7. MOTIVATION FOR THIS PROJECT

7.1 WATER USES BEING APPLIED FOR

The following water uses will be applied for:

- **Section 21 (a)**: taking water from a water resource;
- **Section 21 (b)**: storing of water;
- **Section 21 (c)**: impeding or diverting the flow of water in a water course;
- **Section 21 (e)**: engaging in a controlled activity identified as such in section 37(1) (c);
- **Section 21 (f)**: discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
- **Section 21 (g)**: disposing of waste in a manner which may detrimentally impact on a water resource; and
- **Section 21 (i)**: altering the bed, banks, course or characteristics of a water course.

A full description of each water use is provided in **Chapter 5**.

7.2 POTENTIAL SIGNIFICANT IMPACTS

During the EIA process, environmental aspects were identified that could be affected by the construction of the MWP. The EIR provides an in depth assessment of all environmental studies done in order to identify potential impacts of the MWP. The studies related to water use included:

- Wetlands;
- Aquatic; and
- Water Quality;

The impacts were categorised into those that have a low, medium or high significance and were assessed before and after mitigation measures were to be implemented. For full details on all significant potential impacts please refer to the ***Environmental Impact Assessment Report: P WMA 12/T30/00/5314/3.***

8. SECTION 27 NATIONAL WATER ACT MOTIVATION

8.1 27(A) EXISTING LAWFUL WATER USE

The MWP is a Strategic Integrated Project (SIP 3). Geographic SIPs were identified by the South African Government, one of which is the 'South Eastern node & corridor development' which includes the development of a new dam at Mzimvubu with irrigation system. There are currently no existing lawful water uses.

8.2 27(B) NEED TO REDRESS THE RESULTS OF PAST RACIAL AND GENDER DISCRIMINATION

One of the objectives of the NWA is to address past racial and gender discrimination and assist with alleviating poverty in South Africa. It is therefore important to support and stimulate economic development to assist previously disadvantaged groups.

The Eastern Cape Province covers an area of 168 966 km^2 making it the second largest province by geographical area, covering 13.8 % of South Africa's total land mass. In respect of population group, 86.3 % of the population are black African, 8.3 % are coloured, 4.7 % are white and 0.4 % are Indian or Asian people.

The sex ratio, which measures the proportion of males to females, is 89.0 indicating a higher number of females in the province. Between 1996 and 2001 the population growth rate was 0.46 % p.a. while between 2001 and 2011 it was 0.44 % p.a.

The project impacts the three district municipalities of Joe Gqabi, O. R. Tambo and Alfred Nzo. Of these districts, Joe Gqabi, covers the greatest land area and has the lowest population density across the region at 14/km^2 while O. R. Tambo has the largest population and the highest population density at 110/km^2. With regard to population group, black African people are the dominant group across all districts at over 90 %.

At the local municipal level the project impacts the following 4 local municipalities, Elundini, Mhlontlo, Umzimzubu and Ntabankulu. Of these municipalities Elundini covers the greatest geographical area at 5,065 km^2 and Ntabankulu the smallest area at 1,385 km^2. With a population of 123,976 people Ntabankulu has the highest population density at 90/km^2. Umzimvubu has the highest population with 191 620 people living within the municipal area. At over 98 % black African people are the biggest population group across all municipalities. The sex ratio across all areas indicates a higher number of females compared to males with Ntabankulu having the highest proportion of females to males at 83.8 % and Elundini the lowest at 90.10 %

The area is characterised by high poverty and out-migration resulting in sex ratio imbalances, a high proportion of female headed households and a low population growth rate. Consequently there is a high dependency ratio and a high level of food access inadequacy. The population also lacks basic amenities and relies heavily on subsistence farming.

The MWP will contribute on a macro-economic level to the National as well as the Eastern Cape Province economy.

8.3 27(C) EFFICIENT AND BENEFICIAL USE OF WATER IN THE PUBLIC INTEREST

The Mzimvubu Catchment, one of the poorest regions in South Africa, possesses untapped economic potential in the form of its abundant water resources. The greater Transkei is the region in South Africa with the highest average rainfall and is host to the bulk of South Africa's untapped water, a rare commodity in an otherwise resource abundant nation. The Mzimvubu catchment area has a relatively high mean annual runoff but the water resource remains largely undeveloped and no large dams have been constructed in the area.

Associated with the lack in development are communities of people considered to be amongst the poorest in South Africa. It is for this reason that the Eastern Cape Provincial Government and National Government have identified the Mzimvubu River catchment area as requiring accelerated social and economic upliftment. It is envisaged that by harnessing the available water resources in the catchment area (through the construction of the dams and associated infrastructure), social and economic upliftment will follow (Department of Water Affairs, 2013).

Dams are criticised because of the high cost of construction involved and impacts such as flooding of large areas, and impacts on flow in aquatic and riparian ecosystems, disrupting livelihoods and destroying valuable, potentially arable, land (Department of Water and Sanitation, 2014).

However, dams provide many benefits. The primary benefit is in its supply of water for productive uses. Growth of populations, agricultural expansion and commercial and industrial economic activity relies heavily on South Africa's available water resources as a critical input into economic production. The availability of fresh water is increasingly an impediment to economic development. As such, the MWP is foundational to the development of the Mzimvubu Catchment, and the large scale development associated with the dam can generate significant economic activity in the region. Other medium term benefits include hydroelectric power, recreation, flood control, water supply, waste management and navigation (Department of Water and Sanitation, 2014).

The long term economic benefits associated with the MWP include an increase in quality of life and would impact positively on labour and economic productivity. Examples of these benefits include the value of time saved by households in collecting water, the reduced burden of water-borne disease, tax revenue accruing to the fiscus and most importantly, the long-term economic impact resulting from the improvement in local infrastructure (Department of Water and Sanitation, 2014).

8.4 27(D) SOCIO-ECONOMIC IMPACT OF THE WATER USE IF AUTHORISED

All three District Municipalities (DMs), OR Tambo DM, Alfred Nzo DM and Joe Gqabi DM, impacted by the Mzimvubu Water Project, have published extensive IDPs. All three DM IDPs (Afred Nzo IDP, 2010; Joe Gqabi IDP, 2012/13; OR Tambo IDP, 2012-17) refer to the DM's responsibility for planning, implementation, operation and maintenance of water and sanitation services. The Alfred Nzo IDP states that "*of the estimated 127 878 households approximately 70 000 are serviced with water in one way or another which translates to 45.2% of the population having no access whatsoever to potable water*." Additionally, "*Communities in rural areas are still highly dependent on undeveloped water sources and there remains a challenge in meeting the water demand, due to source identification*". This states the need for an additional water source, such as that which would be provided by the Mzimvubu Water Project.

The authorisation of the water uses will impact positively on the provincial economy. During the peak of the construction period, 2 299 direct employment opportunities will be created with another 843 indirect and 1 036 induced jobs in the provincial economy. Of the direct jobs an estimated 1 057 will be semi-skilled and 771 low-skilled of which probably most will be recruited from the local community.

There is also a positive impact on the Gross Domestic Product to the value of R282.7 million. Low income households also receive a total of R82.42 million out of a total of R528.11 million of the total impact on households.

Although only for a short period, the construction 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 hydro-electricity plant will also contribute considerably to the economy. In the final year 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 semi-skilled and 273 low-skilled, of which probably most will be recruited from the local community.

There is also a positive impact on the Gross Domestic Product to the value of R164.6 million. Low income households also receive a total of R52.38 million out of a total of R335.64 million of the total impact on households.

Once the irrigation scheme is in full production it will also make a very positive contribution in terms of job creation and income to specifically low-income households. An estimated 4 000 individuals will be employed, although not all permanently.

The macro-economic contribution of the irrigation scheme is estimated at a total annual GDP contribution of R129.3 million per year and the total household income at R146.6 million with R38.6 million for low-income households, when expressed in 2013 prices.

The total fulltime employment opportunities are estimated at 1 976 of which 1 301 are direct on the farms which will comprise of the following number of people:

- Permanently on the farms – 7 per unit and 315 in total. This will be tractor drivers, irrigation workers and workshop staff.
- The temporary workers are estimated at 80 per unit with a total of 3 600. This is very often the only job that these workers have and over time a clearer picture will emerge regarding their social situation.

On the other hand, should the water use be authorised, communities currently using resources from the river (e.g. for watering cattle, fishing, reeds etc.) for their livelihoods may be detrimentally affected. For instance, women in the area collect reeds from the river to make mats and brooms which they sell. This may no longer be possible once the dams fill up and inundate the area. Any loss of access to natural resources (e.g. reeds) will be compensated for in the Relocation Action Plan, when it is implemented.

8.5 27(D) SOCIO-ECONOMIC IMPACT OF THE FAILURE TO AUTHORISE THE WATER USE OR USES

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).

Failure to authorise the water uses 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.

8.6 27(E) ANY CATCHMENT MANAGEMENT STRATEGY APPLICABLE TO THE RELEVANT WATER RESOURCE

8.6.1 Mzimvubu to Keiskamma Water Management Area – Integrated Strategic Perspective (ISP)

In support of catchment management, the DWS has developed Integrated Strategic Perspectives in order to guide critical decisions.

The DWS underpin the principles of environmental management in each strategy and there are a number of strategic areas with a particularly strong biophysical/ ecological emphasis. These include:

- The Reserve (groundwater, rivers, wetlands and estuaries);
- Water quality - surface and groundwater;
- The approach towards the clearing of Invasive Alien Plants;
- The management of wetlands;
- Land degradation. Erosion and sedimentation (land care); and
- Land use and especially how this is impacted by land reform and the re-allocation of water.

Much of the emphasis in water resource management has revolved around ensuring that users have sufficient quantities of water. However, as more water gets used and re-used, as quantities get scarce and feedback loops get even tighter, it is quality that begins to take on a dominant role.

The Mzimvubu catchment area has a relatively high mean annual runoff but the water resource remains largely undeveloped and no large dams have been constructed.

The Mzimvubu to Keiskamma Water Management Area ISP reiterates that the benefits to be derived from the development of the Mzimvubu River area will potentially be of national importance. It also identifies the requirement for large-scale development of the Mzimvubu River to be made subject to authorisation at national level.

The ISP proposes that, with appropriate planning, new dams for hydropower generation and irrigation can be located and designed in such a way as to permit the abstraction of water for transfer to other water management areas.

8.7 27(F) LIKELY EFFECT OF THE WATER USE TO BE AUTHORISED ON THE WATER RESOURCE AND ON THE OTHER WATER USERS

The effect of the water use on the water resource and the other water users is summarised in **Chapter 9**.

8.8 27(G) THE CLASS AND THE RESOURCE WATER QUALITY OBJECTIVES OF THE WATER RESOURCE

8.8.1 Ntabelanga Dam - Environmental Water Requirements

Environmental Water Requirements (EWR) are important to downstream ecosystems and are related to the characteristics and timing of natural stream flows.

For the purpose of assessing the impact of making EWR releases on the yield available from the proposed dam, a Rapid Reserve Determination was undertaken for the Ntabelanga Dam site.

The present ecological state of the Tsitsa River is classed as a C or a D, which could be considered low in undeveloped catchments. The low classes, especially the Class D of the Tsitsa River, is predominantly due to the very high sediment loads in the river, which limit habitat availability for the aquatic biota associated with an EWR study (i.e. macro-invertebrates and fish) (Department of Water Affairs, 2013) .

8.9 27(H) INVESTMENTS ALREADY MADE AND TO BE MADE BY THE WATER USERS IN RESPECT OF THE WATER USE IN QUESTION

The investments already made are summarised in **Table 18**.

Table 18: Investments already made

Feasibility Study	R18 849 960.00
EIA Study, Reserve and Lalini investigations	R 9 501 829.00
Detail Design	(services still to be procured)
TOTAL	**R28 351 789.00**

Expenditure, income and employment anticipated by the project is summarised in **Table 19**.

Table 19: Projected Expenditure, Income and Employment

Anticipated CAPEX value of the project on completion	R12.45 billion
Expected annual income to be generated by or as a result of the project	R 5.9 billion during construction R 1.6 billion during operation
New skilled employment opportunities created in the construction phase of the project	An estimated 3 880 jobs
New skilled employment opportunities created in the development phase of the project	Up to 2 620 jobs
New un-skilled employment opportunities created in the construction phase of the project	Up to 2 930 jobs
New un-skilled employment opportunities created in the development phase of the project	Up to 2 300 jobs
Expected value of the employment opportunities during the development and construction phase	R 376 million/year during construction R 268 million/year during operation
Percentage of this value that will accrue to previously disadvantaged individuals	At least 30% during construction
Expected current value of the employment opportunities during the first 10 years	R 3.33 billion

8.10 27(I) THE STRATEGIC IMPORTANCE OF THE WATER USE TO BE AUTHORISED

The development of the Mzimvubu River, the largest undeveloped water resource in the country, is of national significance.

Growth of populations, agricultural expansion and commercial and industrial economic activity relies heavily on South Africa's available water resources as a critical input into economic production. The availability of fresh water is increasingly an impediment to economic development. As such, the MWP is foundational to the development of the Mzimvubu Catchment, and the large scale development associated with the dam can generate significant economic activity in the region.

8.11 27(J) THE QUALITY OF WATER IN THE WATER RESOURCE WHICH MAY BE REQUIRED FOR THE RESERVE AND FOR MEETING INTERNATIONAL OBLIGATIONS

The National Water Act (NWA) No. 36 of 1998 requires that before water use authorisations can be granted to utilise a particular water resource, it is necessary to determine the Reserve for the relevant ecological component of the resource that will be impacted by the proposed water use. This requires the implementation of Resource Directed Measures (RDM) to protect the water resources of the country.

The construction of the Ntabelanga dam has been proposed in the Tsitsa catchment in quaternary catchment T35E. The proposed dam will have both direct (i.e.

hydraulics) and indirect impacts (i.e. geomorphology, habitat integrity and response variables) on the downstream aquatic ecosystem. These impacts necessitate that the Reserve (ecological and basic human needs) are determined for the catchment to ensure adequate protection of the water resources (Departement of Water Affairs, 2013).

The Reserve study had the following findings (Departement of Water Affairs, 2013):

- The water resources of the Tsitsa River at the EWR site is currently in a C category (moderately modified state), mainly due to water quality impacts (a result of increased sedimentation in the system), and localised disturbances (e.g. alien invasive plants and concomitant bank erosion). These changes were observed in both abiotic (i.e. the Desktop Reserve Model (DRM), the Physicochemical Assessment Index (PAI) and Index of Habitat Integrity (IHI)) and biotic (i.e. Macroinvertebrate Response Assessment Index (MIRAI), Fish Response Assessment Index (FRAI) and Specific Pollution sensitivity Index (SPI)) assessments. The overall confidence in these results is medium.

- The system has a moderate Ecological Importance and Sensitivity. This is primarily driven by:

  - the unique Barbus anoplus-type minnow likely to be present in system as high waterfalls both up and downstream create barriers to fish movement, thus enabling the development of an Evolutionary Significant Unit;
  - Oligoneuridae were sampled during the survey (these macroinvertebrates are dependent on high velocities); and c) Perlidae and Prosopistomatidae being present in the system.

The Reserve study found that the Tsitsa River is moderately modified: impacted by both catchment scale processes (e.g. sedimentation) and localised impacts (e.g. alien invasive vegetation). It is critical that the ecological water requirements are met. This will allow management to maintain the REC of a C.

8.12 27(K) THE PROBABLE DURATION OF ANY UNDERTAKING FOR WHICH A WATER USE IS TO BE AUTHORISED

It is recommended that this licence be issued for the maximum allowed period in terms of the National Water Act, 1998, namely 40 years as the infrastructure is designed and built for this period.

9. IMPACT PREDICTION AND RISK ASSESSMENT

Impacts on the water quality and quantity were identified as part of the WULA. Relevant specialist studies are available in the ***Environmental Impact Assessment Report - P WMA 12/T30/00/5314/3***.

9.1 IMPACT ASSESSMENT METHODOLOGY

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

A description of the nature of the impact, any specific legal requirements and the stage (construction / decommissioning or operation) will be given. Impacts are considered to be the same during construction and decommissioning.

The following criteria are used to evaluate significance:

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

- **Extent and location:** This indicates the spatial area that may be affected (**Table 20**).

Table 20: Geographical extent of impact

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

- **Duration:** This measures the lifetime of the impact (**Table 21**).

Table 21: Duration of Impact

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

- **Intensity / severity:** This is the degree to which the project affects or changes the environment; it includes a measure of the reversibility of impacts (**Table 22**).

Table 22: Intensity of Impact

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

- **Potential for irreplaceable loss of resources:** This is the degree to which the project will cause loss of resources that are irreplaceable (**Table 23**).

Table 23: Potential for irreplaceable loss of resources

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

- **Probability:** This is the likelihood or the chances that the impact will occur (**Table 24**).

Table 24: Probability of Impact

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

3	Medium	There is a distinct probability of the impact occurring.
4	High	It is most likely that the impact will occur
5	Definite	The impact will occur regardless of any prevention measures.

- **Confidence:** This is the level of knowledge or information available, the environmental impact practitioner or a specialist had in his/her judgement (**Table 25**).

Table 25: Confidence in level of knowledge or information

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

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

- **Significance:** The significance will be rated by combining the consequence of the impact and the probability of occurrence (i.e. consequence x probability = significance). The maximum value which can be obtained is 100 significance points (**Table 26**).

Table 26: Significance of issues (based on parameters)

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

- **Cumulative Impacts:** This refers to the combined, incremental effects of the impact, taking other past, present and future developments in the same area into account.

  In this instance, no past, present or probable future uses/projects in the area that will result in cumulative impacts have been identified.

- **Mitigation:** Mitigation for significant issues has been incorporated into the EMPR.

9.2 IMPACT ASSESSMENT FOR DAMS AND ASSOCIATED WATER INFRASTRUCTURE

This Chapter presents the findings of the environmental impact assessment for the dams and associated activities (DEA Ref no. 14/12/16/3/3/2/677). All the mitigation measures have been incorporated in the EMPR (**Appendix G**).

The activities assessed under this chapter are listed below:

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

9.2.1 Construction and decommissioning phase

a) Water Quality

The surface water quality of the dam is fit for all users and is such that no water quality problems are expected to occur. The dam will be able to provide water of an acceptable quality to all users, although water for domestic use will have to be treated first before being distributed. Refer to **Appendix D: Water Quality Assessment**.

The release of cold and anaerobic bottom water during periods when the dam becomes stratified could impact on the water quality. This can effectively be mitigated by the installation and correct operation of multiple level outlets.

The sediment balance of the Mzimvubu River and associated estuary will be slightly altered during the life cycle of the project. Sedimentation is unlikely to lead to negative impacts on the Mzimvubu River and the associated estuary and some improvements in the overall sediment balance of the system is considered possible.

The impact on water quality by fertilizers contained in the runoff from irrigated areas was determined by calculating the potential salinity level in the dam. There will be a slight increase in the conductivity and phosphorous levels in the dam. Although this is relevant, it is not significant and the water quality still falls within the ideal range.

The following possible impacts on water quality have been identified for the construction, first filling and decommissioning phases.

i. Impact on river water quality: Contamination of river water by construction materials and the discharge of waste from the construction site.

Lalini and Ntabelanga Dams and associated infrastructure

Some impacts on water quality may occur during the construction and decommissioning phases. These have to do with possible contamination of the river by construction materials, as well as the discharge of waste from the construction site. During construction some increases in sedimentation of the Tsitsa River system and ultimately the Mzimvubu River system is deemed likely. The significance of these impacts is however considered limited as the duration of the impact will be limited to relatively short periods of time. These occurrences are governed by the National Water Act, and as long as this is adhered to, the effect will be minimal. This applies at both sites, namely the proposed Ntabelanga dam and the proposed Lalini dam.

ii. Impacts during first filling of the dam: The creation of anoxic conditions due to decomposition of organic material.

Lalini and Ntabelanga Dams and associated infrastructure

A potential problem that could occur is that any vegetation that is left in the dam basin will begin to decompose once the dam basin is filled with water. This will create anoxic conditions that may persist for a considerable period of time, and will pose a risk to downstream aquatic life, will render the dam basin itself unfit to support aquatic life, and will cause problems at the water treatment plant. The anoxic zone may consist as close as two meters from the surface.

Factors that should be considered when determining if de-bushing is required include:

- the depth of the water in storage;
- the size of the surface area;
- MAR;
- current and expected future water quality;
- land cover; and
- planned future use of the water surface.

The recommendations included in the EMPR regarding dam basin clearing should be adhered to.

This does not address the issues of community collection of plant material or plant rescue for bio-diversity conservation purposes.

The proposed Ntabelanga Dam and Lalini Dam sites both have a very small woody component with the area dominated by grass. Bush removal is recommended, but the amount of biomass is too little to cause serious oxygen depletion even over the short term.

In terms of water quality there is therefore no significant effect on the environment from the construction of the proposed new dams.

Table 27: Assessment of Water Quality Impacts during the construction, first filling and decommissioning phases

Impact on river water quality: Contamination by construction materials	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Ntabelanga Dam and associated infrastructure							
Without Mitigation	Regional	Medium term	Medium	Medium	High	Medium	Medium -Low
With Mitigation	Site	Short term	Negligible	Low	Improbable	Medium	Very low
Lalini Dam size 1 (preferred) and associated infrastructure							
Without Mitigation	Regional	Medium term	Medium	Medium	High	Medium	Medium -Low
With Mitigation	Site	Short term	Negligible	Low	Improbable	Medium	Very low
Lalini Dam size 2 (alternative) and associated infrastructure							
Without Mitigation	Regional	Medium term	Medium	Medium	High	Medium	Medium -Low
With Mitigation	Site	Short term	Negligible	Low	Improbable	Medium	Very low
Lalini Dam size 3 (alternative) and associated infrastructure							
Without Mitigation	Regional	Medium term	Medium	Medium	High	Medium	Medium -Low
With Mitigation	Site	Short term	Negligible	Low	Improbable	Medium	Very low
Creation of anoxic conditions during first filling of the dam	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Ntabelanga Dam and associated infrastructure							
Without Mitigation	Local	Short term	Low	Low	Low	Medium	Very low
With Mitigation	Site	Short term	Negligible	Low	Low	Medium	Very low
Lalini Dam size 1 (preferred) and associated infrastructure							
Without Mitigation	Local	Short term	Low	Low	Low	Medium	Very low
With Mitigation	Site	Short term	Negligible	Low	Improbable	Medium	Very low
Lalini Dam size 2 (alternative) and associated infrastructure							

Without Mitigation	Local	Short term	Low	Low	Low	Medium	Very low
With Mitigation	Site	Short term	Negligible	Low	Improbable	Medium	Very low
Lalini Dam size 3 (alternative) and associated infrastructure							
Without Mitigation	Local	Short term	Low	Low	Low	Medium	Very low
With Mitigation	Site	Short term	Negligible	Low	Improbable	Medium	Very low

b) Aquatic Ecology

Aquatic ecological assessments were undertaken at four points on the Tsitsa River (TS1 at the tail of the proposed Ntabelanga Dam; TS4 immediately upstream of the proposed Ntabelanga Dam wall; TS7 at the tail of the proposed Lalini Dam and TS8 downstream of the proposed Lalini Dam wall) and five other assessment points on tributaries of the Tsitsa River, in April and June 2014 (**Figure 73**).

Based on the aquatic assessment the EIS, PES and DEMC of the systems in the area can be summarised as follows:

Development	Relevant sites	EIS	PES	DEMC
Ntabelanga Dam development	TS1 and TS4	High	C	B
Roads associated with Ntabelanga Dam construction	TS2, TS3 and TS5	Moderate to high	C	C/B
Area between Ntabelanga Dam and Lalini Dam	TS6	Moderate to high	C	C/B
Lalini Dam development	TS7 and TS8	Moderate	C	C
Pipeline development	TS9	Moderate to high	C	C/B
EIS = Ecological importance and sensitivity; PES = Present ecological state; DEMC = Desired ecological management class.				

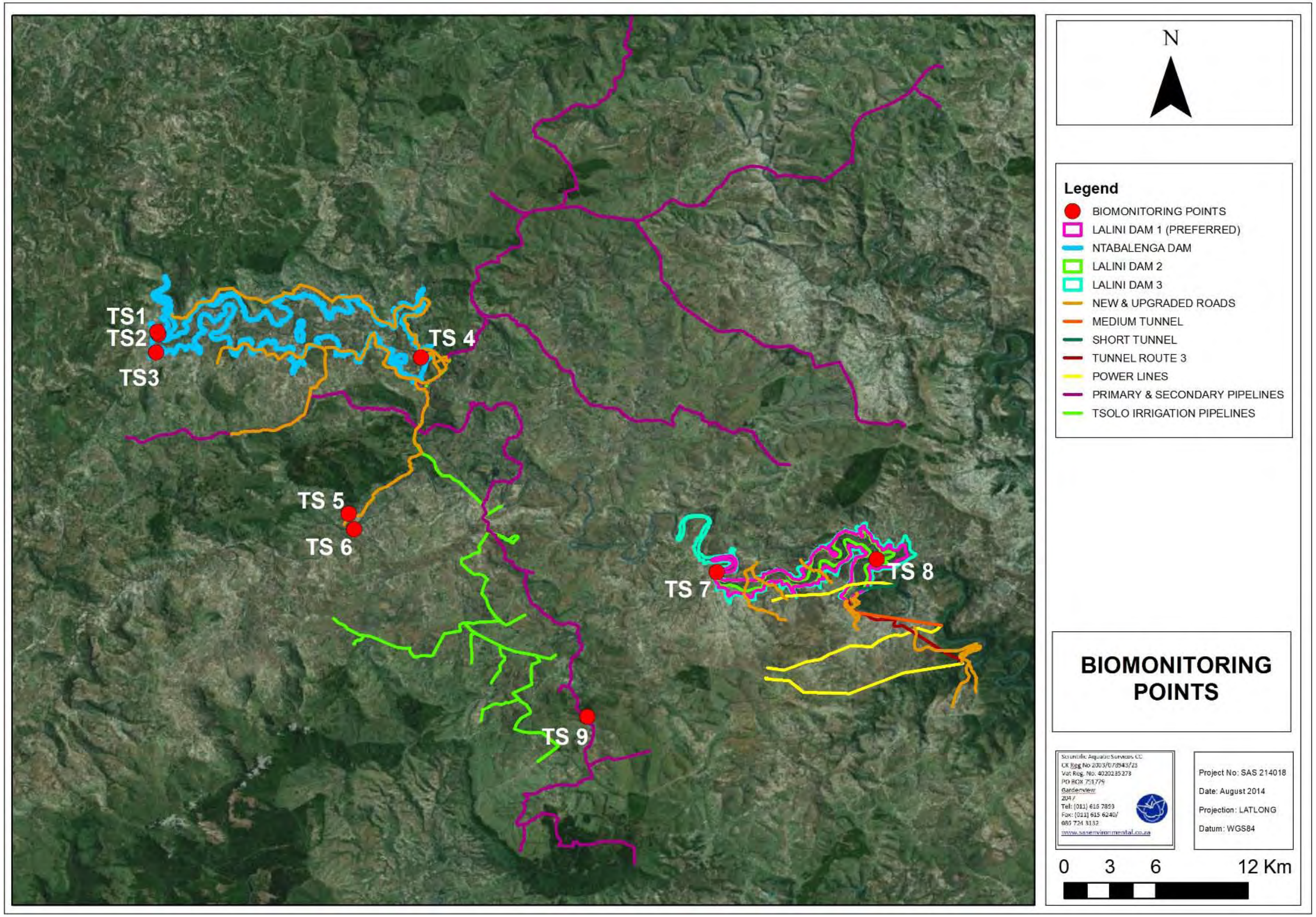

Figure 73: Digital satellite image of the study area showing assessment sites on the Tsitsa River (TS1, TS4, TS7 and TS8) as well as on tributaries of this river (TS2, TS3, TS5, TS6 and TS9) depicted on an aerial photograph in relation to surrounding areas.

The ecological importance of the greater study area is reflected in the findings of the aquatic assessment, particularly with reference to the four sites on the larger Tsitsa River (Ecostatus values ranging between A (Natural) to C (moderately modified) for assessments pertaining to invertebrates and invertebrate habitat). Fish fauna diversity was, however, depauperate as was also indicated in literature sources consulted. Smaller streams are thought to be less resilient to environmental change and more sensitive to disturbances, simply because of the smaller spatial scale in terms of potential areas of refugia and associated faunal and floral diversity to act as "buffer" to change. This is also reflected in the assessment results, with the tributary assessments generally yielding lower classifications. Seasonal changes in terms of the macro-invertebrate assessments are evident, with lower classifications being recorded during the lower flow period in June 2014. Based on the observations made during the site assessments, changes in water quality during the low flow season may affect the aquatic community. This is a concern particularly in the smaller streams emanating in the vicinity of the communities, where potential diffuse and point source pollution exist (e.g. agricultural activities and existing rural settlements) and bacteriological impacts, reduced dissolved oxygen, as well as elevated nitrates and phosphates are observed, due to reduced dilution. Although this was observed during the site assessments, the contributions of lower flow and hence also potentially poorer water quality, as well as sources of pollution cannot be quantified at present.

During the first filling phase, the greatest impact will be habitat alteration/destruction as well as impacts on natural flow rate. These impacts result in secondary impacts on flow sensitive species, species of conservation concern and aquatic biodiversity in general. The impacts (inundation of habitat upstream of the dam walls and disruption of natural flow downstream) are considered high and permanent and hence also applicable to the operation phase. In terms of flow rate, baseflows need to be maintained during both the construction/initial filling and operation phases. Without periodic, seasonal floods with associated "purging" of the river system, impacts such as silting/sedimentation and decrease in general water quality is a possibility.

With the constant peak flow the system will be subject to daily unnatural variations in water level and flow rates, which will negatively affect flow sensitive species and as a result decrease biodiversity. With the seasonal peak flow during winter only, such negative effects can be restricted to a single season.

The area is known to harbour endemic mayflies (Kleynhans 1999). With the dams situated between two waterfalls and hence geographically isolated, the area is likely to contain several macro-invertebrate species of conservation concern. Both prior to and after mitigation this impact is considered to be high to moderately high. Through minimising the time in which stream flow, water quality and habitat is affected during the construction phase of the project this impact can, however, be mitigated to a limited degree.

Electricity generation and distribution

Construction of such infrastructure will be of low impact if mitigated. Mitigation includes minimising the spatial footprint of the development to the greatest degree possible, with special reference to avoiding erosion, silting and sedimentation within the aquatic system. During the operation phase discharge through the Lalini Dam tunnel into the river will also be applicable. The section of river below the dam wall up to the tunnel discharge point will be largely subjected to baseflow which may impact on sensitive biota. The instream flow requirements of the systems are to be adhered to at all times

The shorter the length of the river between the dam wall and discharge point, the smaller the area of impact in terms of silting, sedimentation, decrease in water quality and excessive vegetation growth. The tunnel must also be constructed and positioned in such a manner as to preclude erosion effects at times of peak discharge.

Roads and pipelines

Anticipated impacts resulting from construction and use of roads include vegetation removal, increased risk of erosion, sediment loading into the system and inhibition of water flow. If not designed correctly roads can severely impact on instream habitat as well as bankside stability and riparian habitat. Mitigation again includes minimising the spatial footprint of the development to the greatest degree possible, with special reference to avoiding erosion, silting and sedimentation within the aquatic system during both construction and operation. During the operation phase increased run-off from hard surfaces may also result in erosion. Construction impacts of such infrastructure will be of low significance if mitigated.

i. Loss of aquatic habitat

The proposed dam construction project has significant potential to lead to habitat loss and/or alteration of the aquatic and riparian resources on the study area. Dam wall construction activities itself will be disruptive to current habitat conditions in the Tsitsa River within the dam wall footprint area and associated adjacent laydown areas. Construction activities also generally result in destruction of bank cover, generation of loose soil and other debris that may result in silting and sedimentation of downstream habitat. Apart from dam wall construction, construction of flow gauging weirs, bulk potable water infrastructure (pumping stations, reservoirs, treatment works and distribution lines) and bulk raw water conveyance infrastructure (pipelines, pumping station and reservoir) quarries and borrow pits, accommodation infrastructure and infrastructure will potentially have the same effect on the aquatic resources of the region albeit on a much smaller local scale. The macro-invertebrates community of the Tsitsa River relies on clear water and a stream substrate that is clear of fine silt and sediment. Close monitoring of erosion patterns downstream of the construction area is deemed essential and any areas which are showing erosion to be occurring should immediately be rehabilitated through resloping, stabilisation and revegetation techniques as part of the catchment management plan.

In addition inundation of upstream habitat as the dam fills will result in severe habitat changes, pertaining to the water column depth habitat as well as availability of riffle and rapid habitats upstream of the dam on a local scale. The impounding of the dam will thus lead to a significant loss of habitats comprising of flowing water over rock substrate which is significant for many aquatic macro-invertebrate taxa in the system. In addition less desirable species of fish such as *Micropterus salmoides* and *Cyprinus carpio* will become dominant in the system to the detriment of the endemic ecology of the region. Impacts due to sedimentation can be significant and have the potential to affect the biodiversity and functioning of the system. The still water in the newly created impoundment will allow sediment to settle and will smother the rocky substrate in the stream leading to a loss of rocky habitat types.

ii. Impact on flow dependant species

The damming of drainage areas that occur upstream of the proposed dam walls will lead to a loss of flow and an altered instream flow regime in the Tsitsa River system further downstream. It is notable that the aquatic macro-invertebrate community of the Tsitsa River system are reliant on good flow of water over the rocky stream substrate and the area downstream of the Lalini Dam, due to the remote nature of the gorge has an intact biodiversity. Impacts on instream flow can be significant and has the potential to affect the biodiversity and functioning of the system. Apart from the dam wall itself resulting in local to regional impact, gauging weirs will also have a smaller, local impact in terms of flow, habitat alteration and risk of erosion and sedimentation. With the varying hydro-electric energy generation options, there are varying levels of impact significance on the receiving aquatic environment with the degree of impact varying based on the extent of river in which a significant portion of the instream flow will be lost. All the proposed options are considered to have a borderline high to very high level of impact prior to mitigation while with mitigation, with specific mention of adhering to the Environmental Water Requirement releases the overall significance of the impacts can be reduced to high level impacts.

iii. Loss of aquatic biodiversity

The Tsitsa River is regarded as being of very high importance for migration of eels although the significance of eel migration is considered limited. The system may also provide some migratory connectivity for smaller faunal species including avifauna. In addition to impacts on migration impacts on habitat and instream flow are likely to lead to impacts on biodiversity with the loss of taxa which are sensitive to habitat changes as well changes/reductions in flow.

In particular, the impact on the aquatic macro-invertebrate community which relies on rocky substrate in fast flowing clear water will be significantly impacted by the proposed development.

The movement of instream taxa, with special mention of eels, will be severely affected by the proposed dam, including local effects from gauging weirs. Impacts on migratory movements are likely to occur during the construction and operational phase of the proposed development. In the long term this may negatively affect populations upstream of the dams and may result in loss of this species in certain sections.

Loss of habitat and alteration of flow rate discussed previously will also negatively affect the diversity of the macro-invertebrate community within the system on a local scale. Even with mitigation the impact on aquatic ecology is considered high.

iv. Impact on species with conservation concern

The proposed infrastructures, with special mention of the proposed dam and to a lesser extent gauging weirs, will lead to the formation of an migratory barrier for fish species and in particular eels, as mentioned in the previous section. The area is known to harbour endemic mayflies (Kleynhans 1999). With the location of the two dams situated between two waterfalls and hence geographically isolated, the area is likely to contain several macro-invertebrate species of conservation concern. Both prior to and after mitigation this impact is considered to be high to moderately high. Through minimising the time in which stream flow, water quality and habitat is affected during the construction phase of the project this impact can, however, be mitigated to a limited degree. The "construction phase" does not only refer to dam wall construction, but also all related activities and in particular the construction of the flow gauging weirs.

Table 28: Assessment of impacts on aquatic ecology during the construction, first filling and decommissioning phases

Loss of aquatic habitat	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Ntabelanga Dam and associated infrastructure							
Without Mitigation	Local (2)	Permanent – no mitigation (5)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – no mitigation (5)	High (4)	High (5)	Definite (5)	High	High
Lalini Dam size 1 (preferred) and associated infrastructure							
Without Mitigation	Local (2)	Permanent – no mitigation (5)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – no mitigation (5)	High (4)	High (5)	Definite (5)	High	High
Lalini Dam size 2 (alternative) and associated infrastructure							
Without Mitigation	Local (2)	Permanent – no mitigation	High (4)	High (5)	Definite (5)	High	High

		(5)					
With Mitigation	Site (1)	Permanent – no mitigation (5)	High (4)	High (5)	Definite (5)	High	High
Lalini Dam size 3 (alternative) and associated infrastructure							
Without Mitigation	Local (2)	Permanent – no mitigation (5)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Site (1)	Permanent – no mitigation (5)	High (4)	High (5)	Definite (5)	High	High
Impact on flow dependant species	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Ntabelanga Dam and associated infrastructure							
Without Mitigation	Regional (3)	Permanent – with mitigation (4)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	High (4)	High (5)	Definite (5)	High	High
Lalini Dam size 1 (preferred) and associated infrastructure							
Without Mitigation	Regional (3)	Permanent – with mitigation (4)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	High (4)	High (5)	Definite (5)	High	High
Lalini Dam size 2 (alternative) and associated infrastructure							
Without Mitigation	Regional (3)	Permanent – with mitigation (4)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	High (4)	High (5)	Definite (5)	High	High
Lalini Dam size 3 (alternative) and associated infrastructure							
Without Mitigation	Regional (3)	Permanent – with mitigation (4)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	High (4)	High (5)	Definite (5)	High	High
Loss of aquatic biodiversity	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Ntabelanga Dam and associated infrastructure							
Without Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	High (5)	Definite (5)	High	High
Lalini Dam size 1 (preferred) and associated infrastructure							
Without Mitigation	Regional (3)	Permanent – with mitigation	Medium (3)	High (5)	Definite (5)	High	High

		(4)					
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	High (5)	Definite (5)	High	High
Lalini Dam size 2 (alternative) and associated infrastructure							
Without Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	High (5)	Definite (5)	High	High
Lalini Dam size 3 (alterative) and associated infrastructure							
Without Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	High (5)	Definite (5)	High	High
Loss of aquatic biodiversity	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Ntabelanga Dam and associated infrastructure							
Without Mitigation	Regional (3)	Permanent – with mitigation (4)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	High (5)	High(4)	High	Medium-High
Lalini Dam size 1 (preferred) and associated infrastructure							
Without Mitigation	Regional (3)	Permanent – no mitigation (5)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	High (5)	High(4)	High	Medium-High
Lalini Dam size 2 (alternative) and associated infrastructure							
Without Mitigation	Regional (3)	Permanent – no mitigation (5)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	High (5)	High(4)	High	Medium-High
Lalini Dam size 3 (alternative) and associated infrastructure							
Without Mitigation	Regional (3)	Permanent – no mitigation (5)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	High (5)	High(4)	High	Medium-High
N.B.: reference to the respective projects also considers impact from associated activities, including gauging weirs, bulk potable water infrastructure, bulk raw water conveyance infrastructure, irrigation and agriculture, WWTWs, accommodation infrastructure, quarries and pits, river intake structures and associated works, information centres and miscellaneous activities like constructions camps, lay down areas and storage sites.							

c) Wetlands

Riparian and wetland resources can be considered to be in moderately modified condition, indicating that loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.

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

The Ntabelanga and Lalini Dams will have the greatest impact on wetland and riparian habitat, as wetland habitat will be permanently lost during the first filling. Due to the nature of the development, this cannot be avoided. Additionally, roads and pipelines traverse wetland features; thus it will not be feasible to implement a buffer zone around all wetland features affected by the project. Effective mitigation is therefore necessary to reduce the level of impacts on the wetland features.

The anticipated loss of riparian and wetland habitat arising from the construction of the dams is estimated to be 1034.30 hectares; overall this is deemed to be a relatively insignificant fraction of the wetland resources within the Mzimvubu subWMA.

The following key impacts on wetlands have been identified for the construction, first filling and decommissioning phases:

Ntabelanga Dam and associated infrastructure

Construction of the dam wall not only necessitates the removal of riparian vegetation, but also requires the movement of construction vehicles in the vicinity of or through wetland features (existing roads, earmarked for upgrades, currently traverse several wetland features). The first filling of the dam will result in the permanent loss of wetland habitat; due to the nature of the development, this cannot be avoided. It is therefore imperative that measures are taken in order to minimise the impact on those portions of the affected wetland features which will not be inundated. Construction of associated infrastructure such as accommodation, WWTW and the information centre has the potential to result in the loss of wetland habitat, although these impacts may be reduced with careful planning of the placement of these to minimise the footprint of these structures.

Lalini Dam and associated infrastructure

It is anticipated that the impacts on wetland and riparian habitat as a result of the construction and first filling of the Lalini Dam will be similar in nature to the impacts of the construction of the Ntabelanga Dam, i.e. loss of vegetation, sedimentation of features and permanent loss of habitat due to inundation.

Primary and secondary pipelines, and irrigation pipelines

Where pipelines cross wetland / riparian habitat, with specific mention of drainage lines and channelled valley bottom wetlands, support structures should not be constructed within the active channels and must be placed outside of wetland / riparian habitat wherever feasible. In order to achieve this wetland crossings should take place at 90 degree angles wherever possible.

Table 29: Assessment of impacts on wetlands during the construction, first filling and decommissioning phases

Loss of wetland / riparian habitat and ecological structure	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Ntabelanga Dam and associated infrastructure							
Without Mitigation	2 (local)	2 (medium)	5 (Very high)	5 (High)	(5) Definite	High	High
With Mitigation	2 (local)	2 (medium)	5 (Very high)	5 (High)	(5) Definite	High	High
Lalini Dam size 1 (preferred alternative) and associated infrastructure							
Without Mitigation	2 (local)	2 (medium)	5 (Very high)	5 (High)	(5) Definite	High	High
With Mitigation	2 (local)	2 (medium)	5 (Very high)	5 (High)	(5) Definite	High	High
Lalini Dam size 2 and associated infrastructure							
Without Mitigation	2 (local)	2 (medium)	5 (Very high)	5 (High)	(5) Definite	High	High
With Mitigation	2 (local)	2 (medium)	5 (Very high)	5 (High)	(5) Definite	High	High
Lalini Dam size 3 and associated infrastructure							
Without Mitigation	2 (local)	2 (medium)	5 (Very high)	5 (High)	(5) Definite	High	High
With Mitigation	2 (local)	2 (medium)	5 (Very high)	5 (High)	(5) Definite	High	High
Primary, Secondary Pipelines and Irrigation Pipelines and associated infrastructure							
Without Mitigation	2 (local)	1 (short)	3 (Medium)	3 (medium)	3 (medium)	High	Low
With Mitigation	2 (local)	1 (short)	1 (Negligible)	1 (Low)	2 (low)	High	Very Low
Loss of wetland / riparian ecoservices	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Ntabelanga Dam and associated infrastructure							
Without Mitigation	1 (site)	2 (medium)	5 (Very high)	5 (High)	(5) Definite	High	High

With Mitigation	1 (site)	2 (medium)	5 (Very high)	5 (High)	(5) Definite	High	High
Lalini Dam size 1 (preferred alternative) and associated infrastructure							
Without Mitigation	1 (site)	2 (medium)	5 (Very high)	5 (High)	(5) Definite	High	High
With Mitigation	1 (site)	2 (medium)	5 (Very high)	5 (High)	(5) Definite	High	High
Lalini Dam size 2 and associated infrastructure							
Without Mitigation	1 (site)	2 (medium)	5 (Very high)	5 (High)	(5) Definite	High	High
With Mitigation	1 (site)	2 (medium)	5 (Very high)	5 (High)	(5) Definite	High	High
Lalini Dam size 3 and associated infrastructure							
Without Mitigation	1 (site)	2 (medium)	5 (Very high)	5 (High)	(5) Definite	High	High
With Mitigation	1 (site)	2 (medium)	5 (Very high)	5 (High)	(5) Definite	High	High
Primary, Secondary Pipelines and Irrigation Pipelines and associated infrastructure							
Without Mitigation	2 (local)	1 (short)	2 (Low)	3 (medium)	3 (medium)	High	Low
With Mitigation	2 (local)	1 (short)	1 (Negligible)	1 (Low)	2 (low)	High	Very Low

Impacts on wetland / riparian hydrology and sediment balance	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Ntabelanga Dam and associated infrastructure							
Without Mitigation	1 (site)	2 (medium)	5 (Very high)	5 (High)	(5) Definite	High	High
With Mitigation	1 (site)	2 (medium)	5 (Very high)	5 (High)	(5) Definite	High	High
Lalini Dam size 1 (preferred alternative) and associated infrastructure							
Without Mitigation	1 (site)	2 (medium)	5 (Very high)	5 (High)	(5) Definite	High	High
With Mitigation	1 (site)	2 (medium)	5 (Very high)	5 (High)	(5) Definite	High	High
Lalini Dam size 2 and associated infrastructure							
Without Mitigation	1 (site)	2 (medium)	5 (Very high)	5 (High)	(5) Definite	High	High
With Mitigation	1 (site)	2 (medium)	5 (Very high)	5 (High)	(5) Definite	High	High
Lalini Dam size 3 and associated infrastructure							
Without Mitigation	1 (site)	2 (medium)	5 (Very high)	5 (High)	(5) Definite	High	High
With Mitigation	1 (site)	2 (medium)	5 (Very high)	5 (High)	(5) Definite	High	High
Primary, Secondary Pipelines and Irrigation Pipelines and associated infrastructure							
Without Mitigation	2 (local)	1 (short)	2 (Low)	3 (medium)	3 (medium)	High	Low
With Mitigation	2 (local)	1 (short)	1 (Negligible)	1 (Low)	2 (low)	High	Very Low

9.2.2 Operational phase

a) Water Quality

The following key impacts on water quality downstream of the dams and associated infrastructure have been identified for the operation phase.

i. Water Quality (Downstream effects): Temperature and Oxygen

Lalini and Ntabelanga Dams and associated infrastructure

The storage of a large quantity of water in the proposed dams could lead to eutrophic conditions and an increase in salinity due to the concentrating effect of evaporation losses. These problems tend to be accentuated during periods of prolonged low inflow.

The release of cold and anaerobic bottom water during periods when the dams become stratified could impact on water quality.

ii. Impact on water quality: Sediment balance

Lalini and Ntabelanga Dams and associated infrastructure

The sediment balance of the Mzimvubu River and associated estuary will be slightly altered during the life cycle of the project. During the operational phase of the two dams there will be reduced sediment input to areas below the dams. Although the reduced sediment load may lead to increased erosion and armouring of the river downstream of the dams this impact is not considered highly significant. The aquatic macro-invertebrate community of the Tsitsa River relies on fast flowing water and a substrate free of sediments on the rocky substrate. The reduced sediment load downstream of the dams therefore has the potential to improve the aquatic ecology in these sections of the system.

The Mzimvubu catchment is severely impacted by the erosion of soils due to the highly erodible nature of the soils in the catchment as well as the topography in the catchment and the associated agricultural practices in the catchment. The reduced sediment input that will occur from the Tsitsa River into the Mzimvubu River system is unlikely to lead to negative impacts on the Mzimvubu River and the associated estuary and some improvements in the overall sediment balance of the system is considered possible.

Flow Gauging Weirs

Sedimentation will occur upstream behind the weir structures. Although this is unavoidable, no mitigation is required as this will not impact on the water quality downstream of the weir and the extent of habitat alteration will be very limited.

iii. Impact on water quality: Salinity

The impact on water quality by fertilizers contained in the runoff from irrigated areas was determined by calculating the potential salinity level in the dam. There will be a slight increase in the conductivity and phosphorous levels in the dam. Although this is relevant, it is not significant and the water quality still falls within the ideal range.

Table 30: Assessment of Water Quality Impacts during the operational phase

Water Quality (Downstream Effects): Temperature and Oxygen	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Ntabelanga Dam and associated infrastructure							
Without Mitigation	Regional	Long term	Medium	High	High	High	Medium-high
With Mitigation	Site	Short term	Negligible	Low	Improbable	High	Very Low
Lalini Dam size 1 (preferred) and associated infrastructure							
Without Mitigation	Regional	Long term	Medium	High	High	High	Medium-high
With Mitigation	Site	Short term	Negligible	Low	Improbable	High	Very Low
Lalini Dam size 2 (alternative) and associated infrastructure							
Without Mitigation	Regional	Long term	Medium	High	High	High	Medium-high
With Mitigation	Site	Short term	Negligible	Low	Improbable	High	Very Low
Lalini Dam size 3 (alternative) and associated infrastructure							
Without Mitigation	Regional	Long term	Medium	High	High	High	Medium-high
With Mitigation	Site	Short term	Negligible	Low	Improbable	High	Very Low
Water Quality (Downstream Effects) : Sediment balance	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Ntabelanga Dam and associated infrastructure							
Without Mitigation	Regional	Long term	Low	Medium	High	High	Medium Low
With Mitigation	Regional	Long term	Negligible	Low	Medium	High	Low
Lalini Dam size 1 (preferred) and associated infrastructure							
Without Mitigation	Regional	Long term	Low	Medium	High	High	Medium Low
With Mitigation	Regional	Long term	Negligible	Low	Medium	High	Low
Lalini Dam size 2 (alternative) and associated infrastructure							
Without Mitigation	Regional	Long term	Low	Medium	High	High	Medium Low
With Mitigation	Regional	Long term	Negligible	Low	Medium	High	Low
Lalini Dam size 3 (alternative) and associated infrastructure							
Without Mitigation	Regional	Long term	Low	Medium	High	High	Medium Low
With Mitigation	Regional	Long term	Negligible	Low	Medium	High	Low
Cumulative Impact – *Additional loss of in stream and riparian habitat may occur downstream of the two dams.*							

Sedimentation upstream of weirs	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Ntabelanga Dam and associated infrastructure							
Without Mitigation	Local	Short term	Low	Low	Low	Medium	Very low
With Mitigation	Site	Short term	Negligible	Low	Low	Medium	Very low
Lalini Dam size 1 (preferred) and associated infrastructure							
Without Mitigation	Local	Short term	Low	Low	Low	Medium	Very low
With Mitigation	Site	Short term	Negligible	Low	Improbable	Medium	Very low
Lalini Dam size 2 (alternative) and associated infrastructure							
Without Mitigation	Local	Short term	Low	Low	Low	Medium	Very low
With Mitigation	Site	Short term	Negligible	Low	Improbable	Medium	Very low
Lalini Dam size 3 (alternative) and associated infrastructure							
Without Mitigation	Local	Short term	Low	Low	Low	Medium	Very low
With Mitigation	Site	Short term	Negligible	Low	Improbable	Medium	Very low
Salinity	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Ntabelanga Dam and associated infrastructure							
Without Mitigation	Local	Short term	Low	Low	Low	Medium	Very low
With Mitigation	Site	Short term	Negligible	Low	Low	Medium	Very low
Lalini Dam size 1 (preferred) and associated infrastructure							
Without Mitigation	Local	Short term	Low	Low	Low	Medium	Very low
With Mitigation	Site	Short term	Negligible	Low	Improbable	Medium	Very low
Lalini Dam size 2 (alternative) and associated infrastructure							
Without Mitigation	Local	Short term	Low	Low	Low	Medium	Very low
With Mitigation	Site	Short term	Negligible	Low	Improbable	Medium	Very low
Lalini Dam size 3 (alternative) and associated infrastructure							
Without Mitigation	Local	Short term	Low	Low	Low	Medium	Very low
With Mitigation	Site	Short term	Negligible	Low	Improbable	Medium	Very low

b) Aquatic Ecology

The proposed dam walls will lead to the formation of a migratory barrier and the movement of instream taxa, with special mention of eels, will be severely and permanently affected. As for the construction phase, permanent alteration of natural flow rates and habitat will negative affect aquatic biodiversity with specific reference to macro-invertebrates and riparian vegetation.

The impact on species of conservation concern pertains to eel migration and presence of endemic mayflies. With the two dams situated between two waterfalls and hence geographically isolated, the area is likely to contain several macro-invertebrate species of conservation concern.

During operation, the impact will remain local.

c) Wetlands

The following key impacts on wetlands have been identified for the operation phase:

Ntabelanga and Lalini Dams

Perceived impacts on wetland / riparian habitat will be of a considerably lower intensity during the operational phase of the project in comparison to the construction phase. This is attributed to the anticipated loss of habitat which will occur during the first filling of the dams. Thus, although the duration of the impact is considered to be permanent without the possibility of rehabilitation of those features which will be inundated, the intensity of the impact is considered low.

Fluctuations in the levels of water downstream of the dams as a result of incorrect environmental flow releases of water from the dams may have an impact on riparian vegetation. Prolonged exposure to dry conditions may result in the long-term loss of riparian vegetation, and subsequent increased incision and erosion of river banks leading to increased sedimentation of the river system. In addition rapid releases of large water volumes may lead to scouring of the riparian zone and a loss of some riparian zone cover and species.

Primary, secondary and irrigation pipelines

Major impacts on wetland / riparian features during the operational phases of the pipelines are not anticipated, provided that the impacts on these features are minimised during the construction phase, and that any wetland / riparian areas which were impacted during construction are monitored regularly for proliferation of alien vegetation and sedimentation in the areas of disturbance. During maintenance of pipelines, it is essential that maintenance vehicles remain on designated roads in order to limit the ecological footprint of maintenance activities and reduce further degradation of the wetland / riparian habitat.

Table 31: Assessment of wetland impacts during the operation phase

Loss of wetland / riparian habitat and ecological structure	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Ntabelanga Dam and associated infrastructure							
Without Mitigation	2 (local)	4 (Permanent – mitigation)	2 (Low)	3 (medium)	5 (Definite)	High	Medium High
With Mitigation	2 (local)	4 (Permanent – mitigation)	2 (Low)	1 (Low)	5 (Definite)	High	Medium High
Lalini Dam size 1 (preferred alternative) and associated infrastructure							
Without Mitigation	2 (local)	4 (Permanent – mitigation)	2 (Low)	3 (medium)	5 (Definite)	High	Medium High
With Mitigation	2 (local)	4 (Permanent – mitigation)	2 (Low)	1 (Low)	5 (Definite)	High	Medium High
Lalini Dam size 2 and associated infrastructure							

Without Mitigation	2 (local)	4 (Permanent – mitigation)	2 (Low)	3 (medium)	5 (Definite)	High	Medium High
With Mitigation	2 (local)	4 (Permanent – mitigation)	2 (Low)	1 (Low)	5 (Definite)	High	Medium High
Lalini Dam size 3 and associated infrastructure							
Without Mitigation	2 (local)	4 (Permanent – mitigation)	2 (Low)	3 (medium)	5 (Definite)	High	Medium High
With Mitigation	2 (local)	4 (Permanent – mitigation)	2 (Low)	1 (Low)	5 (Definite)	High	Medium High
Primary, Secondary Pipelines and Irrigation Pipelines and associated infrastructure							
Without Mitigation	2 (local)	1 (short)	2 (Low)	3 (medium)	3 (Medium)	High	Low
With Mitigation	2 (local)	1 (short)	1 (Negligible)	1 (Low)	2 (Low)	High	Very Low
Loss of wetland / riparian ecoservices	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Ntabelanga Dam and associated infrastructure							
Without Mitigation	2 (local)	4 (Permanent – mitigation)	2 (Low)	3 (medium)	5 (Definite)	High	Medium High
With Mitigation	2 (local)	4 (Permanent – mitigation)	2 (Low)	1 (Low)	5 (Definite)	High	Medium High
Lalini Dam size 1 (preferred alternative) and associated infrastructure							
Without Mitigation	2 (local)	4 (Permanent – mitigation)	2 (Low)	3 (medium)	5 (Definite)	High	Medium High
With Mitigation	2 (local)	4 (Permanent – mitigation)	2 (Low)	1 (Low)	5 (Definite)	High	Medium High
Lalini Dam size 2 and associated infrastructure							
Without Mitigation	2 (local)	4 (Permanent – mitigation)	2 (Low)	3 (medium)	5 (Definite)	High	Medium High
With Mitigation	2 (local)	4 (Permanent – mitigation)	2 (Low)	1 (Low)	5 (Definite)	High	Medium High
Lalini Dam size 3 and associated infrastructure							
Without Mitigation	2 (local)	4 (Permanent – mitigation)	2 (Low)	3 (medium)	5 (Definite)	High	Medium High
With Mitigation	2 (local)	4 (Permanent – mitigation)	2 (Low)	1 (Low)	5 (Definite)	High	Medium High
Primary, Secondary Pipelines and Irrigation Pipelines and associated infrastructure							
Without Mitigation	2 (local)	1 (short)	2 (Low)	3 (medium)	3 (Medium)	High	Low
With Mitigation	2 (local)	1 (short)	1 (Negligible)	1 (Low)	2 (Low)	High	Very Low
Impacts on wetland / riparian hydrology and sediment balance	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Ntabelanga Dam and associated infrastructure							
Without Mitigation	2 (local)	4 (Permanent – mitigation)	2 (Low)	3 (medium)	5 (Definite)	High	Medium High
With Mitigation	2 (local)	4 (Permanent – mitigation)	2 (Low)	1 (Low)	5 (Definite)	High	Medium High
Lalini Dam size 1 (preferred alternative) and associated infrastructure							
Without Mitigation	2 (local)	4 (Permanent – mitigation)	2 (Low)	3 (medium)	5 (Definite)	High	Medium High
With Mitigation	2 (local)	4 (Permanent – mitigation)	2 (Low)	1 (Low)	5 (Definite)	High	Medium High

Lalini Dam size 2 and associated infrastructure							
Without Mitigation	2 (local)	4 (Permanent – mitigation)	2 (Low)	3 (medium)	5 (Definite)	High	Medium High
With Mitigation	2 (local)	4 (Permanent – mitigation)	2 (Low)	1 (Low)	5 (Definite)	High	Medium High
Lalini Dam size 3 and associated infrastructure							
Without Mitigation	2 (local)	4 (Permanent – mitigation)	2 (Low)	3 (medium)	5 (Definite)	High	Medium High
With Mitigation	2 (local)	4 (Permanent – mitigation)	2 (Low)	1 (Low)	5 (Definite)	High	Medium High
Primary, Secondary Pipelines and Irrigation Pipelines and associated infrastructure							
Without Mitigation	2 (local)	1 (short)	2 (Low)	3 (medium)	3 (Medium)	High	Low
With Mitigation	2 (local)	1 (short)	1 (Negligible)	1 (Low)	2 (Low)	High	Very Low

9.3 IMPACT ASSESSMENT FOR ELECTRICITY GENERATION AND DISTRIBUTION INFRASTRUCTURE

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

The activities assessed under this chapter are listed below:

- Pipeline and tunnel (including tunnel alternatives) at the proposed Lalini Dam;
- Generation of hydro power and feeding of this power into the existing grid; and
- A 13km power line from the Lalini Dam tunnel outlet (hydropower plant).

9.3.1 Construction and Decommissioning phases

a) Water Quality

The following key impacts on water quality have been identified for the construction and decommissioning phases:

i. Impacts during the construction of the electricity generation and distribution infrastructure

Some impacts on water quality may occur during the construction and decommissioning phases. These have to do with possible contamination of the river by construction materials. These occurrences are governed by the National Water Act, and as long as this is adhered to, the effect will be minimal. This applies to the proposed Lalini Dam site.

Table 32: Water Quality Impacts during the construction of the electricity generation and distribution infrastructure

Contamination by construction materials	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Peak power generation with hydropower tunnel and power line alternative 1							
Without Mitigation	Regional	Medium term	Medium	Medium	High	Medium	Medium - Low
With Mitigation	Site	Short term	Negligible	Low	Improbable	Medium	Very low
Peak power generation with hydropower tunnel and power line alternative 2							
Without Mitigation	Regional	Medium term	Medium	Medium	High	Medium	Medium - Low
With Mitigation	Site	Short term	Negligible	Low	Improbable	Medium	Very low
Peak power generation with hydropower tunnel and power line alternative 3							
Without Mitigation	Regional	Medium term	Medium	Medium	High	Medium	Medium - Low
With Mitigation	Site	Short term	Negligible	Low	Improbable	Medium	Very low
Base-load power generation and with hydropower tunnel and power line alternative 1							
Without Mitigation	Regional	Medium term	Medium	Medium	High	Medium	Medium - Low
With Mitigation	Site	Short term	Negligible	Low	Improbable	Medium	Very low
Base-load power generation with hydropower tunnel and power line alternative 2							
Without Mitigation	Regional	Medium term	Medium	Medium	High	Medium	Medium - Low
With Mitigation	Site	Short term	Negligible	Low	Improbable	Medium	Very low
Base-load power generation with hydropower tunnel and power line alternative 3							
Without Mitigation	Regional	Medium term	Medium	Medium	High	Medium	Medium - Low
With Mitigation	Site	Short term	Negligible	Low	Improbable	Medium	Very low

b) Aquatic ecology

The following key impacts on aquatic ecology have been identified for the construction and decommissioning phases:

i. Loss of aquatic habitat

Impacts due to canalisation and erosion will potentially be caused due to the disturbance of soils, during site clearing and construction, and the alteration of flow regimes in the Tsitsa River.

ii. Impact on flow dependant species, loss of aquatic biodiversity, and impact on species with conservation concern

Impacts on flow will mostly pertain to general construction activities and baseline flow as effected through the Lalini Dam tunnel. Impacts on diversity will mostly pertain to habitat alteration and flow alteration as effected through the Lalini Dam tunnel. These effects have been discussed with reference to dam impact. Construction of the electricity generation and distribution phases will have lower impact compared to that associated with the dams due to the smaller scale of both activity and potential impact. It must however be noted that the further the tunnel daylights from the Lalini dam wall the larger the impact on the instream ecology will be.

Table 33: Assessment of impacts on aquatic ecology during the construction and decommissioning phases

Loss of aquatic habitat	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Proposed Project with Ntabelanga Dam and associated infrastructure							
Without Mitigation	Local (2)	Medium term (2)	Medium (3)	Medium (3)	High (4)	High	Medium-Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (3)	High (4)	High	Low
Proposed Project with Lalini Dam hydroelectric generation site 1 (near falls) and associated infrastructure							
Without Mitigation	Local (2)	Medium term (2)	Medium (3)	Medium (3)	High (4)	High	Medium-Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	High (4)	High	Low
Proposed Project with Lalini Dam hydroelectric generation site 2 (medium range) and associated infrastructure							
Without Mitigation	Local (2)	Medium term (2)	Medium (3)	Medium (3)	High (4)	High	Medium-Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	High (4)	High	Low
Proposed Project with Lalini Dam hydroelectric generation site 3 (furthest from falls largest generation potential) and associated infrastructure							
Without Mitigation	Local (2)	Medium term (2)	Medium (3)	Medium (3)	High (4)	High	Medium-Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	High (4)	High	Low
Impact of flow dependant species	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Proposed Project with Ntabelanga Dam and associated infrastructure							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	High (4)	High	Medium-Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Low
Proposed Project with Lalini Dam hydroelectric generation site 1 (nearest to falls lowest generation potential) and associated infrastructure							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	High (4)	High	Medium-Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Low
Proposed Project with Lalini Dam hydroelectric generation site 2 (midway option) and associated infrastructure							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	High (4)	High	Medium-Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Low

Proposed Project with Lalini Dam hydroelectric generation site 3 (furthest from falls largest generation potential) and associated infrastructure							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	High (4)	High	Medium-Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Low
Loss of aquatic biodiversity	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Proposed Project with Ntabelanga Dam and associated infrastructure							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	High (4)	High	Medium-Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Low
Proposed Project with Lalini Dam hydroelectric generation site 1 (nearest to falls lowest generation potential) and associated infrastructure							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	High (4)	High	Medium-Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Low
Proposed Project with Lalini Dam hydroelectric generation site 2 (midway option) and associated infrastructure							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	High (4)	High	Medium-Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Low
Proposed Project with Lalini Dam hydroelectric generation site 3 (furthest from falls largest generation potential) and associated infrastructure							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	High (4)	High	Medium-Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Low
Impact on species with conservation concern	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Proposed Project with Ntabelanga Dam and associated infrastructure							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Low (2)	High	Very low
Proposed Project with Lalini Dam hydroelectric generation site 1 (nearest to falls lowest generation potential) and associated infrastructure							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Low (2)	High	Very low
Proposed Project with Lalini Dam hydroelectric generation site 2 (midway option) and associated infrastructure							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Low (2)	High	Very low
Proposed Project with Lalini Dam hydroelectric generation site 3 (furthest from falls largest generation potential)							
High	Local (2)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Low (2)	High	Very low
Please note that reference to the respective hydroelectric generation projects also considers impact from associated power lines and the Lalini Dam tunnel.							

c) Wetlands

The following key impacts on wetlands have been identified for the construction phase:

The construction of power lines is considered to be a moderately low risk activity in terms of wetland and riparian habitat conservation. The primary concern associated with this activity is the placement of support towers. Care should be taken to ensure that these structures are not placed within wetland or riparian habitat, or within their respective buffer zones. As with the construction of the pipelines, should it be necessary to place pylons within wetland habitat, it is highly recommended that these structures be placed outside of the active channels (in the case of the drainage lines or channelled valley bottom wetland features), in order to minimise the impacts on the hydrology of these systems.

Table 34: Assessment of wetland impacts during the construction and decommissioning phases

Loss of wetland / riparian habitat and ecological structure	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Peak power generation with hydropower tunnel and power line alternative 1							
Without Mitigation	1 (site)	1 (Short)	3 (Medium)	3 (Medium)	3 (Medium)	High	Low
With Mitigation	1 (site)	1 (Short)	2 (Low)	3 (Medium)	2 (Low)	High	Very Low
Peak power generation with hydropower tunnel and power line alternative 2							
Without Mitigation	1 (site)	1 (Short)	3 (Medium)	3 (Medium)	3 (Medium)	High	Low
With Mitigation	1 (site)	1 (Short)	2 (Low)	3 (Medium)	2 (Low)	High	Very Low
Peak power generation with hydropower tunnel and power line alternative 3							
Without Mitigation	1 (site)	1 (Short)	3 (Medium)	3 (Medium)	3 (Medium)	High	Low
With Mitigation	1 (site)	1 (Short)	2 (Low)	3 (Medium)	2 (Low)	High	Very Low
Base-load power generation and with hydropower tunnel and power line alternative 1							
Without Mitigation	1 (site)	1 (Short)	3 (Medium)	3 (Medium)	3 (Medium)	High	Low
With Mitigation	1 (site)	1 (Short)	2 (Low)	3 (Medium)	2 (Low)	High	Very Low
Base-load power generation with hydropower tunnel and power line alternative 2							
Without Mitigation	1 (site)	1 (Short)	3 (Medium)	3 (Medium)	3 (Medium)	High	Low
With Mitigation	1 (site)	1 (Short)	2 (Low)	3 (Medium)	2 (Low)	High	Very Low
Base-load power generation with hydropower tunnel and power line alternative 3							
Without Mitigation	1 (site)	1 (Short)	3 (Medium)	3 (Medium)	3 (Medium)	High	Low
With Mitigation	1 (site)	1 (Short)	2 (Low)	3 (Medium)	2 (Low)	High	Very Low
Loss of wetland / riparian ecoservices	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Peak power generation with hydropower tunnel and power line alternative 1							
Without Mitigation	1 (site)	1 (Short)	3 (Medium)	3 (Medium)	3 (Medium)	High	Low
With Mitigation	1 (site)	1 (Short)	2 (Low)	3 (Medium)	2 (Low)	High	Very Low

Peak power generation with hydropower tunnel and power line alternative 2							
Without Mitigation	1 (site)	1 (Short)	3 (Medium)	3 (Medium)	3 (Medium)	High	Low
With Mitigation	1 (site)	1 (Short)	2 (Low)	3 (Medium)	2 (Low)	High	Very Low
Peak power generation with hydropower tunnel and power line alternative 3							
Without Mitigation	1 (site)	1 (Short)	3 (Medium)	3 (Medium)	3 (Medium)	High	Low
With Mitigation	1 (site)	1 (Short)	2 (Low)	3 (Medium)	2 (Low)	High	Very Low
Base-load power generation and with hydropower tunnel and power line alternative 1							
Without Mitigation	1 (site)	1 (Short)	3 (Medium)	3 (Medium)	3 (Medium)	High	Low
With Mitigation	1 (site)	1 (Short)	2 (Low)	3 (Medium)	2 (Low)	High	Very Low
Base-load power generation with hydropower tunnel and power line alternative 2							
Without Mitigation	1 (site)	1 (Short)	3 (Medium)	3 (Medium)	3 (Medium)	High	Low
With Mitigation	1 (site)	1 (Short)	2 (Low)	3 (Medium)	2 (Low)	High	Very Low
Base-load power generation with hydropower tunnel and power line alternative 3							
Without Mitigation	1 (site)	1 (Short)	3 (Medium)	3 (Medium)	3 (Medium)	High	Low
With Mitigation	1 (site)	1 (Short)	2 (Low)	3 (Medium)	2 (Low)	High	Very Low
Impacts on wetland / riparian hydrology and sediment balance	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Peak power generation with hydropower tunnel and power line alternative 1							
Without Mitigation	1 (site)	1 (Short)	3 (Medium)	3 (Medium)	3 (Medium)	High	Low
With Mitigation	1 (site)	1 (Short)	2 (Low)	3 (Medium)	2 (Low)	High	Very Low
Peak power generation with hydropower tunnel and power line alternative 2							
Without Mitigation	1 (site)	1 (Short)	3 (Medium)	3 (Medium)	3 (Medium)	High	Low
With Mitigation	1 (site)	1 (Short)	2 (Low)	3 (Medium)	2 (Low)	High	Very Low
Peak power generation with hydropower tunnel and power line alternative 3							
Without Mitigation	1 (site)	1 (Short)	3 (Medium)	3 (Medium)	3 (Medium)	High	Low
With Mitigation	1 (site)	1 (Short)	2 (Low)	3 (Medium)	2 (Low)	High	Very Low
Base-load power generation and with hydropower tunnel and power line alternative 1							
Without Mitigation	1 (site)	1 (Short)	3 (Medium)	3 (Medium)	3 (Medium)	High	Low
With Mitigation	1 (site)	1 (Short)	2 (Low)	3 (Medium)	2 (Low)	High	Very Low
Base-load power generation with hydropower tunnel and power line alternative 2							
Without Mitigation	1 (site)	1 (Short)	3 (Medium)	3 (Medium)	3 (Medium)	High	Low
With Mitigation	1 (site)	1 (Short)	2 (Low)	3 (Medium)	2 (Low)	High	Very Low
Base-load power generation with hydropower tunnel and power line alternative 3							
Without Mitigation	1 (site)	1 (Short)	3 (Medium)	3 (Medium)	3 (Medium)	High	Low
With Mitigation	1 (site)	1 (Short)	2 (Low)	3 (Medium)	2 (Low)	High	Very Low

9.3.2 Operation Phase

a) Water Quality

i. Water Quality (Downstream effects)

Water quality changes (temperature) in the river downstream of the proposed hydropower plant outlet.

Table 35: Water Quality Impacts during the operation of the electricity generation and distribution infrastructure

Water quality changes (Temperature)	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Peak power generation with hydropower tunnel and power line alternative 1							
Without Mitigation	Site	Short term	Negligible	Low	Improbable	Medium	Very low
With Mitigation	Site	Short term	Negligible	Low	Improbable	Medium	Very low
Peak power generation with hydropower tunnel and power line alternative 2							
Without Mitigation	Site	Short term	Negligible	Low	Improbable	Medium	Very low
With Mitigation	Site	Short term	Negligible	Low	Improbable	Medium	Very low
Peak power generation with hydropower tunnel and power line alternative 3							
Without Mitigation	Site	Short term	Negligible	Low	Improbable	Medium	Very low
With Mitigation	Site	Short term	Negligible	Low	Improbable	Medium	Very low
Base-load power generation and with hydropower tunnel and power line alternative 1							
Without Mitigation	Site	Short term	Negligible	Low	Improbable	Medium	Very low
With Mitigation	Site	Short term	Negligible	Low	Improbable	Medium	Very low
Base-load power generation with hydropower tunnel and power line alternative 2							
Without Mitigation	Site	Short term	Negligible	Low	Improbable	Medium	Very low
With Mitigation	Site	Short term	Negligible	Low	Improbable	Medium	Very low
Base-load power generation with hydropower tunnel and power line alternative 3							
Without Mitigation	Site	Short term	Negligible	Low	Improbable	Medium	Very low
With Mitigation	Site	Short term	Negligible	Low	Improbable	Medium	Very low

b) Aquatic ecology

The following key impacts on aquatic ecology have been identified for the operation phase:

i. Loss of aquatic habitat

The section directly below the dam wall up to the dam discharge point will only experience controlled base flow conditions that would lead to loss of the waterfall habitat as well as loss of seasonal natural flow fluctuation events that will affect availability of especially riffle and rapid habitats. Peak flow will result in daily changes in habitat availability, whilst seasonal peak flow (winter only) will result in seasonal variations in habitat availability. Both scenarios will have a high to medium-high impact, with the latter option restricting impact to a single season.

Water released from the Lalini Dam, if not correctly designed can lead to severe erosion and canalisation of the system at the point where the discharge from the Lalini Dam enters the river. This impact can be significant on a site to local scale in terms of river modification and habitat loss, with the potential to affect the hydrological functioning and biodiversity of riverine and wetland systems on a local to regional scale. The closer to the dam wall the pipeline enters the river, the shorter the section subjected to reduced instream flow will be. These impacts have been discussed previously with reference to the operational phase of the dams.

The section directly below the dam wall up to the dam discharge point will only experience controlled base flow conditions at most times that would lead to loss of the waterfall habitat as well as loss of seasonal natural flow fluctuation events that will affect availability of especially riffle and rapid habitats. It must be noted that although the impact significance for each of the alternative tunnel lengths was classified as being the same, the further from the dam wall water is re-introduced to the system the larger the impact on flow dependent species and on the Tsitsa River will be due altered instream flows.

ii. Impact on flow dependant species

Abstraction for agricultural and other purposes from Ntabelanga Dam will negatively affect the amount of water for release and hence flow in the river section between the Ntabelanga and Tsitsa Dams. Even with the base- and peak flow regimes in operation at Lalini Dam, the river section between the dam wall and entry point of the discharge pipe will only be at most times which may affect some more sensitive taxa. As discussed in the section above there will be an impact on the aquatic community downstream of the dam due to the impacts altered streamflow regimes.

With an altered flow regime the river system, this section may be subjected to excessive vegetation growth or silting over the long term which will negatively affect flow-dependant species. Daily peak time flow will lead to drastic daily fluctuations in flow rate that will also negatively affect flow-sensitive species and a change in the natural aquatic macro-invertebrate community structure is deemed highly likely. Seasonal employment of peak time flow will limit such impact so a single season (winter) however impacts on aquatic biota will extend beyond the winter season of peak generation.

iii. Loss of aquatic biodiversity

Permanent alteration of natural flow rates and habitat will negatively affect aquatic biodiversity with specific reference to macro-invertebrates and riparian vegetation. Potential loss of biodiversity, with particular reference to mayflies from the order *Ephemeroptera*, will mostly pertain to habitat alteration and flow alteration as effected through the Lalini Dam tunnel.

iv. Impact on species with conservation concern

As described for the construction phase, impact pertains to eel migration and presence of endemic mayflies. With the two dams situated between two waterfalls and hence geographically isolated, the area is likely to contain several macro-invertebrate species of conservation concern. The impact associated with the operational phase will be permanent and the only mitigation measures applicable pertain to flow regime.

Table 36: Assessment of impacts on aquatic ecology during the operation phase

Loss of aquatic habitat	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Ntabelanga Dam and associated infrastructure							
Without Mitigation	Local (2)	Permanent – with mitigation (4)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-high
Lalini Dam Base generation only and associated infrastructure							
Without Mitigation	Local (2)	Permanent – with mitigation (4)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-high
Lalini Dam Peak time generation and associated infrastructure							
Without Mitigation	Local (2)	Permanent – with mitigation (4)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-high
Lalini Dam Base generation in summer and Peak in winter and associated infrastructure							
Without Mitigation	Local (2)	Permanent – with mitigation (4)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-high
Impact on flow dependant species	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Ntabelanga Dam and associated infrastructure							
Without Mitigation	Regional (3)	Permanent – with mitigation (4)	High (4)	Medium (3)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-High
Lalini Dam Baseflow only and associated infrastructure							
Without Mitigation	Regional (3)	Permanent – with mitigation (4)	High (4)	Medium (3)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-High
Lalini Dam Peak time generation and associated infrastructure							
Without Mitigation	Regional (3)	Permanent – with mitigation	High (4)	Medium (3)	Definite (5)	High	High

		(4)					
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-High
Lalini Dam Baseflow in summer and Peak in winter and associated infrastructure							
Without Mitigation	Regional (3)	Permanent – with mitigation (4)	High (4)	Medium (3)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-High
Loss of aquatic biodiversity	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Ntabelanga Dam and associated infrastructure							
Without Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-High
Lalini Dam Base generation only and associated infrastructure							
Without Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-High
Lalini Dam Peak time generation and associated infrastructure							
Without Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-High
Lalini Dam Base generation in summer and Peak generation in winter and associated infrastructure							
Without Mitigation	Local (2)	Permanent – with no mitigation (5)	Medium (3)	Medium (3)	High (4)	High	Medium-High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-High
Impact on species with conservation concern	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Ntabelanga Dam and associated infrastructure							
Without Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	Medium (3)	High	Medium-Low
Lalini Dam Base generation only and associated infrastructure							
Without Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-High

With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	Medium (3)	High	Medium-Low
Lalini Dam Peak time generation and associated infrastructure							
Without Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	Medium (3)	High	Medium-Low
Lalini Dam Base generation in summer and Peak generation in winter and associated infrastructure							
Without Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	Medium (3)	High	Medium-Low
Please note that reference to the respective projects also considers impact from associated activities, including gauging weirs, WWTWs, accommodation infrastructure, river intake structures and associated works and information centres.							

c) Wetlands

i. Loss of wetland / riparian habitat and ecological structure, loss of wetland / riparian habitat ecoservices and impacts on wetland / riparian hydrology and sediment balance

Release of water in the generation tunnels, and maintenance of the power line infrastructure will be the primary impacting factors on wetland / riparian habitat during the operational phase. Species composition and community structure of riparian vegetation may be influenced by the release of water in the generation tunnels if the EWR is not managed properly.

Table 37: Assessment of wetland impacts during the operation phase

Loss of wetland / riparian habitat and ecological structure, loss of wetland / riparian habitat ecoservices, and impacts on wetland / riparian hydrology and sediment balance	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Peak power generation with hydropower tunnel and power line alternative 1							
Without Mitigation	1 (site)	1 (Short)	3 (Medium)	3 (Medium)	4 (High)	High	Medium-Low
With Mitigation	1 (site)	1 (Short)	2 (Low)	3 (Medium)	2 (Low)	High	Very Low
Peak power generation with hydropower tunnel and power line alternative 2							
Without Mitigation	1 (site)	1 (Short)	3 (Medium)	3 (Medium)	4 (High)	High	Medium-Low
With Mitigation	1 (site)	1 (Short)	2 (Low)	3 (Medium)	2 (Low)	High	Very Low
Peak power generation with hydropower tunnel and power line alternative 3							
Without Mitigation	1 (site)	1 (Short)	3 (Medium)	3 (Medium)	4 (High)	High	Medium-Low
With Mitigation	1 (site)	1 (Short)	2 (Low)	3 (Medium)	2 (Low)	High	Very Low

Loss of wetland / riparian habitat and ecological structure, loss of wetland / riparian habitat ecoservices, and impacts on wetland / riparian hydrology and sediment balance	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Base-load power generation and with hydropower tunnel and power line alternative 1							
Without Mitigation	1 (site)	1 (Short)	3 (Medium)	3 (Medium)	4 (High)	High	Medium-Low
With Mitigation	1 (site)	1 (Short)	2 (Low)	3 (Medium)	2 (Low)	High	Very Low
Base-load power generation with hydropower tunnel and power line alternative 2							
Without Mitigation	1 (site)	1 (Short)	3 (Medium)	3 (Medium)	4 (High)	High	Medium-Low
With Mitigation	1 (site)	1 (Short)	2 (Low)	3 (Medium)	2 (Low)	High	Very Low
Base-load power generation with hydropower tunnel and power line alternative 3							
Without Mitigation	1 (site)	1 (Short)	3 (Medium)	3 (Medium)	4 (High)	High	Medium-Low
With Mitigation	1 (site)	1 (Short)	2 (Low)	3 (Medium)	2 (Low)	High	Very Low

9.4 IMPACT ASSESSMENT FOR ROADS INFRASTRUCTURE

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

The activities included under this chapter are listed below:

- Upgrading and relocation of roads and bridges; and
- Construction of new access roads around the Lalini Dam site.

9.4.1 Construction and Decommissioning Phases

a) Water Quality

The following key impacts on water quality have been identified for the construction and decommissioning phases:

i. Impacts during the construction of the road infrastructure

Some impacts on water quality may occur during the construction and decommissioning phases. These have to do with possible contamination of the river by construction materials. These occurrences are governed by the National Water Act, and as long as this is adhered to, the effect will be minimal. This applies to the proposed upgrading, realignment and construction of access roads.

Table 38: Water Quality Impacts during the construction of the road infrastructure

Contamination by construction materials	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Without Mitigation	Regional	Medium term	Medium	Medium	High	Medium	Medium -Low
With Mitigation	Site	Short term	Negligible	Low	Improbable	Medium	Very low

b) Aquatic ecology

Relocation and upgrading of bridges will have site specific impacts at riverine points of construction. Impacts due to canalisation and erosion will potentially be caused due to the disturbance of soils, during site clearing, and the alteration of flow regimes in the Tsitsa River and tributaries. If effectively mitigated, such impacts will be of short duration and low intensity. It must be noted that many of the crossings will be over small streams of limited ecological importance and sensitivity although due to the limited flow in the systems care must be taken during construction to not adversely affect these systems.

Probable latent impacts on a site specific to local scale thus include:

- Localised erosion (not significant);
- Localised changes to instream and riparian habitat (not significant);
- Localised sedimentation of the system may lead to altered instream habitat (potentially significant);
- Localised changes to instream and riparian habitat (not significant);
- Some localised changes to aquatic and riparian zone community assemblages (not significant).
- Some changes to the hydrology of the system may occur altering instream habitats on a localised scale (not significant).
- Localised changes to instream and riparian habitat and cover types (not significant);
- Some localised changes to aquatic and riparian zone community assemblages (not significant).

Table 39: Assessment of impacts on aquatic ecology during the construction phase

General impact	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Proposed Roadways							
Without Mitigation	Local (1)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Very low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Low (2)	High	Very low

c) Wetlands

The following key impacts on wetlands have been identified for the construction and decommissioning phases:

Existing roads currently traverse some wetland or riparian habitat, and thus these habitats have already undergone some transformation as a result. The construction of new roads therefore poses a greater threat to the integrity of wetland or riparian habitats, particularly in the vicinity of the Lalini Dam where few roads presently exist.

Table 40: Assessment of wetland impacts during the construction phase

Loss of wetland / riparian habitat and ecological structure and impacts on wetland / riparian hydrology and sediment balance	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Without Mitigation	1 (site)	1 (short)	3 (Medium)	3 (Medium)	3 (Medium)	High	Low
With Mitigation	1 (site)	1 (Short)	2 (Low)	3 (Medium)	2 (Low)	High	Very Low
Loss of wetland / riparian ecoservices	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Without Mitigation	1 (site)	1 (short)	3 (Medium)	3 (Medium)	3 (Medium)	High	Low
With Mitigation	1 (site)	1 (Short)	2 (Low)	3 (Medium)	2 (Low)	High	Very Low

9.4.2 Operation Phase

a) Water Quality

There will be no impacts on water quality of the Tsitsa River during the operation of the access roads.

b) Aquatic ecology

Extensive development project activities often cause a change to peak flows in the river system downstream of the project site, due to changes in surface coverage. Development of a project area will change the surface coverage in some areas from vegetated soil to buildings, hardened gravel roads, paved areas (parking), and compacted earth. These new surface types will allow considerably less infiltration into the ground (typically 0-20%) as compared to the natural surface (typically 60-70%), resulting in more surface runoff following storms and consequently higher peak flow rates. However, such an impact on river peak flow rates would be large insignificant on a local or regional scale. On a site specific scale run-off may result in erosion and sedimentation but such impact can be mitigated.

Table 41: Assessment of impacts on aquatic ecology during the operation phase

General impact	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Proposed road upgrades							
Without Mitigation	Local (1)	Short term (1)	Low (2)	Low (2)	Low (2)	High	Very low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (2)	Low (2)	High	Very low

c) Wetlands

As with the pipelines and power lines, the primary impact on wetland / riparian habitat during the operational phase of the roads is that of maintenance. Additionally, the anticipated increased volume of traffic on the roads due to the continued operations of the dams escalates the risk of toxicants such as motor vehicle oil reaching the wetlands and river systems in runoff from the roads. In the same manner, the likelihood of increased sediment and water inputs to the wetlands and river systems is increased.

Table 42: Assessment of wetland impacts during the operation phase

Loss of wetland / riparian habitat and ecological structure	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Without Mitigation	1 (site)	1 (short)	3 (Medium)	3 (Medium)	3 (Medium)	High	Low
With Mitigation	1 (site)	1 (Short)	2 (Low)	3 (Medium)	2 (Low)	High	Very Low
Loss of wetland / riparian ecoservices	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Without Mitigation	1 (site)	1 (short)	3 (Medium)	3 (Medium)	3 (Medium)	High	Low
With Mitigation	1 (site)	1 (Short)	2 (Low)	3 (Medium)	2 (Low)	High	Very Low
Impact on wetland / riparian hydrology and sediment budget	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Without Mitigation	1 (site)	1 (short)	3 (Medium)	3 (Medium)	3 (Medium)	High	Low
With Mitigation	1 (site)	1 (Short)	2 (Low)	3 (Medium)	2 (Low)	High	Very Low

10. MITIGATION MEASURES

This section of the report will present the mitigation measures that have been incorporated into the preliminary design of the MWP to avoid environmentally sensitive areas in the study area.

The EMPR (**Appendix G**) includes a comprehensive set of mitigation measures for the design/planning, construction and operation phases of the project.

10.1 RIVER AND STREAM CROSSINGS

- The Contractor is responsible for controlling riparian and in stream damage to the river systems that will be crossed. Construction shall be halted in the event of aquatic organism stress caused by the works (as detected through *in situ* monitoring and visual assessment), until adequate controls are put in place.
- The Contractor must prepare for each river crossing a detailed method statement that will include, but not be limited to:
  - A biophysical description of the site;
  - Timing and duration of river crossing construction;
  - An itemised list of the equipment that will be used for the river crossing construction;
  - Measures to maintain flow in the system throughout the construction period;
  - A description of the design and methods for the creation of any stream diversions;
  - Measures that will be used to control sediment and turbidity, spillage of fuel and cement, and monitoring programme to provide rapid feedback on the effectiveness of controls;
  - Measures that will be used to stabilise river embankments after construction and to return the channel to its pre-construction profile or to a more stable profile; and
  - Measures that will be used to minimise the impact of blasting (if any) on aquatic species.
- During Construction the contractor must make provision to maintain the natural flow of any drainage line affected by construction.
- In excavating the bed of the water body, the Contractor must backfill the excavation with material which was originally removed from the stream bed. Further care must be taken to minimise the amount of material used for backfill which have abrasive surfaces.
- Where isolating the location of a works, the following measures, amongst others, may be considered by the contractor in order to minimise the risk of increased suspended sediment in the water column downstream of the works:
  - Elimination of surface flow through the construction site;

  - o The use of non-erodible materials for the construction of berms, coffer dams or other isolation structures used in a works within a flowing water course. The use of non-earthen dam structures such as aquadams are possible options;
  - o In cases where the entire flow of water of a water body is diverted around the water crossing site, it must be returned to the water body immediately downstream of the crossing site;
  - o The use of silt fences or hay bales to isolate the construction area from the water body in situations where the flow velocities and volumes are low;
  - o The removal and temporary storage of any material excavated from the bed or banks of the water body until the materials are replaced within the stream or permanently removed from the site;
  - o The treatment of any water removed from the isolation area, prior to discharge into the downstream river course, to remove suspended sediment.
- The Contractor must monitor the effect of construction on downstream sediment loads. The monitoring programme shall include sampling in the river upstream and downstream of the works during the period when construction in the river is taking place.
- During the construction works, the Contractor must remove any fish that are found within the isolated portion of the river crossing, without harm to the fish, to an area of the water body immediately adjacent to the river crossing, outside the isolated portion of the river crossing site.

10.1.1 Bridges

- Clearly delineate the boundaries of the construction area as to ensure that the footprint of the impacted area is kept as small as possible;
- Use of an adequate long bridge span to avoid constricting the natural active channel and minimise constriction of any overflow channel;
- Placement of foundations onto nonscour-susceptible material (e.g. bedrock or coarse rock material) or below the expected maximum depth of scour;
- Set bridge abutments or footings into firm natural ground (e.g. not fill material or loose soil) when places on natural slopes;
- Use appropriate measures as needed in steep, deep drainages to retain approach fills or use a relatively long practicable bridge span, as per the EMPR (see section on “reinforcement and protection of downstream banks and streambed”);
- Avoid the placement of abutments in the active stream channel to the extent practicable;
- Place in-channel abutments in a direction parallel to the streams flow where necessary; and
- Use suitable measures to avoid or minimise, to the extent practicable, damage to the bridge as associated road, from expected flood flows, floating

debris, and bedload, as per the EMPR (see section on "reinforcement and protection of downstream banks and streambed" as well as design specifications for roads);

- Inspect the bridge at regular intervals and perform maintenance as need to maintain the function of the structure.

10.1.2 Temporary river crossings

- Temporary river crossings will be constructed to accommodate site traffic over the Tsitsa River.
- All temporary river crossings will be constructed by placing 1 m diameter pipes next to each other, the number of pipes that will be placed end to end will be determined by the width of the river crossing needed.
- Rocks, gabions or Reno mattresses will be placed along the intake and outlet of pipe culverts to reduce scouring of the river banks.
- No river crossings are foreseen outside the construction area, however if this is required the Engineer and the ECO will be consulted and the method statement will be revised in accordance to address rehabilitation issues.

10.1.3 Culverts

- Align the culvert with the natural stream channel;
- Clearly delineate the boundaries of the construction area as to ensure that the footprint of the impacted area is kept as small as possible;
- Cover the culvert with sufficient fill to avoid or minimise damage by traffic;
- Construct at or near natural elevation of the streambed to avoid or minimise potential flooding upstream of the crossing and erosion below the outlet;
- Install culverts long enough to extend beyond the toe of the fill slopes to minimise erosion;
- Use suitable measures to avoid or minimise water from seeping around the culvert;
- Use suitable measures to avoid or minimise culvert plugging from transported bedload and debris; and
- Regularly inspect culverts and clean as necessary.

10.1.4 Construction camp sites

- The Contractor must comply with all relevant laws and regulations concerning water provision, sanitation, wastewater discharge and solid waste disposal.
- The Contractor may not establish any campsite within 100m of any watercourse.
- The Contractor must prepare documentation that specifies details pertaining to site layout, topsoil management, sewage treatment, solid waste disposal, erosion control, litter management, provision for vehicle and plant servicing, water supply and rehabilitation.
- The Contractor must classify al hazardous material to be used on site according to recognised Codes of Practice such as SABS Code 0228 for the

identification of Dangerous Substances and Goods and the Department of Water Affairs and Sanitation's minimum requirements for the Handling, Classification and Disposal of Hazardous Waste, and must ensure that the handling, storage, transport and disposal of these materials meets the requirements of these Codes.

- At river crossings, the contractor must place on-site tools and equipment, such as pumps, compressors and generators on bermed impermeable sheeting to prevent hydraulic fluid or fuel leaks from contaminating soil or ground water or entering any watercourse or wetland.
- That contractor must ensure that all equipment which is required to work in rivers is cleaned of oil, grease and other contaminants damaging to aquatic life.
- The contractor must ensure that there is sufficient absorbent material available onsite to manage accidental spills.

10.1.5 Rehabilitation

- The river channel embankment must be returned to the pre-existing (or more stable) profile than that which existed prior to construction.
- The river embankment must be stabilised, using necessary protection measures, including re-vegetation, rip-rap, re -profiling, reno mattresses and other measures, to ensure that the embankments are protected against erosion.
- Measures using indigenous grasses to permanently stabilise disturbed areas must be fully effective by the end of one growing season.
- Debris disposal and clean up shall be carried out to return the river course to its pre-existing condition prior to construction.

10.1.6 Drainage from bridge crossing during the Operational Phase

The function of drainage is to dispose of sub-surface and surface water via designed outlets through various bridge components, in order to prevent the development of water pressure behind earth retaining structures or the accumulation of water on bridge decks which could prove hazardous to road users. In other locations drainage outlets are required to dispose of water which has percolated through joints, deck surfacing or fill beneath sidewalks, to avoid entrapment and durability problems.

The specific components which require the provision of drainage facilities are:

- Abutments, retaining walls and culvert barrels, behind which drainage filters and pipes are required to collect ground water and dispose of this through weepholes.
- 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.

The monitoring staff is expected to verify that the particular products proposed by the contractor comply with the specification and that when installed are adequately secured in place to avoid being dislodged during the concreting and backfilling operations.

10.2 RIVER INTAKE STRUCTURES

River intake structures will take the form of mass concrete measuring weirs with upstream wells for pumped abstraction for the small water abstractions. This will be finalised in detail design stage.

10.3 RIVER OUTLET STRUCTURES

The main outlet works in the dams are multi-level towers and pipes within a reinforced concrete structure, discharging to a rock lined stilling basin just downstream of the dam wall. Other river outlets (from small hydropower plants) are generally from concrete headwalls, and are normally accompanied by appropriate erosion control such as stilling basins or gabion works. This will be finalised in detail design stage.

10.4 WETLAND CROSSINGS

- Mitigation measures to limit the impacts (such as ensuring the design of crossings allows for the retention of wetland soil conditions) must be implemented at all wetland crossings already in place;
- Quarries and borrow pits should ideally be placed within the dam footprints in order to preserve wetland and riparian habitat outside of the dam footprints, and to reduce sedimentation of the riparian resources;

- Minimise the construction footprints and implement strict controls of edge effects;
- Erosion management and sediment controls such as the use of gabions or reno mattresses, revegetation of profiled slopes, erosion berms, drift fences with hessian and silt traps must be strictly implemented from the outset of construction activities;
- An alien vegetation control programme is implemented, as encroachment of alien vegetation is already apparent in the study area and is expected to increase as a result of the disturbances resulting during the construction process. Rehabilitation of disturbed areas, utilising indigenous wetland vegetation species, will assist in retaining essential wetland ecological services, particularly flood attenuation, sediment trapping and erosion control, and assimilation of nutrients and toxicants, thus reducing the impacts of construction related activities;
- Implement measures such as sediment control, and prevention of pollution (solid wastes, oil spills, discharge of sewage) to minimise impacts on the water quality of nearby adjacent rivers;
- Support structures for pipelines must be placed outside of riparian features, channelled valley bottom wetlands and drainage lines. Should it be essential to place such support structures within these features, the designs of such structures must ensure that the creation of turbulent flow in the system is minimised, in order to prevent downstream erosion. No support pillars should be constructed within the active channels. In order to achieve this all crossings of wetlands should take place at right angles wherever possible;
- The Ecological Water Requirements (EWR) as set out in the Reserve Determination Volume 1: River (Report P WMA 12/T30/00/5212/7) for the Ntabelanga Dam, and the EWR determined for the Lalini Dam, must be adhered to;
- During operations and maintenance of infrastructure, vehicles must remain on designated roads and not be permitted to drive through sensitive wetland / riparian habitat, particularly on the edges of the dams where loss of wetland habitat and therefore ability of the wetlands to provide ecological services, is already compromised.
- Maintenance personnel must ensure that any tools and/or waste products resulting from maintenance activities are removed from the site following completion of maintenance.
- Wherever possible, it is preferable that existing roads be upgraded, rather than constructing new roads, in order to minimise the impact of construction on wetland / riparian habitat;
- Where it is necessary to traverse features such as drainage lines, channelled valley bottom wetlands and riparian habitat, the crossing designs of bridges must ensure that the creation of turbulent flow in the system is minimised, in order to prevent downstream erosion. No support pillars should be constructed within the active channels. In order to achieve this all crossings of wetlands should take place at right angles wherever possible;
- If it is absolutely unavoidable that wetland / riparian habitat is affected during the construction of new roads, especially during bridge or culvert construction,

disturbance to any wetland crossings must be minimised and suitably rehabilitated. The design of such culverts / bridges should allow for wetland soil conditions to be maintained both upstream and downstream of the crossing to such a degree that wetland vegetation community structures upstream and downstream of the crossing are maintained. In this regard, special mention is made of:
  - The design of such culverts and/or bridges should ensure that the permanent wetland zone should have inundated soil conditions throughout the year extending to the soil surface;
  - The design of such culverts and/or bridges should ensure that the seasonal wetland zone should have water-logged soils within 300mm of the soil surface at all times;
  - Temporary wetland zone areas should have waterlogged soil conditions occurring to within 300m of the land surface during the summer season;
- Ensure that no incision and canalisation of the wetland system takes place as a result of the construction of the culverts;
- It must be ensured that flow connectivity along the wetland features is maintained;
- Reinforce banks and drainage features where necessary with gabions, Reno mattresses and geotextiles;
- Monitor all systems for incision and sedimentation;
- As much vegetation growth as possible should be promoted within the wetland areas in order to protect soils. The use of indigenous vegetation species where hydroseeding, wetland and rehabilitation planting (where applicable) are to be implemented is essential;
- Regular maintenance of all roads, with specific mention of wetland / riparian crossings, must take place in order to minimise the risk of further degradation to wetland / riparian habitat.

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

- The Contractor must adhere to the provisions of the EMPR in order to prevent permanent damage occurring as a result of construction of the works to all wetlands affected by the proposed infrastructure.
- As far as practical possible, the contractor must schedule construction activities to take place during winter when surface and subsurface water flows are lowest.
- The Contractor must not remove any vegetation within the wetland, other than that which is absolutely necessary.
- The construction area is to be defined and any areas beyond the construction area to be cordoned off with danger tape and designated as ‘no go’ areas for personnel and construction vehicles.

- The contractor must manage all temporary construction roads in or adjacent to wetlands so as to disperse runoff and avoid concentrating water flows.
- Disturb the least amount of area as practicable when crossing a standing water body. Clearly delineate the boundaries of the construction area as to ensure that the footprint of the impacted area is kept as small as possible;
- Avoid as far as practicable the movement of ground equipment on unstable, wet, or easily compacted soils and on steep slopes unless operation can be conducted without causing excessive rutting, soil puddling, or run-off of sediments directly into water bodies;
- Install suitable storm water and erosion control measures to stabilise disturbed areas and waterways during times of no construction in the specific area as to prevent sedimentation mobilization during rainfall events;
- Provide for sufficient cross drainage to minimize changes to, and avoid restricting, natural surface and subsurface water flow of the wetland under the road to the extent practicable;
- Use suitable measures to increase soil-bearing capacity and reduce rutting from expected vehicle traffic;
- Construct fill roads when necessary as to maintain road geometry and alignment;
- Don’t use drainage bottoms as turn-around areas for construction vehicles;
- The fill used in the construction of the road will be constructed as far as practicable possible parallel to the flow of water and be as low to the natural ground level as practicable; and
- Construct the road with sufficient surface drainage as to allow for surface flows in such a manner that it prevents erosion.

11. MONITORING AND COMPLIANCE

Please refer to the Environmental Management Programme (EMPR) attached as an appendix in the ***Environmental Impact Assessment for the Mzimvubu Water Project: P WMA 12/T30/00/5314/3.*** Monitoring will be required during the period of construction, when the disturbance will occur. Water quality will be monitored during the construction and operational phase of the dams.

11.1 ROLES AND RESPONSIBILITIES

A number of people are responsible throughout the project, i.e. during planning, construction and operation of the all water uses for this development, to ensuring that environmental best practices are adhered to. This list includes, and is not limited to the following people:

- Developer or Implementing Agent: Person or organisation funding the implementation of the project;
- Environmental Consultant: Independent environmental practitioner(s) responsible for the preparation and submission of environmental authorisation applications, impact reports;
- Project Manager: Representative of the Implementing Agent who co-ordinates all aspects of the project;
- Design Engineer: Involved during the design and planning stage and is responsible for ensuring that the relevant environmental planning and design considerations are taken into account during these phases;
- Contractor: Appointed by the Implementing Agent to conduct the construction. The contractor must ensure that all staff employed for the project receive sufficient training;
- Site Engineer: Person responsible for supervision and quality control on site and may at times assume the responsibilities of the Project Manager;
- Environmental Officer: Person responsible for managing the day-to-day on-site implementation of the Construction Contract;
- Environmental Control Officers (ECO): Person responsible for conducting environmental audits as required. An independent ECO is an unaffiliated party, generally appointed for external audits of projects conducted in sensitive areas.

11.2 MONITORING DURING THE CONSTRUCTION PHASE

11.2.1 Abstraction

During the construction phase the water abstracted directly from the water resource will be recorded and reported within the monthly monitoring report. The number of water tankers used will be recorded and the total volume used monthly will be calculated. The quantity of surface water abstracted must be metered or gauged and the total recorded as at the last day of each month.

11.2.2 Water Quality

a) Baseline water quality monitoring

The objective of the baseline water quality monitoring is to provide a background record against which the performance of the environmental management plan can be assessed. As such two conditions have to be considered, namely the construction phase and the operational phase. During the construction phase the impact is from the discharge of waste and waste water from the various construction activities, while during the operational phase the impact will be from storing water in the proposed dam, and the transfer of water from one catchment to another.

Construction Phase

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.

It is recommended that samples for a comprehensive analysis are 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 of 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 variables for which guidelines are available are shown in the **Table 43** (an **X** indicates that guidelines are available, shaded variables denote General Standard variables). Only four user groups were considered, as the variables that apply for human consumption also apply to livestock watering (the guideline values are different), and the same applies for aquaculture and the aquatic ecosystem.

Table 43: Water quality variables for which guidelines are available

Variable	User Group			
	Domestic	Irrigation	Ecosystem	Recreation
Aluminium	X	X	X	
Ammonia	X		X	
Arsenic	X	X	X	
Asbestos	X			
Atrazine	X		X	

Variable	User Group			
	Domestic	Irrigation	Ecosystem	Recreation
Beryllium		X		
Boron		X		
Cadmium	X	X	X	
Calcium	X			
Chloride	X	X		
Chlorine			X	
Chromium	X	X	X	
Cobalt		X		
Coliforms (F)		X		
Colour	X			
Copper	X	X	X	
Corrosion	X	X		
Cyanide			X	
Dissolved Organic Carbon	X			
Dissolved Oxygen			X	
Endosulfan			X	
Fluoride	X	X	X	
Indicator Organisms	X			X
Iron	X	X	X	
Lead	X	X	X	
Lithium		X		
Magnesium	X			
Manganese	X	X	X	
Mercury	X		X	
Molybdenum		X		
Nickel		X		
Nitrate	X			
Nitrogen (Inorganic)		X	X	

Variable	User Group			
	Domestic	Irrigation	Ecosystem	Recreation
Odour	X			X
pH	X	X	X	X
Phenols	X		X	
orus (Inorganic)			X	
Potassium	X			
Radioactivity	X			
Selenium	X	X	X	
Settleable Matter (Susp Solids)	X	X	X	
Sodium	X	X		
Sodium Adsorption Ratio		X		
Sulphate	X			
Trihalomethanes	X			
Temperature			X	
TotalDissolved Solids (Cond)	X	X	X	
Total Hardness	X	X		
Turbidity	X			X
Uranium		X		
Vanadium	X	X		
Zinc	X	X	X	

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 SO_4)

- Fluoride (mg/l F)
- Chloride (mg/l Cl)
- Nitrate/Nitrite (mg/l NO_3 / NO_2)
- Potassium (mg/l K)
- Aluminium (mg/l Al)
- Phosphate (mg/l PO_4)
- Total Alkalinity (mg/l $CaCO_3$)

Sampling Frequency
Construction is scheduled to start as early as possible after all necessary authorisations have been obtained, and therefore less than one year of sampling may be available to establish baseline conditions. However, 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 (± 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.

11.2.3 Water Management

General

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

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.

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 operations shall continue 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.

The Contractor shall minimise the use of water and shall immediately attend to any wastage. 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.

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.

Quality and quantity monitoring

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 Water Management Method Statement 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 Water Management Method Statement 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 un-treated 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 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 44**. Water quality monitoring reports must be submitted to the Engineer within 10 days of taking the sample.

Table 44: 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 (faecal) coliform bacteria	No *E. coli* (0/100 m ℓ) or No Thermotolerant (faecal) coliform bacteria (0/100 m ℓ)
Fluoride (as F)	Not to exceed 1.0 mg/ ℓ
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 $N0_3$)	Not to exceed 1.5 mg/ ℓ

VARIABLE	REQUIRED EFFLUENT STANDARD
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 $P0_4$)	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^{o}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

<u>Watercourses</u>

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.

Up and downstream of 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 per cent 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 45**). The laboratory should be requested to provide the results of these samples within 14 working days.

Table 45: 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 50m 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.

<u>On-site management</u>

Storm water and site drainage

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.

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.

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.

Settlement ponds

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.

Crossing of aquifers

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.

Working in rivers and wetlands

The Contractor will 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.

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.

The Contractor must ensure substratum restoration during the rehabilitation phase of the contract. 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.

Trench excavations and dewatering

The ingress of 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 stockpiled in accordance with the specifications.

Water that has entered the trench or 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 44)** 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.

Cleaning and Washing

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.

No surface run-off of oils, cement, litter, paints etc. which could pollute or alter current water quality are to be deposited into the river system or nearby streams and rivers. Any abstraction of water for construction purposes must be approved by DWS. Prevention and mitigation measures must be implemented to ensure water quality is not adversely affected by such abstraction.

Silt and erosion control

The Contractor shall implement measures to prevent, reduce and mitigate water contamination, including prevention of contamination by suspended sediments. The Contractor shall provide proper storm water drainage plans that shall not concentrate water on downstream receiving streams or water courses. Storm water shall be diverted to lessen its erosive impact upon the surrounding environment. All material and soil stockpiles will be managed to prevent erosion in accordance with the specifications.

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.

Oil interceptor

Oily waters and contaminated waters arising from vehicle refuelling 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.

Construction waste water

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. Runoff 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.

Recycling water

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.

11.2.4 Aquatic Biomonitoring

Ongoing biomonitoring must take place from 1 year prior to construction (on a quarterly basis) and throughout construction and operation (on a minimum of a six monthly basis in the spring and autumn of each year) to determine trends in ecology and define any impacts requiring mitigation.

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 as well as upstream and downstream of the hydroelectric generation tunnel. If any trends are observed where impacts on the aquatic ecology are becoming unacceptable, measures to reduce the impacts must be immediately implemented.

The following assessments must be undertaken as part of the aquatic biomonitoring:

1. Habitats assessment
    a. IHIA
    b. IHAS

2. Macro-invertebrate assessment
    a. SASS5
    b. MIRAI

3. Annually
    a. Fish assessments using FRAI
    b. Riparian vegetation using VEGRAI

All aquatic biomonitoring should be undertaken by a suitably qualified and South African River Health Program (SA RHP) accredited assessor.

11.3 MONITORING DURING THE OPERATIONAL PHASE

11.3.1 Auditing and Reporting

- During the construction phase the site Environmental Officer shall compile a monthly report on the construction phase activities and record any impacts on the surface water resource and wetland areas;
- DWS shall conduct a bi-annual internal audit on compliance during the construction phase. A report on the audit shall be submitted to the act Regional Head: DWS within one month of finalisation of the report, and shall be made available to an external auditor.

11.3.2 Emergency Incident Reporting

Section 20 of the National Water Act, 1998 (Act 36 of 1998), requires that the responsible person or any other person involved in an incident that may cause potential pollution of the water resource to undertake the following actions as soon as reasonably possible after obtaining knowledge of the incident:

- Notify the Department of Water Affairs;
- Notify the South African Police Service;
- Notify the relevant catchment management agency;
- The responsible person must –
    - Take all reasonable measures to contain and minimise the effects of the incident;
    - Undertake the clean-up procedures;
    - Remedy the effects of the incident; and

- Take such measures as the catchment management agency or the Department may verbally or in writing direct within a specified timeframe.

12. PUBLIC PARTICIPATION PROCESS

12.1 AUTHORITY CONSULTATION

A pre-application meeting was held at the Department of Environmental Affairs (DEA) offices in Pretoria on 25 March 2014. The purpose of the meeting was to introduce the project to DEA, and agree on the proposed process and programme to be followed as well as associated roles and responsibilities.

As the project is a Strategic Integrated Project (SIP3) and a priority for DWS, delays in the EIA process should be avoided as far as possible. The programme for the EIA study was presented at the meeting and it was resolved that an Authorities Forum be established for the project, in order to obtain inputs and comments on the draft reports from the various organs of state involved ,in a timeous manner.

The First Authorities Forum meeting took place on 28 May 2014. The objectives of the meeting were to present the project and the findings of the Draft Scoping Report to the various organs of State involved, and obtain their comments on the draft Scoping Report.

The Authorities Forum includes representatives from the following organs of State:

- Department of Environmental Affairs;
- DWS regional and head office;
- Department of Agriculture, Forestry and Fisheries;
- Department of Rural Development and Land Reform;
- Department of Trade and Industry;
- Department of Energy;
- Eskom;
- SAHRA;
- Department of Public Enterprises;
- Department of Minerals Resources;
- Economic Development Department;
- EC Department of Economic Development, Environmental Affairs and Tourism;
- EC Department of Rural Development and Agrarian Reform;
- Eastern Cape Local Government and Tribal Authorities;
- EC Department of Roads and Public Works;
- EC Provincial Heritage Resources Authority;
- Affected Local and District Municipalities; and
- Amatola Water.

12.2 STAKEHOLDER IDENTIFICATION AND DATABASE

DWS has engaged with a number of stakeholders and role-players on this project during the feasibility study stage. A stakeholder database, including existing I&APs was provided at the beginning of the EIA process, which is updated on an ongoing basis as new stakeholders register on the database.

12.3 PARALLEL STAKEHOLDER LIAISON BY THE DEPARTMENT OF WATER AND SANITATION

There are several parallel stakeholder liaison initiatives for the project as a whole in addition to the public participation process for the EIA. Issues relevant to the EIA identified during these initiatives are incorporated into the process on an ongoing basis.

Table 46 lists the Department's formal and informal liaison structures and activities for this project, their purpose and representation.

Table 46: Department of Water and Sanitation formal and informal liaison structures and activities for the Mzimvubu Water Project

Liaison Structure	Purpose	Representation
Project Steering Committee (PSC) (Meetings take place every second month)	Guidance pertaining to strategic issues related to the project	▪ Department of Water and Sanitation and other relevant national departments ▪ EC Government ▪ Municipalities in the project area ▪ Key sectors such as conservation
Study Management Committee (Meetings take place every second month)	To co-ordinate and synchronize all the activities, to ensure efficient communication and to manage components and phases of the project	Department of Water and Sanitation: Options Analysis and EAP.
Eastern Cape Social and Economic Consultative Council (ECSECC) (13 February 2014, 26 March 2014, 6 March 2014)	ECSECC is a multi-stakeholder policy research and development planning organisation dedicated to evolving new forms of development cooperation between government, labour, organised business and developmental non governmental organisations	The ECSECC team is made up of over 40 committed professional and administrative staff. Subject experts, facilitators and development practitioners work in multidisciplinary teams.
Integrated Wild Coast Development Programme Steering Committee (19 February 2014)		

12.4 NOTIFICATION LETTERS, ON-SITE NOTICE AND BACKGROUND INFORMATION DOCUMENT

A letter notifying I&APs of this application for environmental authorisation, as well as the applications for the Water Use Licence, heritage permits, and borrow areas approval was sent to all registered stakeholders together with a Background Information Document (BID). Both the English and isiXhosa versions were distributed by the local facilitators as well as placed on the DWS website. The BID covers all the applications that form part of the project. A newspaper advertisement was published in both local and provincial newspapers announcing the EIA process for this project and providing contact details for I&APs to register as a stakeholder. On-site notices were also posted, providing a brief background on the project and contact details in order for I&APs to request further information and/or to register as a stakeholder (**Figure 74**).

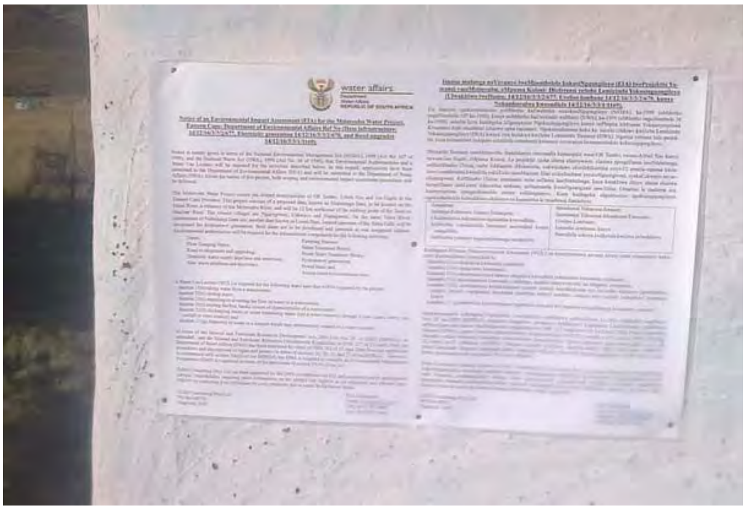

Figure 74: On-site notice (English and isiXhosa)

12.5 NEWSPAPER ADVERTISEMENTS

Notice of the applications was advertised in the Herald on 29 April 2014, in the Daily Dispatch on 05 June 2014 (**Figure 75**) and in the Mthatha Fever on 12 June 2014.

ISAZISO MALUNGA NOVAVANYO LWEMPEMBELELO KOKUSINGQONGILEYO (EIA) LWEPROJEKTHI YAMANZI YASEMZIMVUBU, EMPUMA KOLONI

IReferensi yeSebe Lemicimbi Yokusingqongileyo (Ulwakhiwo lweDama: 14/12/16/3/3/2/677, Uveliso lombane 14/12/16/3/3/2/678, kunye Nokuphuculwa kweendlela 14/12/16/3/3/1/1169.

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Ifeksi: (012) 665 1886

ILISO consulting

Figure 75: Advertisement in the Daily Dispatch (isiXhosa)

12.6 PUBLIC COMMENT PERIOD FOR DRAFT AND FINAL REPORTS

12.6.1 Draft Scoping Report

The Draft Scoping Report was made available to I&APs for a 30-day public comment period, from 9 May 2014 to 9 June 2014. The draft report was available for download from the DWS website (://www.dwa.gov.za/mzimvubu) and hard copies were also available for perusal.

Copies of the Draft Scoping Report were available at the following venues:

Location	Venue
East London	Mrs Glenn Hartwig East London Central Library, Reference Library First Floor Gladstone Street East London 5200 (043) 722-4991
Mthatha	Mrs Vuyiswa Lusu Walter Sisulu University Nelson Mandela Drive Unitra, Umtatha 5117, 047-5022382 /2319

Tsolo	Mhlontlo Local Municipality 128 Mthuthuzeli Mpehle Avenue Tsolo 5170
Ntabelanga	Siqhungqwini Junior Secondary School Siqhungqwini A copy was also given to the local Chief (Chief Mabantla). Tel: 079 397 7131
Lalini	Mhlontlo Local Municipality Technical department Office 26 96 Church Street Qumbu 5180

Three public meetings were held during the week of the 12th of May 2014 near the proposed Ntabelanga Dam site (in Siqhungqwini), in Tsolo and in Lalini. The purpose of these meetings was to engage with the public, provide information and allow stakeholders to raise any comments or objections.

12.6.2 Final Scoping Report

The Final Scoping Report was made available electronically for a 21-day public comment period.

12.6.3 Draft Environmental Impact Assessment Report and Water Use Licence Application Technical Report

The draft EIR and Water Use Licence Application Technical Report were made available to I&APs for comment from the DWS website (http://www.dwa.gov.za/projects.aspx) and hard copies were also available for perusal from the following venues for a thirty (30) day comment period, held from 24 November to 12 January 2015:

Location	Venue
East London	Mrs Glenn Hartwig East London Central Library, Reference Library First Floor Gladstone Street East London 5200 (043) 722-4991
Mthatha	Mrs Vuyiswa Lusu Walter Sisulu University Nelson Mandela Drive Unitra, Umtatha 5117 047-5022382 /2319
Tsolo	Mhlontlo Local Municipality

	128 Mthuthuzeli Mpehle Avenue Tsolo 5170
Qumbu	Mhlontlo Local Municipality Technical department Office 26 96 Church Street Qumbu 5180
Maclear	Mr Khayalethu Gashi Elundini Local Municipality 1 Seller Street, Maclear Eastern Cape 5480

A round of public meetings took place during the last week of November 2014 in order to provide an update on the project and report back to stakeholders on the findings of the Impact Assessment phase. Meetings were held in the following venues.

	Location	**Venue**	**Date and Time**
Ntabelanga Dam and Irrigation farms	Thambekeni	Headman Mthethunzima's household	Monday, 24 November 2014 10:00
	Mpetsheni	Mpetsheni Church	Monday, 24 November 2014 14:00
	Shukunxa	Shukunxa Church	Tuesday 25 November 2014 10:00
	Ngxoto	Ngxoto Junior Secondary School	Tuesday 25 November 2014 14:00
	Tsolo	Tsolo Town Hall	Wednesday, 26 November 2014 10:00
	Siqungqwini	Siqungqwini Junior Secondary School	Wednesday, 26 November 2014 14:00
Lalini Dam and Hydropower generation	Lalini	Lalini Junior Secondary School	Thursday, 27 November 2014 10:00
	Lotana	Lotana Church	Thursday, 27 November 2014 14:00
	Shawbury/	Chief Veco's household	Friday, 28 November

	KuNotsweleba		2014 10:00
	Siqikini	Siqikini Junior Secondary School	Friday, 28 November 2014 14:00

12.6.4 Final Environmental Impact Assessment Report and Water Use Licence Application Technical Report

The Final EIA Report and Water Use Licence Application Technical Report will be made available electronically for a 21-day public comment period.

12.7 FOCUS GROUP MEETINGS

A focus group meeting with the Department of Agriculture, Forestry and Fisheries was held on 20 May 2014 to discuss agriculture and land tenure issues associated with the project.

Between 28 June and 11 July 2014 a field trip was undertaken across the project region. During this time various meetings were held as indicated below.

Date	**Venue**
28 June 2014	Shukunxa Village
30 June 2014	Ngqongweni
10 July 2014	Mpetsheni
10 July 2014	Sibomvaneni Village
10 July 2014	Ntabelanga Dam Basin
10 July 2014	Mawasa Location
11 July 2014	Lalini Dam Basin

In addition, focus group meetings were held with the Department of Energy (18 July 2014) and Nyandeni LM (30 September 2014).

12.8 NEWSLETTERS

A Newsletter (Newsletter #3) was compiled, providing information on the Environmental Impact Assessment process, progress to date and the way forward.

The newsletter was distributed electronically to all registered stakeholders on 12 August 2014. In addition, 150 copies (in English) and 350 copies (in isiXhosa) of the newsletter were printed and distributed to local communities by the local facilitators within the project area on 19 and 20 August 2014. Hard copies were also left at the relevant municipal offices.

A follow up newsletter (Newsletter #4) will be compiled and distributed once a decision has been made regarding the application for environmental authorisation.

12.9 ISSUES AND RESPONSES REPORT

Feedback received from stakeholders is recorded in the Issues and Responses Report (IRR) and has been incorporated in the IWULA where applicable.

12.10 KEY ISSUES

The key issues that have been raised during the public participation process are summarised below.

1. The dams will store water that would previously have flowed down the Tsitsa River into the Mzimvubu River and ultimately through the estuary to the sea. Some water will be abstracted from the dams for, primarily, domestic and agricultural use. Other water will be released from the dams for power generation in a way that alters the natural flow regime. At some times the rivers will therefore have less water than natural and at other times they will have more. Changes to the flow regimes in rivers, especially where potentially sensitive area such as the Tsitsa Falls and associated pristine gorge downstream of the proposed Lalini Dam and the Mzimvubu estuary, could impact on the aquatic and riparian ecosystems and associated ecosystem services provided by the rivers. The impact of the proposed altered flow regimes in the rivers on the **aquatic and riparian ecosystems** therefore need to be assessed.

2. The Mzimvubu Project is located in a part of the country that currently experience severe soil erosion with associated high **sediment** levels in the rivers. Concern has been raised that this condition will cause the dams to silt up, reducing their yield and affecting the functioning of the equipment (e.g. abstraction and water treatment). Impacts on the river channel and water quality immediately downstream of the dams, where water carrying less sediment than when entering the dam is released, are also envisaged.

3. When a dam is constructed the land that will be inundated by water will be permanently altered and the current functionality will be lost (and replaced with a lake). The proposed dams are expected to inundate 10.34 km^2 of wetlands, grassland and savannah habitats as well as man-made structures, roads and powerlines. The plants and animals that currently depend on the river, wetland, grassland or savannah habitats will either have to move/be moved to use other resources or will die. The significance of this **ecological impact** needs to be assessed.

4. Some people are currently living and providing for their existence from the resources in the areas that will be inundated by water or replaced by infrastructure. These families will have to be **relocated** to new homes and **compensated** for their loss of livelihoods. This is usually a socially disruptive and personally traumatic experience that needs careful attention and management.

5. The Mzimvubu Project is expected to cost R 12.5 billion. The **financial and economic viability** has been questioned. Financial viability implies the project is evaluated at market prices. Economic viability implies that the project is evaluated at prices which reflect the relative scarcity of inputs and outputs. The main purpose of this project is to contribute to the development of an impoverished rural area of the Eastern Cape by making water available to the area. The investment by government must therefore be evaluated against the background of the projected contribution to social and economic development. A project of this nature may make economic sense, but not be affordable. In such a case government's continuous grants and subsidies may be necessary. The EIA study is not the right vehicle to determine financial viability and affordability. An economic cost benefit analysis (ECBA) was therefore done as part of this EIA and not a financial cost benefit analysis. The funding of the project is an important issue and during this analysis it became clear that it will take up to 10 years to attain maximum production from the irrigation scheme and possibly financial profitability. Financial viability can only be attained by grant funding on an annual basis without any repayment pre-conditions. The high poverty levels in the project area are such that it is improbable that more than 10% of the domestic users will be able to pay for the water. Therefore, a long term annual subsidy will have to be provided for. The Lalini Dam Hydro-Electricity Generation is financially viable and can be funded by loans.

6. The specific area of the Eastern Cape Province has a large untapped **agricultural potential**. Any agricultural development based on commercial principles will, however, be faced with a number of stumbling blocks. These include the problem of land ownership, shortage of management skills for commercial farming, available markets, and support structures such as production inputs and funding.

7. A large infrastructure project of this nature will result in an influx of people and consequently increase the demand for municipal services such as water, electricity, roads, sewerage, housing and social services (clinics, schools etc.). This will place a significant burden on an already over-extended **Local government**.

8. There is a need for better roads in the study area. **Road upgrades** are especially welcomed by communities.

9. As some roads and bridges will be inundated by the dams, new bridges and roadrealignments will be required. This will influence travel routes, distances and travel times. Where the proposed realignments will result in significant increases in **travel times and distances** (e.g. travelling from the villages north of

Ntabelanga Dam to Maclear), alternative routes must be provided in order to maintain or improve the current level of service in the areas concerned.

10. Community members recognize that this project has the potential to generate opportunities for **employment**. Community members requested that **skills development** programmes be implemented in the area before construction commences so that the recipient communities can equip themselves to take up these opportunities. Community members also requested advice on **what courses/qualifications** at what institutions would be best to embark on to prepare themselves for the upcoming opportunities.

13. CONCLUSION AND RECOMMENDATION

The MWP is a Strategic Integrated Project (SIP 3) identified by the South African Government which includes the development of a new dam at Mzimvubu with irrigation system.

The MWP consisted of the development of the Ntabelanga and Lalini Dams and its associated infrastructure which is a conjunctive scheme that consists of water resource infrastructure, treated domestic water supply infrastructure, raw water supply infrastructure, power and affected infrastructure.

The Mzimvubu Catchment is located in one of the poorest regions in South Africa and possesses untapped economic potential in the form of its abundant water resources.

The MWP will redress the results of past racial and gender discrimination by contributing, on a macro-economic level, not only to the National but the Eastern Cape Province economy. The long term economic benefits associated with the MWP include an increase in quality of life and would impact positively on labour and economic productivity.

Failure to authorise the water uses would contradict the obligation on the State to advance the interests of the poor. 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.

The benefits of the project in terms of economic and social development are expected to be high, provided the necessary conditions for the success of the project are met and the recommended mitigation and enhancement measures are adhered to.

However, some significant negative impacts, mostly related to aquatic ecology and wetlands, have been identified. Some of these impacts are permanent and cannot be mitigated to an acceptable level.

The Impacts on water quality, although relevant is insignificant and the development will not detract from the fitness for use of the water in the study area.

It is recommended that the licence is issued for a period of 40 years as the infrastructure is designed and built for this period.

14. REFERENCES

BKS (Pty) Ltd (2009) DWAF Water Resource Study in Support of the AsgiSA EC

AsgiSA EC (2009) *The Agricultural assessment and irrigation water use study*

Berliner, D. and Desmet, P. (2007) *Eastern Cape Biodiversity Conservation Plan: Technical Report*. Department of Water and Sanitation and Forestry Project No 2005-012, Pretoria. 1 August 2007

Department of Water Affairs, South Africa (2013a) *Feasibility Study for the Mzimvubu Water* Project, *Water Resources*

Department of Water and Sanitation, South Africa (2013b) *Feasibility Study for the Mzimvubu Water Project: Geotechnical Investigations*. DWA Report No: P WMA 12/T30/00/5212/10. Prepared by Jeffares & Green (Pty) Ltd.

Department of Water and Sanitation, South Africa (2014a) *Environmental Impact Assessment for the Mzimvubu Water Project: Environmental Impact Assessment Report.* DWS Report No: P WMA 12/T30/00/5314/3. Prepared by ILISO Consulting (Pty) Ltd*.*

Department of Water and Sanitation, South Africa (2014b) *Environmental Impact Assessment for the Mzimvubu Water Project: Water Quality Assessment Report.* DWS Report No: P WMA 12/T30/00/5314/13. Prepared by Scientific Aquatic Services cc**.**

Department of Water and Sanitation, South Africa (2014c) *Environmental Impact Assessment for the Mzimvubu Water Project: Aquatic Ecology Assessment.* DWS Report No: P WMA 12/T30/00/5314/15. Prepared by Scientific Aquatic Services.

Department of Water and Sanitation, South Africa (2014d) *Environmental Impact Assessment for the Mzimvubu Water Project: Wetland Assessment*. DWS Report No: P WMA 12/T30/00/5314/15. Prepared by Scientific Aquatic Services cc**.**

National Protected Areas Expansion Strategy, 2010

Reserve Determination Volume 1: River (Report P WMA 12/T30/00/5212/7

Statistics South Africa (2012) *General Household Survey, Selected development indicators, July 2012,* Pretoria: Statistics South Africa

Statistics South Africa (2012) *Census 2011,* Pretoria: s.n.

www.climate-data.org

APPENDIX A

APPLICATION FORMS

APPENDIX B

WATER USE SUMMARY TABLE

APPENDIX C

MAPS

APPENDIX D

WATER QUALITY ASSESSMENT

REFER TO REPORT NO: P WMA 12/T30/00/5314/13

APPENDIX E

WETLAND STUDY

REFER TO REPORT NO: P WMA 12/T30/00/5314/16

APPENDIX F

AQUATIC ASSESSMENT

REFER TO REPORT NO: P WMA 12/T30/00/5314/15

APPENDIX G

ENVIRONMENTAL MANAGEMENT PROGRAMME

REFER TO REPORT NO: P WMA 12/T30/00/5314/14