



D2: Scoping Study

**Maseru WDM
QW5; 1527**

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Lead Author: Malcolm
White

QA'd by: Gavin Quibell,
Charlotte Ellis

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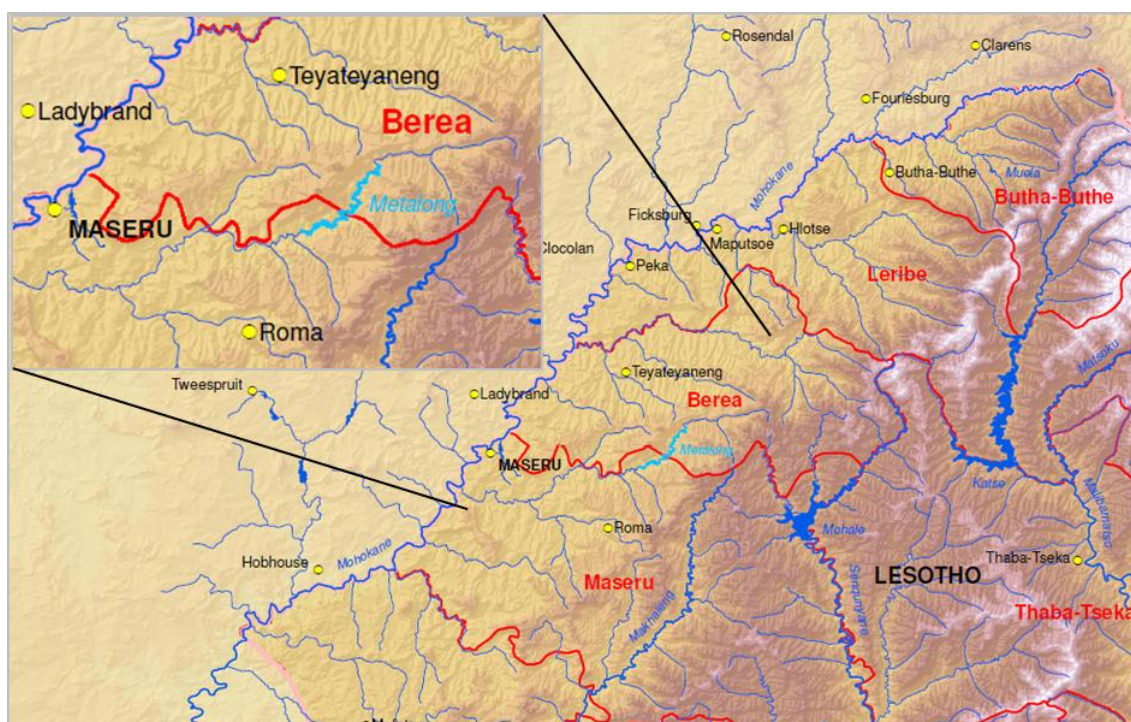
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Introduction

Water Demand Management (WDM) in Maseru holds potential benefits through saving water, and improved financial status in Maseru – which may result in improved pollution management and reduced demands on the Caledon / Mohokare River. This may contribute towards the provision of environmental flows in this shared river and would help address potential water quality problems in the river with benefits to both Lesotho and South Africa from May through to September. The potential also exists to establish a Private / Private partnership with clothing and textile industries, based on the successful monitoring of a pilot site, and on the basis of assured water supplies and contributions to improved environmental conditions

Deliverable 2 of this study is focussed on a review of the possible transboundary benefits of WDM in Maseru if fully implemented. The issue of WDM in Maseru cannot be separated from the operation of the Metolong Dam and Water Supply Program (MDWSP), currently under construction and which will provide a new source of potable water for the Maseru area. This project, and its relationship to WDM and the issue of transboundary flows is included in this scoping review.

Figure 1 Location of Maseru and Metolong Dam¹



Any intervention which results in the increased dilution of flows in the river downstream of Maseru and/or a reduced level of poor quality return flow, will significantly improve the quality of water in the Caledon/Mohakare River downstream of Maseru during the dry season. This scoping exercise aims to briefly present and discuss these interventions, centred around water demand management in Maseru.

¹ Figure 1-1 is based on Figure 2-1 in Lesotho State of Water Resources Report

Context

Gross Domestic Product (GDP) growth in Lesotho over the last 20 years has exceeded 3%, largely driven by manufacturing exports and more recently by construction, water, mining and services. Exports now account for nearly 30 percent of Gross National Product (World Bank, 2009). Most of this comes from the textile industry which includes more than 50 firms employing approximately 40,000 people in the greater Maseru area. Water and wastewater services are essential to the continued contribution of these industries which use about half of all water consumed in Maseru and the lack of water and wastewater infrastructure presents a major constraint to continued economic growth. The growth of the garment industry has stimulated an increase in urban migration. The capital city of Maseru experienced 5.5 percent population growth per year between 1996 and 2006, increasing to over 350,000 people. Continued growth will see the population reach around 430,000 by 2013.

The existing water supply system is inadequate to satisfy the needs of the existing population, who are not all supplied, let alone that of a rapidly expanding population and growing economy.

Water supply to Maseru

Current water supply system

Currently the only source of raw water for treatment and supply to Maseru is derived from a single intake on the Mohokare (Caledon) River. Flows in this river can become so low in the winter months that the security of supply is severely threatened, particularly during the dry winter months when flows are frequently inadequate to meet the city's needs. Emergency releases from the Muela Dam (part of the LHWP – Lesotho Highlands Water Project) have been required in order to supplement flow in the Mohokare River and augment urban supply to Maseru. The treaty between Lesotho and South Africa does not make allowance for water transferred from Katse Dam to be used for this purpose.

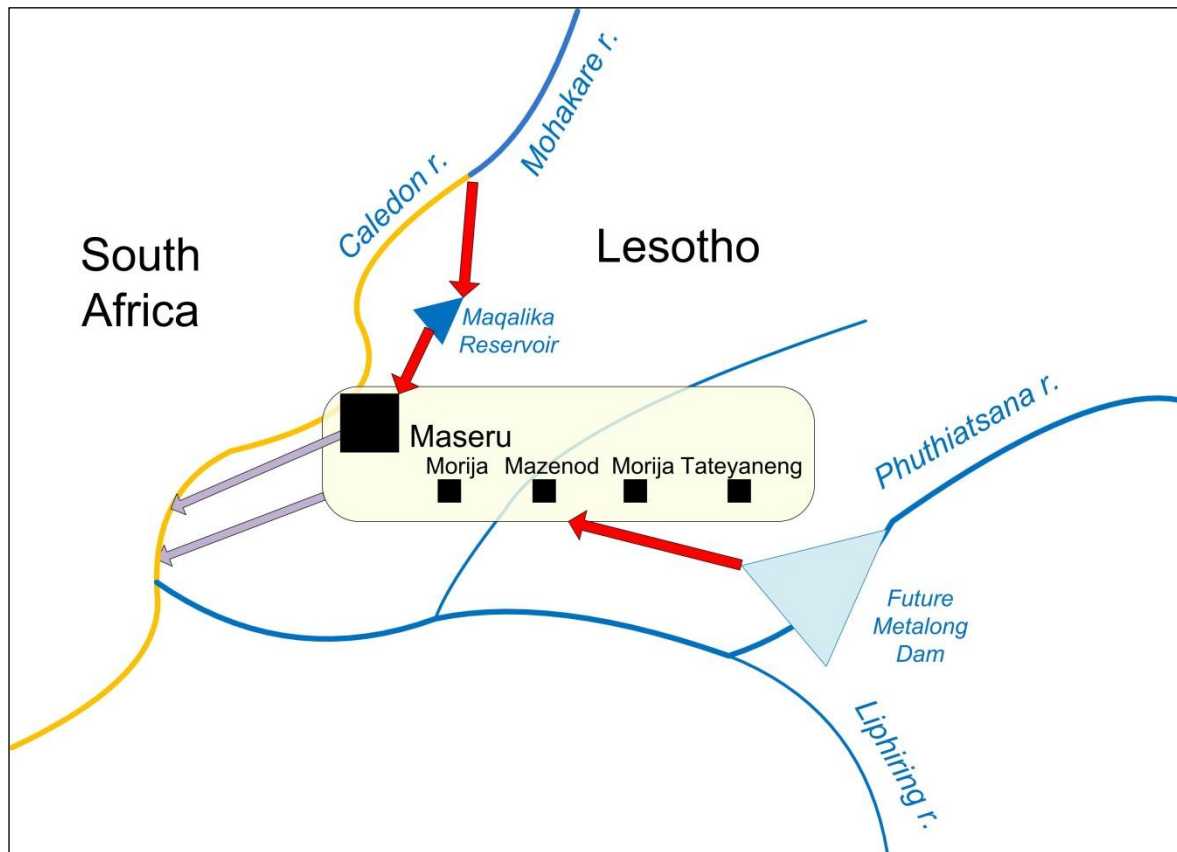
Water abstracted from the Mohakare River is stored in the Maqalika Reservoir but the capacity is too small to provide significant added security. From the Maqalika Reservoir water is transferred to the Maseru water treatment plant which has a production capacity of 65 million litres per day (23,741 million per annum). In recent years it has been able to supply around half of this, approximately 12,700 million litres per annum. According to WASCO data as reported in the State of Water Resources Report (WRP Consulting Engineers, 2012), 86% of this goes to domestic users, only 1% to industry and 13% other users (businesses, institutions, construction). Given that the textiles industry is responsible for around half of Greater Maseru's water demand (World Bank, 2009), abstraction from the Mohakare River is around $0.8\text{m}^3/\text{s}$ of which just over half is treated by WASCO.

According to WASCO figures unaccounted water makes up 34% of the $0.41\text{m}^3/\text{s}$ that they treat. This compares to an average of around 25.4% for larger municipalities in South Africa so there is clearly scope for reducing unaccounted for water.

The existing Maseru water supply system is not large enough to supply water to the entire population of Greater Maseru estimated at 430,000. Taking the 34% losses into account the current system is only supplying around

45l/cap/day or 1.4m³/cap/month to domestic users. This represents an average figure assuming that everybody is being supplied with water. In fact, a large proportion of the population is not supplied at the present time.

Figure 2 Schematic showing current and proposed bulk water supply systems for Maseru (Lowlands)



Metolong Dam and Water Supply Programme

To meet increasing demands for water, the Government has recognized that the need to provide a secure source of water for the fast-growing, urban Lowland areas of Lesotho which is central to continued socio-economic development of the country. To address the need for long-term, secure water supplies to the Lowlands a feasibility study of the Lesotho Lowlands Water Supply Scheme (LLWSS) was carried out in 2004 and identified the least-cost, long-term solution for bulk supply to Maseru and the surrounding Lowlands areas as the Metolong Dam and Water Supply Program (MDWSP).

The project involves the construction of a 73m high, roller compacted concrete dam on the South Phuthiatsana River, and associated infrastructure. The South Phuthiatsana River has a catchment area of some 250 km² at the proposed site of the Metolong Dam, with a Mean Annual Runoff of some 53.67 Mm³. The dam will store 53 Mm³. Full supply level will be at 1671 masl. Associated infrastructure includes a water treatment plant with an average capacity of 75 Ml/day, 112 km of transmission mains, four pump stations, and two storage reservoirs serving Maseru and the neighbouring towns. The MDWSP aims at providing 75,000 m³ per day of additional treated water, ensuring the provision of safe water supply to 80 percent of the greater Maseru area.

Water Quality

Water quality in the Mohakare River both upstream and downstream of the Maseru offtake and return flow points is reported on in the Annual State of Water Resources Report (WRP Consulting Engineers, 2012). Levels of conductivity, phosphate and iron (indication of heavy metals) are significantly higher at the downstream (Ratjomose) sampling point. This is illustrated below (note that the axes scales have been adjusted to enhance visualisation)

Figure 3 Water quality in the Mohakare River upstream and downstream of Maseru

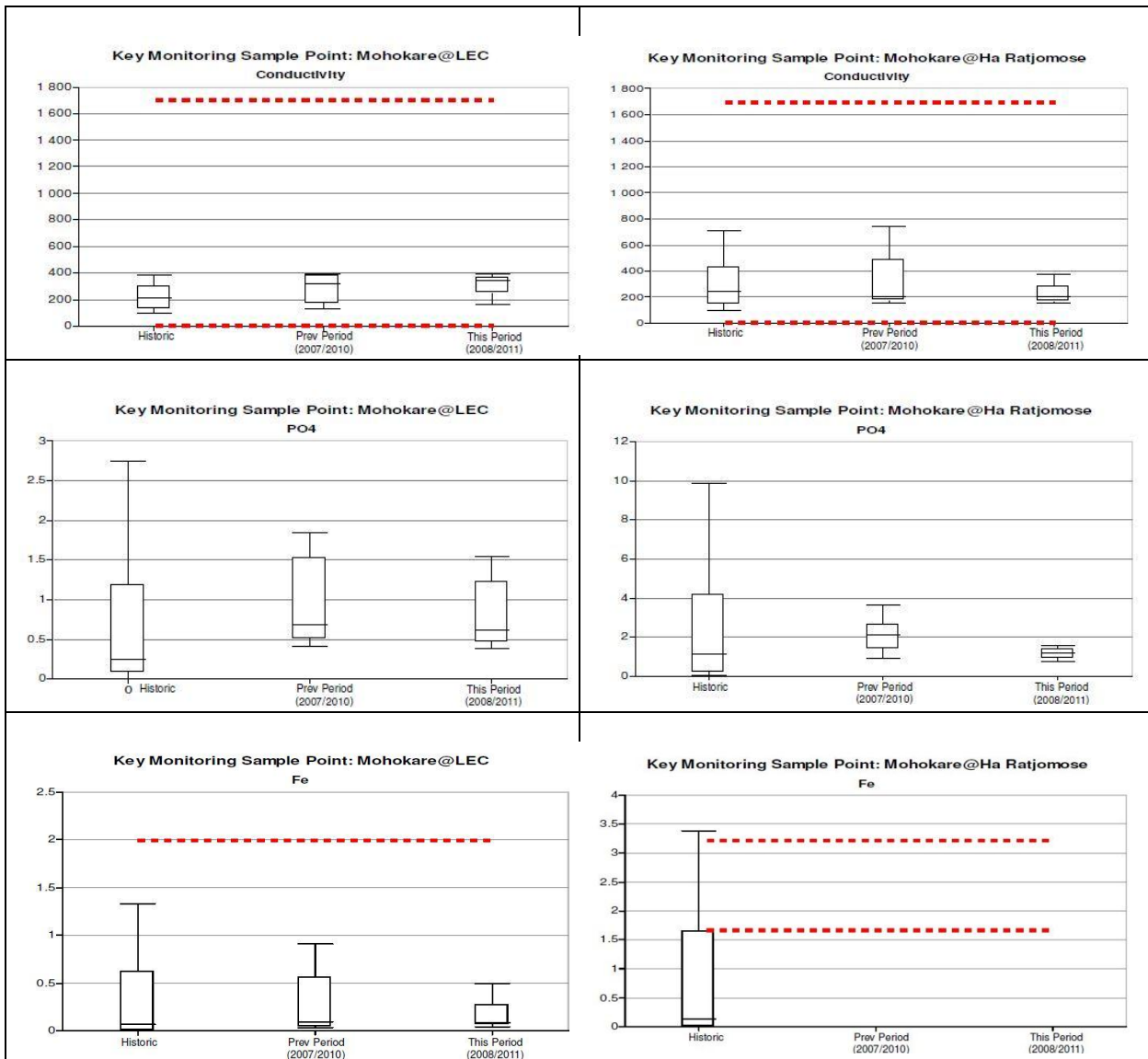
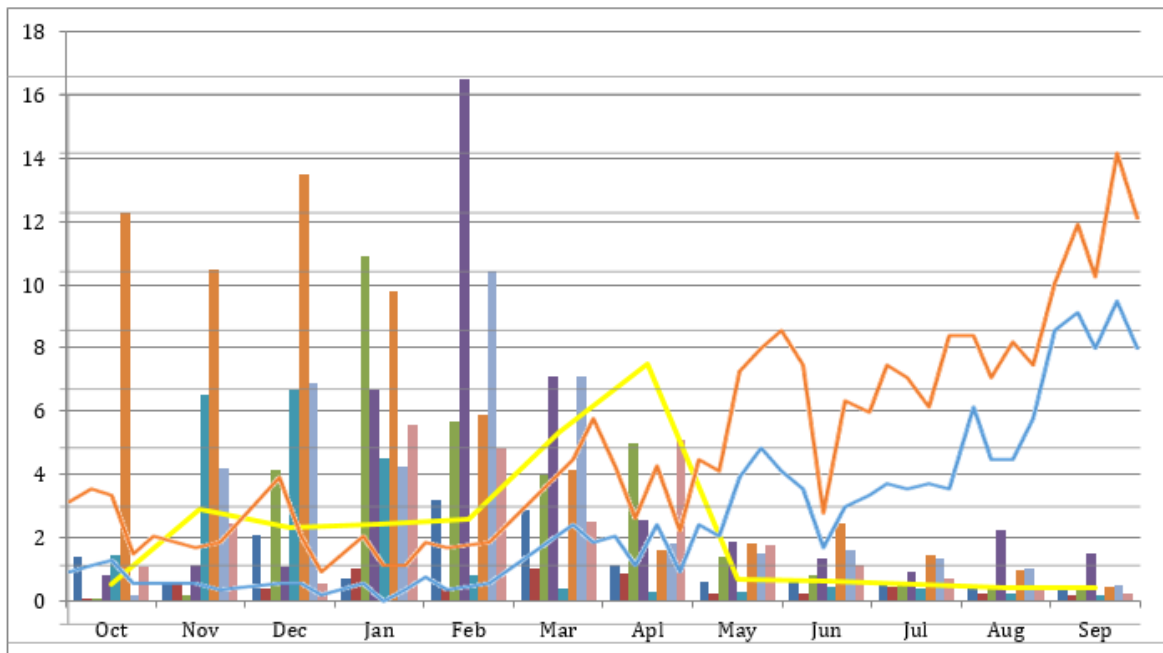


Figure 4 shows the monthly environmental flows (Mm³) for the Caledon / Mohokare River required to maintain the Present Ecological State (solid yellow line) set against the total monthly flows / month for the last 8 years (bars), and typical sulphate (solid blue line) and Chloride (solid orange line) concentrations.

Figure 4 Environmental Flows set against total monthly flows



These graphs show a 'deficit' in desired environmental flows in the May to September period, and the associated increasing sulphate and chloride concentrations. Reducing demands on the Caledon / Mohokare River in these months can have significant environmental and water quality benefits in this shared river system.

Potential Interventions

Water Demand Management

WASCO currently supplies approximately 12,770 million litres per year. Approximately 4,380 million litres a day of water are unaccounted for and it is estimated that this could be reduced by around 1,500 million litres per annum. This represents a financial saving of around 17.5 million Moluti per annum. Approximately the same amount is supplied to industry and it can be assumed that losses are similar.

Water demand management interventions can provide significant financial savings and can have short pay-back periods so can easily be justified. It is also clear that WDM would result in freeing up water for use in improving levels of supply to currently under or inadequately served parts of the city and surrounding area, although many of these areas are already targeted by the new Metolong Dam.

A saving of 3,000 million litres per annum is equivalent to only 0.1m³/s. In view of the fact that some of this saving will probably be used to supply currently under-supplied or non-supplied areas, this represents the maximum reduction in abstraction from the Mohokare River that could be envisaged. The direct impacts of WDM in Maseru on flows in the Caledon/Mohokare River are therefore likely to be small, although there may be some impact on the lowest flows. However, WDM should remain a priority intervention ensuring efficient use of water because of its pro-poor benefits. WDM could reduce abstraction from the resources and make water available towards supplying the ecological water needs especially during the months with elevated concentration of pollutants. WC/WDM will also reduce the volume of wastewater that need to be treated with associated cost benefits.

Continued engagement with WASCO through WDM may also provide the means to recommend the conjunctive use of water sources in the new Metolong Dam and the Mohokare River.

Unauthorised Abstractions between Muela and Maseru

The Muela Dam was constructed on the Ngoe River, a tributary of the Mohakare River, as part of the LHWP. It receives inflow via transfers from the Katse Dam and local runoff from its own small catchment. Compensation releases are made equivalent to the mean annual runoff of the Ngoe catchment. It has two functions, i) to balance transfer flows through the hydropower station and ii) to provide the necessary tailwater levels and head for transfer through the delivery tunnel to South Africa. In exceptional circumstance, additional water has been released from the Muela Dam in order to support flows in the Mohakare River at the Maseru abstraction point.

Water flowing in the Mohakare River upstream of Maseru is subject to a significant level of unauthorised abstraction for irrigation. The amounts of water are considered to be significant, perhaps an order of magnitude greater than the savings in abstraction that could be made through WDM in Maseru.

A thorough investigation into the extent of unauthorised abstraction would be useful, followed by action to stop it and/or legalise some of it as considered appropriate. This is a transboundary issue and ORASECOM could play a role in supporting implementation.

Conjunctive Operation of Maseru (lowland water supply)

Construction of the proposed Metolong Dam and associated water supply system will provide an excellent opportunity for conjunctive use of water from the Mohakare and the Phuthiatsana River. Well managed conjunctive use of the two sources can be carried out to:

- Protect the Mohakare River during the months of August to October by minimising abstraction from the river to the existing water treatment works and supply system and maximising use of the new Metolong Dam and associated system during these periods.
- During times when flows in the Mohakare River are adequate, increase use of the existing abstraction works and water supply system in order to protect storage in the Metolong Dam for use during the dry season and satisfaction of environmental flow requirements in the Phuthiatsana and Mohakere/Caledon Rivers.
- Support environmental flows in the Mohakare River and Caledon River further downstream

Integrated management of the two sources will most likely result in more efficient utilisation reducing the risk of drought restrictions. The development of appropriate integrated drought restriction operating rules is recommended.

Conjunctive use will require that there is adequate interconnectivity of the two systems and it is not known to what extent the design of the Metolong Dam and associated system has made allowance for this. The aims of a conjunctive use system also need to be carefully designed and incorporated into system management rules.

Implementation of Environmental Flow Requirements

The issue of environmental flow requirements downstream of the proposed Metolong Dam has been investigated and presumably taken into account in the design of the dam. Environmental flows downstream of Maseru in the Mohakare/Caledon River have also been investigated and will eventually be subject to endorsement by the member states of ORASECOM although this may take some time. Implementation, i.e. the observation of them, of recommendations on environmental flow requirements would play a major role in improving water quality in the Mohakare/Caledon River and could be supported by conjunctive use of the existing Maseru water supply system and the Metolong Dam and Water Supply System.

Conclusions and recommendations

There are a number of measures which can directly or indirectly support the improved transboundary water quality of the Mohakare/Caledon River while at the same time bringing other benefits which are both pro-poor and supportive of a growing economy. These measures are best implemented as a package since they are interdependent.

- Effective conjunctive use operation of the combined Maseru water supply system (existing Maseru system and Metolong Dam) should be seen as a priority on which early action is required to ensure that all necessary measures are incorporated into the design of the Metolong Dam supply system.
- Water resources modelling (systems analysis) aimed at devising optimum operational rules for the Metolong Dam should be carried out incorporating both the existing Maseru water supply system and the Metolong Dam and constraints imposed by environmental flow requirements both in the Phuthiatsana River and the Mohakare/Caledon River.
- The implementation of a WDM programme, focussed on pressure and leakage management should be investigated through implementation of the proposed pilot project. The programme should bring significant financial benefits, free up water and financial resources so that underserved communities can benefit, and reduce the quantity of poor quality return flows to the Mohakare River. While not expected to have a large impact, the resultant reduced abstraction from the Mohakare River should have a positive effect on the quality of flows downstream, especially during the dry season when even a low level of dilution can be significant
- The current high level of unauthorised abstraction from the Mohakare/Caledon River upstream of Maseru should be thoroughly investigated and an assessment of its impact made.
- The enforcement of environmental flow requirements both in the Phuthiatsana River and the Mohakare/Caledon River will play a role in maintaining adequate low flows in the Mohakare/Caledon River.

References

World Bank. (2009). *Project Information Document; Water Sector Improvement Project (Second Phase)*. Maseru: World bank / Ministry of Natural Resources, Kingdom of Lesotho.

WRP Consulting Engineers. (2012). *State of Water Resources Report*. Maseru: Office of the Commissioner of Water.

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