties and receive feedback from those parties.

Management and mitigation requirements

- Provide communication channels and mechanisms through which local communities and construction workers can address their expectations and concerns.
- Establish channels of communication between local communities and Contractors to ensure that construction workers behave in a manner acceptable to these local communities.
- Encourage local people to report any suspicious activity associated with the construction sites.
- Appoint a Professional Service Provider to facilitate independent consultative structures (see **Chapter 7**), consisting of representatives of the Traditional Authority, municipalities, ward councillors and communities to address any concerns or grievances that community members may have regarding the project during construction.

- Ensure that the Decisions Register is maintained, and is available to any member of the public who wishes to access it.
- Alert local businesses to the fact that with the arrival of construction workers the population of the area will increase and they are likely to be faced with a higher demand and will need to purchase sufficient stock.
- Monitor the effect that construction is having on infrastructure on a regular basis and immediately report any damage to infrastructure to the relevant authority to carry out maintenance or repairs.
- Where damage has been reported regular follow-ups are required to ensure rapid repair.
- Provide swift and honest feedback in response to all queries.
- Sensitise construction workers from outside the area to the traditions and practices of local communities.
- Ensure that all consultation is gender inclusive.
- Prioritise gender inclusivity and equity in access to resources, goods, services and decision making with the aim of empowering women.
- Prioritise and articulate gender inclusivity and equity in the project documents by including specific strategies and guidelines for implementation.
- The project documents should also include clear mechanisms through which the actual implementation of the activities and the impact on the ground can be monitored and evaluated.
- Factors such as culture should be considered when planning for gender activities since they play a great role in influencing gender relations.
- In implementing the project consider the gender equity objectives of the Food and Agricultural Organisation (FAO). These objectives to be obtained by 2025 include.
 - “1. *Women participate equally with men as decision-makers in rural institutions and in shaping laws, policies and programs.*
 2. *Women and men have equal access to and control over decent employment and income, land and other productive resources.*
 3. *Women and men have equal access to goods and services for agricultural development and to markets.*
 4. *Women’s work burden is reduced by 20% through improved technologies, services and infrastructure.*
 5. *Percentage of agricultural aid committed to women/gender-equality related projects is increased to 30% of total agricultural aid’* (Food and Agricultural Organization of the United Nations, 2012, pp. 4-5).
- An important aspect of programme design is to gain an understanding of the differing roles, responsibilities, capacities, and constraints of women and men in the region.

b. Complaints management

Objectives

-
- To establish and maintain a system of records which provide full documentation of complaints handling.
 - To timeously and effectively address all complaints received.
 - To timeously inform affected parties of disruptive activities.

Targets

- Establish processes and procedures to effectively address all complaints received.
- All complaints will be acknowledged within 28 days of receipt.
- Respond effectively to all complaints received within 28 days, unless additional information and/or clarification are required.

Management and mitigation requirements

- A formal accessible grievance procedure should be implemented and communicated to communities.
- Address all grievances swiftly, in a fair and transparent manner.
- Develop a grievance procedure to specifically address gender matters.
- The EER shall open and maintain a Complaints Register and an Incidents Register in which all complaints or incidents received from the community must be recorded. The following information must be recorded in the Complaints Register:
 - The name and contact detail of the complainant (if not anonymous).
 - The date, time and nature of the complaint.
 - The response and investigation undertaken.
 - Which actions were taken and who the person responsible for the action was.
- The following must be recorded in the Incidents Register:
 - The name of the person/s involved in the incident.
 - The date, time and nature of the incident.
 - The response and reason for the incident.
 - The actions that were taken.
- If the construction staff is approached by the community they will be polite and courteous and assist them with locating the relevant personnel who will deal with the complaint.
- Affected parties will be informed in writing of predictable disruptive activities at least 24 hours before hand. This can take place by way of leaflets and must include the contact information for the Engineer and the Contractor.

8.3 CONSTRUCTION SITE

8.3.1 Purpose

This management and mitigation plan defines the establishment and management of the construction site(s) to prevent or minimise environmental impacts these might cause. This management and mitigation plan applies to the construction site at the Ntabelanga Dam as well as the construction site at Lalini Dam.

8.3.2 Components

The plan is made up of the following components:

- a) Establishment of the site office.
- b) Signage on site.
- c) Ablution facilities.
- d) Eating areas.
- e) Training and induction of construction staff.
- f) Handling and disposal of contaminated water.
- g) Hazardous materials storage.
- h) Vehicle and equipment refuelling and maintenance.
- i) Water conservation and recycling.
- j) Trench excavations and dewatering.
- k) Site clearance.
- l) Contractors Camp and lay-down areas.
- m) Batching Plants.
- n) Roads and Access.
- o) Gates and fences.
- p) Site closure.

a. Establishment of the site office

Objective

To minimise impacts associated with the establishment, operation and decommissioning of the site office.

Target

Effectively located site office(s).

Management and mitigation requirements

- Limit the footprint area of all construction activities to what is absolutely essential in order to minimise the loss of clean water runoff areas and the concomitant recharge of streams in the area.
- The Contractor shall produce a site plan showing the positions of all buildings (e.g. site office and workshops), vehicle wash areas, fuel storage areas, stockpile areas, and other infrastructure, the extent of impact, norms and standards for

- compliance and rehabilitation standards for the approval of the Engineer prior to the establishment of the site.
- The site office should as far as possible be located in an area which has already been cleared or disturbed by previous human activity.
 - Materials, soil stockpile areas, fuels, chemical storage areas, concrete batching areas, and vehicle maintenance areas shall be located away from environmentally sensitive areas and protected from Storm water runoff, fire, and access by unauthorised persons. Inert material should be stored above the 1:20 year floodline, offices above the 1:50 year foodline and all hazardous material and activities above the 1:100 year floodline.
 - The placement of buildings and equipment will be done to minimise the footprint and visual impact of the sites.
 - Down-lighting will be used at night and the Contractor shall ensure that lighting on site does not interfere with road traffic or cause a reasonably avoidable disturbance to the surrounding community or other users of the area.
 - Large (trunk diameter 100 mm or more) indigenous trees within the confines of the site that will be retained are to be adequately protected and indicated on the construction layout maps.
 - Vehicles and equipment shall undergo regular maintenance to identify and remedy fuel and oil leaks.
 - Appropriate fire suppression equipment and trained personnel shall be available on-site throughout construction activities. In particular, the Contractor will ensure that specific staff undergo basic fire fighting training and place on record copies of certificates to this effect. The Contractor will ensure that all staff working on site have gone through fire danger awareness training before work on site can commence. The fire fighting equipment required on site is:
 - Fire extinguishers (dry powder canisters) placed at storage, field camps and accommodation sites;
 - A 500 litre water tanker with pump on a dedicated fire fighting bakkie; and
 - Hand held equipment (fire beaters and Raco).
 - Locate and clearly indicate convenient access routes, temporary loading and packing areas, and turning circles so that vehicle movement can be confined to these areas.
 - Locate temporary waste bins and skips so that they are easily accessible for removal.
 - Waste bins and skips shall have lids (Waste Management System Method Statement shall be submitted for approval prior to start of construction). The Contractor's representative responsible for implementation shall be a registered professional engineer.
 - All informal fires in the vicinity of construction areas should be prohibited to prevent impacts on the riparian vegetation and stream substrate.

b. Signage on site
Objective

To ensure safety of workers and the public.

Targets

No accidents or loss of life.

Management and mitigation requirements

- Entrances to the construction site must have signs and other control measures restricting access to the public.
- All entrances to the construction site must have a site layout plan.
- All borrow areas and quarries must be demarcated;
- Access points to all restricted areas (e.g. the batching plant, waste storage and transfer areas, areas where any hazardous substances are stored and lagoons) must be signed indicating the type of Personal Protective Equipment and training required.
- No under 16 year olds are allowed on site unless in a bus and under the supervision of the Contract Manager.
- Clearly demarcate ecologically sensitive areas through the use of signage and marked boundaries, and restrict access thereto.
- The ECO has the right to prescribe any additional signage required.

c. Ablution facilities

Objective

To ensure that where ablution facilities are supplied that the facilities comply with norms and standards.

Targets

- Sufficient ablution facilities supplied at all construction sites; and
- Ablution facilities comply with applicable norms and standards.

Management and mitigation requirements

The Contractor must provide ablution facilities for the construction staff. The following should be taken into consideration for the location and management of ablution facilities:

- Appropriate sanitary facilities must be provided and all waste removed to an appropriate waste facility.
- Ablution facilities provided will include shelter, toilets, and washing facilities.
- Preference should be given to minimising septic tank facilities and optimising above ground effluent management systems, as well as water conservation urinals.
- Toilets will be provided at the preferred ratio of one toilet per 15 workers, but not less than one toilet per 30 workers.
- Sanitation facilities shall be located within 100 m of any point of work, but not closer than 32 m from any water body.

- Only approved portable chemical toilets will be provided at work areas in residential areas.
- Ablution facilities provided shall be maintained in a hygienic state and serviced regularly to ensure proper operation.
- All spillage shall be reported to the Engineer and in excess of 25 l to the DEA, with immediate remediation.
- The contents of chemical toilets will be removed to an approved disposal site – no discharge into the environment or burying of sewage must be allowed.
- The toilets will be serviced and cleaned on the last construction day before the builder's holiday.
- Personnel washing areas shall be placed and constructed in such a manner so as to ensure that no pollution occurs, including groundwater pollution.

d. Eating areas

Objective

The Contractor must ensure that the people working on the project have a safe area to eat their meals.

Target

All people involved in the project are to be well informed of the designated eating areas.

Management and mitigation requirements

- The Contractor shall designate eating areas for all his staff within the Construction Site;
- No eating of meals shall take place outside these designated areas without the approval of the Engineer;
- Waste bins with lids shall be provided and emptied regularly; and
- Temporary shade must be provided.

e. Training and induction of staff

Objective

The Contractor must ensure that all people involved in the project (including sub-contractors, visitors, inspectors, casual workers, etc.) are aware of and familiar with the environmental requirements for the project. A register must be kept of all persons accessing the site and their induction training, including date. Training is valid for a period of one year. Prior to site establishment the Contractor must provide a Method Statement demonstrating adequacy of training material and the means of assessing effectiveness (e.g. test).

Target

All people who are involved with the project are aware of the environmental requirements for the project.

Management and mitigation requirements

The Contractor has the responsibility to provide the site foreman with environmental training and to ensure that he is capable of passing the information to all the construction staff. Training of the construction staff shall include:

- How construction activities can impact on the environment and what can be done to mitigate such activities;
- Possible disturbance to birds, animals, and reptiles, and their respective habitats shall be minimised;
- Construction staff shall be made aware of the appearance of possible archaeological or historical objects and to notify the EER if such an object is found;
- Management and minimising of waste;
- Maintenance of equipment to prevent the accidental discharge or spillage of fuel, oil, lubricants, and other chemicals;
- Responsible handling of chemicals and spills;
- Emergency procedures and incident reporting;
- Making staff aware of the dangers of fire during regular tool box talks;
- Local traditions and practices;
- Regularly reinforce, amongst construction workers, the importance of respecting local traditions and practices through toolbox talks. In this regard encourage the participation of locally recruited construction workers to assist in reinforcing this point;
- Code of Conduct; and
- Training must include a written/verbal test.

The ECO will monitor the performance of the construction staff to ensure that the points that were relayed during their training and induction have been understood and are being followed. If required, a translator may be requested to explain aspects of the environmental requirements or acceptable social behaviour that are unclear.

The Contractor will ensure that construction staff are aware of the following rules:

- No alcohol or drugs are allowed on site;
- No firearms allowed on site;
- Pets are not allowed on site;
- Firewood may not be harvested from the site or from adjacent areas;
- Trespassing on neighbouring properties is forbidden;
- Cigarette butts will not be disposed of in the bushland or grassland areas; and
- Fines shall be implemented for transgressions.

f. Handling and disposal of contaminated water

Objective

To ensure the handling and disposal of contaminated water is done within the framework of applicable acts and regulations.

Targets

- No discharge of polluting elements to any Storm water drain, stream or river; and
- A 100% compliance to relevant standards.

Management and mitigation requirements

- No discharge of pollutants such as cement, concrete, lime, chemicals, fuels, or oils will be allowed into any water resource;
- Grey water from kitchens, showers, and/or sinks shall be discharged in accordance with NEMWA Waste Regulations and DWA General Discharge Standards;
- Runoff from fuel depots, workshop areas, wash bays, and concrete swills shall be treated as hazardous liquid waste in accordance with the NEMWA Norms and Standards;
- Wash areas shall be placed and constructed in such a manner so as to ensure that no pollution occurs, including groundwater pollution; and
- Contaminated water must be stored in accordance with NEMWA Norms and Standards and removed by tanker to a licensed facility.

g. Hazardous materials storage

Objective

To ensure that hazardous materials storage is effective and compliant with national, provincial and local regulatory requirements.

Target

Ensure 100 % compliance to national, provincial, and local regulatory requirements.

Management and mitigation requirements

Hazardous materials include diesel, petroleum, oil, bituminous products, cement, solvent-based paints, lubricants, explosives, drilling fluids, pesticides, herbicides and Liquid Petroleum Gas (LPG). Material Safety Data Sheets (MSDSs) shall be available on site for all hazardous substances to be used on site.

- Materials storage areas will not be allowed in close proximity to ecologically sensitive areas;
- Materials storage areas shall be sited outside the 1:50 year flood line of watercourses;
- Storage areas shall be roofed with impervious material;
- Hazardous chemicals or potentially hazardous chemicals used during construction shall be stored in secondary containers and all relevant MSDSs shall be available on site;
- The relevant emergency procedures relevant to particular chemicals used on site, as per the MSDSs and suppliers guidelines, will be followed in the event of an emergency;

- The Contractor shall prevent discharge of any pollutants such as cement, lime, chemicals, fuels, and oils into any water sources and adequate Storm water control measures will be implemented where these substances are handled;
- Explosives storage shall comply with the Explosives Act;
- Ensure that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakage.

h. Vehicle and equipment refuelling and maintenance

Objective

- Ensure that vehicle, plant and equipment refuelling is practiced in such a manner that no secondary pollution or emergency situation is created.
- Ensure that vehicles and equipment are properly maintained.

Targets

- Storage of flammable material shall be done according to prescribed standards at all times.
- Refuelling of vehicles and equipment shall be done according to prescribed standards at all times.
- Vehicles and equipment function at their optimum at all times.
- Regularly inspect all vehicles for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into topsoil.

Management and mitigation requirements

- Fuel (petrol and diesel) may be stored on site provided that the Norms and Standards are complied with.
- Ensure all construction equipment and vehicles are properly maintained at all times.
- In the event of a vehicle breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced near the surface to prevent ingress of hydrocarbons into topsoil and subsequent habitat.
- Washing of tools and/or equipment shall take place at dedicated washing facilities within the construction camps. Suitable wash facilities must be provided at all construction camps and all wastewater must be treated before discharge into any natural watercourse.
- Oily water and contaminated water arising from vehicle re-fuelling yards, vehicle-washing facilities and vehicle maintenance yards will be directed to an impermeable oil/water interceptor. Separation tanks and oil interceptors will be inspected on a weekly basis. Hydrocarbons collected from the oil interceptor will be collected and pumped to a storage tanker for disposal or recycling at an appropriate facility. The Contractor shall set up a waste register and log the volumes of all contaminated water removed from site for disposal. The Contractor shall obtain a waste disposal certificate from the registered general/hazardous waste landfill site or recycling company.

- Oil separators will be installed in the drainage systems of diesel and oil storage facilities, and will be connected to a discharge system. A sketch of the discharge system comprising relevant data (depth, dimensions, etc.) must be provided by the Contractor on site for any required intervention or maintenance operation. These facilities will be inspected regularly by the Environmental Officer to ensure they are functioning correctly.

i. Water conservation and recycling

Objective

To minimise water use and maintain sustainability.

Targets

- To ensure regular maintenance of all pipes and taps.
- To ensure water use is kept within allocated water limits.

Management and mitigation requirements

- The Contractor will take all practical measures to minimise water use on site and will immediately attend to any wastage. This will include monitoring of pressure pipes for leaks, closing taps when not in use, efficient use of water for washing of plant, recycling water as much as possible etc. The quantity of water used for construction purposes must be monitored.
- Water derived from or generated through construction related activities that becomes contaminated must be treated to ensure compliance with Water Quality Monitoring Specifications before being released back into the environment. The Contractor shall re-use or recycle as much of this water as possible. Water whose quality meets these standards and is approved by the Engineer may be used for the irrigation of rehabilitated areas. Irrigation of agricultural lands shall not be permitted with water impacted by construction activities.

j. Trench excavations and dewatering

Objective

Responsible excavation and dewatering of trenches

Targets

No contamination due to ingress of water, materials or substances into trenches.

Management and mitigation requirements

- The ingress of surface water into the trench excavation must be prevented with the placement of suitably constructed berms or drainage lines on either side of the trench. Topsoil or other excavated material shall be prevented from being washed away or allowed to contaminate the storm water.
- Trenches shall be re-filled to the same level and state of compaction as the surrounding land surface to minimise erosion. Excess soil shall be spoiled or stockpiled in accordance with the specifications.

- Water that has entered the trench or is found naturally underground must be removed from the working area in order to complete the safe and effective laying of the pipeline. Such water may not be pumped to or be allowed to drain directly into a water course, drainage line or wetland. Water removed from trenches during dewatering operations must be pumped at low pressures into suitable settling ponds for treatment (where necessary) to attain compliance to the water quality concentration limits (**Table 8-4**) prior to release from site. The water may not be used to irrigate a landowner's crops.
- The Contractor shall prevent hydrocarbon spillage within the trench. All visible hydrocarbon spillages shall be skimmed off or removed by suitable methods before dewatering and shall be disposed of in terms of the specifications for waste management.
- Pump attendants must be designated and trained to manage pumps in a responsible manner, ensuring no environmental degradation occurs whilst maintaining the pumps efficacy. All pumps must be fitted with drip trays and be securely placed to prevent the pumps from accidentally falling into the trench. Should pumps leak any hydrocarbons, the pumps will immediately be switched off and receive the appropriate off-site maintenance. All pumps will be operated and maintained in a good working condition at all times.

k. Site clearance

Objective

Limit extent of areas cleared for construction purposes.

Minimise impacts associated with site clearance.

Target

Minimal impacts associated with site clearance.

Compliance with SANS standards for site clearance (SANS 2001-BS1:2008).

Management and mitigation requirements

- Contractors may clear vegetation for storage and camp areas as approved by the Engineer. No plants or trees outside of the designated camp or work areas may be disturbed, defaced, destroyed or removed.
- Restrict vegetation clearance of the construction sites to the drier months to decrease the potential for erosion caused by rainfall.
- Ensure that good construction practice is followed in terms of the clearing of areas, including use of water control berms and clearing footprint areas that are as small as possible.
- No areas falling outside of the study area may be cleared for construction purposes.
- Adhere to SANS standards for site clearance (SANS 2001-BS1:2008).
- Any plants or trees of value, close to the construction servitude that will remain, should be marked clearly and must not be disturbed, defaced, destroyed or

removed for the duration of the Contractor's presence on site, unless otherwise specified by the ECO through the Engineer.

I. Contractors construction camp and lay-down areas

Objective

To ensure all lay down areas are allocated designated areas.

Target

To ensure all lay-down areas are restricted to designated areas.

Management and mitigation requirements

Same as for site establishment (see **sub-section a.**).

m. Batching plants

Objective

To assign designated areas for batching plants.

Targets

- To prevent sludge runoff into the natural water system.
- To prevent contamination of the natural water system.

Management and mitigation requirements

Locate as per site establishment layout plan and waste management requirements.

n. Roads and access

Objective

To prevent traffic congestion.

Target

To ensure all construction vehicles use approved roads.

Management and mitigation requirements

- Develop all permanent and temporary roads and access routes as indicated on the approved site establishment plan to the relevant standards and codes of practice.
- Route re-alignments must be considered to avoid significant vegetation specimens and communities, natural features and sites of cultural and historical significance identified by the EER or Heritage specialist. These deviations must be approved by the Engineer.
- Minimise the construction of access and haul roads by effective planning.
- Any additional routes and turning areas required by the Contractor must be approved by the Engineer in consultation with the ECO, indicating the position and extent of the proposed route/area.

- Minimise routes through drainage lines and riparian zones wherever possible. Where access through drainage lines and riparian zones is unavoidable construction should be perpendicular to the drainage line.
- Define speed limits at all times on site roads.
- Allow for safe pedestrian crossing where necessary.
- Maintain all access routes and roads adequately in order to minimise erosion and undue surface damage. Repair rutting and potholing and maintain Storm water control mechanisms.
- Runoff from roads must be managed to avoid erosion and pollution.
- Maintain all construction related roads in a functional manner.
- The Engineer will indicate whether or not it is necessary to keep a photographic record of private roads used to access work areas.

o. Gates and fences

Objective

To ensure existing and construction specific fencing and gates are maintained in good order.

Target

- Existing private fencing and gates maintained in pre-construction condition.
- Sensitive areas protected from construction activities.

Management and mitigation requirements

- Repair any damage caused to existing private property, fences and gates.
- Respect the open or closed status of gates for the duration of the construction period.
- Small sensitive areas may be fenced where necessary, as the work site progresses.
- Limit clearing for fencing to the removal of trees and shrubs within one (1) m of the fence line. No removal of the grass cover or topsoil is to occur within this width.
- Retain temporary fencing and/or gates in position until replaced by permanent fencing or until the Engineer directs their removal.
- If temporary fencing and or gates are removed temporarily for the execution of any part of the Works then these must be reinstated as soon as practicable by the Contractor.

p. End of Construction Site Closure

Objective

To have an appropriately cleared and rehabilitated site after construction.

Target

- Properly cleared construction site.
- All rehabilitation measures have been implemented successfully.

Management and mitigation measures

In the event of temporary or permanent site closure the Contractor shall check the site, ensure that the items included in a comprehensive site closure checklist to be issued to the Contractor by the Environmental Officer are addressed.

Fuels / flammables / hazardous materials stores

- Ensure fuel stores are as low in volume as practicable.
- There are no leaks.
- The outlet is secure and locked.
- The bund is empty.
- Fire extinguishers are serviced and accessible.
- The area is secure from accidental damage through vehicle collision.
- Emergency and contact numbers are available and displayed.
- There is adequate ventilation in enclosed spaces.
- There are no stores or containers within the 1:50 year flood line.

Safety

- Site safety checks have been carried out in accordance with the Occupational Health and Safety Act (No. 85 of 1993) prior to site closure.
- That there is an inspection schedule and log for use by security or contracts staff.
- All trenches and manholes are secured.
- Applicable notice boards are in place and secured.
- Emergency and Management contact details are prominently displayed.
- Security personnel have been briefed and have the facilities to contact or be contacted by relevant management and emergency personnel.
- Night hazards such as reflectors, lighting, traffic signage etc have been checked.
- Fire hazards identified and the local authority notified of any potential threats e.g. large brush stockpiles, fuels etc.
- Pipe stockpiles are wedged / secured.
- Scaffolds are secure.
- Structures vulnerable to high winds are secured.

Erosion

- Wind and dust mitigation measures are in place.
- Excavated and filled slopes and stockpiles are at a stable angle and capable of accommodating normal expected water flows.
- Re-vegetated areas have a water schedule and the supply to such areas is secured.
- There are sufficient retention ponds or channels in place.

Water contamination and pollution

- Hazardous fuel stores are secure.

- Cement and materials stores are secure.
- Toilets are empty and secured.
- Refuse bins are empty and secured.
- Bunding is clean and treated with appropriate material that will absorb/ breakdown and where possible be designed to encapsulate minor hydrocarbon spillage.
- Drip trays are empty and secure.

8.4 SOLID WASTE MANAGEMENT

8.4.1 Purpose

The inappropriate handling and disposal of solid waste materials can impact on both human safety and risk contamination of the natural environment. This management and mitigation plan covers the handling and disposal of solid waste, including domestic, construction, and hazardous waste, generated during construction. The general waste management principles of prevent, minimise, recycle or re-use, with disposal as a last option will apply. Only permitted, registered and municipal landfills will be considered as options for disposal of waste. The Contractor must compile a Waste Management Method Statement that identifies the registered professional Engineer that is responsible for the management of waste on the site.

8.4.2 Components

The plan is made up of the following components:

- a) Domestic waste.
- b) Inert waste.
- c) Hazardous waste.

a. Domestic waste

Objective

To ensure that all domestic waste generated during construction is disposed of at a municipal waste disposal facility.

Target

Domestic waste is disposed of at a municipal waste disposal facility.

Management and mitigation requirements

- A refuse control system will be established for the removal of domestic waste.
- The Contractor will ensure that the site is kept clean and tidy at all times.
- Littering will not be allowed on site.
- Dumping of waste will not be allowed.
- The excavation and use of rubbish pits on site is forbidden.
- Burning of rubbish is forbidden.
- Timber, metal, oil, paper, bricks, tyres, batteries and any other major recyclable wastes will be stored in safe, secure areas.
- A separate oil container will be used to ensure that oil wastes are contained.
- Maintenance and domestic refuse (e.g. scrap metal, packaging materials, etc) will be collected in appropriate bins for recycling or sent to a landfill site at regular intervals for disposal.
- All chemical drums will be transported to a designated and bunded area when empty before appropriate disposal.
- All vehicles transporting any project related waste must have a tracker installed.

- Certificates of safe disposal must be provided for every load and must include the date and vehicle registration number.

b. Inert waste

"inert waste" means waste that:

- (a) does not undergo any significant physical, chemical or biological transformation after disposal;
- (b) does not burn, react physically or chemically biodegrade or otherwise adversely affect any other matter or environment with which it may come into contact; and
- (c) does not impact negatively on the environment, because of its pollutant content and because the toxicity of its leachate is insignificant and which include discarded concrete, bricks, tiles and ceramics, discarded glass and discarded soil, stones and dredging spoil, as listed in Schedule 3 of the Act.

Objective

To ensure that inert waste is responsibly disposed of.

Targets

Responsible reuse and/or disposal of inert material or waste.

Management and mitigation requirements

The Contractor must compile a Method Statement for the management of inert waste.

The Method Statement will include (*inter alia*) the following provisions:

- Construction waste material will be recycled or re-used (e.g. for levelling or as cover material in landfill sites) in the construction process as far as possible.
- Regular clearing and disposal of spoil material.
- Where waste is to be transported by truck, it will be covered appropriately when travelling through inhabited areas.
- All vehicles transporting rock/spoil from the Lalini hydropower tunnel must have a tracker installed.
- Construction-related waste must not be placed in the vicinity of any riparian areas.

c. Hazardous waste

Objective

To ensure that hazardous waste, such as bitumen, tar, oil, etc. is disposed at an appropriate registered waste disposal facility.

Target

Hazardous waste will always be disposed of at a registered waste disposal facility for toxic/hazardous material.

Management and mitigation requirements

Oil and lubricant waste management:

- Used oil, lubricants, and cleaning materials from the maintenance of vehicles and machinery shall be collected in a holding tank and sent back to the supplier.
- 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, as this may end up in the aquatic systems due to run-off.
- Water and oil will be separated in an oil trap. Oils collected in this manner will be retained in a safe holding tank and removed from site by a specialist oil recycling company for disposal at approved waste disposal sites for toxic/hazardous materials. Oil collected by a mobile servicing unit will be stored in the service unit's sludge tank and discharged into the safe holding tank for collection by the specialist oil recycling company.
- Dumping of waste will not be allowed.
- All used filter materials shall be stored in a secure bin for disposal off site.
- All vehicles transporting any project related waste must have a tracker installed.
- Certificates of safe disposal must be provided for every load and must include the date and vehicle registration number.

8.5 VISUAL/ AESTHETICS

8.5.1 Purpose

There are several general visual mitigating measures which must be applied either during the construction phase or operation phase to prevent/minimise impact on the community.

8.5.2 Components

- a) Visual impact of new dams, power lines and access roads.

a. Visual impact of new dam

Objective

To decrease visual impacts caused by the new dams, power lines and access roads.

Target

To minimise visual impacts caused by the new dams, power lines and access roads.

Management and mitigation requirements

- Limit areas of invasiveness. The extent of unnecessary damage to natural surrounds must be kept to a minimum.
- Hoarding should be erected, where appropriate, to screen the excavation and construction activities as well as to prevent local passers-by from entering the construction site. The hoarding should be painted in natural colours or can be constructed out of natural materials, i.e. woven grass / wattle.
- Discourage the unnecessary usage of high voltage lights during night construction.
- Utilise existing roads to divert traffic away from construction sites, wherever possible.
- Limit the number and usage of visually intrusive traffic signage to that required by codes of practice and regulations.
- All new roads and bridges should mimic the style and visual character of the existing infrastructure.
- All new roads routed through untransformed land should be regarded as least favourable.
- Rehabilitate all construction scarring outside dam basins.

8.6 AIR QUALITY

8.6.1 Purpose

To maintain the emissions of dust particulates and exhaust fumes to a minimum to minimize health hazards and nuisance to workers and persons in adjacent areas and preventing damage to natural vegetation and crops.

8.6.2 Components

- a) Truck transport and road dust entrainment.
- b) Excavation and Earthworks.
- c) Stockpiles and spoil dumps.
- d) Vehicle and machinery emissions.

a. Truck transport and road dust entrainment

Objective

To avoid exceeding acceptable dust levels at the construction sites.

Target

Successfully investigate all exceedances of the acceptable dust levels at the defined control point(s).

Management and mitigation requirements

- Vehicles travelling along the access roads must adhere to speed limits to avoid creating dust.
- A maximum speed limit of 40 km/hr must be adhered to on all site roads.
- All roads and construction areas must be sprayed with water as required to maintain dust levels within the acceptable limits. This is particularly necessary during the dry season when increased levels of dust generation can be expected. These areas should not be over-sprayed causing water run-off and subsequent sediment loss in the vicinity of the subject property.
- Construction camp and haulage road construction areas (these are areas that have been stripped of vegetation) must be dampened to avoid excessive dust.
- Where dust is unavoidable, screening may be required.
- PM₁₀ concentrations should not exceed 75µg/m³ within a 24-hour period more than four times a year.
- Dust fallout rates should not exceed the levels indicated in the air quality baseline study.
- The Contractor must submit an air quality (dust) management method statement that must include but is not limited to the following:
 - Identification of high dust generation activities.
 - Techniques proposed for controlling dust. These may include water spraying and/or application of dust suppressants.

- If water spraying is the chosen method of dust control adequate provision must be made for designated water trucks for the sole purpose of administering dust suppression (i.e. these are not to be used for production purposes). The method statement must detail the route/area that each water truck is designated for and how regularly dust suppression in these areas will be undertaken.
- If the use of dust suppressants is the chosen method of dust control, the drivers of the truck must be adequately trained in mixing and applying this measure on routes/areas. The method statement must detail mixture requirements and route/area that each water truck is designated for and how regularly dust suppression in these areas will be undertaken.
 - Areas for water abstraction and expected volumes must be determined and highlighted.
 - A reporting structure to record volumes must be established.
- The method statement must be submitted for approval by the Engineer prior to being implemented when physical work commences on site.

b. Excavation and Earthworks

Objective

To ensure dust emissions are kept to a minimum.

Target

To reduce dust emissions, and to keep within the South African standards.

Management and Mitigation requirements

- Areas that are to have the topsoil stripped for construction purposes must be limited and only stripped when work is about to take place.
- Re-vegetate dry, exposed areas to stabilise surfaces.
- Only remove secure covers in small areas and not all at once.
- All activities must be damped down, especially during dry weather.
- Develop a method statement for identified activities that results in exceedance of the acceptable dust levels at the control point (see **sub-section a.**).
- Batch plants need to employ special dust suppression measures.
- The contractor must submit an air quality (dust) management method statement (see **sub-section a.**)

c. Stockpiles and Spoil dumps

Objective

To ensure dust particles from stockpiles and spoil dumps are kept to a minimum.

Target

Locate stockpiles in areas least susceptible to heavy winds.

Management and mitigation requirements

- Limit the height and slope of the stockpiles to reduce wind entrainment. For example, a flat shallow stockpile will be subject to less wind turbulence than one with a tall conical shape.
- Keep stockpiles or mounds away from the site boundary, sensitive receptors and watercourses. If necessary, take into account the predominant wind direction to reduce the likelihood of affecting sensitive receptors.
- Make sure the stockpiles are maintained for the shortest possible time.
- Seed, re-vegetate or turf long term stockpiles to stabilise surfaces or use surface binding agents
- Erect fences of similar height and size to the stockpile to act as wind barriers and keep these clean using wet methods. Porous fences or hedges often make the most suitable shelter.
- Develop a method statement for identified activities that results in exceedance of the acceptable dust levels at the control point (see **sub-section a.**).

d. Vehicle and machinery emissions

Objective

To ensure that vehicle and machinery emissions comply with acceptable norms and standards.

Target

- All construction vehicles and machinery emissions will be screened on a weekly basis.
- Ensure all construction equipment and vehicles are properly maintained at all times.

Management and mitigation requirements

- Service construction vehicles and machinery on a monthly basis, with a major service every six months.
- The Contractor shall inspect all construction vehicles and machinery every morning for defects (indicator lights, oil leaks, etc) and excessive emissions.
- Vehicle emissions shall be tested as per the prescribed methods and standards every week.
- All vehicles or machines not complying with the specified standard shall be immediately removed from service.
- All complaints received regarding emissions from construction vehicles or machinery shall be recorded as well as actions taken to rectify the situation.

8.7 NOISE CONTROL

8.7.1 Purpose

There are several general noise mitigating measures/principles which must be applied during the construction phase in order to prevent/minimise impacts on the identified noise sensitive areas. These requirements apply to all of the construction areas of the project.

8.7.2 Components

- a) General noise mitigation.
- b) Noise from the plant and machinery.
- c) Noise from blasting.
- d) Noise from vehicles.

a. General Noise Mitigation

Objective

To minimise noise levels.

Target

To ensure noisy operations are restricted to day time hours.

Management and mitigation requirements

- The induced acceptable noise levels in the residential areas identified during the noise baseline shall not exceed 45dBA during the day and 35dBA at night.
- Noisy operations should be combined so that they occur where possible at the same time.
- Construction activities are to be contained to working hours during the day and early evening. Night-time activities near noise sensitive areas should be avoided wherever possible.
- Deliveries of material and any noisy offloading activities should be restricted to daytime.
- With regard to unavoidable very noisy construction activities in the vicinity of noise sensitive areas, the Contractor should liaise with local residents on how best to minimise impact, and the local population should be kept informed of the nature and duration of intended activities.
- The Contractor is to submit a method statement that must include, but is not limited to, the following:
 - Identification of areas and activities of high noise generation potential in relation to sensitive receptors and monitoring points;
 - Measures for managing and limiting noise generated by plant, activities and personnel;
 - Blasting measures: process of notifying close receptors,
 - Scheduling where possible the location and timing of noise generating activities in relation to sensitive receptors particularly at night.

- As construction workers operate in a very noisy environment, it must be ensured that their working conditions comply with the requirements of the Occupational Health and Safety Act (OHSA) (Act No 85 of 1993). Where necessary ear protection gear should be worn.
- Given that construction activities will expose workers to excessive noise rating levels, it is recommended that a baseline noise survey also be conducted as soon as possible following commencement of site activities. This noise survey will quantify worker exposures to noise during typical activities and allow for informed comment on the relative risks to hearing presented by various activities – i.e. identify sources of excessive noise and allow for demarcation of noise zones. A formal noise survey will also permit structuring of an appropriate audiometric examination protocol for construction workers – as required by the Noise Induced Hearing Loss Regulations – OHSA Act 85 of 1993.
- No amplified music shall be allowed on site. The use of radios, tape recorders, compact disc players, television sets etc. shall not be permitted unless the volume is kept sufficiently low as to avoid any intrusion on members of the public within range. Sound amplification equipment is not to be used unless in emergency situations.

b. Noise from the plant and machinery

Objective

To minimise noise emanating from the construction activities, this may be a nuisance to the surrounding residential areas.

Target

To ensure noisy machinery is located away from sensitive areas or minimise the time that they are in use in these areas.

Management and mitigation requirements

- Construction site yards, concrete batching plants, asphalt batching plants, construction worker camps and other noisy fixed facilities should be located well away from noise sensitive areas. Once the proposed final layouts are made available by the contractor(s), the sites must be evaluated in detail and specific measures designed into the system.
- All equipment shall be kept in good working order with immediate attention being paid to slipping fanbelts, worn bearings and other sources of anomalous noise.
- Equipment shall be operated within specifications and capacity (e.g. no overloading of machines).
- Regular maintenance of equipment will be undertaken particularly with regards to lubrication.
- Equipment shall be operated with appropriate noise abatement accessories such as sound hoods which must be correctly maintained.

- Equipment shall be operated in as diversified a manner as possible (i.e. if possible, spread operation of equipment throughout working periods rather than operating several items simultaneously).
- Equipment shall be turned off when not in use.

c. Noise from Blasting

Objective

To ensure noise levels are kept to a minimum during blasting.

Target

To ensure blasting is restricted to daytime hours.

Management and mitigation requirements

- Sufficient notice must be provided to the surrounding receptors should there be a need for blasting to occur.
- Blasting operations are to be strictly controlled with regard to the size of explosive charge in order to minimise noise and air blast, and timings of explosions. The number of blasts per day should be limited, blasting should be undertaken at the same times each day and no blasting should be allowed at night.

d. Noise from Vehicles

Objective

To minimise noise levels caused by construction vehicles

Target

To ensure compliance with requirements of the Occupational Health and Safety Act (Act No 85 of 1993).

Management and mitigation requirements

- All construction vehicles, plant and equipment are to be kept in good repair.
- Truck traffic should be routed away from noise sensitive areas, where possible.

8.8 TRAFFIC

8.8.1 Purpose

Construction activities inherently have the potential to impact on traffic flow and patterns. Compliance to the road safety measures and recommendations would minimise disruptions and negative impacts to traffic flow and patterns.

8.8.2 Components

- a) Construction signage.
- b) Traffic movement of construction vehicles.

a. Construction signage

Objective

The objective is to warn the general public of construction traffic, and to manage traffic on site.

Target

The target is to ensure road safety along the public roads and on site and to increase awareness of slow moving vehicles.

Management and mitigation requirements

- Where existing public roads are used to access the construction areas, adequate construction signage is in place to inform the public of increased construction activities in the affected areas by placing adequate signage.
- Traffic signs should warn construction vehicles of the presence of pedestrians and school children along the road. Likewise, traffic signs should warn community road users of the presence of construction vehicles.

b. Traffic movement of construction vehicles

Objective

Ensuring road safety for regular road users and construction vehicles.

Targets

- Regulation of construction traffic to minimise the impact on regular road users.
- Regulation of normal road traffic to minimise impact of construction activities on these road users and to ensure a safe passageway for both these road users as well as normal road users.

Management and mitigation requirements

- All vehicle drivers entering the construction camp must pass a breathalyzer test.
- Random drug testing may be undertaken on site.
- The maximum speed limit for all vehicles on site shall be 40 km / hour.
- All parking must be reverse parking.
- When a road on site is within 10 m of a drop of 1.5 m or more, it must have a guard rail.

- Access roads must not have obstructed views so that vehicles are always visible.
- Construction vehicles should only make use of approved demarcated roads in order to limit the ecological footprint of the proposed development activities, avoid encroaching into the wetland areas or their respective buffer zones and reduce the possibility of collisions.
- The number of trucks that pass through communities should be kept to a minimum.
- Construction vehicles must not be permitted to drive through wetland / riparian habitat, and must remain on designated roads.
- The Engineer shall prepare a method statement that will consider alternatives to transporting goods through towns for haulage of high volume construction material.
- Implement traffic flow controls where road closure or partial road closure is unavoidable. This can either be in the form of providing alternative access routes via detours and/or the use of one-way traffic flow control.
- In the event of one-way traffic flow control, trained personnel should be used to regulate the traffic to prevent severe delays at waiting points.

8.9 WATER MANAGEMENT

8.9.1 Purpose

Construction activities inherently have the potential to impact on the water environment, specifically surface water. This management and mitigation plan ensures that construction activities are managed in such a manner that any negative impacts are mitigated or prevented.

The Contractor must compile a Water Management Method Statement to be approved by the Engineer that includes monitoring and reporting mechanisms that cover all water abstractions from the river or any other water source, waste discharge, soil erosion and water quality aspects.

8.9.2 Components

- a) General
- b) Storm water runoff and discharge.
- c) Erosion protection.
- d) Flood lines.
- e) Proximity to rivers, streams and/or wetlands.
- f) Water abstracted from river and streams.
- g) River crossings / alteration of water courses.
- h) Crossing of aquifers
- i) Pollution control.

a. General

The Contractor shall submit a Water Management Method Statement (WMMS), including measures for water conservation, for approval by the Engineer, prior to the commencement of works.

The WMMS must include monitoring and reporting mechanisms that cover all water abstractions from the river or any other water source, waste discharge, soil erosion and water quality aspects.

The WMMS must include measures to prevent the pollution of any river, stream or wetland with grease, hydrocarbons, suspended solids or other contaminants emanating from construction activities. These measures shall include a site plan, approved by the Engineer, on which is shown monitoring points of all treated or untreated discharges to a public stream (considered to be industrial wastewater for this purpose) where monitoring of flow rate and quality will be undertaken in accordance with the requirements of Schedule 3 of Government Notice 665 published in Government Gazette No 36820 dated 6 September 2013.

The WMMS should include an indication of how water and wastewater/effluent will be managed at/with respect to (i) camps and associated facilities, including batching/mixing plants; (ii) excavations, (iii) pumping operations, (iv) cleaning and washing bays, (v) site drainage (silt and erosion control), (vi) storm water, and (vii) river/wetland and erosion gulley crossings.

b. Storm water run-off and discharge

Objectives

To ensure that Storm water runoff and discharge are effectively controlled.

Targets

- No flooding of the construction sites as a result of storm water control measures.
- No erosion as a result of storm water control measures.
- No silt pollution as a result of storm water control measures.

Management and mitigation requirements

- The Contractor must submit a storm water management method statement to the Engineer for approval before the start of construction. The method statement must take into account relevant sections of the specifications.
- The Contractor shall provide proper storm water drainage plans that shall not concentrate water on downstream receiving streams or water courses.
- Storm water drainage lines shall be constructed by the Contractor to divert runoff water around the construction site to prevent contamination of the water and collection of water in excavations.
- Storm water shall be diverted to lessen its erosive impact upon the surrounding environment.
- The Contractor shall obtain the Engineer's approval for all settlement pond designs. Temporary settlement ponds must be constructed and maintained by the Contractor for the settling out of suspended solids. Each pond must be of sufficient capacity to allow for the steady through flow of waste water without threat of this water contaminating natural water courses. The ingress of water from natural water courses into settling ponds must be prevented.
- Flocculants may need to be used if the settling ponds do not achieve the desired reduction in the concentration of suspended solids. The disposal of flocculated sludge will conform to the specifications for waste disposal.
- All storm water drainage lines shall contain water flow arrestors to prevent erosive action on the sides of the drainage lines.
- The Contractor shall not alter or damage existing drainage lines, levees or dams or modify the course or channel of water courses without the prior approval of the Engineer. The Contractor must ensure that all storm water lines are reinstated or rehabilitated on completion of construction activities.
- Suitable means for the control and disposal of accumulated Storm water which may run off from any earthworks, building or paving shall be provided.

- The disposal of Storm water to any street surface shall first be confirmed with the Local Authority that adequate capacity is available.
- No Storm water shall be allowed to enter any drainage installation.
- Any waste water and/or storm water that is discharged during the construction phase will have to comply with the requirements of the National Water Act, specifically with the conditions set by the General Standard (Regulation 9225, Government Gazette, 18 May 1984) unless a licence is issued that sets specific standards for selected variables.

c. Erosion protection

Objectives

To ensure that all Storm water outlets are protected against erosion.

Targets

No erosion channel formation as a result of Storm water outlets.

Management and mitigation requirements

- The Contractor must submit an Erosion Control Method Statement for approval by the Engineer.
- Identified areas where erosion could occur must be appropriately protected by installing the necessary temporary and/or permanent drainage works as soon as possible and by taking other appropriate measures to prevent water from being concentrated in rivers/streams and from scouring slopes, banks or other areas.
- All material and soil stockpiles will be managed to prevent erosion in accordance with the specifications.
- Any erosion channels which develop during the construction period must be suitably backfilled, compacted and restored to a proper condition (i.e. vegetated etc.).
- Erosion management and sediment controls such as the use of gabions or reno mattresses, re-vegetation of profiled slopes, erosion berms, drift fences with hessian and silt traps must be strictly implemented at erodible areas from the outset of construction activities to prevent gully formation.
- Erosion berms should be installed every 50m where the track has a slope of less than 2%, every 25 m where the track slopes between 2% and 10%, every 20m where the track slopes between 10% and 15% and every 10 m where the track slope is greater than 15%.
- Silt traps should be provided to remove sand/silt particles from run-off.
- Where excavation takes place, the affected area should be properly stabilised and re-vegetated to minimise erosion risk.
- Appropriate mitigation to control sediment input into rivers will be required during construction.
- Storm water control measures must, amongst others, consider and provide for the following:

- Use of silt screens;
- Use of straw bales as filters, which are placed across the flow of overland Storm water overlays:
- Channelling Storm water run-off through natural grassland buffer areas (at least 20 m);
- Silting of storm water pipes in adjoining developments and townships as a result of run-off from the road reserve shall not be permitted. If this does occur, it shall be the responsibility of the Contractor to clean out the pipes to restore their functionality;
- Gabions or storm water control structures should be used to disperse Storm water flows and/or prevent and control erosion where necessary along rivers or streams;
- In the case of high volumes of storm water flow, retention ponds must be provided;
- All erosion protection measures have to be maintained on a continual basis;
- Corrective actions have to be taken as and when required to stop any signs of erosion;
- Regular inspections by competent personnel need to be undertaken at especially:
 - Inlet and outlet points of drainage structures,
 - Storm water release points, and
 - Along sections where drainage structures are laid on steep slopes.
- Where possible, Storm water should be released in grassy areas which act as a natural filter and reduce the erosion potential of the water.
- The stabilization of headcuts during the construction phase to prevent erosion and sedimentation will be undertaken through various methods to limit or eliminate erosion and sedimentation i.e. gabions, rock packing, vegetation establishment, bales and poles, vegetation sausages and top soil simulation.

d. Floodlines

Objectives

To ensure that only limited construction activities take place within predetermined flood lines.

Targets

- Determine the 1:20, 1:50 and 1:100 flood lines for all rivers and streams at which construction activities will take place.
- Draw maps with an appropriate scale to show all construction activities in relation to the 1:20, 1:50 and 1:100 flood lines.
- No unauthorised activities within the 1:100 year flood line.
- Where possible construction activities should only take place during low flow periods when as little of the construction site and exposed sediment is in contact with the flow as possible.

Management and mitigation requirements

Flood lines (1:20, 1:50 and 1:100 year) should be determined prior to construction to ensure risks are adequately managed. These must also be clearly indicated on the layout plans.

e. Proximity to rivers, streams and/or wetlands

Objectives

To ensure that construction activities close to rivers, streams and / or wetlands do not negatively affect rivers, streams and / or wetlands.

Targets

- No impact on riparian vegetation.
- No impact on wetland vegetation.
- No silt pollution in rivers and streams as a result of construction activities.

Management and mitigation requirements

- The Contractor shall take all necessary measures when working within rivers to ensure that the water quality of these systems is not adversely impacted by the construction activities.
- Limit the footprint area of the construction activity to what is absolutely essential in order to minimise the loss of clean water runoff areas and the concomitant recharge of streams in the area.
- Where appropriate, large individual indigenous riparian trees should be avoided during construction and should be marked on site.
- Minimise disturbance of instream and bankside areas to avoid erosion and sediment load into the system.
- As far as possible keep all instream areas and stream banks off limits to general activity during the construction phase; this can be achieved by permitting only essential construction personnel within 32 m of all riparian systems.
- The construction infrastructure and coffer dams and stream diversions must at no time lead to upstream ponding and inundation or lead to the constriction of flow and downstream erosion.
- Appropriate design and mitigation measures must be developed to prevent impacts on the natural flow regime of the water courses (i.e. through placement of structures/support).
- If this is not possible, measures must be developed to minimise impacts on surface water e.g. erosion, siltation, pollution etc.
- The proximity of construction activities in relation to springs, wetlands and streams shall be clearly shown on a map with a 1:10 000 scale.
- No construction activities other than those authorised shall take place within any wetland boundary.

- No construction activities other than those authorised, such as construction of the dam wall, shall be within 50 meters from the edge of any river/stream or within the 1:20 year flood line, whichever is the greatest.
- Pollutants collected will be stored in sealed drums for recycling.
- A water quality monitoring plan shall be developed and implemented in accordance with the WMMS
- This plan shall include monitoring points, frequency of samples, and variables that should be analysed (see **section 8.18**).

f. Water abstracted from river and streams

Objectives

To obtain authorisation for water abstraction and to minimise impacts to the aquatic and riverine ecosystems.

Targets

- Obtain all necessary authorisations in terms of Section 21 of the National Water Act (No.36 of 1998).
- No surface run-off of oils, cement, litter, paints etc. which could pollute nearby streams and rivers.

Management and mitigation requirements

- Any abstraction of water for construction purposes must be approved by DWS.
- Natural water sources (e.g. springs, streams, open water bodies) shall not be used as a source of water by the Contractor without the Engineer's approval.
- Prevention and mitigation measures must be implemented to ensure water quality is not adversely affected by such abstraction.

g. River crossings / alteration of water courses

Objectives

To prevent and mitigate disturbance and change to the riparian zones and instream habitats of rivers and streams during construction of water course crossings.

Targets

- No impact on riparian vegetation.
- No impact on wetland vegetation.
- No silt pollution in rivers and stream as a result of construction activities.

Management and mitigation requirements

- All construction roads in or adjacent to the riparian zone should be aligned and managed so as to minimise disturbance of the riparian zone and instream habitats.
- Monitor all systems for incision and sedimentation.

-
- For natural watercourses, the original geometry, topography and geomorphology in both cross-sectional and longitudinal profile should be reinstated at, above or below river crossings.
 - For controlling sediment input into any rivers, streams or wetland the use of hay bales packed in rows across diversions and active flow areas could limit sedimentation inputs and buffer the pH:
 - such bales will need to be removed and disposed of after construction;
 - other alternative methods for controlling sediment should also be considered;
 - all coffer dams, causeway and construction materials should be removed from the river and riparian zone immediately after construction at the site is completed;
 - disturbed areas of the riparian zone should be re-vegetated using either a specified seed mix and/or appropriate indigenous trees where necessary and according to slope and risks in terms of bank erosion along the rivers or streams;
 - ripping and discing of temporary access and construction roads in the riparian zone should be undertaken in order to assist with natural vegetation re-establishment and the control of bank erosion;
 - large individual indigenous riparian trees should be avoided during construction where appropriate.
 - The mitigatory methods should be audited during construction, and monitored for a period thereafter, until full rehabilitation is assured and stability demonstrated.
 - 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.
 - It must be ensured that migratory connectivity and stream continuity is maintained throughout the construction phase of the project.
 - Edge effects (impacts on areas beyond the construction footprint due to less than desirable care and management), such as erosion and riparian zone alien plant species proliferation, which may affect aquatic habitat within surrounding areas, need to be strictly managed through ensuring good housekeeping and strict management of activities near river crossings.
 - The Contractor must ensure that adequate measures are in place to prevent contamination of natural water bodies. These measures will include coffer dams or pumping water from the point of source to be treated before release back into the system.
 - The Contractor shall take all necessary precautions and properly deal with and dispose of all water, in accordance with the specification to ensure that:
 - the Works are kept sufficiently dry at all times for their proper and safe execution;
 - there is no deleterious impact on the environment and adjacent properties; and
 - damage, inconvenience or interference arising from flood waters is prevented.

Such measures shall be implemented for the duration of the Contract and shall at all times be subject to the agreement of the Engineer with regard to the sufficiency of measures and the degree of environmental protection achieved.

- No impediment to the natural water flow other than approved erosion control works and Engineer approved river and wetland crossings shall be permitted. In addition, such crossings shall be performed according to the Engineer approved methodology for construction.
- On completion of the Works, all temporary diversions, protective works and dewatering systems shall be removed by the Contractor. Affected areas shall be rehabilitated according to the specifications.

h. Crossing of aquifers

Objectives

To prevent and mitigate disturbance to aquifers.

Targets

No contamination of aquifers.

Management and mitigation requirements

- A method statement shall be required to be submitted to the Engineer for approval before commencement of any works.
- Where the aquifer is directly affected by the Works (i.e. the excavation will be through permeable / water-bearing strata), the methodology employed must ensure that contamination of the aquifer is prevented. Therefore, appropriate measures must be used to prevent the possible migration of pollutants or contaminated water from entering the aquifer.
- Disposal of water into the receiving environment from dewatering operations will not proceed in areas overlying known aquifers. All contaminated water must be removed and dealt with outside a buffer zone 50 m around the aquifer.

i. Pollution control

Objectives

To ensure no pollution of any river, stream and / or wetland with grease, hydrocarbons, suspended solids, etcetera.

Targets

- Implement measures to prevent pollution (solid wastes, oil spills, discharge of sewage) to minimise impacts on the water quality of nearby adjacent rivers.
- The results of samples taken of the river shall show no deterioration in water quality from the baseline water quality.
- All incidents shall be reported to the relevant office of DWS.
- No complaints regarding water pollution.

Management and mitigation requirements

- Storage, handling and disposal of fuels, oils, lubricants and other potentially harmful chemicals (and their containers) shall be done under proper supervision in accordance with the manufacturer's instructions.
- Containers that contained toxic or harmful materials shall not be rinsed and re-used.
- Such containers shall not be stored or disposed on site. These containers shall be destroyed to prevent re-use and disposed in accordance with the manufacturers' instructions at a permitted waste disposal facility.
- Certificates of safe disposal shall be kept on record.
- Discharges of liquid waste shall under no circumstances be allowed.
- No surface run-off of oils, cement, litter, paints etc. which could pollute or alter water quality are to be deposited into the river system or nearby streams and rivers.
- Where pollution of a water body may potentially occur, the contractor shall ensure adequate measures (e.g. containment, drainage diversion systems, attenuation, settlement dams, and oil absorbent products) are in place to prevent pollution.
- Areas where cement is mixed and containers washed shall be confined to a minimum sized area, which is bunded, so that contaminated run-off is contained.
- Any spillages of pollutants, irrespective of size, shall be contained and cleaned immediately.
- The WWTW must be well managed and strict monitoring and control of effluent discharge must take place to ensure that the impact on the receiving environment is minimised.
- The Contractor shall implement measures to prevent, reduce and mitigate water contamination, including prevention of contamination by suspended sediments.
- The Contractor shall prevent discharge of any pollutants, such as cements, concrete, lime, chemicals and fuels into any water sources. Water from kitchens, showers, sinks, workshops, etc. shall be discharged into the prescribed waste water treatment works. Run-off from fuel storage areas / workshops / vehicle washing areas and concrete swills shall be directed via an oil separator into a settlement pond and this will be disposed of at a site approved by the Engineer. Appropriate measures to prevent water pollution at/from batching plants must be implemented.
- Water not disposed of as above, must comply with the other environmental requirements if it is to be recycled or re-used.
- Any waste water that is discharged during the construction phase will have to comply with the requirements of the National Water Act, specifically with the conditions set by the General Standard (Regulation 9225, Government Gazette, 18 May 1984) unless a licence is issued that sets specific standards for selected variables.

8.10 AQUATIC ECOSYSTEMS

8.10.1 Purpose

Construction activities inherently have the ability to negatively impact on aquatic ecology and riparian vegetation. The following mitigation measures will help to ensure that the negative impacts can be avoided or adequately mitigated.

8.10.2 Components

- a) Removal of riparian vegetation.
- b) Reinforcement and protection of the downstream banks and streambed.
- c) Dam basin clearing.
- d) Maintenance of baseflows

a. Removal of riparian vegetation

Objective

- To maintain aquatic habitats at the proposed dam.
- To ensure riverine habitats are maintained during dam basin clearance.

Target

- To prevent impact on the river system during vegetation removal.
- To ensure riparian habitats are maintained during dam clearance.

Management and mitigation requirements

- Phased removal of vegetation, limiting the amount of exposed areas and confining the majority of disturbances to the dry season.
- Translocation of red data riparian plant species to alternative sites.
- Accurate floodline calculation.
- Prevent exotic vegetation encroachment.
- Adequate provision of inundated habitats for fish and aquatic macro invertebrates must be provided for or remain, which will not decay quickly or disrupt the physical or chemical characteristics of the water.

b. Reinforcement and protection of downstream banks and streambed

Objective

To ensure that the river banks are protected against erosion.

Targets

- To prevent erosion of the river banks.
- To stabilise the riverbanks and beds.

Management and mitigation requirements

- Reinforce banks and drainage features where necessary with gabions, reno mattresses and geotextiles.

- Stabilisation of river banks in the vicinity of any bridge crossings over the Tsitsa River or any of its tributaries by either employing one of the individual techniques below or a combination thereof, including:
 - Reprofilling of the banks of disturbed drainage areas to a maximum gradient of 1:3 to ensure bank stability;
 - Revegetation of re-profiled slopes;
 - Temporary stabilisation of slopes using geotextiles; and
 - Installation of gabions and reno mattresses.
- Any areas where bank failure is observed, due to the effects of bridge crossings, should be immediately repaired by reducing the gradient of the banks to a 1:3 slope.

c. Dam basin clearing

Objective

Maintain water quality in a state that does not impact on use, including ecological.

Target

Current and future water quality indicates that clearing of trees/bushveld from the dam basin prior to impoundment is recommended.

Management and Mitigation Requirement

- Vegetation clearing must include trees and bushes, but excludes grass. Identified very large trees may be left.
- The roots of plants should not be removed, but plants should rather be cut down close to ground level with a chain-saw.
- Topsoil should not be disturbed.
- The material that is removed will first be made available to the communities in the area.
- Any on-site sanitation should be cleared in order to prevent impacts on water quality.
- Non-commercial material to be removed should be burned in a hot fire in order to minimise air quality impacts. This can be achieved by stacking the material in rows and burning.
- The areas of the basin that are cleared/ not cleared should be marked on a map for future use.

d. Maintenance of baseflows

Objective

No detrimental impact on the ecological Reserve.

Target

The EWR as defined in the Reserve determination studies must be adhered to at all times.

Management and Mitigation Requirement

Release flows as stipulated in the Reserve determination studies throughout construction.

8.11 NATURAL MATERIALS SOURCING AND EARTHWORKS / STOCKPILES

8.11.1 Purpose

To ensure that materials are sourced from authorised operations and that potential impacts from stockpiled material on the environment are limited.

8.11.2 Components

The plan is made up of the following components:

- a) Materials sourcing.
- b) Earthworks /stockpiles.

a. Materials sourcing

Objectives

To ensure that materials used for construction are from authorised operations.

Targets

A 100% record of the source of all materials.

Management and mitigation requirements

The Contractor will prepare a source statement to indicate the sources of all materials (including topsoil, sand, natural gravel, stone, asphalt, etc.) and submit these to the Engineer for approval, which must include sources from commercial suppliers and sources indicated in the EMPL.

b. Earthworks/ Stockpiles

Objectives

To ensure that material stockpiled does not negatively impact on the surrounding environment.

Targets

Stockpiles are constructed and maintained appropriately.

Management and mitigation requirements

During the life of the stockpiles, the following measures will be taken:

- Stockpiles will be positioned and sloped to create the least visual impact.
- Stockpiles will not be allowed underneath trees or against the trunks of trees.
- Stockpiles will be constructed and maintained to avoid erosion of the material and contamination of the surrounding environment (including measures such as berms and hessian sheets to prevent erosion and sedimentation).
- The heights of stockpiles should be minimised as far as possible to reduce wind entrainment and stockpiles should be located as far away as possible from sensitive receptors.

- Windbreaks should be erected around stockpiles where possible in order to reduce wind entrainment of dust emissions.
- Storage of construction material used for road upgrades should be localised within designated areas, if possible, to ensure the minimisation of the ecological footprint area and prevent loss of natural habitat along the road.

Once stockpiles have been removed, the following measures will be taken:

- The site will be re-instated to its original condition.
- No foreign material generated and/or deposited during construction will remain on the site.

8.12 TOPSOIL MANAGEMENT

8.12.1 Purpose

To ensure that topsoil is suitably stored for subsequent use in the rehabilitation and re-vegetation of the site.

8.12.2 Components

Prior to site establishment and any earthmoving operations, the Contractor will strip and stockpile all topsoil within the footprint of the construction activities.

- a) Topsoil stripping.
- b) Topsoil stockpiling.
- c) Topsoil storage.

a. Topsoil stripping

Objective

To ensure topsoil is removed for subsequent use and re-vegetation.

Target

To ensure vegetation is removed for subsequent use and rehabilitation.

Management and mitigation requirements

Soil shall be stripped in a phased manner, so as to retain vegetation cover for as long as possible to avoid prolonged exposure of soils to wind and water erosion.

b. Topsoil stockpiling

Objective

To stockpile topsoil for subsequent use in the rehabilitation and re-vegetation of the site.

Target

To retain the usefulness of topsoil for the rehabilitation of the site.

Management and mitigation requirements

- All topsoil shall be stockpiled separately from subsoil and/or rocky material.
- No imported topsoil will be used as the final backfill layer.
- Stockpiles will be located away from rivers, stream, drainage lines, and areas of temporary or permanent inundation.
- Topsoil stockpiles shall be convex and shall not exceed 3 metres in height.

c. Topsoil storage

Objectives

To ensure topsoil is stored in a manner to allow re-vegetation later.

Targets

To ensure topsoil is stored in an adequate manner for re-use.

Management and mitigation requirements

- Topsoil must not be stored in or near sensitive areas.
- Stockpiled topsoil shall not be compacted.
- The Contractor will implement measures to prevent topsoil from being blown away or washed away.

8.13 SPOIL MANAGEMENT

8.13.1 Purpose

The purpose of the spoil (excavated subsoil) management plan is to ensure that spoil is stockpiled, transported and disposed of in an appropriate manner.

8.13.2 Components

The plan is made up of the following components:

- a) Locating spoil disposal sites.
- b) Transporting spoil.

a. Locating spoil disposal sites

Objectives

- To ensure that social and environmental requirements are taken into consideration for the siting of the spoil stockpiles.
- To ensure that spoil is disposed of in an environmentally friendly manner, complying with all regulatory requirements.

Targets

To prevent negative impacts occurring during disposal of spoil material.

Management and mitigation requirements

- The Contractor will identify candidate spoil stockpile sites for use during construction.
- Permanent spoil sites for material that cannot be re-used can be located below the full supply level of the proposed dams while complying with the other mitigation requirements.
- Spoil stockpiles shall be located away from seepage zones, floodlines, water resources and other ecologically sensitive areas and not within the 1:20 year floodline, or within a horizontal distances of 50 m (whichever is greater) of a water course, drainage line or identified wetland.
- The Contractor will estimate spoil volumes to be accommodated at potential sites by modelling the dump size, layout and form.
- The Contractor shall develop a spoil stockpile plan, which will include the following:
 - Estimate size of stockpiles;
 - Erosion (wind and water) prevention measures;
 - Measures to prevent spoil dump contamination, vehicular and public access.
- Stockpiles shall not have slopes steeper than 1 vertical: 2.5 horizontal.
- Spoil stockpiles should be protected with appropriate soil conservation measures from wind and water erosion. Depending on local conditions, such measures could include:
 - regular watering;

- erosion control fabric; and
- grass seeding.
- No waste, such as construction waste, building rubble and domestic waste will be allowed on the spoil stockpiles.
- Spoil stockpiles will be cleared of any alien vegetation.
- Stockpiles will not be allowed underneath trees or against the trunks of trees.
- Avoid spoil handling and dumping in windy or excessively rainy conditions.

b. Transporting of spoil

Objectives

To ensure that spoil is transported from the site of origin to the disposal site in a manner that will not create negative impacts.

Target

No complaints received from residents and road users regarding dust from spoil transport vehicles.

Management and mitigation requirements

- Vehicles should be routed away from noise sensitive areas wherever possible.
- In built up areas a speed limit of 40km/h for heavy vehicles will be strictly enforced.
- Vehicles transporting spoil material must be covered or soil sprayed with water before leaving site if transportation is required in excessively windy conditions as directed by the ECO.

8.14 FAUNA AND FLORA

8.14.1 Purpose

Construction activities inherently have the potential to impact on the environment, specifically flora and fauna. This management and mitigation plan ensures that construction activities are managed in such a manner that any negative impacts are mitigated or prevented.

8.14.2 Components

- a) Protection of ecologically sensitive areas/ habitats and endangered fauna and flora.
- b) Weeds and alien vegetation.
- c) Dam basin clearing.
- d) Animal and plant rescue and relocation

a. Protection of ecologically sensitive areas/habitats and endangered fauna and flora

Objective

- To minimise transformation and fragmentation of habitat for fauna and flora; and
- To minimise harvesting pressure on vegetation at the proposed new dam site

Targets

- Maintenance of viable corridors of natural habitat in the project area.
- Minimise impact on natural vegetation.
- Maintenance of vegetation surrounding infrastructure in natural condition.
- Prevent unnecessary removal of vegetation.
- Ensure as little disruption to animals as possible.

Management and mitigation requirements

- Minimise the construction footprints.
- 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.
- Areas cleared for temporary work outside of the future dam full supply level shall be stabilised as soon as possible.
- Implement strict controls of edge effects such as proliferation of alien vegetation, increased sedimentation and erosion, disturbances of soils, dumping of construction waste etc. as a result of vegetation clearing and disturbances to the soil profile, which may affect faunal habitat and wetland resources within surrounding areas, especially in areas of increased ecological sensitivity.
- No trapping or hunting of fauna is to take place;
- Construction teams should not be allowed access to areas of untransformed vegetation where opportunities for poaching may be present. Penalties should be levied on any construction workers that transgress and poachers should be prosecuted under relevant provincial legislation.

- As far as possible avoid disturbance of Mountain Rocky Outcrops or mountain/afromontane forest habitat units and avoid disturbance of protected floral species when construction activities of the associated dam infrastructure take place.
- Possible re-alignment of infrastructure (such as roads, pipelines and power lines) should be considered to ensure that less highly sensitive areas will be affected by construction.
- Re-alignment of infrastructure to avoid protected trees, wherever possible.
- Placement areas for power line support towers should remain as small as possible.
- Edge effects of all construction activities, such as erosion (see **sections 8.9**) and alien plant species proliferation (see **sub-section b.**), which may affect floral habitat, need to be strictly managed.

b. Weeds and alien vegetation

Objective

To minimise invasion of alien plants in the areas affected by construction.

Targets

Maintenance of vegetation in natural conditions and surrounding infrastructure.

Management and mitigation requirements

- Restrict development footprint to absolute minimum area necessary.
- Rehabilitate disturbed sites through ripping of soil surface and planting with a seed mix of relevant indigenous grasses appropriate to the specific area.
- It is critical that an alien vegetation control programme be implemented within areas associated with the project, as encroachment of alien vegetation is already apparent and is expected to increase as a result of the disturbances resulting during the construction process.
- No vehicles should be allowed to drive through designated sensitive wetland areas during the eradication of alien and weed species.

c. Animal and plant rescue and relocation

Objective

To minimise loss of individuals belonging to indigenous faunal and floral species.

Target

No impacts on indigenous threatened, endemic, rare and protected species.

Management and Mitigation Requirement

Faunal species

- Any animals found in the development footprint area should 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 during the first filling, that will be inundated when the full supply level of the dams is reached.

Floral species

- A holding nursery should be established for indigenous vegetation suitable for re-planting on rehabilitated surfaces after completion of construction at the accommodation site for operational staff, information centre, etc. The holding nursery can become an on-going community project.
- A floral species rescue operation should be implemented, targeting indigenous floral species. The walk-down and rescue and relocation operation should take place prior to clearing any areas affected by construction. The dam basins, the areas impacted by the access road to the hydropower plant and haul roads at Lalini Dam, as well as the areas identified by the floral specialist for rescue and relocation (see **Appendix E**) must be included.
- Prior to clearance of any area for construction activities, a thorough quadrant search of the footprint must be undertaken during the flowering season to search for the known Red Data List (RDL) floral species listed in the Floral Impact Assessment compiled in support of the EIR, in order to rescue affected species. Individual plants can be translocated to the outside of the footprint or removed to a suitable botanical garden for cultivation and protection. This should only be done after consultation with provincial conservation authorities.

8.15 HERITAGE

8.15.1 Purpose

Heritage sites are fixed features in the environment, occurring within specific spatial confines. Any impact upon them is permanent and non-reversible. Those resources that cannot be avoided and that are directly impacted by the development can be excavated/ recorded and a management plan can be developed for future action. Those sites that are not impacted on can be written into the management plan; hence they can be avoided or cared for in the future.

8.15.2 Components

- a) Protected heritage sites.
- b) Chance heritage finds.

a. Protected heritage sites

Objective

Protection of archaeological, historical and any other site or land considered being of cultural value within the project boundary against vandalism, destruction and theft.

Target

Compliance with heritage legislation.

Management and mitigation requirements

- All graves outside the full supply levels of the dams within 300 m of associated infrastructure should be demarcated by the EER, in consultation with the next-of-kin. Demarcation shall be for the duration of construction, with metal stanchions, fencing wire and red and white barrier tape.
- The Contractor may not disturb, deface, destroy or remove protected heritage resource features, whether fenced or not. If any archaeological features, graves or skeletal remains are found, work must cease and the Engineer must be informed immediately. Work may proceed only once the site has been investigated by a person nominated by the Engineer and has been signed off as being cleared.
- Contractors and workers should be briefed on the locations of the existing heritage sites within the construction areas.

b. Chance heritage finds

Objective

To ensure heritage sites and graves discovered during construction are addressed in terms of legislation.

Target

The preservation and appropriate management of new discoveries in accordance with the National Heritage Resources Act (Act No. 25 of 1999), should these be discovered during construction.

Management and mitigation requirements

- The Contractors and workers should be notified that archaeological sites and graves might be exposed during the construction work.
- Should any heritage artefacts or graves be exposed during excavation, work on the area where the artefacts or remains were discovered, shall cease immediately and the ECO shall be notified as soon as possible.
- All discoveries shall be reported immediately to the archaeologist so that an investigation and evaluation of the finds can be made. Acting upon advice from these specialists, the ECO will advise the necessary actions to be taken;
- Contractors and workers shall be advised of the penalties associated with the unlawful removal of cultural, historical, archaeological or paleontological artefacts, as set out in the National Heritage Resources Act (Act No. 25 of 1999), Section 51. (1).

8.16 HEALTH AND SAFETY

8.16.1 Purpose

Construction activities inherently have the potential to impact on the health of the construction workers and the community. This management plan ensures that the community are made aware of the health implications and mitigation measures that would prevent or minimise the impacts caused.

8.16.2 Components

- a) Safety of construction workers.
- b) Construction related illnesses.
- c) Disaster management.

a. Safety of construction workers

Objective

Construction workers' health and safety in terms of their working conditions will be managed in line with the requirements of the Occupational Health and Safety Act (Act No 85 of 1993).

Target

- Compliance with the Occupational Health and Safety Act.
- No incidents.

Management and mitigation requirements

- Fence off all construction sites and control access to these sites.
- Clearly mark any hazardous areas and regularly monitor these areas to ensure that people and animals avoid these areas.
- Liaise with the South African Police Services (SAPS) and Community Policing Forums to ensure that construction sites are monitored.
- Ensure that operators and drivers are properly trained and make them aware, through regular toolbox talks, of any risk they or their equipment may pose to the community. Place specific emphasis on the vulnerable sector of the population such as children and the elderly.
- Ensure that fires lit by construction staff are in designated areas and that safety precautions, such as not lighting fires in strong winds and that fires are completely extinguished before being left unattended, are strictly followed.

b. Construction related illnesses

Objective

To ensure that construction workers are informed of all construction related health risks.

Target

Ensure all workers are educated on the symptoms of all possible construction related illnesses.

Management and mitigation requirements

- All Contractors are to conduct a baseline risk assessment prior to performing any construction activities. This risk assessment must identify and evaluate all of the risks to the health and safety of persons engaging in construction activities. Focus on illnesses should be on diarrhoeal disease and sexually transmitted diseases.
- All construction workers should be subject to baseline (pre-employment) medical examinations. The structure of these examinations should be at the discretion of a registered Occupational Medical Practitioner.
- All workers are to have easy access to drinking water.
- All equipment is to be maintained according to their design specifications to prevent vibration stress.
- All defective or broken equipment and vehicles are to be removed from site until they are repaired.
- All staff is to be educated on the impacts and symptoms of vibration stress.
- Issuing appropriate personal protective equipment (PPE) (e.g. brimmed hats, peaked caps, hard hats, safety boots, etc) and enforcing the use of such PPE.
- Education and training of workers on ways and means of reducing their risks of diarrhoeal disease infection – i.e:
 - No swimming or bathing in uncontrolled water sources
 - No drinking water from uncontrolled or unknown sources
 - No urinating in water sources / courses
 - Follow good personal hygiene practices (washing hands, etc.)
 - Avoid eating food from unknown or suspect sources
 - Avoid raw or undercooked foods.
- Ensure that an on-site HIV and AIDS policy and strategy are in place and that construction workers have easy access to condoms.

c. Disaster management

Objective

Ensuring the health and safety of construction workers on site.

Targets

- Trained first aid workers on site.
- Standard operating procedure in the case of an emergency.

Management and mitigation requirements

- Implement surveillance and monitoring programmes, and undertake regular safety inspections of the Works.

- Implement a disaster management plan that includes a well-developed public communication process and evacuation plan.
- Ensure that all communication and warning systems are regularly tested and maintained.
- Consult with private ambulance services and/or hospitals so that they are aware of the project and would be able to provide emergency and/or medical services if needed.

8.17 SITE REHABILITATION

8.17.1 Purpose

The purpose of site rehabilitation is to successfully restore areas disturbed by construction to their natural state.

8.17.2 Components

- a) Disturbed areas to be rehabilitated.
- b) Re-vegetation of disturbed areas.
- c) Rehabilitation and reinstatement of borrow pits, quarries and blasting areas.
- d) Rehabilitation of wetland and riparian areas.

a. Disturbed areas to be rehabilitated

Objective

To ensure all areas disturbed during construction are rehabilitated to their natural state/pre-construction condition.

Target

Achieve acceptable vegetation cover, meaning that not less than 75% of the area grassed or hydro-seeded shall be covered with grass and that no bare patches exceeding 0.25 m² in an area of 1 m x 1 m shall occur. In the case of sodding, acceptable cover shall mean that the entire areas shall be covered with live grass at the end of any period not less than three months after sodding.

Rehabilitation management plan and method statement

Prior to the commencement of Rehabilitation the Contractor shall prepare a Rehabilitation Plan and Method Statement for the acceptance of the Engineer, which will include but will not be limited to the following:

- Sites for stockpiling and protection of topsoil recovered from cleared construction areas.
- Soil improvements and fertilisation plan for areas to be rehabilitated.
- Methods for planting grasses from seed, cuttings and sods.
- Sources and specifications for compost, manure and mulching material.
- Detail Method for preparing areas for rehabilitation, and for planting grass from seeds, from cuttings, by hydro-seeding and by sodding.
- Detail Method for planting trees and shrubs, with reference to sub-section (b).
- Maintenance of the rehabilitated areas during the establishment period and up to the handover period.
- Plant and equipment to be used for the rehabilitation of disturbed areas.

Management and mitigation requirements

The Rehabilitation Plan and Method Statement will include, *inter alia*, the following requirements:

- Clear the site of all inert waste and rubble, including surplus rock, foundations and batching plant aggregates. After the material has been removed, the site shall be re-instated and rehabilitated.
- Subject to approval by the Engineer, in consultation with the ECO, certain borrow pits and/or quarries may be utilised for the disposal of waste rock and inert building rubble. If approval is not granted, all excess spoil and inert rubble must be disposed of at a licensed disposal site, where it could be accepted as cover material.
- Remove from site all domestic waste and dispose of in the approved manner at a licensed municipal waste disposal site.
- Cordon off areas that are under rehabilitation as no-go areas using danger tape and steel droppers (or other approved method). If necessary, these areas should be fenced off to prevent vehicular, pedestrian and livestock access.
- Re-vegetation must match the vegetation type, which previously existed, unless otherwise indicated in the Contract or specified by the Engineer.
- Control invasive plant species and weeds by means of extraction, cutting or other approved methods.

b. Re-vegetation of disturbed areas

Objective

To ensure natural habitats are restored/re-instated.

Target

- Removal of invasive alien plants.
- Re-vegetation in a correct manner to encourage growth.
- Achieve acceptable grass cover.

Management and mitigation requirements

- Rehabilitate and naturalise areas beyond the development footprint, which have been affected by the construction activities, using indigenous grass species.
- All planting work is to be undertaken by suitably experienced personnel, making use of the appropriate equipment.
- Planting should preferably be done just before or during the rainy season.
- Where local soil has poor drainage, broken rock (approximately 75 mm in diameter) must be placed to a depth of 150 mm at the bottom of the planting hole prior to planting trees/shrubs and backfilling with approved plant medium mixture.
- If impenetrable shale, rock, clay or a high water table is encountered, making the above hole sizes impossible, then seek advice from the Engineer.

-
- Backfill planting holes with excavated material/approved topsoil, thoroughly mixed with weed free manure or compost (per volume about one quarter of the plant hole), one cup of 2:3:2 fertiliser and an approved ant and termite poison.
 - As much of the soil from container plants as possible must be retained around the roots of the plant during planting.
 - The plant must be planted into the specified hole size with the approved soil, compost and fertiliser mix used to refill the plant hole and must cover all the roots and be well firmed down to a level equal to that of the surrounding in situ material.
 - After planting, each plant must be well watered, adding more soil upon settlement if necessary.
 - Add mulch to the surface area of the bermed basin.
 - Where necessary, protect newly planted trees against wind, frost and wild animals by means of fencing, sacking or frost nets.
 - Thoroughly water plants as required until the plants are able to survive independently (i.e. depending on the rainfall).
 - Water aloes and bulbs directly after transplanting to settle the soil.
 - Remove stakes and wire binds over time as required, as plants become established.
 - The Contractor shall remove all visible weeds from the placement area and from the topsoil before replacing the topsoil.
 - Topsoil shall be spread evenly over the surface. The final prepared surface shall not be smooth, but furrowed to follow the natural contours of the land.
 - Where sodding is required, light scarification shall be carried out to contain the sods.
 - Re-vegetated areas showing less coverage than what is defined as acceptable after one growing season shall be prepared and re-vegetated from scratch.
 - Repair any damage to re-vegetated areas to maintain coverage.
 - Work areas will be rehabilitated as soon as possible after completion of construction activities in an area, to minimise the potential for erosion and maximise the established time after re-vegetation.
 - Suitable, area-specific and naturally occurring rooted trees and grasses must be planted within disturbed areas in the dam basin so as to reduce the input of sediments and pollutants into the dam via runoff.
 - Suitable, area-specific and naturally occurring riparian vegetation must be rehabilitated in disturbed areas downstream of the dam as well as at river crossings (e.g. for roads and pipelines) so as to aid in bank stability and erosion control.
 - Any runnels or erosion channels that develop during the construction period or during the vegetation establishment period shall be backfilled and compacted, and the areas restored by the Contractor in accordance with the specifications for rehabilitation.

c. Rehabilitation and reinstatement of borrow pits, quarries and blasting areas

Objective

To ensure borrow pits, quarries and blasting areas are reinstated and rehabilitated where required.

Target

- To make safe all borrow pit and excavation areas.
- To make safe all blasting areas.

Management and mitigation requirements

- Make safe all dangerous excavations by backfilling, grading and blasting as required.
- Reinstatement borrow areas and quarries, as required in terms of the relevant Environmental Management Plans (**Appendix C**).
- Programme the backfill of excavations so that subsoil is deposited first, followed by the topsoil. Compact in layers for best results.
- Backfill French drains, sludge dams and evaporation dams and compact, covering with a final layer of topsoil to a height of 100 mm above the surrounding ground surface.
- Deficiency of backfill may not be made up by excavating haphazardly within the Work Site.
- Monitor backfilled areas for subsidence (as the backfill settles) and fill depressions using available material.
- Dismantle and flatten temporary drifts and river crossings, reinstating all drainage lines to approximate their original profile.
- Shape all disturbed areas to blend in with the surrounding landscape.
- Ensure that no excavated material or stockpiles are left on site and that all material remaining after backfill is smoothed over to blend in with the surrounding landscape.
- Blasting areas should be left as rough as possible to facilitate the establishment of vegetation.

d. Rehabilitation of wetland and riparian areas

Objectives

To rehabilitate wetland and riparian areas to their former state.

Targets

Full compliance with the rehabilitation plan.

Management and mitigation requirements

- For all work conducted in rivers and wetlands, the Contractor must ensure substratum restoration during rehabilitation. Impermeable clay layers must be

recreated / restored to reinstate the sub-surface hydrology and to ensure that perched water tables sustaining wetland habitats are kept intact. Any impermeable layers encountered within the wetland shall be recorded, and their depths and types noted. These layers will need to be recreated during rehabilitation. The Contractor shall submit to the Engineer for approval, a method statement that deals specifically with the restoration of impermeable substratum layers prior to the commencement of works.

- Riparian areas that may have been disturbed during construction should be rehabilitated through re-profiling and re-vegetation upon completion of construction.
- All soils compacted as a result of construction activities at the dam walls should be ripped and profiled. Special attention should be paid to alien and invasive control within these areas. Alien and invasive vegetation control within and around wetland / riparian areas should take place to prevent further loss of wetland / riparian habitat.
- Rehabilitation of disturbed wetland areas during and post-construction must be done using indigenous wetland vegetation species in order to assist in retaining essential wetland ecological services, particularly flood attenuation, sediment trapping and erosion control, and assimilation of nutrients and toxicants.
- 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 hydro-seeding, wetland and rehabilitation planting (where applicable) are to be implemented.

8.18 MONITORING

8.18.1 Purpose

A series of environmental variables are to be monitored during the construction phase to ensure compliance with the relevant legislation.

8.18.2 Components

- a) Noise monitoring.
- b) Air quality monitoring.
- c) Water quality monitoring.
- d) Aquatic life monitoring.
- e) Rehabilitation monitoring.

a. Noise monitoring

Objective

Ensure noise generating activities are located away from sensitive areas.

Target

Ensure compliance with the National Noise Control Regulations and SANS 10103:2008 guidelines.

Monitoring Methods

- As construction workers operate in a very noisy environment, it must be ensured that their working conditions comply with the requirements of the Occupational Health and Safety Act (Act No 85 of 1993). Regular monitoring during construction activities need to be conducted.
- Noise monitoring shall be implemented in all sites identified in the baseline study. The objective is to proactively limit avoidable noise levels generated by construction activities at least to the extent where surrounding residents are not disturbed.
- Monitoring will be undertaken in accordance SANS 10103:2008, by independent specialists appointed by the Contractor. Monitoring of noise must be undertaken monthly. Monthly reports must provide a comparative analysis, with the SANS guidelines and baseline results, and include mitigation measures to be implemented where allowable thresholds have been exceeded. If construction activities are to be undertaken at night, provision for night time noise monitoring must also be made.

b. Air Quality Monitoring

Objective

To proactively prevent, manage and mitigate impacts caused by particulate emissions on communities and receiving environment.

Target

- Air quality monitoring shall be implemented in all sites identified in the baseline study.
- Ensure that airborne dust from the construction activities does not cause any nuisance problems or result in complaints from I&APs.
- To determine the source of the emissions, and the impact on the receiving environment through source based performance indicators.
- To install a dust fallout monitoring network before the construction phase begins.

Monitoring methods

- Monitoring will be undertaken in accordance with the National Environmental Management: Air Quality Act, 2009; GN 263 and SANS 1929:2005, by independent specialists appointed by the contractor.
- Monitoring of dust fallout rates and PM₁₀ must be undertaken monthly and results shall be compared to the standards contained in **Tables 8-2** and **8-3**.
- Monthly reports must provide a comparative analysis, with the SANS guidelines and baseline results, and include mitigation measures to be implemented where allowable thresholds have been exceeded.
- The ECO/Engineer may issue instructions to cease activities causing dust, based on visual observations, where dust emissions from work areas could constitute a health hazard or nuisance. Work may proceed once remedial action has taken place.
- Continuous PM₁₀ monitoring, as this provides real-time data which reflects instantaneous peaks, diurnal and nocturnal trends and seasonal variation, should take place for highly sensitive receptors. The PM₁₀ data analysis must include comparison to local metrological data. Monitoring will be undertaken according to SANS 1929:2005.
- The focus is on avoiding dust and PM₁₀ levels exceeding generally acceptable thresholds for residential and construction areas, but with a general target of the average dust deposition rate over a year not exceeding 300 mg/m²/day and PM₁₀ concentrations not exceeding an annual average of 40 µg/m³ per 24-hour period. The following are acceptable levels, as averages over 30 days:

Table 8-2: Permissible dust deposition rates (as per SANS 1929:2005)

Band Description	Dustfall Rate (mg/m ² /day)	Comments
Residential areas	D < 600	Permissible for residential and light commercial
Construction areas	600 < D < 1 200	Permissible for heavy commercial and industrial

Table 8-3: National Ambient Air Quality Standards for particulate matter (PM₁₀) (as per the National Environmental Management: Air Quality Act, 2004 GN 263)

Averaging Period	Concentration	Frequency of Exceedence	Compliance Data
24 hours	75 µg/m ³	4	Immediate

- When the abovementioned thresholds are exceeded the situation will be investigated and the cause must be eliminated.
- When the dust deposition rate at any point exceeds 2400 mg/m²/day immediate remedial action must be taken, and an incident report submitted.
- If a situation arises which leads to complaints from occupiers of properties adjacent to the work area that dust emissions constitute a health hazard or a nuisance, or the Engineer from visual observation believes this to be the case, instructions will be issued by the Engineer that the activities causing the offending episode must cease immediately and the episode will be investigated. Only once proposed remedial action has been approved by the Engineer may the Contractor implement such action at his cost and may work in that area resume.
- A monthly report must be submitted to the Engineer within 10 days of taking the last sample containing results of monitoring and comments on the progress made in dealing with this aspect and records of all notable events.

c. Water quality monitoring

Objective

To maintain current water quality.

Target

- Prevent impact on aquatic life due to discharge of waste and waste water from the various construction activities.
- To conduct regular water quality analysis to identify impacts on water quality and maintain acceptable water quality.

Monitoring Phase

It is recommended that samples for a comprehensive analysis be collected at the recommended sites for baseline monitoring, in order to establish a more exact relationship between the variables that are measured as part of the National Water Quality Monitoring Network and the additional variables that are required for the baseline study. This can then be used for the purposes of correlation, should this be required.

Variables

The baseline monitoring should consider those variables that describe the fitness for use by all possible downstream users. This can only be done if guidelines are available, as without guidelines it is not possible to assess the impact. For this

reason the variables that are considered in the South African Water Quality Guidelines should be used.

The proposed development will not affect all of the variables, nor are all of the variables relevant in the affected catchments (Uranium and radioactivity are examples of this), while other variables are not practical to measure (odour). Some variables are calculated from the concentrations of measured variables (Sodium Adsorption Ratio, Total Hardness, Corrosivity). The approach is therefore to use primarily those variables that are listed as part of the General Standard, and also those variables that were identified as variables of concern during the water quality study.

The variables that should be measured in terms of the General Standard are:

- Colour (Cobalt-Platinum Units)
- pH (pH Units @ 25 °C)
- Dissolved Oxygen (mg/l O₂) (To be measured in situ)
- Faecal Coli (CFU/100ml)
- Temperature (°C) (To be measured in situ)
- Chemical Oxygen Demand (mg/l)
- Oxygen Absorbed (mg/l)
- Conductivity (mS/m @ 25 °C)
- Suspended Solids (mg/l)
- Sodium (mg/l Na)
- Soap, oil, grease (mg/l)
- Residual chlorine (mg/l Cl)
- Free and saline ammonia (mg/l N)
- Arsenic (mg/l As)
- Boron (mg/l B)
- Hexavalent chromium (mg/l Cr)
- Total chromium (mg/l Cr)
- Copper (mg/l Cu)
- Phenolic compounds (mg/l phenol)
- Lead (mg/l Pb)
- Cyanides (mg/l Cn)
- Sulphides (mg/l S)
- Fluoride (mg/l F)
- Zinc (mg/l Zn)
- Manganese (mg/l Mn)
- Cadmium (mg/l Cd)
- Mercury (mg/l Hg)
- Selenium (mg/l Se)

Some of these variables can be expected to be absent, or if present, occur in trace concentrations. However, confirming this will represent information that otherwise could be held in doubt:

- Calcium (mg/l Ca)
- Magnesium (mg/l Mg)
- Sulphate (mg/l SO₄)
- Fluoride (mg/l F)
- Chloride (mg/l Cl)
- Nitrate/Nitrite (mg/l NO₃ / NO₂)
- Potassium (mg/l K)
- Aluminium (mg/l Al)
- Phosphate (mg/l PO₄)
- Total Alkalinity (mg/l CaCO₃)

Sampling Frequency

Construction is scheduled to start in July 2016. Site establishment will take some time, and it can be accepted that more time is available before any serious disturbance to the river occurs.

In order to determine accurate statistic parameters for the baseline condition, monitoring should be conducted over at least one year in order to detect seasonal variations. At the same time a total of at least 19 measurements are required in order to determine the 95th percentile value. Water quality data is under normal conditions highly correlated, and collecting samples at too short an interval will generate data that are not statistically independent. A sampling interval of at least two weeks is recommended in order to ensure the statistical independence of the measurements. A fortnightly sampling programme over one year will yield 27 results, which will be adequate to calculate statistical parameters at a reasonable confidence ($\pm 10\%$).

A sampling interval of two weeks is therefore recommended.

A one year sampling programme is not sufficient to detect trends, but the historic data from the DWS can be used for this purpose.

Sampling Protocol

The sampling protocol as prescribed by the laboratory that will perform the analyses must be followed. In the absence of a clear sampling protocol, the guidelines presented in Water Research Commission Report No: TT 117/99 must be followed.

Sample Analyses

Measurements and analytical processes must conform to the appropriate SANS, or to the Standard Methods if no SANS method is applicable.

Sampling Sites

For the purposes of compliance monitoring, upstream and downstream samples should be collected during the construction period. For the purposes of establishing the baseline conditions, four sampling sites are recommended, one upstream of the Ntabelanga Dam, one downstream of the Ntabelanga Dam, one downstream of the Lalini Dam and one downstream of the Ngcolora tributary. The sites should be chosen such that they will not be directly affected by construction activities, or inundated after completion of the proposed dam.

The Contractor must appoint a suitably qualified water quality specialist for approval by the Engineer to implement a water quality monitoring programme for monitoring the water quality in the Tsitsa River only.

The flow rate and quality of all potential discharges of treated and un-treated waste water from the construction site, at points marked on a site plan in the WMMS for approval by the Engineer, will be monitored in accordance with the requirements of Schedule 3 of Government Notice 399 published in Government Notice 665 published in Government Gazette No 36820 dated 6 September 2013.

Water sampling must follow a clear protocol specified by the laboratory that will perform the analyses. Measurements and analytical procedures must conform to the relevant SANS.

All discharges from settlement ponds, sewage treatment works, batching plants, washing areas and any other areas must be sampled and tested at points approved by the Engineer. The quality of point discharges shall comply with the criteria given in **Table 8-4**. Water quality monitoring reports must be submitted to the Engineer within 10 days of taking the sample.

Table 8-4: List of Water Quality Variables to be Sampled at the Discharge Point

VARIABLE	REQUIRED EFFLUENT STANDARD
Arsenic (as As)	Not to exceed 0.1 mg/ ℓ
Boron (as B)	Not to exceed 0.5 mg/ ℓ
Cadmium (as Cd)	Not to exceed 0.05 mg/ ℓ
COD	Not to exceed 5 mg/ ℓ
Colour, odour, taste	Free of any substance in a concentration capable of producing any colour, odour or taste
Conductivity	Not to exceed 250 mS/m
Copper (as Cu)	Not to exceed 0.02 mg/ ℓ
Cyanide (as Cn)	Not to exceed 0.5 mg/ ℓ
Dissolved oxygen	At least 75% saturation
Feacal coliforms Thermotolerant coliform bacteria (faecal)	No <i>E. coli</i> (0/100 m ℓ) or No Thermotolerant (faecal) coliform bacteria (0/100 m ℓ)
Fluoride (as F)	Not to exceed 1.0 mg/ ℓ

VARIABLE	REQUIRED EFFLUENT STANDARD
Free & saline ammonia (as N)	Not to exceed 1.0 mg/ ℓ
Lead (as Pb)	Not to exceed 0.1 mg/ ℓ
Manganese (as Mn)	Not to exceed 0.1 mg/ ℓ
Mercury (as Hg)	Not to exceed 0.02 mg/ ℓ
Nitrate (as NO ₃)	Not to exceed 1.5 mg/ ℓ
Nitrite	Not to exceed 1.0 mg/ ℓ
pH	Between 5,5 and 7,5
Phenolic compound (as phenol)	Not to exceed 0.01 mg/ ℓ
Phosphate (as PO ₄)	Not to exceed 1.0 mg/ ℓ
Residual Chlorine (as Cl)	Non residual chlorine
Selenium (as Se)	Not to exceed 0.05 mg/ ℓ
Soap, oil, grease	No soap, oil or grease
Sodium	Not to be increased by more than 50 mg/ℓ above influent
Sulphides (as S)	Not to exceed 0.05 mg/ ℓ
Suspended solids	Not to exceed 10 mg/ℓ
Temperature	Maximum of 25°C. In addition the effect of water discharged into watercourses shall not raise the water within the watercourse at a point 500 m downstream of the point of discharge by more than 2°C above the temperature of the water 500 m upstream of the Works
Total Chromium (as Cr)	Not to exceed 0.05 mg/ℓ
Zinc (as Zn)	Not to exceed 0.03 mg/ℓ

Up and downstream monitoring is required (sites to be determined by specific context and up/downstream land-use/impacts). Pre construction (baseline) samples must be collected. The final monitoring sample must take place after rehabilitation is complete.

The following variables must be monitored:

- Temperature
- pH
- Electrical conductivity
- Dissolved oxygen
- Suspended solids.

The Engineer may require more detailed testing where there is evidence of contamination.

Water quality sampling at the upstream and downstream monitoring sites will be made at the same time –around noon - each day. The maximum “allowable limit of change” in any water quality parameter at the downstream monitoring point should not be greater than 10 % above the value for the respective water quality parameter measured at the upstream monitoring point. Careful records shall be kept of all occasions when the water quality at a downstream monitoring point has exceeded the limits of allowable change.

Should the values of any of these key indicator variables at the downstream site vary by 10 percent or more relative to measurements of the same variables taken at approximately the same time at the upstream site, it could indicate that associated changes have occurred in some of the other water quality variables. Immediate mitigation action will be required on the site and water samples should be collected as soon as possible and sent to the accredited analytical laboratory for analysis of the full list of river and wetland variables (**Table 8-5**). The laboratory should be requested to provide the results of these samples within 14 working days.

Table 8-5: Full list of Water Quality Monitoring variables for rivers and wetlands

Parameters and Variable	Testing Frequency	Test Responsibility
COD (mg/l)	Every 2 days when flow is present	Collect sample on site analyze in laboratory
Nitrate and Nitrite (mg/l)	Every 2 days when flow is present	Sample on site & laboratory analysis
Orthophosphates (mg/l)	Every 2 days when flow is present	Sample on site & laboratory analysis
Suspended Solids (TSS) (mg/l)	Every 2 days when flow is present	Sample on site & laboratory analysis
Soaps, oil and grease (mg/l)	Every 2 days when flow is present	Sample on site & laboratory analysis
Free & Saline ammonia (mg/l)	Every 2 days when flow is present	Sample on site & laboratory analysis
Faecal Coliform bacteria (per 100ml)	Every 2 days when flow is present	Sample on site & laboratory analysis
Conductivity (mS/m)	Daily when flow is present	Measure on site using hand-held meter
Dissolved oxygen (% saturation)	Daily when flow is present	Measure on site using hand-held meter
pH	Daily when flow is present	Measure on site using hand-held meter
Temperature	Daily when flow is present	Measure on site using hand-held meter when any one of the key variables deviates by more than 10% from the upstream value at the construction site
Turbidity (NTU)	Daily when flow is present	Measure on site using hand-held meter when any one of the key variables deviates by more than 10% from the upstream value at the construction site

Note: Concentrations of the above variables measured 50 m downstream of the works in a water resource system must not differ by more than 10% of concentrations of the same variables measured 300 m upstream of the works.

As soon as practically possible, each incident of water contamination shall be investigated, the contamination source(s) located and mitigatory measures implemented to prevent further contamination. A set of confirmatory measurements

shall be taken after the implementation of remedial/mitigatory actions to demonstrate that the problem has been dealt with successfully.

d. Aquatic life monitoring

Objective

To monitor invertebrate fish communities.

Target

Prevent impact on invertebrate fish communities during construction phase.

Monitoring phase

Ongoing aquatic biomonitoring on a minimum of a quarterly basis must take place until one year after construction. If any trends are observed where impacts on the aquatic ecology are becoming unacceptable, measures to reduce the impacts must be immediately implemented. All aquatic biomonitoring should be undertaken by a suitably qualified and South African River Health Program (SA RHP) accredited assessor.

e. Rehabilitation monitoring

Objective

Monitor and document progress made in the implementation of re-instatement and rehabilitation measures.

Targets

- Record initial conditions of the work sites during the pre-construction survey phase, using photographs.
- Monitor rehabilitation activities for the duration of the legal liability period on a monthly basis or as required by the Engineer.
- Document and report findings to the Engineer and Client in a monthly report for action of the Contractor.

Monitoring phase

Monitoring on a monthly basis or as required by the Engineer will be undertaken by the EER during the Rehabilitation phase. This will encompass a site inspection of all the areas disturbed by construction activities and that fall above full supply level to determine acceptable grass cover and to detect bare patches and damage by erosion or sedimentation. Any bare patches where the grass has not taken or where it has been damaged or has dried out shall be re-cultivated, planted, sodded or hydro-seeded, as per the Rehabilitation Plan and Method Statement.

8.19 SITE CLOSURE

Once the environmental items on the incidents register list have been adequately addressed, the ECO will provide an environmental performance certificate confirming that the environmental specifications applicable to the Contractor(s) have been met. This certificate will be submitted to the Engineer prior to the final Certificate of Completion being issued.

9. MANAGEMENT AND MITIGATION PLANS FOR OPERATION

9.1 SCOPE AND PURPOSE

This operational EMPR focuses on the Ntabelanga and Lalini Dams. Recommendations have been provided regarding the irrigation component of the project (e.g. farmer training, crop selection etc.) in the Environmental Impact Assessment Report. These recommendations should be considered by the relevant parties in charge of implementing the irrigation component as certain critical conditions must be met for this component to be successful. However they are not included here.

The purpose of the Operational EMPR is to outline a system for the conservation of the natural resources affected by the project, the sustainable use of the dams and the management of the environmental and flood releases from the dams. The broad objectives of the Operational EMPR are to:

- document and manage the local and downstream impacts of the operation of the dams;
- provide a framework for identifying risks, setting objectives and targets; and implementing management actions;
- implement a system of continuous improvement; and
- implement a system of periodic monitoring and evaluation.

9.2 ORGANISATIONAL STRUCTURE

Roles and responsibilities must be defined once the institutional arrangements for operation are known.

9.3 DEVELOPMENT OF MANAGEMENT AND MITIGATION PLANS

A comprehensive set of Management and Mitigation Plans for operation must be developed before the last Contractor hands over the site. This should involve defining environmental impacts and risks, establishing targets, recommending management actions, and making the necessary provisions for monitoring and evaluation.

9.4 OPERATING RULES

The dam operating rules, once finalised, will form part of the operational EMPR.

The operating rules should, *inter alia*, address the following issues:

- Water releases and impact of stratification on the downstream users – i.e. water quality issues, deoxygenation of lower levels etc.

- Management of ecological releases. Specifically, the Ecological Water Requirements (EWR) as set out in the Reserve Determination for the Ntabelanga Dam, and the EWR determined for the Lalini Dam, must be adhered to at all times.
- Release of freshets.
- Firebreaks.
- Alien invasive/ weed control in the buffer area.

9.5 DISASTER MANAGEMENT PLAN

A comprehensive disaster management plan, as required by dam safety legislation, must be developed, specifically dealing with the risk of dam failure and the ensuing environmental and social impacts.

The plan must include a well-developed public communication process aiming to warn affected parties downstream of the dam, as well as an evacuation plan.

9.6 DECISIONS REGISTER

Ensure that the Decisions Register is maintained, and is available to any member of the public who wishes to access it.

9.7 RESOURCE MANAGEMENT PLAN

A Resource Management Plan (RMP) should be prepared, including information regarding the use of and access to the dam basins.

The protection of sensitive areas as identified by the ecologist and wetland specialist should be considered in developing the RMP.

The following issues (among other things) should be considered in the RMP:

- Aquaculture would be a viable option in the impoundments. This is especially true since the segment of the river is not sensitive from a fish ecology point of view. The Ntabelanga Dam may be suitable for aquaculture with trout as the water in the dam may be cool enough to support the fish at this point in the system. Both the Ntabelanga dam and the Lalini dam can potentially be used for aquaculture of Tilapia (*Oreochromis mossamicus*) and/or catfish (*Clarias gariepinus*). Tilapia have more commercial value but both can definitely contribute to the production of protein in the area which is generally lacking in protein production.
- Whether or not to fence off portions of the dam basin has to be decided following further consultation with affected parties.
- Investigate and consult local communities on the need to provide suitable hard access points around the dam basin for people and animals.

- Consider the viability of having life guard facilities available, particularly if recreational facilities associated with the dam are developed. Encourage/facilitate swimming lessons within the communities surrounding the dam basins.

9.8 OPERATION AND MAINTENANCE SPECIFICATIONS

The following specifications should form part of the management and mitigation plans to be developed for the operational phase of the project:

- The infrastructure should be adequately maintained to retain the smallest footprint possible and prevent post construction impacts on the local instream habitat such as erosion or sedimentation due to a lack of infrastructure maintenance.
- Inspections of the dam basin should be repeated at least bi-annually and maintenance work should be completed as soon as damage is observed. The dam wall should be inspected as required by dam safety legislation and after severe weather or flood occurrences.
- Regularly monitor and maintain the state of the gabions in order to ensure the stability of the gabion structures and prevent bank failure.
- If there has been a failure of one or more mesh wires, the area must be repaired.
- The gabion structures should be inspected for excessive localised bulging and settlement.
- Excessive localised bulging of gabions should be repaired by opening, emptying and repacking the affected units.
- Where excessive settlements have occurred, the cause should be investigated. In severe cases, the affected area should be taken down and reconstructed, reinstating the foundation. Where settlements are minor, these should be monitored on a six monthly basis to determine if it is an initial settlement problem or a long-term problem. Initial settlements generally stabilise and do not cause further problems. Long-term settlements must be investigated as to the cause and remedial action taken.
- Regularly inspect wetland and riparian crossings for sedimentation and incision and proliferation of alien vegetation.
- If any areas downstream of the two proposed dams are observed where excessive erosion is occurring, these areas should be rehabilitated immediately.
- During operational use and maintenance of infrastructure, vehicles must remain on designated roads to limit the ecological footprint of the proposed development activities as well as to reduce the possibility of collisions. In particular, vehicles must 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 severely compromised due to the dam footprints.

- Maintenance personnel must ensure that any tools and/or waste products resulting from maintenance activities are removed from the site following completion of maintenance.
- 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.
- Removal of alien vegetation and good housekeeping within the road reserve must take place at all times.
- Any spills by maintenance teams or road users should be cleaned up and treated immediately and all work overseen by a suitably qualified professional.
- All staff motor vehicles should be regularly inspected for leaks, and re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into topsoil.
- Maintain the potable water infrastructure, control pollution and curb illegal taps. If no such measures are implemented the community may be worse off as a result of water borne diseases or no water at all.
- Erosion and alien and invasive vegetation proliferation, which may affect faunal habitat within surrounding areas, need to be strictly managed throughout the operational phase of the project, particularly in areas of increased ecological sensitivity.
- Alien and invasive species should be eradicated and controlled to prevent their spread beyond the infrastructure footprint.
- Ensure that operational related activities are kept strictly within the development footprint.
- Ensure that fires are only lit in designated areas and not during the windy season. All fires must also be extinguished before being left unattended. In this regard, warning signs must be placed in appropriate areas.
- No trapping or hunting of fauna by operational and maintenance staff is to take place.
- The use of the access road to the hydropower plant by motor vehicles must be controlled by way of a manned boom gate or other suitable control method.

9.9 MONITORING, REPORTING, AUDITING AND CONTINUAL IMPROVEMENT

Monitoring and auditing will ensure compliance with the provisions of the EMPR. Monitoring objectives and frequency of data collection will have to be reviewed once a comprehensive set of objectives and targets has been identified.

The following monitoring requirements have been identified at this stage:

- a) Throughout the life of the operation aquatic biomonitoring should take place to monitor aquatic ecological trends in the receiving environment at strategic points upstream and downstream of the impoundments, weirs and crossings. If any

trends are observed where impacts on the aquatic ecology are becoming unacceptable, measures to reduce the impacts must be immediately implemented. All aquatic biomonitoring should be undertaken by a suitably qualified and South African River Health Program (SA RHP) accredited assessor.

- b) Throughout the life of the operation water quality monitoring should take place, focussing on the impact of storing water in the dams, the discharge from WWTWs, the use of pesticides and herbicides for irrigated agriculture, and the transfer of water from one catchment to another (if applicable).
- c) Monitor the state of rehabilitated areas by undertaking annual site visits to determine the levels of soil stabilisation, vegetation cover, vegetation species diversity, and survival of planted species. Implement remedial measures as required.



Regular audits must be undertaken to ensure that objectives have been achieved within the given timeframe. Reporting of compliance to the Operational EMPR should be submitted to the environmental authorities. An assessment of the gaps and way forward will allow for continual improvement.

APPENDIX A: EXAMPLE OF METHOD STATEMENT

APPENDIX B: EXAMPLE OF EMERGENCY INCIDENT REPORT

NB! Please ensure that all the information provided in brackets are removed before submitting this report to the all the Authorities.

This form provides a template for the emergency incident report required in terms of section 30(5) of the National Environmental

 <p>environmental affairs Department: Environmental Affairs REPUBLIC OF SOUTH AFRICA</p> 	Document Type:	Emergency Incident Report	
	Title for the incident:		
	Date of the incident :		
Reference:		Initial Submission Date:	
Revision No.:		Compiled by:	

Management Act (Act No. 107 of 1998) (hereinafter "NEMA") in which the responsible person or, where the incident occurred in the course of that person's employment, his or her employer, must, within 14 days of the incident, report to the Director General, provincial head of department and municipality such information as is available to enable an initial evaluation of the incident, including: (a) the nature of the incident; (b) the substances involved and an estimation of the quantity released and their possible acute effect on persons and the environment and data needed to assess these effects; (c) initial measures taken to minimise impacts; (d) causes of the incident, whether direct or indirect, including equipment, technology, system, or management failure; and (e) measures taken and to be taken to avoid a recurrence of such incident.

In terms of section 30(1)(a) of NEMA, an "incident" means an unexpected sudden occurrence, including a major emission, fire or explosion leading to serious danger to the public or potentially serious pollution of or detriment to the environment, whether immediate or delayed.

In line with section 24 of the Constitution of the Republic of South Africa (Act No. 108 of 1996), "serious" is taken to be a measure of the impact of an incident where such an incident has had, could have had, is having, or will have a negative impact on human health or well-being.

1. RESPONSIBLE PERSON

In terms of section 30(1)(b) of NEMA, the "responsible person" includes any person who: (i) is responsible for the incident; (ii) owns any hazardous substance involved in the incident; or (iii) was in control of any hazardous substance involved in the incident at the time of the incident.

1.1 Name:		1.2 Designation:	
1.3 Postal Address:		1.4 Physical Address:	
1.5 Telephone		1.6 Telephone (A/H):	
1.7 Fax:			
1.8 E-mail:			
1.9 Nature of Business:			

2. EMERGENCY INCIDENT SUMMARY INFORMATION

Mark the appropriate boxes

2.1 Fire:		2.2 Spill:		2.3 Explosion:		2.4 Gaseous Emission:	
2.5 Injuries		2.6 Reportable injuries:		2.7 Hospitalisation:		2.8 Fatalities:	
2.9 Open water impacts:		2.10 Ground water impacts:		2.11 Atmospheric impacts:		2.12 Soil impacts:	
2.13 Own emergency response involved		2.14 Fire prevention services involved		2.15 Government hazardous materials emergency response involved		2.16 More than 1 governmental emergency response service involved	
2.17 Emission of non-toxic substances at low concentrations		2.18 Emission of non-toxic substances at high concentrations		2.19 Emission of toxic substances at low concentrations		2.20 Emission of toxic substances at high concentrations	
2.21 No evacuation required		2.22 Immediate area evacuated		2.23 Immediate surrounds evacuated		2.24 Evacuation of the general public	
2.25 Others							

3. INITIAL EMERGENCY INCIDENT REPORT

In terms of section 30(3) of NEMA, the responsible person or, where the incident occurred in the course of that person's employment, his or her employer must forthwith after knowledge of the incident, report through the most effective means reasonably available: (a) the nature of the incident; (b) any risks posed by the incident to public health, safety and property; (c) the toxicity of substances or byproducts released by the incident; and (d) any steps that should be taken in order to avoid or minimise the effects of the incident on public health and the environment to: (i) the Director General; (ii) the South African Police Services and the relevant fire prevention service; (iii) the relevant provincial head of department or municipality; and (iv) all persons whose health may be affected by the incident.

3.1 Description	3.2 Date:	3.3 Time:	3.4 Medium:	3.5. Name and contact details:
Hydro Carbon Spill				
LOCAL :				
PROVINCIAL: (Those deal with Environmental issues)				
DIRECTOR GENERAL: (Department of Environmental Affairs)				
Any other Director General of National Department, E.g. Department of Water Affairs				

4. INCIDENT DETAILS

In terms of NEMA section 30(5)(a) and (d), the responsible person must report on the nature of the incident as well as the causes of the incident, whether direct or indirect, including equipment, technology, system, or management failure

4.1 Location of the incident

4.2 Incident start date and time:

4.3 Incident duration:

4.4 Duration of exposure:

4.5. Incident description:

Background of the incident:

Operation:

Incident type:

Action Taken:

Root Cause of the incident:

Contributory Factors to the incident:

Conclusion:

4.6. Wind speed and direction

4.7. Ambient air temperature

4.8. Weather conditions

4.9. Other relevant meteorological conditions

5. POLLUTANTS RELEASED DURING INCIDENT

In terms of NEMA section 30(5)(b), the responsible person must report on the substances involved and an estimation of the quantity.

List all the pollutants directly released during the incident (i.e. exclude those pollutants that resulted from mitigation measures, e.g. flaring, treatment, dilution etc.)

5.1. Substance or mixture of substances	5.2. Reference Number	5.3. Phase eg solid, liquid or gas	5.4. Total Quantity emitted/released	5.5. Units eg Kg, L etc	5.6. Nature of emission/release

6. SECONDARY POLLUTANTS RESULTING FROM INCIDENT

In terms of NEMA section 30(5)(b), the responsible person must report on the substances involved and an estimation of the quantity released.

List all the pollutants that resulted from mitigation measures, e.g. flaring, treatment, dilution etc.

6.1. Substance or mixture of substances	6.2. Reference Number	6.3. Phase	6.4. Total Quantity emitted/released	6.5. Unit	6.6. Nature of emission

7. POLLUTANT CONCENTRATIONS

In terms of NEMA section 30(5)(b), the responsible person must report on the substances involved and an estimation of the quantity released.

List all the pollutants detailed in previous section:

7.1. Substance or mixture of substances	7.2. Reference Number	7.3. Estimated pollutant concentration on different radius			
		7.3.1. 10m	7.3.2. 100m	7.3.3. 500m	7.3.4. >2000m
[The name recognised by any national or internationally recognised chemical referencing system]	[Reference to any national or internationally recognised chemical referencing system]	[estimate the concentration of the pollutant in water, soil and/or air within a 10m radius of the epicentre of the incident] [provide the units used in a case of estimating concentration (e.g. ppm)]	[estimate the concentration of the pollutant in water, soil and/or air within a 100m radius of the epicentre of the incident] [provide the units used in a case of estimating concentration (e.g. ppm)]	[estimate the concentration of the pollutant in water, soil and/or air within a 500m radius of the epicentre of the incident] [provide the units used in a case of estimating concentration (e.g. ppm)]	[estimate the concentration of the pollutant in water, soil and/or air within a > 2000 m radius of the epicentre of the incident] [provide the units used in a case of estimating concentration (e.g. ppm)]

¹ Concentration at the plume

² Concentration that was falling on the ground

8. INCIDENT IMPACT

In terms of NEMA section 30(5)(b), the responsible person must report on possible acute effects on persons and the environment and the responsible must provide data needed to assess these effects;

8.1. Minor injuries	
8.2. Reportable injuries	
8.3. Hospitalisation	
8.4. Fatalities	
8.5. Biological impacts	
8.6. Impact area	
8.7. Data	

9. EXISTING PREVENTION PROCEDURES AND/OR SYSTEMS

9.1. Foresight	[Briefly describe whether the incident could have, or had, been foreseen, e.g. was it included in any environmental impact assessment, risk assessment, health and safety plan, etc.]
9.2. Procedures and/or systems	Attach any relevant safety, health and environmental plans (including any statutory planning requirements) that detail what actions should be taken in the event of the incident that is the subject of this report
9.3. Procedure and/or systems failures	[Describe any failures or shortfalls in procedures and/or systems that may have contributed to the incident] All procedures and checklist in place and signed off.
9.4. Technical measures	[Describe any technical measures, equipment, 'fail-safe' devices, etc. that are in place to prevent the occurrence of the incident] Communications & discussions in place.
9.5. Technical failure	[Describe any failures of technical measures, equipment, 'fail-safe' devices, etc. that are in place to prevent the occurrence of the incident]

10. INITIAL INCIDENT MANAGEMENT

In terms of NEMA section 30(5)(c), the responsible person must report on initial measures taken to minimise impacts.

10.1. Evacuation	N/A
10.2. Technical measures	
10.3. Mitigation measures	[Describe all measures taken to minimize the impact] SOPEP gear activated
10.4. Emergency Services	[Describe any governmental emergency services involvement] SAMSA/TNPA advised

11. CLEANUP AND/OR DECONTAMINATION

In terms of NEMA section 30(5)(c), the responsible person must report on initial measures taken to minimise impacts.

11.1. Cleanup and/or decontamination			
11.2. Permissions and Instructions			
Provide details of any permission and/or instructions received from any organ of state during initial incident management, cleanup and/or decontamination			
11.3. Type	11.4. Statute	11.5. Issued By	11.6. Name and contact details

12. MITIGATION MEASURES

In terms of NEMA section 30(5)(e), the responsible person must report on measures taken and to be taken to avoid a recurrence of such an incident.

12.1. Measure	12.2. Objective	12.3. Cost	12.4. Timing
[Briefly describe each of the measures taken, and to be taken, to avoid a recurrence of such incident]	[Briefly describe the objective of the measure, i.e. the desired outcome of the measure]	[Estimate the cost of the measure in terms of capital costs and/or recurrent costs]	[Provide information on the timing for the full implementation of the measure]

12. MITIGATION MEASURES

In terms of NEMA section 30(5)(e), the responsible person must report on measures taken and to be taken to avoid a recurrence of such an incident.

12.1. Measure	12.2. Objective	12.3. Cost	12.4. Timing

13. AUTHORISATIONS

Provide details on all authorisations (including permits, licenses, certificates, etc.) in respect of the activity to which this incident relates.

13.1. Type	13.2. Statute	13.3. Issued By	13.4. Issue & Expiry Date
[Describe the nature or type of authorisation, e.g. Registration Certificate]	[Provide the reference for the authorisation, e.g. section X of the National Environmental Management Act (Act No. 107 of 1989)]	[Provide contact details for the issuing authority]	[provide the date of issue and expiry]

14. HISTORY

Provide details of all similar incidents involving the responsible person in the past (i.e. from 1998). Similar incidents include those that: (i) involved similar circumstances; (ii) involved similar emissions; (iii) involved similar personnel; and/or (iv) involved similar impacts.

14.1. Incident title	14.2. Report reference	14.3. Date of incident	14.4. Summary of event
[Provide the title used in the relevant emergency incident report]	[Provide the reference in respect of the relevant emergency incident report]	[Date of incident]	[Provide a summary of the event]

Signed by, or as a mandated signatory for, the responsible person:		Date:	
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APPENDIX 1

List of affected people as results of the incident

NAME	ADDRESS	PHONE	FAULT	REMARKS

APPENDIX 2

Layout map of the area likely to be affected or affected as a result of the incident



Disclaimer

Any other information not covered in the reporting template must be included.

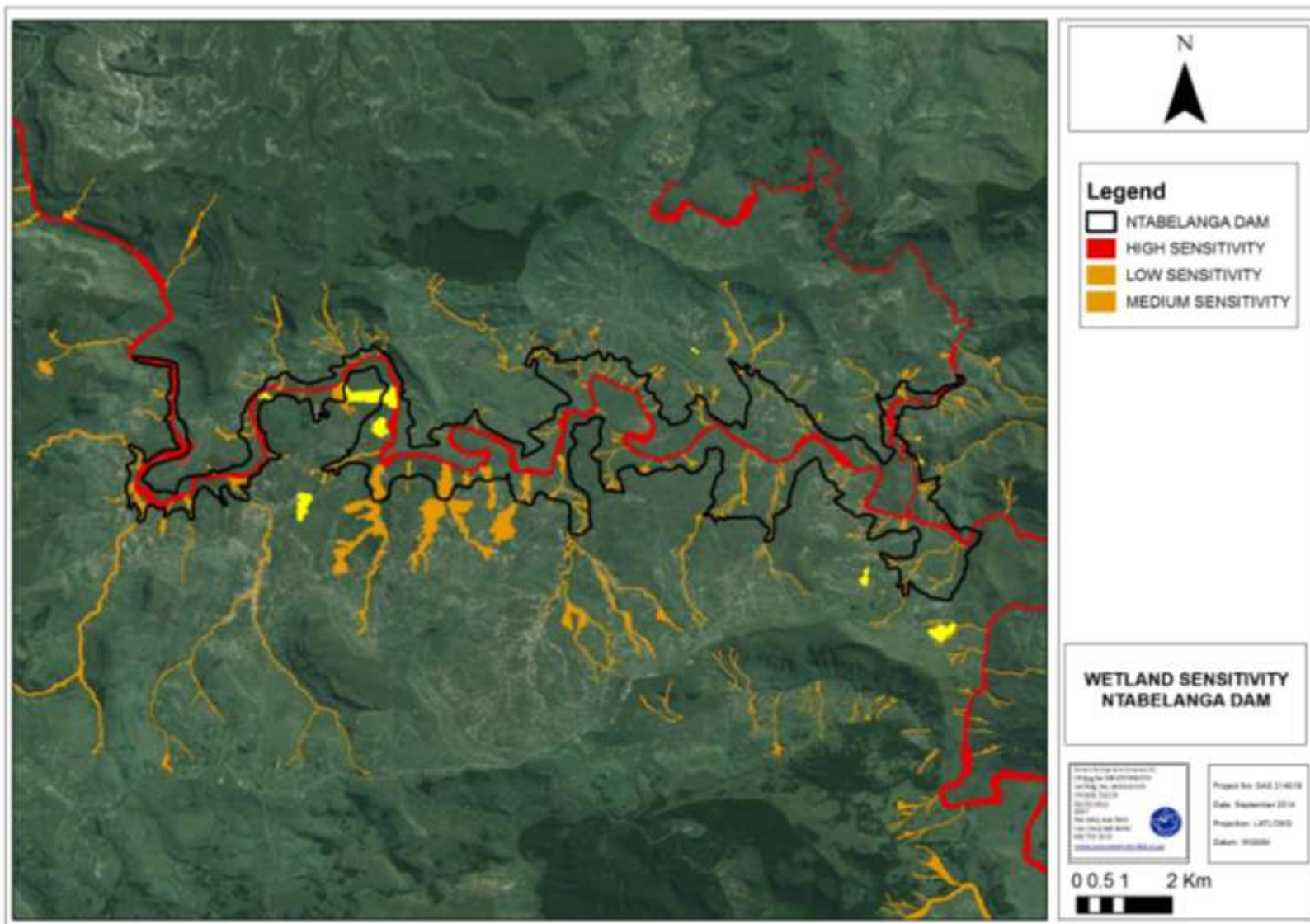
CAUTION

In terms of section 30 (11) of NEMA as amended, it is an offence not to report an incident and liable on conviction to a fine not exceeding R 1 million or imprisonment for a period not exceeding 1 year, or to both such a fine and such imprisonment.

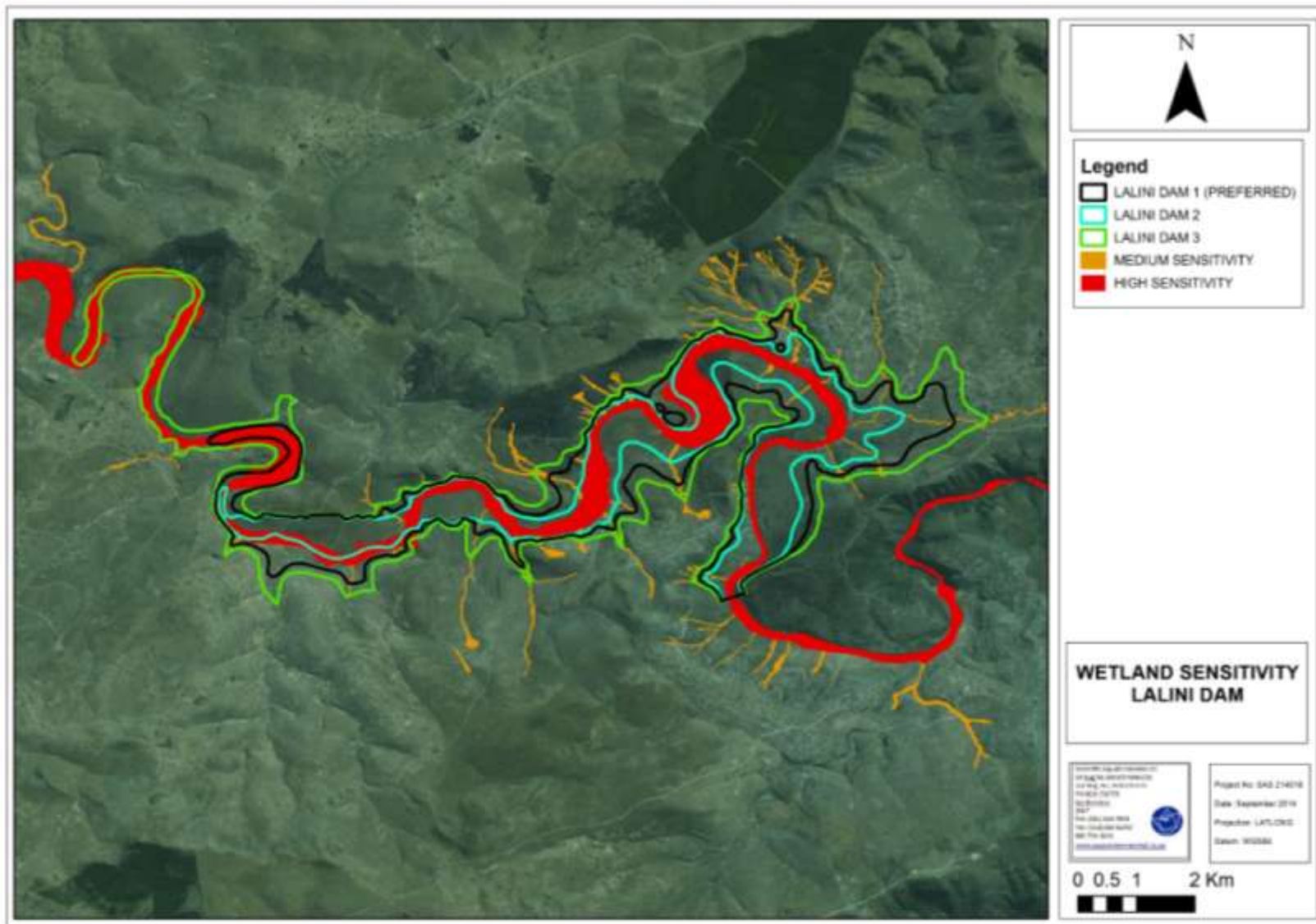
APPENDIX C: ENVIRONMENTAL MANAGEMENT PLANS FOR THE BORROW AREAS AND QUARRIES

Please refer to **Appendix E** of the Environmental Impact Assessment Report

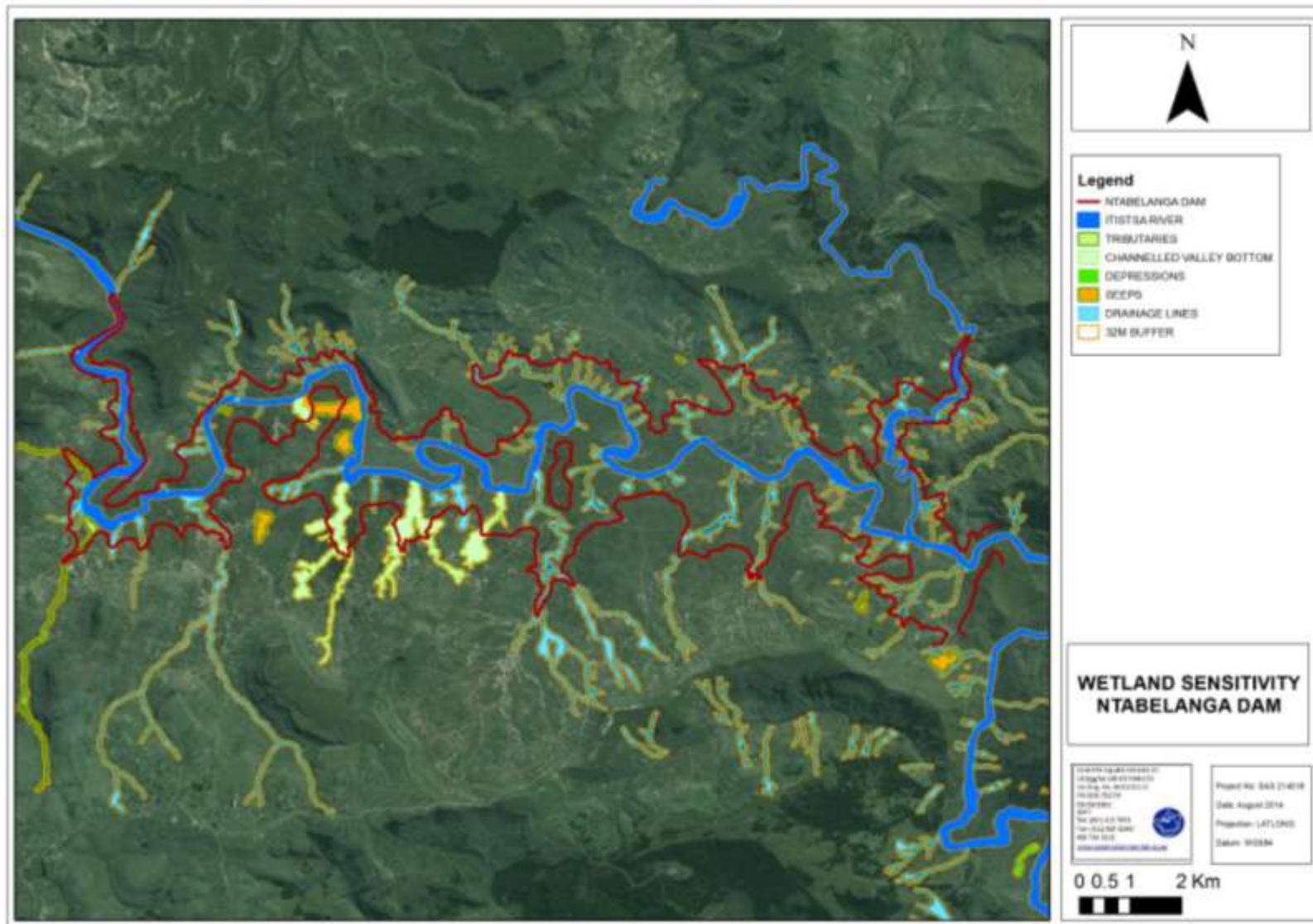
APPENDIX D: ECOLOGICAL SENSITIVITY MAPS



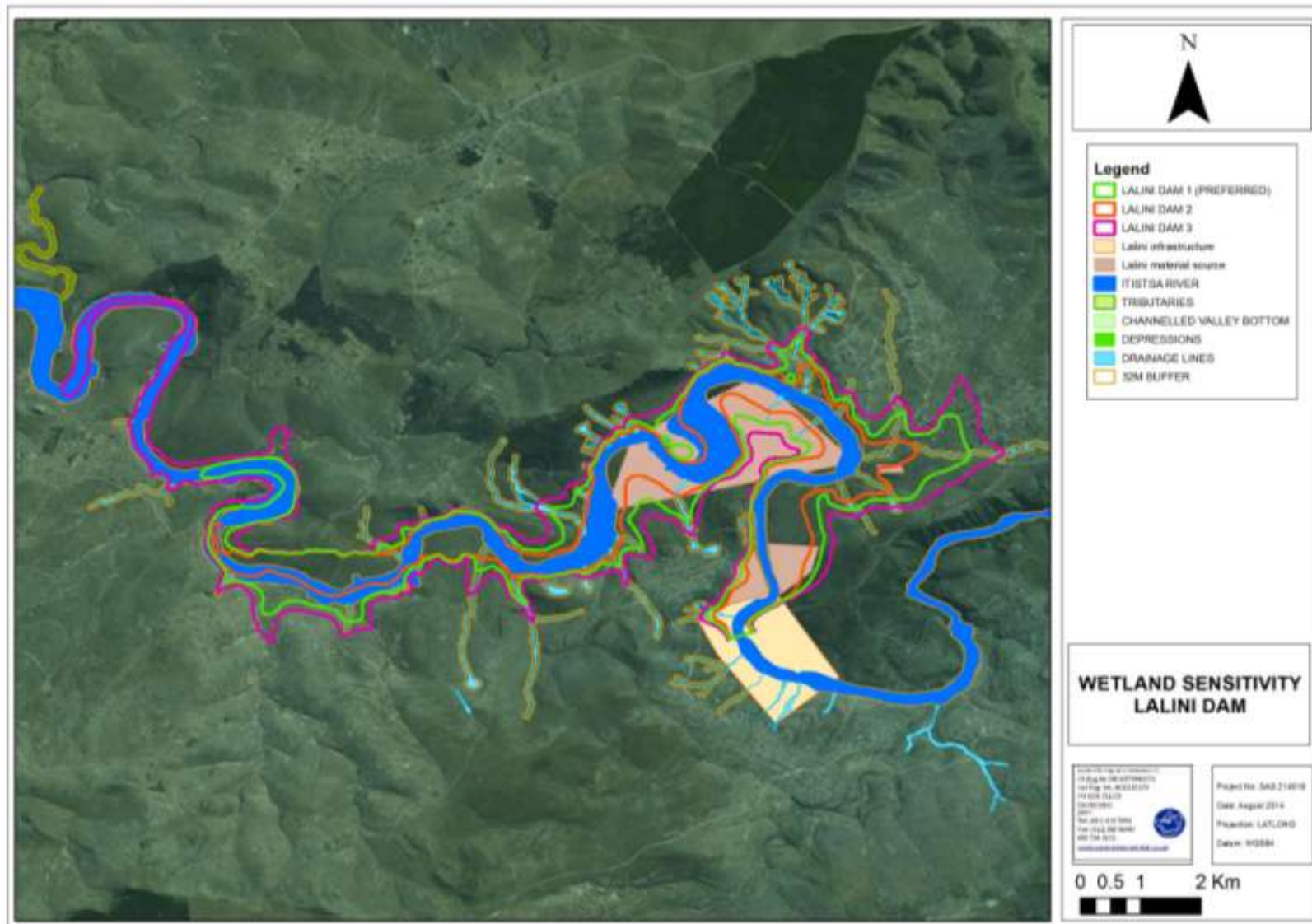
Conceptual presentation of the sensitivity of the wetland and riparian features associated with the proposed Ntabelanga Dam



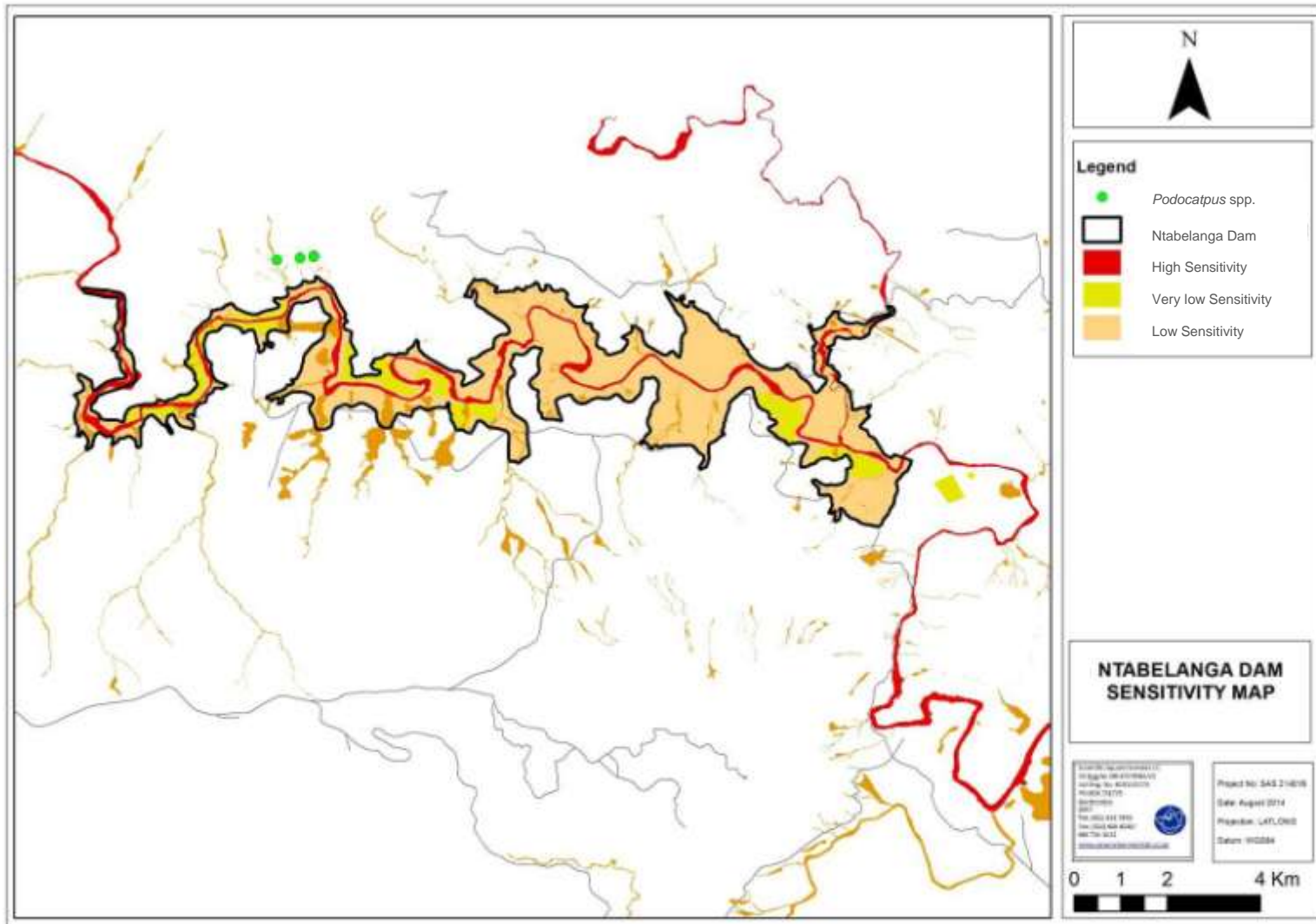
Conceptual presentation of the sensitivity of the wetland and riparian features associated with the proposed Lalini Dam



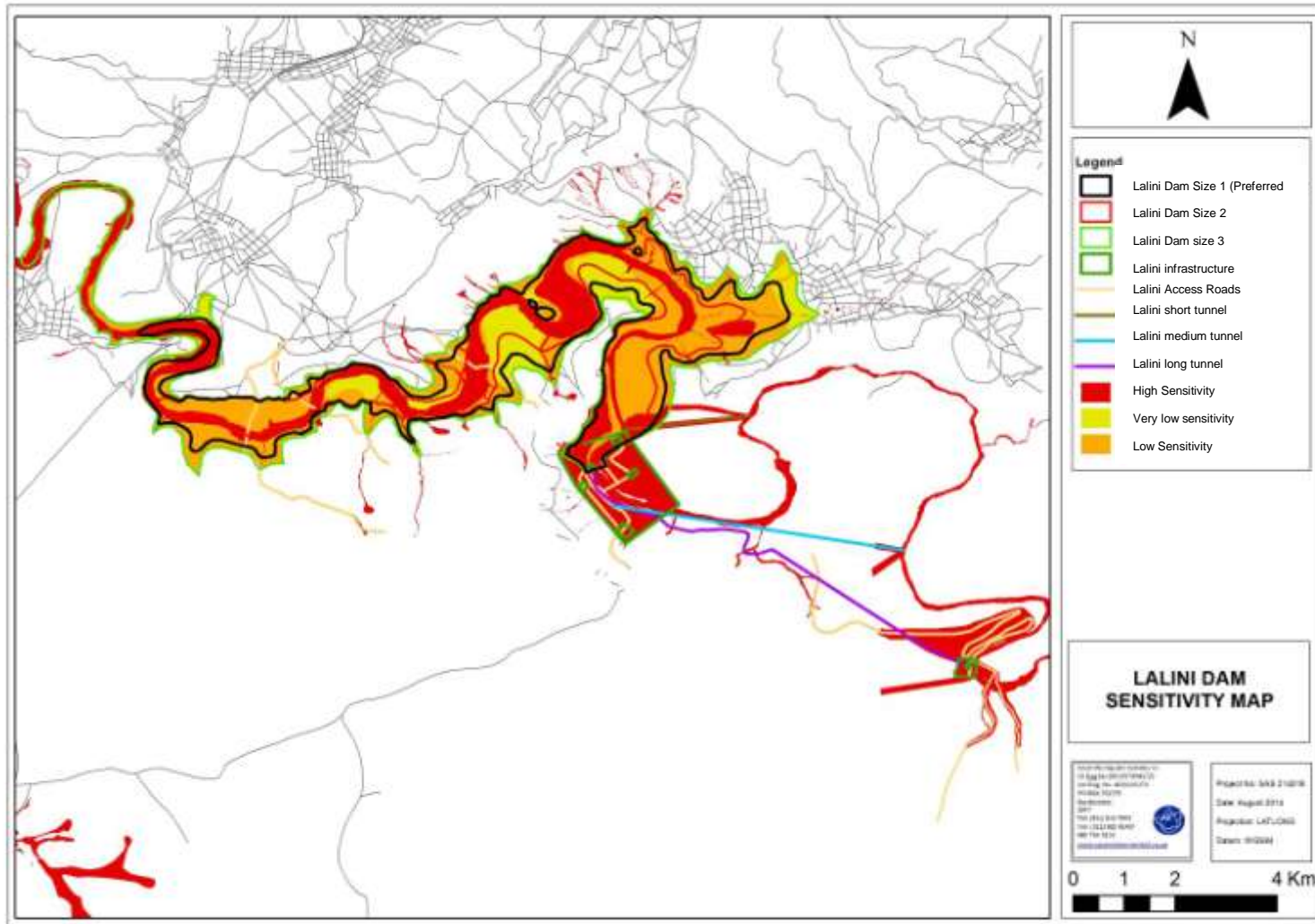
Conceptual presentation of the riparian and wetland delineations, with the associated buffer zone, in the Ntabelanga Dam vicinity



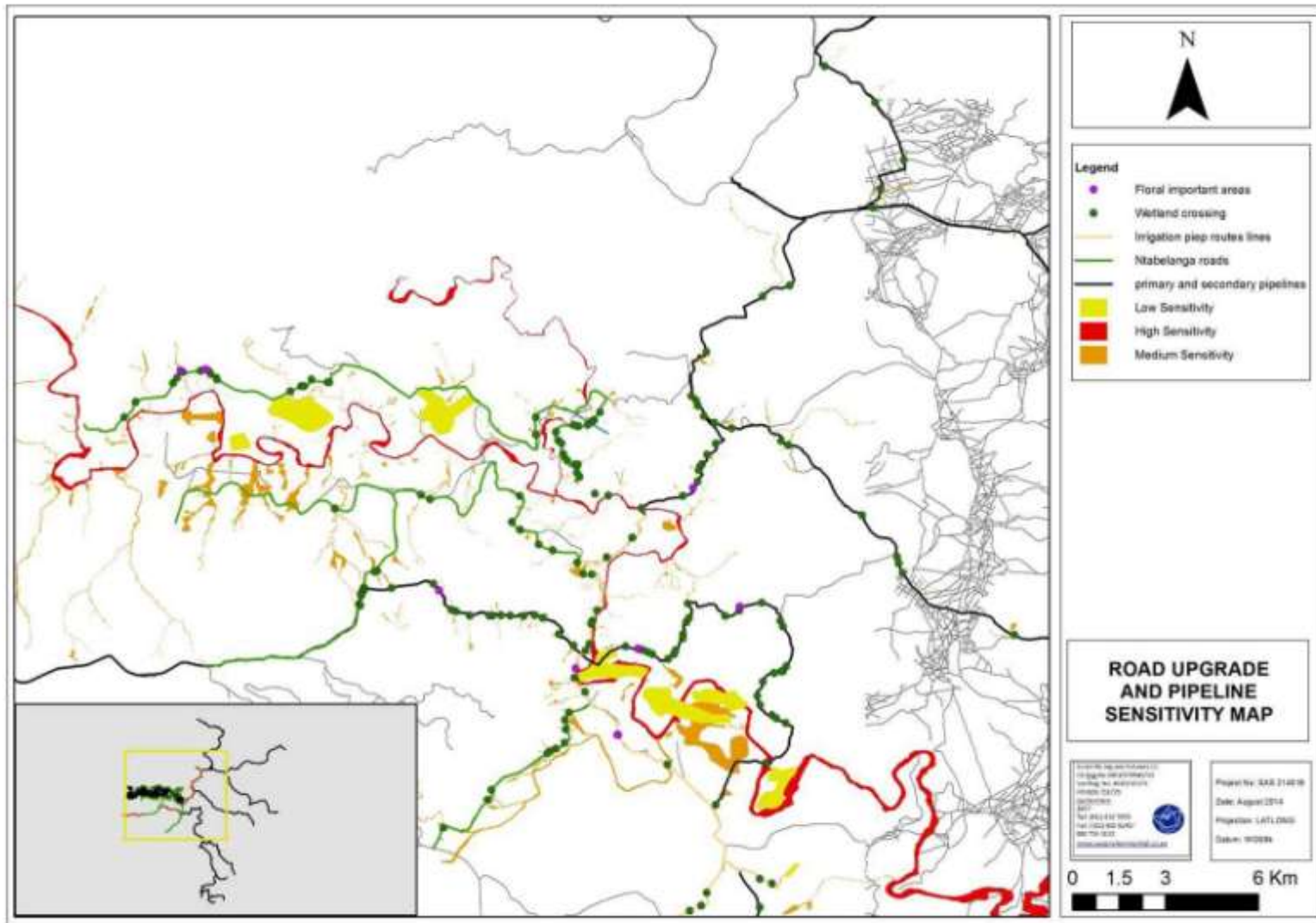
Conceptual presentation of the riparian and wetland delineations, with the associated buffer zones, in the Lalini Dam vicinity



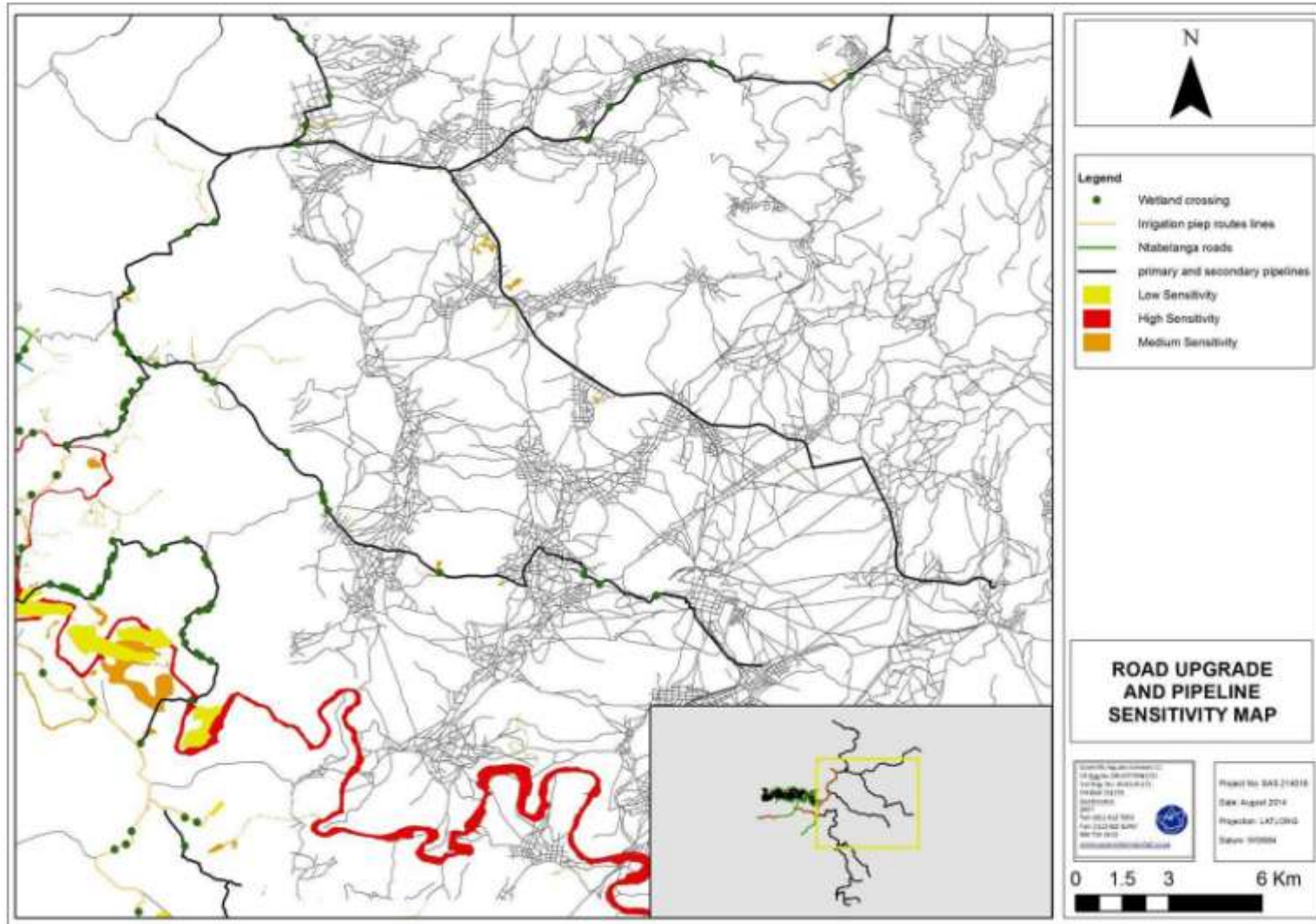
Floral sensitivity map for the Ntabelanga Dam study area and infrastructure associated with the dam



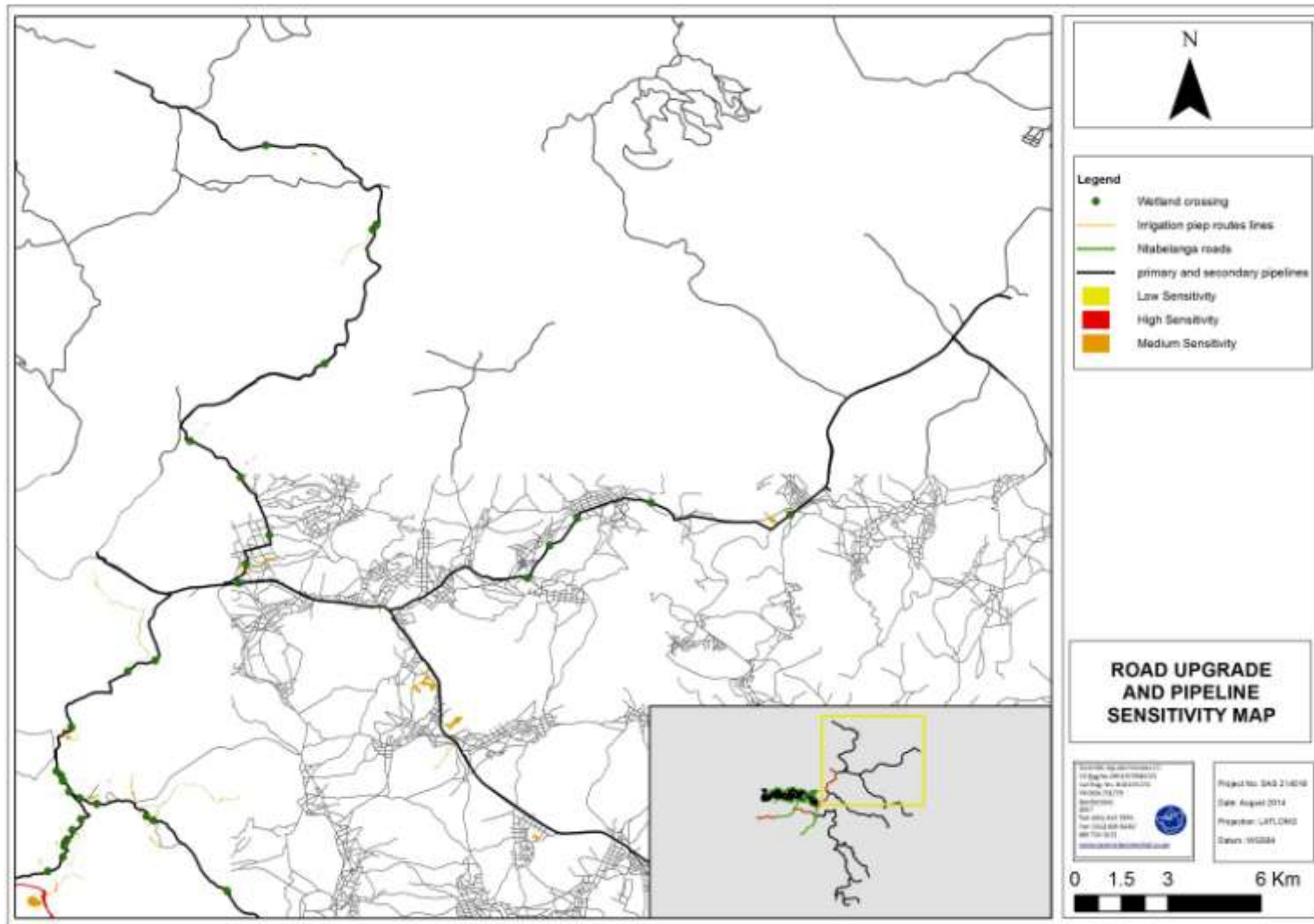
Floral sensitivity map for the Lalini Dam area and associated infrastructure



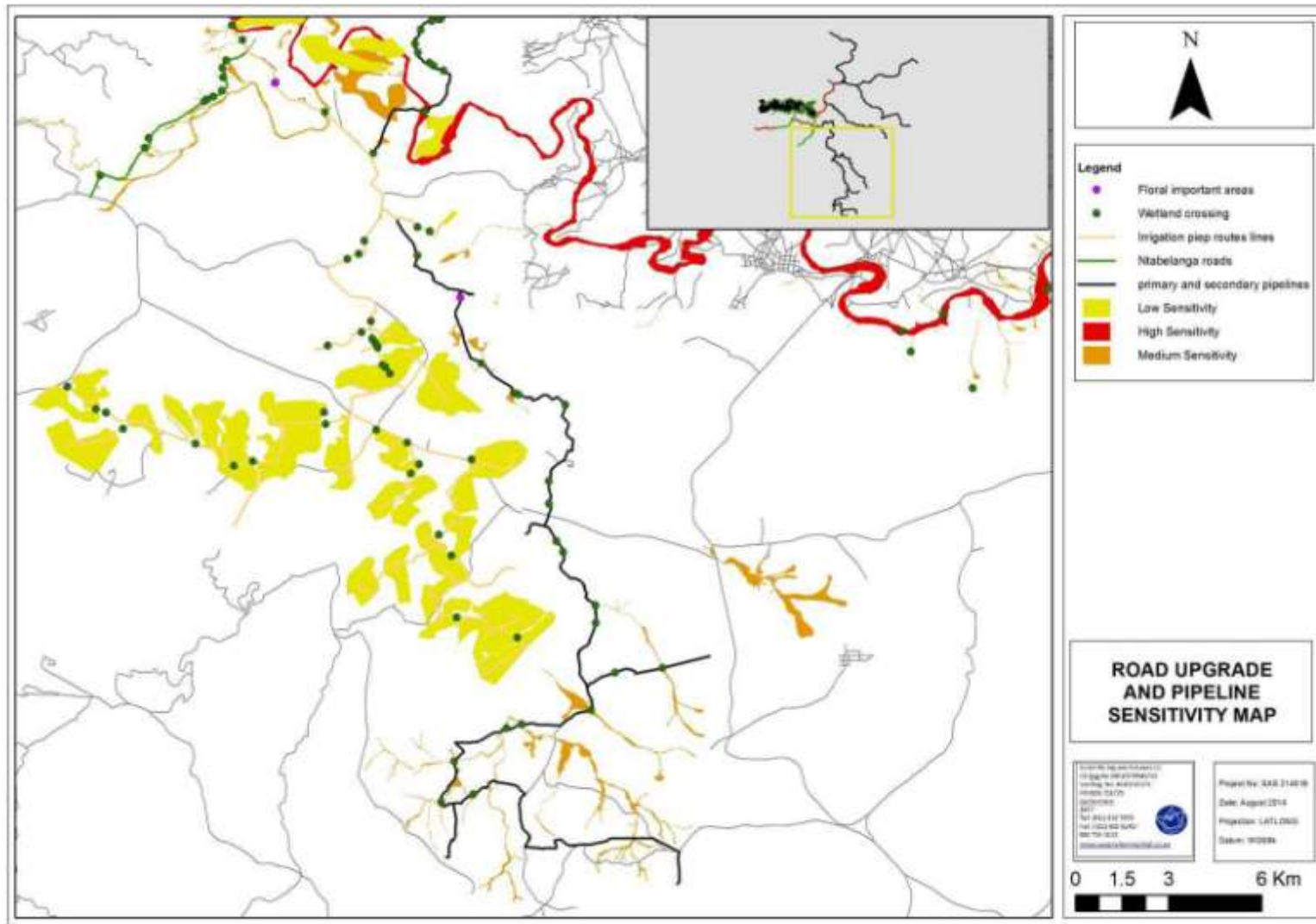
Sensitivity map for the proposed road upgrade and pipelines



Sensitivity map for the proposed pipelines



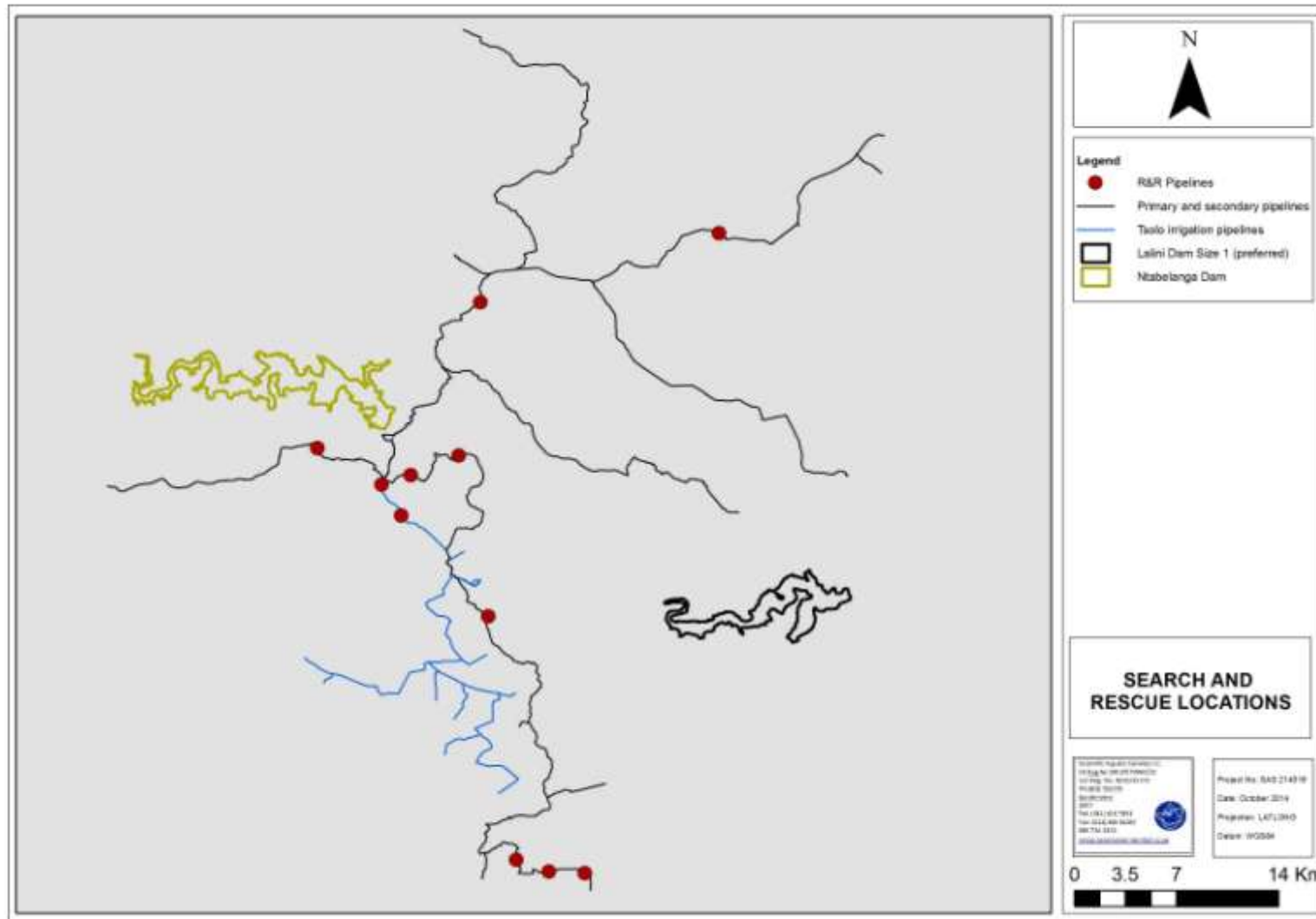
Sensitivity map for the proposed pipelines



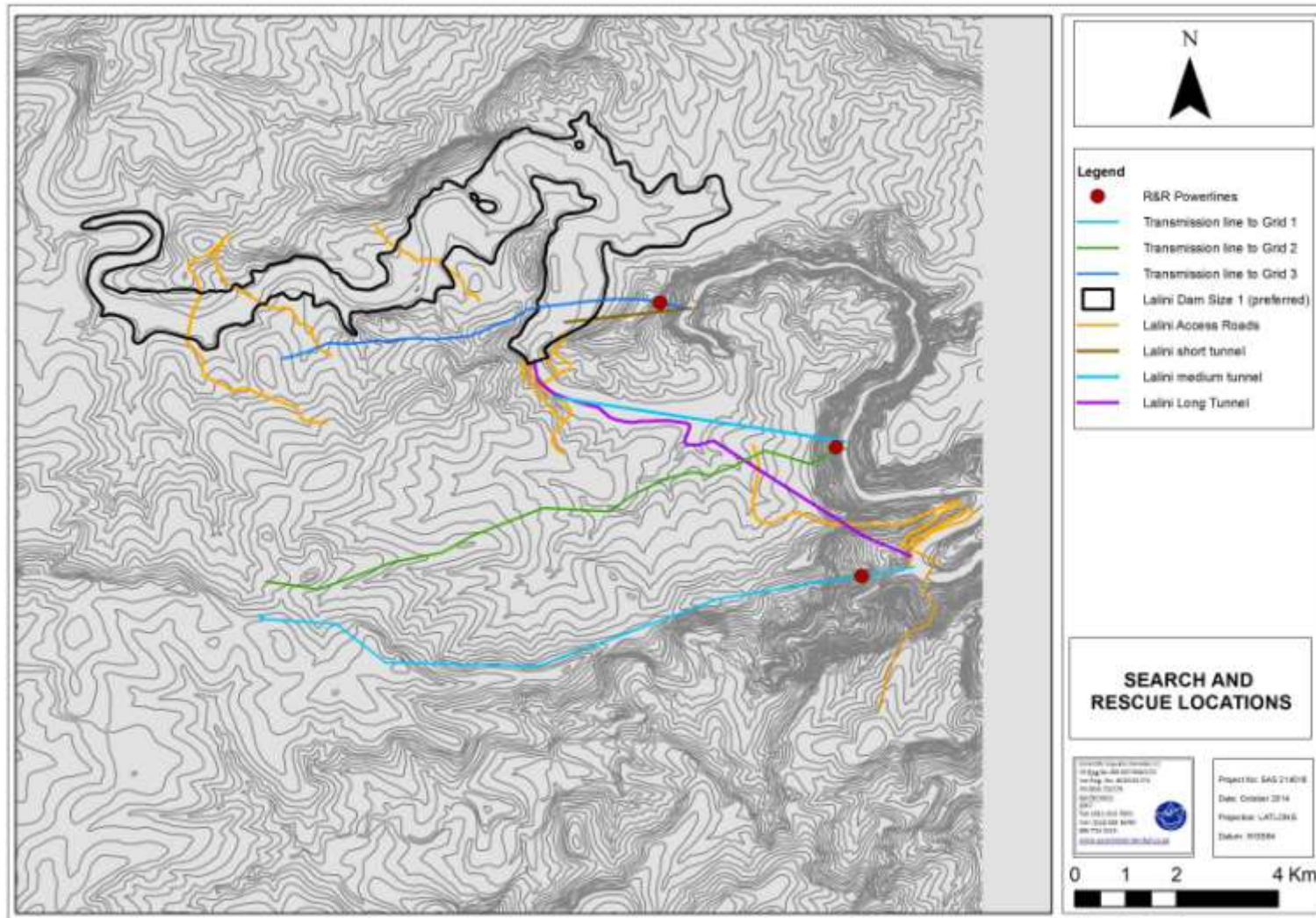
Sensitivity map for the proposed pipelines

APPENDIX E: KEY SEARCH AND RESCUE LOCATIONS

In addition to the entire dam basins, the areas marked on the following maps must be subjected to search and rescue.



Areas identified along the pipeline routes that require search and rescue before construction activities commence



Areas identified along the power line routes that require search and rescue before construction activities commence



Areas identified along the proposed road upgrade areas and new roads that require search and rescue before construction activities commence