REPORT NUMBER: P RSA A000/00/8809

Department of Water Affairs

Chief Directorate: Integrated Water Resource Planning
Directorate: Options Analysis

MOKOLO AND CROCODILE (WEST) WATER AUGMENTATION PROJECT (MCWAP) FEASIBILITY STUDY: TECHNICAL MODULE

Project No. WP9528

PRE-FEASIBILITY STAGE REPORT 1
WATER REQUIREMENTS

Lead Consultant: Africon

In association with: KV3, VELAVKE

LIST OF REPORTS

REPORT NO	DESCRIPTION	REPORT NAME
FEASIBILITY STAGE		
P RSA A000/00/8109	Main Report	MCWAP FEASIBILITY STUDY TECHNICAL MODULE SUMMARY REPORT
P RSA A000/00/8409	Supporting Report 8A	GEOTECHNICAL INVESTIGATIONS PHASE 1
P RSA A000/00/8709	Supporting Report 8B	GEOTECHNICAL INVESTIGATIONS PHASE 2
P RSA A000/008509	Supporting Report 9	TOPOGRAPHICAL SURVEYS
P RSA A000/00/8609	Supporting Report 10	REQUIREMENTS FOR THE SUSTAINABLE DELIVERY OF WATER
P RSA A000/00/8209	Supporting Report 11	PHASE 1 FEASIBILITY STAGE
P RSA A000/00/8309	Supporting Report 12	PHASE 2 FEASIBILITY STAGE
PRE-FEASIBILITY STAGE		
P RSA A000/00/8809	Supporting Report 1	**WATER REQUIREMENTS**
P RSA A000/00/8909	Supporting Report 2	WATER RESOURCES
P RSA A000/00/9009	Supporting Report 3	GUIDELINES FOR PRELIMINARY SIZING, COSTING AND ECONOMIC EVALUATION OF DEVELOPMENT OPTIONS
P RSA A000/00/9109	Supporting Report 4	DAMS, ABSTRACTION WEIRS AND RIVER WORKS
P RSA A000/00/9209	Supporting Report 5	MOKOLO RIVER DEVELOPMENT OPTIONS
P RSA A000/00/9309	Supporting Report 6	WATER TRANSFER SCHEME OPTIONS
P RSA A000/00/9409	Supporting Report 7	SOCIAL AND ENVIRONMENTAL SCREENING
INCEPTION STAGE		
P RSA A000/00/9609	Inception	INCEPTION REPORT

REFERENCE

This report is to be referred to in bibliographies as:

Department: Water Affairs, South Africa, 2008. Mokolo Crocodile (West) Water Augmentation Project (MCWAP) Feasibility Study. Pre-Feasibility Stage: Report 1 Water Requirements. Prepared by Africon in association with Kwezi V3 Engineers, Vela VKE, WRP Consulting Engineers and specialists.

DWA Report No. **P RSA A000/00/8809**

REPORT DETAILS PAGE

Project name:	***Mokolo and Crocodile (West) Water Augmentation Project (MCWAP)***
Report Title:	**Pre-Feasibility Study Report 1 - Water Requirements**
Author:	***J Pienaar***
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PSP

Approved for PSP by:

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Study Leader

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PREFACE

The Mokolo (Mogol) River catchment is part of the Limpopo Water Management Area (WMA). The Mokolo River originates close to Modimolle (Nylstroom) and then drains to the north into the Limpopo River. The Mokolo Dam (formerly known as the Hans Strijdom Dam) is the largest dam in the catchment. The dam was constructed in the late 1970s and completed in July 1980, to supply water to Matimba Power Station, Grootegeluk Mine, Lephalale (Ellisras) Municipality and for irrigation downstream of the dam. Based on the water infrastructure, the current water availability and water use allows only limited spare yield existing for future allocations for the anticipated surge in economic development in the area.

There are a number of planned and anticipated consequential developments in the Lephalale area associated with the rich coal reserves in the Waterberg coal field for which additional water will be required. These developments include inter alia the development of further power stations by Eskom, the potential development of coal to liquid fuel facilities by Sasol and the associated growth in mining activities and residential development.

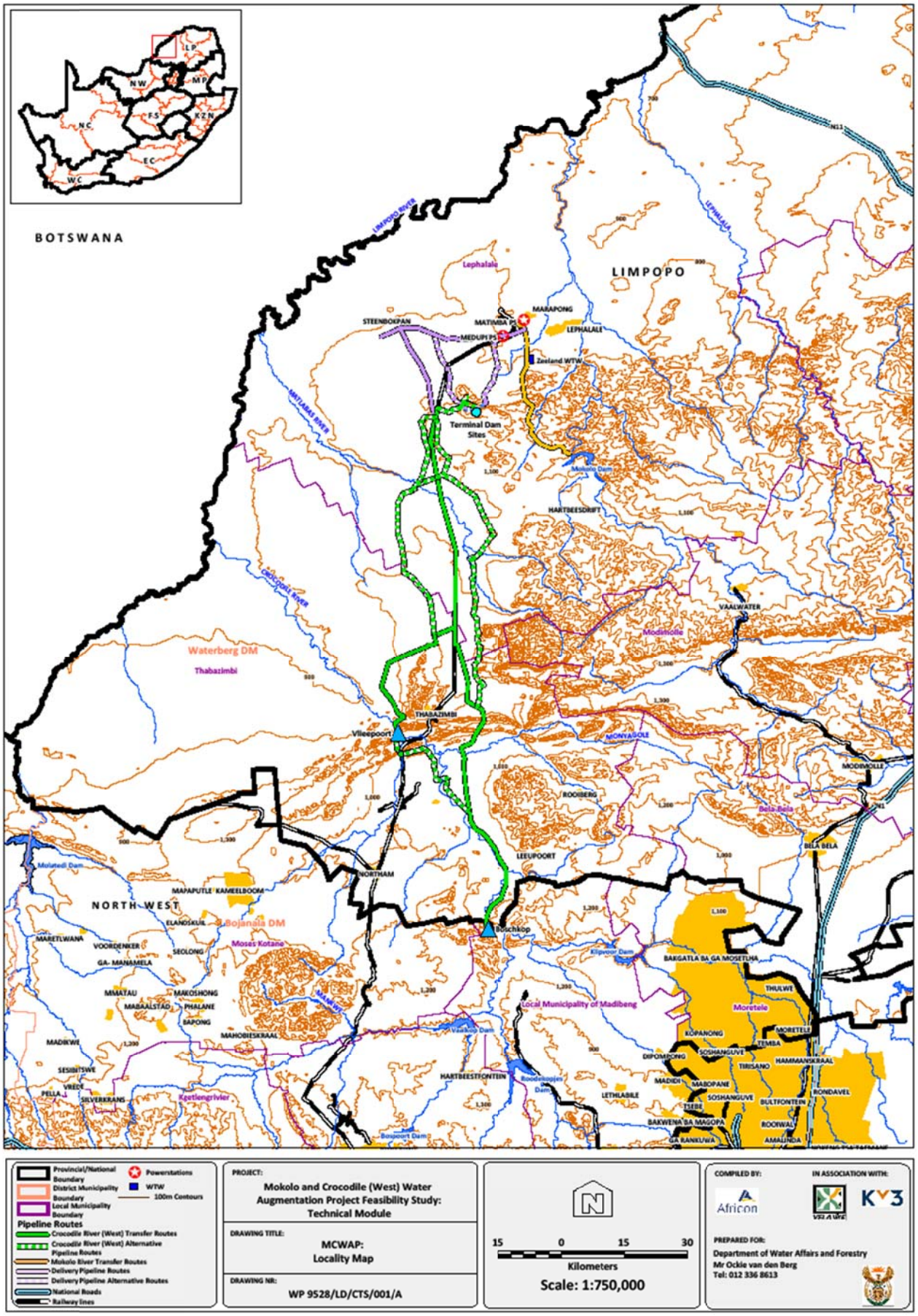
The development of new power stations is of high strategic importance with tight timeframes. Commissioning of the first generation unit will start in September 2010 and additional water needs to be available by mid 2011 according to the expected water requirements. A solution addressing the water needs of the Lephalale area must be pursued. The options to augment existing water supplies include transferring surplus effluent return flows from the Crocodile River (West) / Marico WMA to Lephalale and the area around Steenbokpan shown on the map indicating the study area on the following page.

The Department of Water Affairs and Forestry commissioned the Mokolo Crocodile (West) Water Augmentation Project (MCWAP) to analyse the options for transferring water from the Crocodile River (West). In April 2008 the Technical Module of this study was awarded to Africon in association with Kwezi V3, Vela VKE and specialists. The focus of the Technical Module is to investigate the feasibility of options to:

- Phase 1: Augment the supply from Mokolo Dam to supply in the growing water requirement for the interim period until a transfer pipeline from the Crocodile River (West) can be implemented. The solution must over the long term, optimally utilise the full yield from Mokolo Dam.
- Phase 2: Transfer water from the Crocodile River (West) to the Lephalale area. Options to phase the capacity of the transfer pipeline (Phase 2A and 2B) must be investigated.

The Technical Module has been programmed to be executed at a Pre-feasibility level of investigation to identify different options and recommend the preferred schemes, which was followed by a Feasibility level investigation of the preferred water schemes. Recommendation on the preferred options for Phase 1 and Phase 2 Schemes were presented to DWA during October 2008 and draft reports were submitted during December 2008. Feasibility Stage of the project commenced in January 2009 and considered numerous water requirement scenarios, project phasing and optimisation of pipeline routes. The study team submitted draft Feasibility report during October 2009 to the MCWAP Main Report in November 2009.

This report (Report 1 – Pre-Feasibility Stage: Water Requirements, P RSA A000/00/8809) cover the collation of water requirement studies, analysis of data and updating water requirement scenarios.


BOTSWANA
LIMPOPO
NORTH WEST
Lephalale
MARAPONG
LEPHALALE
STEENBOKPAN
MATIMBA PS
MEDUPI PS
Zeeland WTW
Terminal Dam Sites
HARTBEESDRIFT
Mokolo Dam
Crocodile River
Waterberg DM
Thabazimbi
THABAZIMBI
Vlieepoort
VAALWATER
Modimolle
MODIMOLLE
MONYAKOLE
ROOIBERG
Bela-Bela
BELA BELA
LEEUPOORT
NORTHAM
Molatedi Dam
MAHAPUTLE KAMEELBOOM
ELANDSKUIL
Bojanala DM
Moses Kotane
MARETLWANA
VOORDENKER
SEELONG
GA- MANAMELA
MMATAU
MAKOSHONG
MABAALSTAD
PHALANE
BAPONG
MAHOBIESKRAAL
MADIKWE
SESHUTSWE
VREDE
PELLA
SILVERKRANS
Kgetlengrivier
Boschkop
Klipvoor Dam
BAKGATLA BA GA MOSETLHA
Local Municipality of Madibeng
Moretele
THULWE
KOPANONG
MORETELE
TEMBA
DIPOMPONG
SOSHANGUVE
HAMMANSKRAAL
TIRISANO
MADIDI
MABOPANE
SOSHANGUVE
RONDAVEL
TSEBE
BULTFONTEIN
ROOIWAL
AMANDA
BAKWENA BA MAGOPA
GA RANKUWA
HARTBEESTFONTEIN
Roodekopjes Dam
LETHLABILE
Vaalkop Dam
Bospoort Dam
Provincial/National Boundary
District Municipality Boundary
Local Municipality Boundary
Powerstations
WTW
100m Contours
Pipeline Routes
Crocodile River (West) Transfer Routes
Crocodile River (West) Alternative Pipeline Routes
Mokolo River Transfer Routes
Delivery Pipeline Routes
Delivery Pipeline Alternative Routes
National Roads
Railway lines
PROJECT:
Mokolo and Crocodile (West) Water Augmentation Project Feasibility Study: Technical Module
DRAWING TITLE:
MCWAP: Locality Map
DRAWING NR:
WP 9528/LD/CTS/001/A
15 0 15 30
Kilometers
Scale: 1:750,000
COMPILED BY:
African
IN ASSOCIATION WITH:
KV3
PREPARED FOR:
Department of Water Affairs and Forestry
Mr Ockie van den Berg
Tel: 012 336 8613

LIST OF ABBREVIATION & ACRONYMS

a	Annum
CTL	Coal-to-Liquid Fuel
CWRS	Crocodile West Reconciliation Strategy
DWA	Department of Water Affairs
FBC	Fluidised Bed Combustion
FGD	Flue Gas Desulphurisation
FSL	Full Supply Level
ha	Hectare
IAAPs	Independent Power Producers
MCWAP	Mokolo and Crocodile (West) Water Augmentation Project
WMA	Water Management Area

MOKOLO CROCODILE (WEST) WATER AUGMENTATION PROJECT FEASIBILITY STUDY

TECHNICAL MODULE

TABLE OF CONTENTS

PAGE

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1. INTRODUCTION

1.1 Background

The Mokolo (Mogol) River catchment is part of the Limpopo Water Management Area (WMA). The Mokolo River originates close to Modimolle (Nylstroom) and then drains to the north into the Limpopo River. The Mokolo Dam (formerly known as the Hans Strijdom Dam) is the largest dam in the catchment. The dam was constructed in the late 1970s and completed in July 1980, to supply water to Matimba Power Station, Grootegeluk Mine, Lephalale (Ellisras) Municipality and for irrigation downstream of the dam. Based on the water infrastructure, the current water availability and water use allows only limited spare yield existing for future allocations for the anticipated surge in economic development in the area.

There are a number of planned and anticipated consequential developments in the Lephalale area associated with the rich coal reserves in the Waterberg coal field for which additional water will be required. These developments include:

- Construction of Eskom's Medupi Power Station presently underway;
- Development of further Eskom power stations;
- Possible development of power stations by Independent Power Producers (IPPs);
- Extension of the Grootegeluk mining operations and further mines;
- Possible petrochemical industries to be developed around the coal field further west of Lephalale;
- Possible exploitation of gas resources; and
- Accelerated growth in the population in the area.

The development of new power stations is of high strategic importance with tight timeframes. Commissioning of the first generation unit at Medupi Power Station commences in September 2010 and additional water needs to be made available by mid 2011 according to the expected water requirements. Hence the project is of high priority and the timely completion of the water augmentation in line with the timeframe for commissioning the first and other units is not negotiable.

A solution addressing the water needs of the Lephalale area must be pursued. The options to augment existing water supplies include transferring surplus effluent return flows from the Crocodile River (West) / Marico WMA and the raising of the full supply level (FSL) of the Mokolo Dam. The primary focus of the Mokolo Crocodile (West) Water Augmentation Project (MCWAP) is on the full utilisation of all the yield from the existing Mokolo Dam and the transfer of water from the Crocodile River (West) to the Lephalale area.

1.2 Purpose of the Report

This report is the first in a series of supporting reports that comprise the Pre-Feasibility Stage Report of the MCWAP Feasibility Study: Technical Module. The report consolidates the work that has been done to determine the expected growth in the total water requirement in the study area up to 2030. The focus is on the large water users, namely Lephalale Local Municipality (potable and light industrial), Eskom (power

generation), Sasol (coal to liquid fuel beneficiation processes), Exxaro (coal mining) and expected further mining activities.

1.3 Description of Study Area

The MCWAP Study Area comprises the area between the Crocodile River (West) in the South and the Lephalale/Steenbokpan demand area in the North. The Crocodile River reaches downstream of Roodekopjes Dam and the Mokolo Dam form part of the broader study area. The project will be using water from the shared international Limpopo watercourse. The figure below indicates the geographical location and towns in the vicinity of the project.

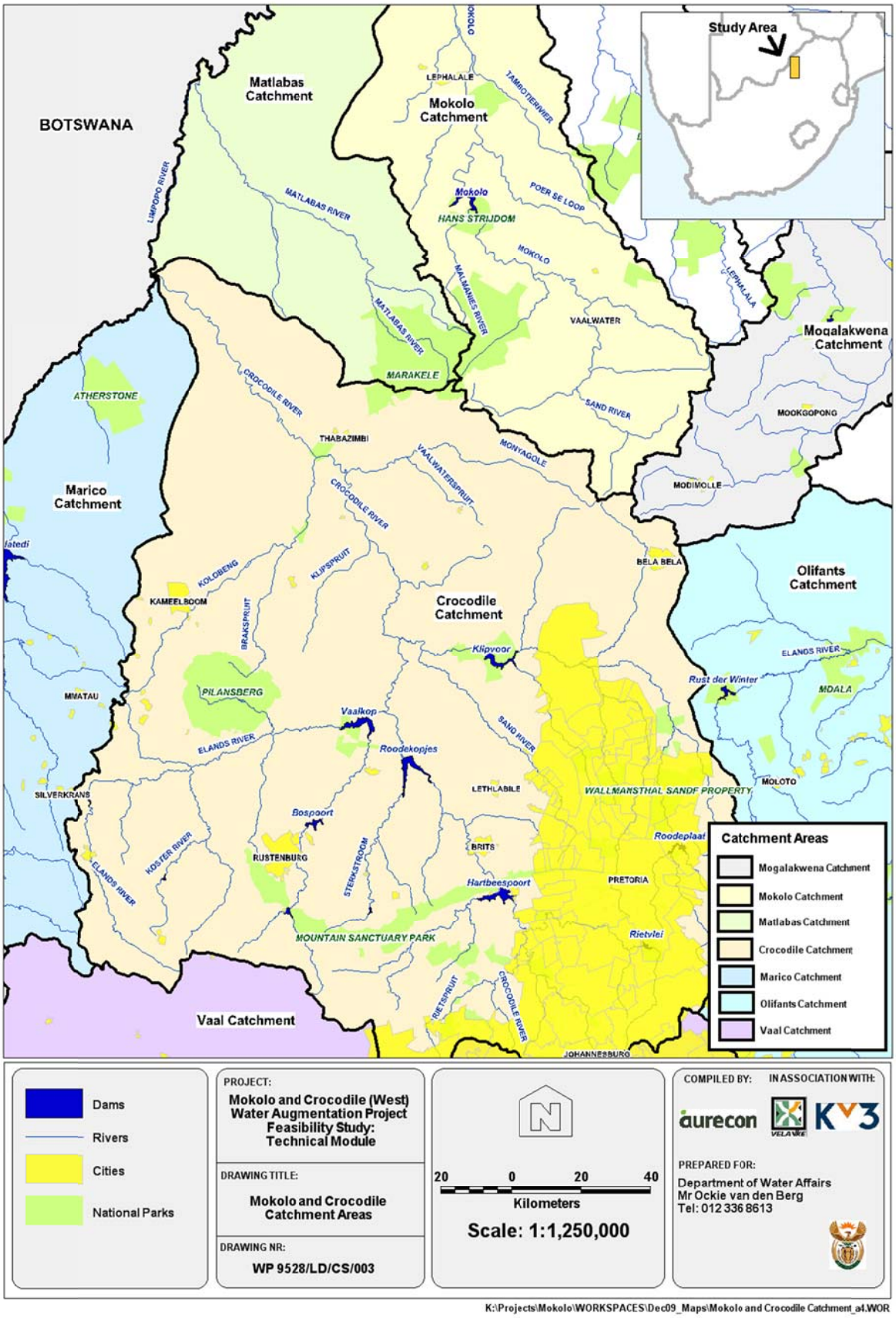


Figure 1-1: Locality Map

2. BACKGROUND STUDIES

Related studies conducted by the Department of Water Affairs and Forestry (DWA) are briefly described below. The purpose and output of these studies are important as it provides the context to the water requirement scenarios discussed further in this report.

2.1 Water Requirements and Availability Scenarios for the Lephalale Area

The DWA initiated a study to develop a reconciliation strategy for the Crocodile River (West) System. This is referred to as the Crocodile West Reconciliation Strategy (CWRS). The CWRS focuses on strategies for resolving imbalances between water requirements and water availability in the Crocodile River (West).

Eight different scenarios of water requirements for the Lephalale area were prepared for this study. The scenarios are the result of several discussions between representatives of DWA, Lephalale Municipality, Eskom, Sasol and the mines to ascertain the projected water use figures for different possible development scenarios.

The eight scenarios are differentiated based on the expected number of power stations, technology used for power stations, the presence of Sasol in the area, the scale of coal mining activities associated with the different levels of industrial development, associated construction activities, and the associated growth in potable and light industrial requirements. The growth in water requirements are projected for the period 2007 to 2030, for each of the eight scenarios.

The study comments on the water balance for the Crocodile/Mokolo system by comparing the water requirements scenarios with the modelled yield of water resources (Mokolo Dam and Crocodile River (West) surpluses) in the area. The result for the high growth scenario in effluent return flow in the Crocodile River Catchment is depicted in Figure 2-1 below. The water requirement scenarios are discussed in more detail in the Water Resources Report, Report 2 of the MCWAP Technical Module Pre-feasibility Stage Report.

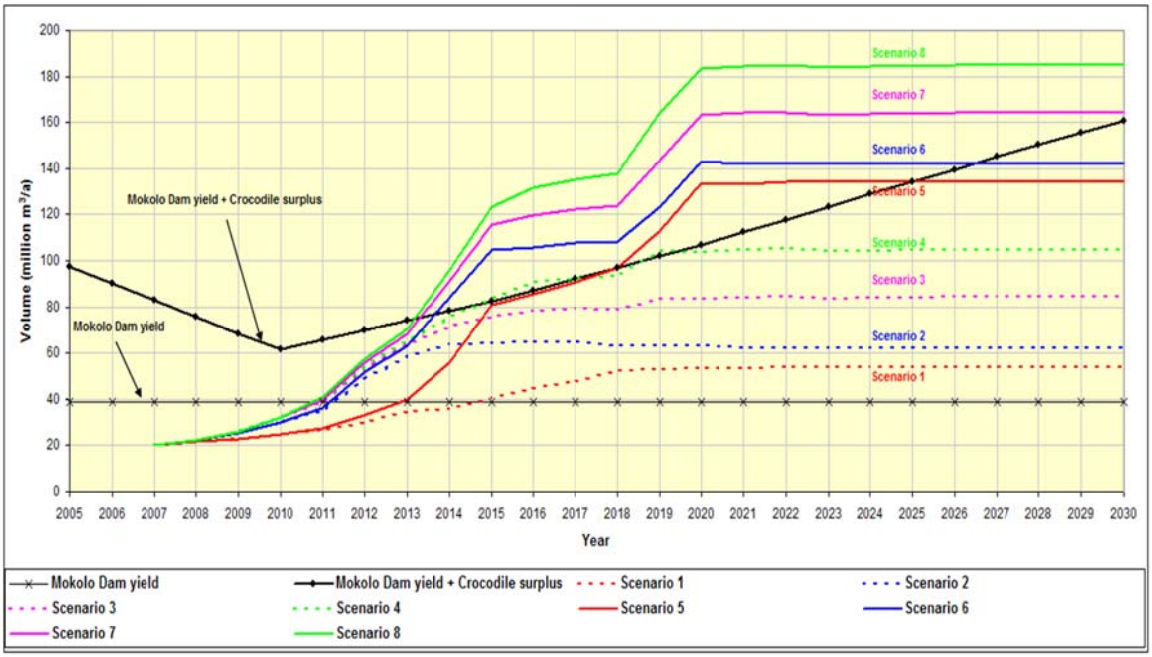


Figure 2-1: Crocodile/Mokolo System Balance

The study concludes that growing water requirements in the Lephalale area can be supplied from own sources (Mokolo Dam) until 2009. Water transfers from the Crocodile River (West) catchment to the Lephalale area will then be required to meet the growing water requirement. The projected surpluses in the Crocodile River Catchment will have to be supplemented with water from the Vaal River System and need to be in place between 2010 and 2013.

2.2 DWA Lephalale Bulk Infrastructure Grant Feasibility Study

2.2.1 Study Purpose

Africon was appointed by DWA on behalf of Lephalale Municipality to plan for the implementation of essential bulk water services for the municipality. This plan is required to prepare for the implementation of projects to provide bulk water services to municipal customers effectively and timely over the next 25 years. All significant municipal water needs including institutional, social and the needs of the urban population arising from the industrial development will be addressed. The study is not limited to the provision of required infrastructure. Furthermore investigates the emerging potential towards local economic development and wealth creation.

2.2.2 Service Extent

The study aims to satisfy all the requirements of the DWA under the bulk infrastructure grant regarding bulk water services for Lephalale up to a level where implementation can commence. This includes the provision, treatment, storage and bulk supply of water, potable or non potable, from the most feasible sources to serve developed and future developing areas of Lephalale local Municipality. The primary study area is the municipal area which is situated in the North Western part of the Waterberg District Municipality. This includes the communities living in 38 villages near Lephalale River in the area formerly known as Mokerong 1. These communities are presently being supplied from ground water sources of which the quality and availability are not always satisfactory and

in some instances from the alluvium in the river bed where the river is not perennial. The current water resources are limited.

Bulk water services are required to serve the growing population of the town of Lephalale, and surrounding areas. Additional water sources are required, sufficient treatment facilities and bulk storage and distribution infrastructure have to be provided. Therefore, future developments and resultant growth, determination of the water requirement, technical solutions and all aspects significantly affecting performance and sustainability of bulk water provision forms part of the scope of work. Over and above the infrastructure required the implementing process addressing asset ownership, responsibilities, financing and operation must be addressed. The study in fact needs to address all aspects which have a direct bearing on the sustainable provision of bulk water services over the long term.

2.2.3 Estimated Municipal Urban Water Requirements

The estimated future Municipal urban water requirements based on the development scenario are summarised below:

Table 2-1: Estimated Municipal Urban Requirement (million m^3/a)

Town/Area	2010	2013	2016	2020	2025	2030
Lephalale / Marapong + Medupi / Mining	6.870	9.281	11.383	11.294	11.873	12.481
Steenbokpan Town, Sasol, Power stations	0.000	6.593	15.824	27.185	27.190	27.928
Municipality	**6.870**	**15.874**	**27.207**	**38.479**	**39.063**	**40.409**

These requirements were used to update the water use requirement scenarios for the MCWAP Technical Module. The process of updating these scenarios is discussed hereinafter.

3. USER WATER REQUIREMENTS

3.1 Process to Update User Water Requirements

The terms of reference for the MCWAP Feasibility Study: Technical Module specifies that the feasibility study investigation for the transfer system from the Crocodile River (West) to the Lephalale/Steenbokpan demand area be based on both Scenarios 4 and 8 defined in the CWRS. It is further required that the water requirements used in these scenarios be updated with the most recent water use projections from the users.

Scenarios 4 and 8, as constructed in the CWRS, comprise the following:

Table 3-1: Definition of Water Requirement - Scenarios 4 and 8

Scenario	Description
Scenario 4	Matimba power station equipped with existing fluidised bed combustion (FBC) technology, Medupi power station equipped with flue gas desulphurisation (FGD) technology, 3 additional new power stations (FGD), coal supply to 5 power stations, Exxaro projects, the associated construction activities and the associated growth in Lephalale and Steenbokpan.
Scenario 8	Scenario 4 + Sasol development of two coal-to-liquid fuel (CTL) plants and the associated mine construction activities and the associated population growth in Steenbokpan.

Scenario 8 represents the likely scenario in terms of the expected development over the next 15 to 20 year. The feasibility planning will also be done for the Scenario 4 water requirements, which excludes investment by Sasol in the area. Sasol is in the process of determining the feasibility to invest in two Coal to Liquid Fuel (CTL) facilities in the vicinity of Steenbokpan. A final decision is likely to be made during the first quarter of 2009. Sasol's water requirement represents approximately 44% (Scenario 8) of the total water requirement in the area.

At the time of finalising this report the water requirements were updated to scenario 11. The key water users' development milestones were under review due to current economic conditions.

In May 2008 the water users were requested to provide updated annual water use projections based on their most recent project scoping and water requirement estimates and Scenarios 4 and 8 updated accordingly. The updated water requirements tables for Scenarios 4 and 8, 25 August 2008 release, are included in Appendix A of this report. The requirements of the individual users are discussed below.

In addition to the above the monthly water use pattern of each user was requested and used to determine the monthly split and annual peak factors to be applied when designing the transfer system. The results are discussed in Section 4 hereinafter.

3.2 Eskom Water Use Projections

The Eskom water use projection for industrial use peaks at 62.6 million m^3/a in 2026. It is made up as follows:

Table 3-2: Eskom Water Use Projections

Component	Water use projection
Matimba Power Station (existing)	Current water requirement Constant 3.6 million m^3/a from 2008 to 2030
Medupi Power Station (under construction)	Water for construction is required from 2008. Water for the first power generation unit is required from September 2010 and will increase at 6 month intervals as further units are commissioned. The requirement peaks at 14 million m^3/a in 2016 The first three generation units will initially not be fitted with Flue Gas Desulphurisation (FGD) Technology. The boilers will be fitted with the technology after commissioning of the last generation unit.
Future Power Station 3 (CF2 with FGD)	Water required from 2012 and peaks at 15 million m^3/a in 2018 Water required in the vicinity of Steenbokpan
Future Power Station 4 (CF3 with FGD)	Water required from 2017 and peaks at 15 million m^3/a in 2023 Water required in the vicinity of Steenbokpan
Future Power Station 5 (CF4 with FGD)	Water required from 2020 and peaks at 15 million m^3/a in 2026 Water required in the vicinity of Steenbokpan

Monthly peaks were applied to the monthly projects provided by Eskom. The peaks were derived from historical observations by Eskom which indicate an increased usage of 25% for a three month period from August to October. It was assumed that the same peak will apply for all new power stations.

The water use projections tables as provided by Eskom are included in Appendix B of this report.

3.3 Sasol Water Use Projections

The Sasol water use projection for industrial use peaks at 84 million m^3/a in 2023. It is made up as follows:

Table 3-3: Sasol Water Use Projections

Component	Water use projection
Construction activities	Two construction periods from 2011 to 2013 and 2017 to 2019 with annual requirements of 0.5, 1 and 2 million m^3/a
CTL facilities	Mafutha 1 will be commissioned over two years starting 2014 and reaching a peak requirement of 37 million m^3/a in 2016 Mafutha 2 will be commissioned over two years starting 2020 and reaching a peak requirement of 37 million m^3/a in 2022

Component	Water use projection
	Total requirement for the two facilities will be 74 million m^3/a of which 10 million m^3/a will be domestic effluent The facilities will be constructed in the vicinity of Steenbokpan
Coal mining and beneficiation	Water required from 2011 and peaking at 10 million m^3/a in 2023. Required in the vicinity of Steenbokpan

The water use projections tables as provided by Sasol are included in Appendix C of this report.

3.4 Exxaro Water Use Projections

The Exxaro water use projection for industrial use peaks at 27.9 million m^3/a in 2024. It is made up as follows:

Table 3-4: Exxaro Water Use Projections

Component	Water use projection
Mining activities near Lephalale	The water requirement increase from 2008 and peaks at 21.816 million m^3/a in 2018 This requirement includes the increased water usage at Grootegeluk mine to provide coal to Medupi Power Station. This requirement includes a provision of 8 million m^3/a for Independent Power Producers
Mining activities near Steenbokpan	The water is required from 2012 and peaks at 6.12 million m^3/a in 2024

The water use projections tables as provided by Exxaro are included in Appendix D of this report.

3.5 Water Use Projections for Other Mines

Contracts for coal supply to the three future power stations have not been awarded. The anticipated water usage of a typical mine supplying coal to power stations are therefore included in the water requirements.

Table 3-5: Water Use Projections for Other Mines

Component	Water use projection
Mine for Eskom power station 3	Water required from 2011 and peaks at 5 million m^3/a in 2016
Mine for Eskom power station 4	Water required from 2016 and peaks at 5 million m^3/a in 2022
Mine for Eskom power station 5	Water required from 2019 and peaks at 5 million m^3/a in 2023

These projections are based on that reported in the CWRS report on water requirements and availability scenarios for the Lephalale area.

3.6 Lephalale Municipality Water Use Projections

The expected growth in the Lephalale Local Municipality area is based on the mining and use of substantial coal deposits west of Lephalale to Steenbokpan and stretching into Botswana. A probable growth scenario for the Municipality, residential and associated industrial, commercial and educational development, was developed in conjunction with the DWA Lephalale Bulk Infrastructure Grant Feasibility Study. The data sources used and assumptions made to determine the probable growth is discussed below.

3.6.1 Demographics

Demographic forecasts developed by Glen Steyn Associates [(1)] using Statistics South Africa demographic data as the basis. Further input was obtained from all known present and potential future developers in the area.

The following assumptions applied:

- Multiplier factors that simulate the overall ratio of population growth relative to the increase in temporary and permanent workers moving into the area:
  - 1.4 for permanent employees and contractors
  - 1.3 was used for temporary (construction) workers
- Permanent employees include contractors employed on a continuous or permanent base.
- All development and growth has been calculated and presented in terms of households.
- Assumed that every 4 construction workers are equivalent to one household.
- Population figures supplied by Sasol (60 000 people per CTL facility) include all associated industrial and support services including public, social and commercial sectors. A household size of 4 was assumed.
- A population growth rate of 1% (equivalent to the national growth figure) was assumed compared to the 2.5% previously used in the Lephalale Master Plan 2006.

3.6.2 Spatial Settlement

Current information indicates that the location of developments will result in the population residing either in Lephalale or near Steenbokpan.

- Lephalale – settlement will take place in the town itself or in Marapong which is nearer to the existing and future developments.
- Steenbokpan – an expected settlement pattern was assumed based on information from spatial settlement data for the urban populations in Lephalale/Marapong, the Spatial Development Framework (2006) for the municipality, input from Glen Steyn, and input from Town and Regional Planners[(2)] Winterbach Potgieter and Partners.

3.6.3 Criteria for Estimating Water Consumption

The following guidelines were used in determining unit rate consumption figures:

- Guidelines for the Development of Human Settlement Planning and Design[(3)] as revised August 2003 (Red Book); [(1);]
- Stand sizes;

- Climate (hot, dry, rainfall of only 420 mm/a);
- Implementing of water conservation and demand management;
- Probable water tariff increases; and
- Historic water consumption.

The following densities were assumed for determination of water consumption:

- Residential 1: 1 house per stand (average size 8 units/hectare)
- Residential 2: Maximum 20 units/ha
- Residential 3: Maximum 40 units/ha

Table 3-6 below summarises the residential mix and unit consumption rates used to determine future water consumption. It should be noted that the unit consumption rates adopted falls within the lower range of accepted engineering norms notwithstanding the environmental factors indicating higher than normal usage.

Table 3-6: Residential Mix and Unit Consumption

1: Residential Mix

According to Bigen Master Plan, [4]; residential units as follow:

				Lephalale		Marapong	
Current Residential Mix:	**%**	**AADD (l/d)**	**AADD (l/d)+ 15% losses**	**% development**	**AADD l/d/hh**	**% development**	**AADD l/d/hh**
Res1	60%	1375	1581	75.00%	1500	25.00%	1000
Res2	30%	937.5	1078	75.00%	1000	25.00%	750
Res3	10%	712.5	819	75.00%	750	25.00%	600

Africon new Estimates:

				Lephalale		Marapong	
Estimated Future Mix:	**%**	**AADD (l/d)**	**AADD (l/d)+ 15% losses**	**% development**	**AADD l/d/hh**	**% development**	**AADD l/d/hh**
Res1	33.33%	950	1093	75.00%	1000	25.00%	800
Res2	33.33%	900	1035	75.00%	950	25.00%	750
Res3	33.33%	675	776	75.00%	700	25.00%	600

Assume the mix in residential demands will change over a period of 10 years, starting in 2009

The Master Plan for Engineering Services in Lephalale Municipality (compiled by Bigen Africa, second draft September 2007) model for non-domestic water use was assessed and adopted, with an adjustment to the associated water uses to provide for the effect of water conservation and demand management and increased water tariffs.

Table 3-7: Non Domestic Water Use Assumptions

2: Non domestic use					
	Number of ha and water demand/5 000 households				
Master Plan 2006:	Business	Industrial	Commercial	Mixed uses	Educational
2006 figures (Hectares)	20	20	20	10	50
2006 figures demands (m3/ha/day)	27.5	13.75	14.4	18.5	10
Calculated AADD for 2006 (m3/day)	550	275	288	185	500
TOTAL (m^3/d)	**1798**				
	Number of ha and water demand/5 000 households				
Adjusted (Africon August 2008)	Business	Industrial	Commercial	Mixed uses	Educational
2006 figures (Hectares)	20	20	20	10	50
2006 figures demands (m3/ha/day)	18.3	9.2	9.6	12.4	6.7
Calculated AADD for 2006 (m3/day)	366.9	183.4	192.1	124.0	333.5
TOTAL (m^3/d)	**1199.8**				

Based on the assumptions above, 1 200 m^3/day was allowed per 5 000 households for all uses other than domestic use.

3.6.4 Projected Total Water Requirement

The resultant total water requirements for Scenarios 4 and 8 are summarised below.

Table 3-8: Scenario 4: Projected Municipal Requirement (million m^3/a)

Component	**Current (2008)**	**Projected (2030)**
Current households (including Marapong)	3.127	2.906
Industrial/Commercial/Educational Development		
At Lephalale	0.769	2.338
At Steenbokpan		0.478
Power stations		
Medupi		0.497
Power station 3		1.432
Power station 4		1.376
Power station 5		1.322
Mining (Exxaro) (including on mine potable)	0.341	6.740
Mining (Exxaro) (Steenbokpan)		2.493
Total	**4.870**	**19.582**
Required at Lephalale	**4.870**	**12.481**
Required at Steenbokpan	**0**	**7.101**

Table 3-9: Scenario 8: Projected Municipal Requirement (million m^3/a)

Component	Current (2008)	Projected (2030)
Current households (including Marapong)	3.127	2.906
Industrial/Commercial/Educational Development		
At Lephalale	0.769	2.338
At Steenbokpan		5.310
Power stations		
Medupi		0.497
Power station 3		1.432
Power station 4		1.376
Power station 5		1.322
Mining (Exxaro) (including on mine potable)	0.341	6.740
Mining (Exxaro) (Steenbokpan)		2.493
Mafutha Town at Steenbokpan		11.995
Mafutha 1&2 Plant Potable		4.000
Total	**4.870**	**40.409**
Required at Lephalale	**4.870**	**12.481**
Required at Steenbokpan	**0**	**27.928**

Notes to the tables:

- The requirements for temporary construction workers are not shown in the summary tables, but have been allowed for in the detailed Water Requirement Tables. (Appendix A)
- A requirement for Mafutha town is was determined using Secunda and surrounding towns as reference and taking into consideration the difference between the Mpumalanga Highveld and Waterberg area where Mafutha will be located.
- Peak flow requirements were considered in the analysis and applied to monthly water requirements that will be used to size infrastructure.

3.7 Irrigation Use

The dam supplies irrigation water to the downstream scheduled area which has an allocation of 10.4 million m^3/a. However, the current operating rule is to release 16 million m^3/a, cut back to zero should the dam stored volumes drop below 50% of the active storage. The effect of these two release rules has been found to be very similar for the other users. The upper catchments are dependent on run-of-river abstraction and water use from farm dams (DWA 2006) [(5)].

4. TOTAL WATER REQUIREMENT FOR MCWAP

4.1 Comparison of Growth Scenarios

The growth in water requirements for Scenario 4 and 8 over the period 2008 to 2030 is provided below. Figure 1 illustrates the requirements for the April 2008 estimates and the revised July 2008 estimates. The graphs indicate year end totals and include the requirement for 10.4 million m^3/a for irrigation downstream of the Mokolo Dam.

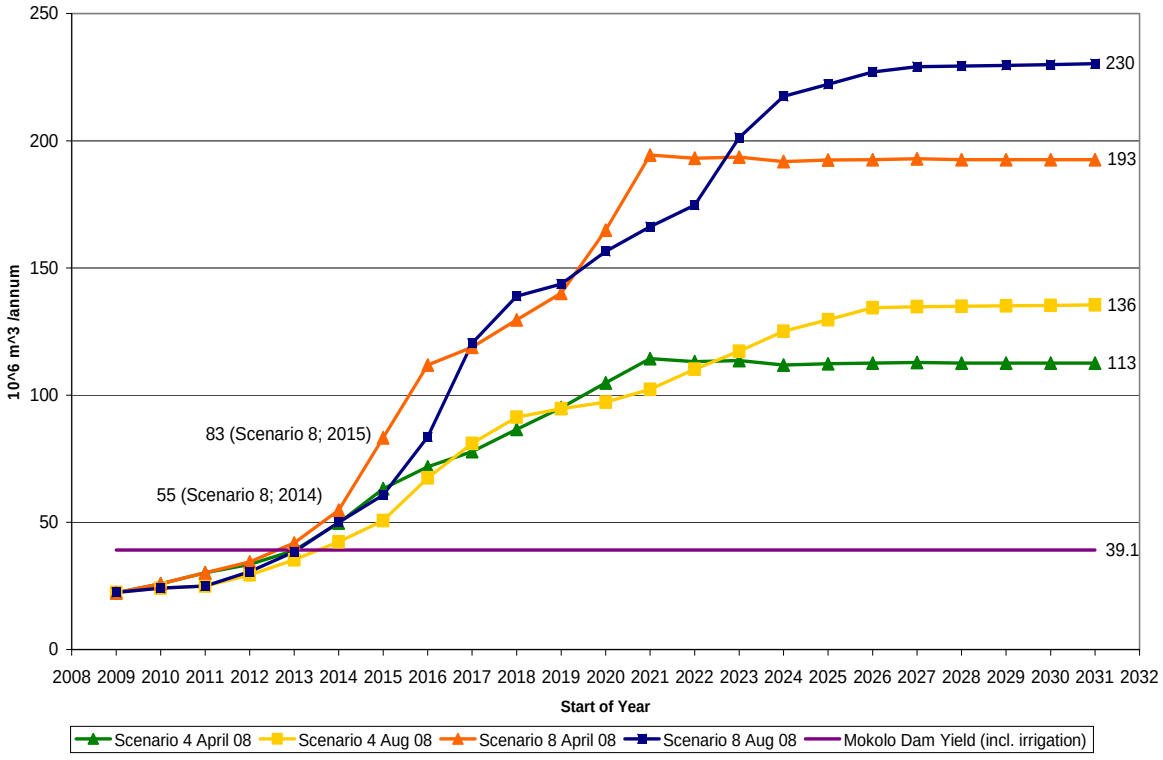


Figure 4-1: Comparison of Water Requirement Scenarios including Irrigation (25 August 2008 release)

4.2 MCWAP Scheme Capacities

The baseline figures to be used for planning and sizing the options for the interim delivery from Mokolo Dam and ultimate transfer from both the Mokolo Dam and the Crocodile River (West) has been established using the water use requirements as presented above:

- Phase 1: Mokolo Transfer System delivering from Mokolo Dam:
  - Minimum required combined Mokolo transfer system capacity during the interim period (May 2011 to July 2014) - 50.4 x 10^6 m^3/a (peak month water requirement being 4.2 million m^3 delivered during July 2008)
  - Ultimate Mokolo system supply after commissioning of Crocodile River (West) transfer system – 28.7 x 10^6 m^3/a including any losses.
  - These figures exclude irrigation requirements
- Phase 2A: First phase of a Crocodile (West) Transfer System – 110 x 10^6 m^3/a (from July 2014 to July 2020). This capacity is based on the total combined transfer

capacity required in July 2019 for Scenario 8 (138 x 10^6 m^3/a) and will be sufficient for the Scenario 4 requirement in 2030.

- Phase 2B: Second phase of Crocodile (West) Transfer System – 81 x 10^6 m^3/a. This is the additional transfer capacity required for the Scenario 8 requirement in 2030.
- Total Crocodile River (West) transfer capacity for Scenario 8 – 191 x 10^6 m^3/a. This is calculated as the total water requirements of 230 million m^3/a less the irrigation requirement (10.4 x10^6 m^3/a) less the volume transferred from Mokolo Dam (28.7 x 10^6 m^3/a).

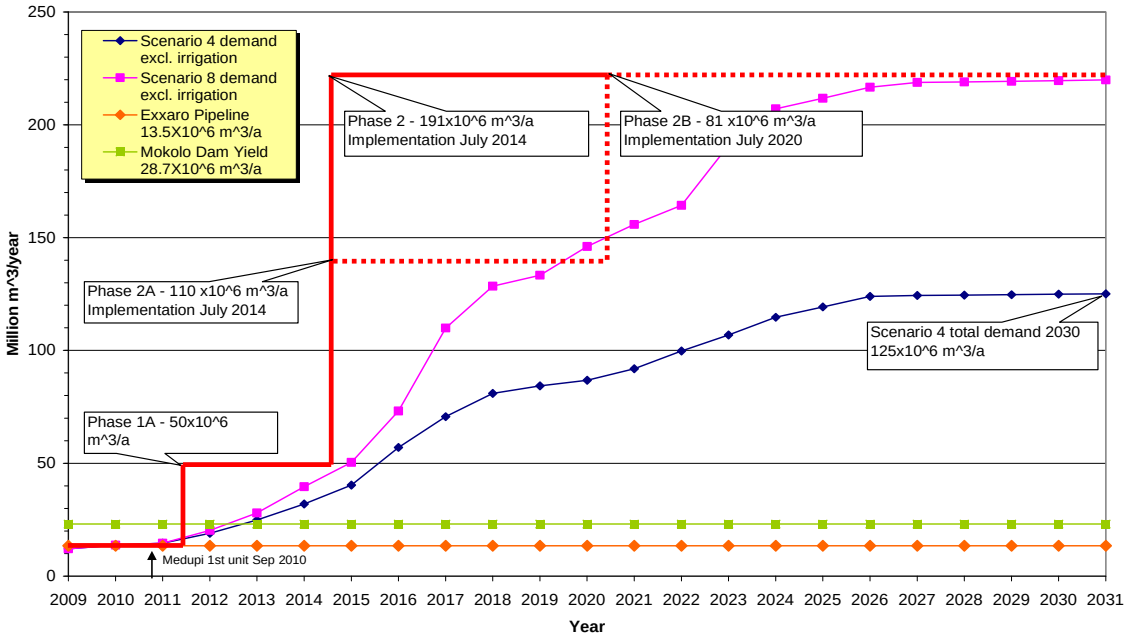


Figure 4-2: Indication of Transfer Volumes (excluding Reliability, Redundancy and Irrigation Requirements)

4.3 Peak Flow Requirements

Peak flow requirements have been applied on the monthly water requirement for Eskom and Lephalale Municipality. The peak factor included for Eskom is based on historic measurements at Matimba Power Station which indicates that a 25% peak is experienced annually from August to October. Monthly peaks included for Lephalale Municipality is based on historic flow measurements taken at Zeeland Water Treatment Works.

The resultant monthly peak flow requirement based on the annual average daily demand for the total scheme is 9%. This requirement will be allowed for in the design of the pipelines and pump stations.

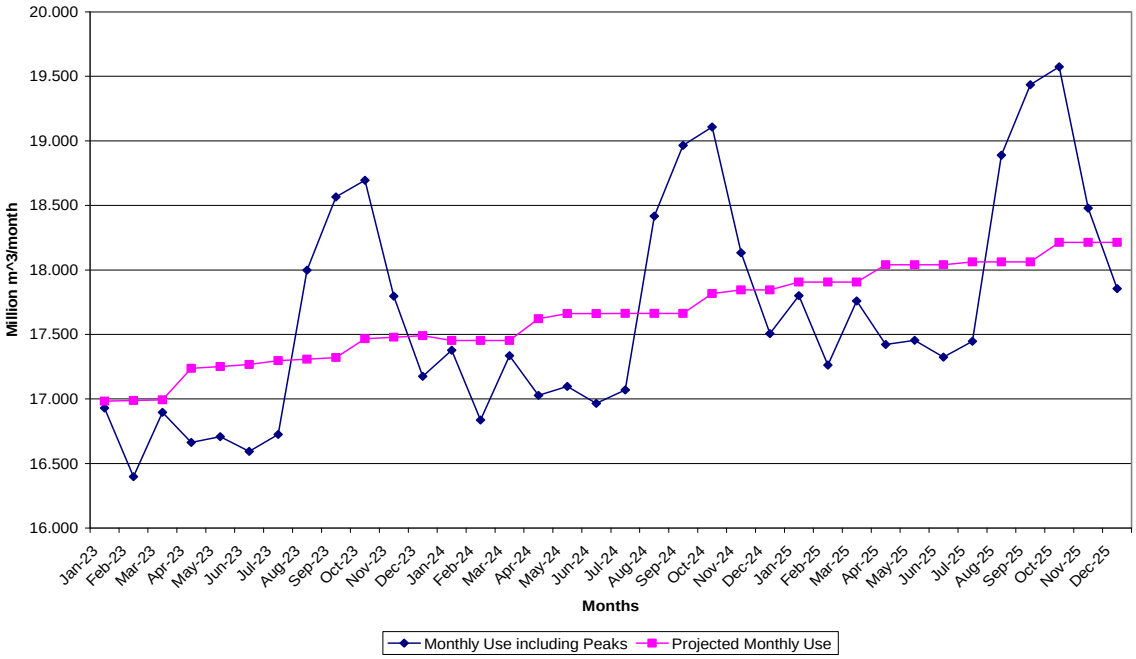


Figure 4-3: Projected Monthly Peak Water Use Requirements

4.4 Return Flows

The potential to optimally utilise outflows from the various Waste Water Treatment Works will need to be assessed to confirm the potential of the resource. Currently the potential quantity is estimated at 20 million m^3/a of which 10 million m^3/a will be utilised by Sasol in the Coal to Liquid Fuel Facilities. The balance can be utilised for other industrial users such as coal mines, but has not been allocated.

The infrastructure to convey and store the treated effluent flow will have to be planned and developed.

4.5 Transfer Volumes

4.5.1 Mokolo Dam

The annual volumes of water to be transferred from Mokolo Dam are indicated in the table below. The net water requirement is based on the total annual water requirement as determined above (taking cognisance of installed transfer capacity). Transfer and evaporation losses are estimated at 2% and river losses are added to obtain the gross water requirement. River loss estimates are described in Supporting Report 4 – Dams, Abstraction Weirs and River Works (P RSA A000/00/9109).

Table 4-1: Annual Transfer Volumes for Mokolo Dam Abstraction (million m^3/a)

Year	Net Water Requirement	Add Transfer Losses	Gross Water Requirement	
			Mokolo Dam	Rivers Bend Weir
2008	12.131	12.374	12.374	15.251
2009	13.747	14.022	14.022	17.283
2010	14.597	14.889	14.889	18.352
2011	20.252	20.657	20.657	25.461
2012	28.025	28.586	28.586	35.234
2013	39.629	40.421	40.421	49.821
2014	36.412	37.140	37.140	45.777
2015	27.400	27.948	27.948	34.447
2016	28.700	29.274	29.274	36.082
2017	28.700	29.274	29.274	36.082
2018	28.700	29.274	29.274	36.082
2019	28.700	29.274	29.274	36.082
2020	28.700	29.274	29.274	36.082
2021	28.700	29.274	29.274	36.082
2022	28.700	29.274	29.274	36.082
2023	28.700	29.274	29.274	36.082
2024	28.700	29.274	29.274	36.082
2025	28.700	29.274	29.274	36.082
2026	28.700	29.274	29.274	36.082
2027	28.700	29.274	29.274	36.082
2028	28.700	29.274	29.274	36.082
2029	28.700	29.274	29.274	36.082
2030	28.700	29.274	29.274	36.082

The safe yield of Mokolo Dam was determined at 39.1 million m^3/a, of which 10.4 million m^3/a is allocated for irrigation releases. The balance, 28.7 million m^3/a, is therefore available for used by domestic and industrial users. The long term gross water requirements for the Mokolo Dam option takes account of the transfer and evaporation losses (29.274 million m^3/a). The losses therefore need to be supplied from the Crocodile River West (Phase 2 of the project). For the purpose of the Pre-Feasibility analysis it was assumed that the loss, being small, will be supplied from the Crocodile River West. The additional cost of supplying the water from the Crocodile River (West) will be insignificant.

The gross water requirement for the Rivers Bend Weir option exceeds the safe yield of Mokolo Dam from 2012 onwards. The loss cannot be replaced with Crocodile River (West) water as this will require that the Zeeland Water Treatment Works be upgraded to treat Crocodile River (West) water. This is currently not planned. The additional cost of supplying the water from the Crocodile River (West) will in this case be significant.

4.5.2 Crocodile River (West)

The annual volumes of water to be transferred from Crocodile River (West) for the scheme options are indicated in the tables below. The net water requirement is based on the total annual water requirement as determined above (taking cognisance of installed transfer capacity). Transfer, evaporation and leakage losses from the terminal reservoirs are estimated at 2%. These plus river losses are added to obtain the gross water

requirement. River loss estimates are described in Supporting Report 4 – Dams, Abstraction Weirs and River Works (P RSA A000/00/9109) [6];

Table 4-2: Annual Transfer Volumes Crocodile (West) Abstraction, Phase 2, Scenario 4 (million m^3/a)

Year	Net Water Requirement	Add Transfer Losses	Gross Water Requirement of Option	
			Boschkop	Vlieëpoort
2008	0.000	0.000	0.000	0.000
2009	0.000	0.000	0.000	0.000
2010	0.000	0.000	0.000	0.000
2011	0.000	0.000	0.000	0.000
2012	0.000	0.000	0.000	0.000
2013	0.000	0.000	0.000	0.000
2014	9.689	9.883	12.104	15.008
2015	28.453	29.022	35.543	44.072
2016	42.009	42.849	52.478	65.070
2017	52.378	53.426	65.431	81.131
2018	55.608	56.720	69.466	86.134
2019	58.127	59.289	72.612	90.035
2020	63.307	64.573	79.084	98.060
2021	71.177	72.600	88.915	110.249
2022	78.212	79.777	97.704	121.147
2023	86.065	87.787	107.514	133.311
2024	90.618	92.430	113.201	140.362
2025	95.337	97.244	119.096	147.672
2026	95.665	97.578	119.506	148.180
2027	95.851	97.768	119.738	148.467
2028	96.038	97.959	119.972	148.758
2029	96.227	98.152	120.208	149.051
2030	96.418	98.346	120.446	149.346

Table 4-3: Annual Transfer Volumes Crocodile (West) Abstraction, Phase 2, Scenario 8 (million m^3/a)

Year	Net Water Requirement	Add Transfer Losses	Gross Water Requirement of Option	
			Boschkop	Vlieëpoort
2008	0.000	0.000	0.000	0.000
2009	0.000	0.000	0.000	0.000
2010	0.000	0.000	0.000	0.000
2011	0.000	0.000	0.000	0.000
2012	0.000	0.000	0.000	0.000
2013	0.000	0.000	0.000	0.000
2014	13.990	14.270	16.464	19.434
2015	44.668	45.562	52.569	62.051
2016	81.321	82.947	95.704	112.967
2017	99.884	101.881	117.550	138.754
2018	104.662	106.755	123.173	145.392
2019	117.523	119.873	138.309	163.258
2020	127.226	129.770	149.728	176.737
2021	135.683	138.396	159.680	188.485

Year	Net Water Requirement	Add Transfer Losses	Gross Water Requirement of Option	
			Boschkop	Vlieëpoort
2022	162.257	165.502	190.955	225.401
2023	178.442	182.011	210.003	247.885
2024	183.139	186.802	215.531	254.410
2025	188.004	191.764	221.256	261.168
2026	190.067	193.868	223.683	264.033
2027	190.296	194.102	223.953	264.352
2028	190.525	194.336	224.223	264.670
2029	190.884	194.701	224.645	265.168
2030	191.245	195.070	225.070	265.670

Table 4-4: Annual Transfer Volumes Crocodile (West) Abstraction, Phase 2A, Scenario 8 (million m^3/a)

Year	Net Water Requirement	Add Transfer Losses	Gross Water Requirement of Option	
			Boschkop	Vlieëpoort
2008	0.000	0.000	0.000	0.000
2009	0.000	0.000	0.000	0.000
2010	0.000	0.000	0.000	0.000
2011	0.000	0.000	0.000	0.000
2012	0.000	0.000	0.000	0.000
2013	0.000	0.000	0.000	0.000
2014	13.990	14.270	16.464	19.434
2015	44.668	45.562	52.569	62.051
2016	81.321	82.947	95.704	112.967
2017	99.884	101.881	117.550	138.754
2018	104.662	106.755	123.173	145.392
2019	110.000	112.200	129.455	152.808
2020	110.000	112.200	129.455	152.808
2021	110.000	112.200	129.455	152.808
2022	110.000	112.200	129.455	152.808
2023	110.000	112.200	129.455	152.808
2024	110.000	112.200	129.455	152.808
2025	110.000	112.200	129.455	152.808
2026	110.000	112.200	129.455	152.808
2027	110.000	112.200	129.455	152.808
2028	110.000	112.200	129.455	152.808
2029	110.000	112.200	129.455	152.808
2030	110.000	112.200	129.455	152.808

Table 4-5: Annual Transfer Volumes Crocodile (West) Abstraction, Phase 2B, Scenario (million m^3/a)

Year	Net Water Requirement	Add Transfer Losses	Gross Water Requirement of Option	
			Boschkop	Vlieëpoort
2008	0.000	0.000	0.000	0.000
2009	0.000	0.000	0.000	0.000
2010	0.000	0.000	0.000	0.000
2011	0.000	0.000	0.000	0.000
2012	0.000	0.000	0.000	0.000

Year	Net Water Requirement	Add Transfer Losses	Gross Water Requirement of Option	
			Boschkop	Vlieëpoort
2013	0.000	0.000	0.000	0.000
2014	0.000	0.000	0.000	0.000
2015	0.000	0.000	0.000	0.000
2016	0.000	0.000	0.000	0.000
2017	0.000	0.000	0.000	0.000
2018	0.000	0.000	0.000	0.000
2019	7.523	7.673	8.854	10.451
2020	17.226	17.570	20.272	23.929
2021	25.683	26.196	30.225	35.677
2022	52.257	53.302	61.500	72.594
2023	68.442	69.811	80.548	95.077
2024	73.139	74.602	86.075	101.602
2025	78.004	79.564	91.800	108.360
2026	80.067	81.668	94.228	111.225
2027	80.296	81.902	94.498	111.544
2028	80.525	82.136	94.768	111.863
2029	80.884	82.501	95.189	112.360
2030	81.245	82.870	95.615	112.863

Table 4-6: Annual Transfer Volumes Crocodile (West) Abstraction, Phases 2 & 3, Scenario 8 (million m^3/a)

Year	Net Water Requirement	Add Transfer Losses	Gross Water Requirement of Option	
			Boschkop	Vlieëpoort
2008	0.000	0.000		0.000
2009	0.000	0.000		0.000
2010	0.000	0.000		0.000
2011	0.000	0.000		0.000
2012	0.000	0.000		0.000
2013	0.000	0.000		0.000
2014	12.596	12.848		17.498
2015	44.668	45.562		62.051
2016	81.321	82.947	95.704	
2017	99.884	101.881	117.550	
2018	104.662	106.755	123.173	
2019	117.523	119.873	138.309	
2020	127.226	129.770	149.728	
2021	135.683	138.396	159.680	
2022	162.257	165.502	190.955	
2023	178.442	182.011	210.003	
2024	183.139	186.802	215.531	
2025	188.004	191.764	221.256	
2026	190.067	193.868	223.683	
2027	190.296	194.102	223.953	
2028	190.525	194.336	224.223	
2029	190.884	194.701	224.645	
2030	191.245	195.070	225.070	

5. REFERENCE LIST

(1) Lephalale Spatial Development Framework, Lephalale Local Municipality assisted by Winterbach Potgieter & Partners, First Draft, 2006

(2) Economic Development Plan for Lephalale Municipality Glen Steyn and Associates, Final Draft, 2008

(3) Meetings and discussions with Cobus Winterbach, Winterbach Potgieter & Partners, 2008

(4) Guidelines for the Development of Human Settlement Planning and Design as revised August 2003 (Red Book)

(5) Lephalale Municipality Master Planning of Engineering Infrastructure in the Ellisras/Marapong Nodal Area, Bigen Africa, Second Draft, 2008

(6) (DWA 2006)

(7) MCWAP Supporting Report 4 – Dams, Abstraction Weirs and River Works (P RSA A000/00/9109)

(8) Department of Water Affairs, South Africa Lephalale Bulk Water Feasibility Study – Scoping Report: Implementation Ready Plan. Prepared by Africon on behalf of the Directorate : Strategic Planning (Bulk Infrastructure Grant), 2009

Appendix A

Updated Water Requirement Tables

(25 August 2008 Release)

	A	B	HK	HL	HM	HN	HO	HP	HQ	HR	HS	HT	HU	HV	HW	HX	HY	HZ	IA	IB	IC	ID	IE	IF	IG
1	**MCWAP Technical Module: Water demand tables**																								
2	**Date: 25 August 2008**																								
3																									
4	**Water requirements for Scenario 8: Scenario 4 + SASOL**																								
5	**Peaks Indicated**																								
6	**Unit: million m^3/annum or million m^3/month**																								
7																									
8	**USER**	**Delivery Area**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
9			**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**
10	**ESKOM INDUSTRIAL DEMAND**																								
11	Matimba Power Station	Industrial Eskom Lephalale	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600
12	Medupi Power Station (with FGD)	Industrial Eskom Lephalale	0.876	0.719	0.713	1.775	2.930	5.085	9.400	13.492	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000
13	Future Eskom Power Station 3 (CF-2 with FGD)	Industrial Eskom Steenbokpan					0.431	0.719	0.713	3.513	8.041	13.066	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000
14	Future Eskom Power Station 4 (CF-3 with FGD)	Industrial Eskom Steenbokpan										0.431	0.719	0.713	3.513	8.041	13.066	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000
15	Future Eskom Power Station 5 (CF-4 with FGD)	Industrial Eskom Steenbokpan													0.431	0.719	0.713	3.513	8.041	13.066	15.000	15.000	15.000	15.000	15.000
16	**Sub-Total (Eskom)**		**4.476**	**4.319**	**4.313**	**5.3748**	**6.9606**	**9.404**	**13.714**	**20.605**	**25.641**	**31.097**	**33.319**	**33.313**	**36.544**	**41.360**	**46.379**	**51.113**	**55.641**	**60.666**	**62.600**	**62.600**	**62.600**	**62.600**	**62.600**
17	**Peak factor**		**1.000**	**1.000**	**1.000**	**1.0000**	**1.0000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
18	**Sub-Total Peaks Included (Eskom)**		**4.476**	**4.319**	**4.313**	**5.3748**	**6.9606**	**9.404**	**13.714**	**20.605**	**25.641**	**31.097**	**33.319**	**33.313**	**36.544**	**41.360**	**46.379**	**51.113**	**55.641**	**60.666**	**62.600**	**62.600**	**62.600**	**62.600**	**62.600**
19	**COAL MINES INDUSTRIAL DEMAND**																								
20	Exxarro																								
21	Mining activities near Lephalale	Industrial Exxaro Lephalale	2.785	3.053	3.414	4.239	5.413	6.914	8.845	14.451	20.480	21.611	21.816	21.816	21.816	21.816	21.816	21.816	21.816	21.816	21.816	21.816	21.816	21.816	21.816
22	Mining activities near Steenbokpan	Industrial Exxaro Steenbokpan					0.045	0.137	0.262	1.290	2.055	2.867	3.322	4.200	4.890	5.430	5.460	5.845	6.120	6.120	6.120	6.120	6.120	6.120	6.120
23	Mine for Eskom Power Station 3	Industrial other mines				1.100	2.300	2.800	2.800	4.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000
24	Mine for Eskom Power Station 4	Industrial other mines									1.100	2.300	2.300	2.800	2.800	4.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000
25	Mine for Eskom Power Station 5	Industrial other mines												1.100	2.300	2.800	2.800	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000
26	**Sub-Total (Coal Mines)**		**2.785**	**3.053**	**3.414**	**5.3390**	**7.7580**	**9.851**	**11.907**	**19.741**	**28.635**	**31.778**	**32.438**	**34.916**	**36.806**	**39.046**	**40.076**	**42.661**	**42.936**	**42.936**	**42.936**	**42.936**	**42.936**	**42.936**	**42.936**
27	**SASOL INDUSTRIAL DEMAND**																								
28	Construction	Industrial Sasol				0.500	1.000	2.000				0.500	1.000	2.000											
29	CTL Facility (Mafutha 1 + Mafutha 2)	Industrial Sasol				0.375	1.000	1.500	3.500	5.000	24.250	32.375	32.500	35.500	36.750	37.000	56.250	64.000	64.000	64.000	64.000	64.000	64.000	64.000	64.000
30	Coal mining and beneficiation	Industrial Sasol				0.375	0.750	1.000	2.250	3.000	4.250	5.375	5.750	6.000	7.250	8.000	9.500	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000
31	**Sub-Total (Sasol)**					**1.2500**	**2.7500**	**4.500**	**5.750**	**8.000**	**28.500**	**38.250**	**39.250**	**43.500**	**44.000**	**45.000**	**65.750**	**74.000**	**74.000**	**74.000**	**74.000**	**74.000**	**74.000**	**74.000**	**74.000**
32	**MUNICIPAL DEMAND**																								
33	Current households (including Marapong)	Municipal demand Lephalale	3.127	3.215	3.175	3.111	3.046	2.978	2.910	2.839	2.767	2.692	2.617	2.604	2.630	2.657	2.683	2.710	2.737	2.765	2.793	2.821	2.849	2.877	2.906
34	Industrial/Commercial/Educational Development																								
35	At Lephalale	Municipal demand Lephalale	0.769	1.033	1.136	1.404	1.689	1.650	1.827	2.185	2.087	2.071	2.074	2.095	2.116	2.137	2.159	2.180	2.202	2.224	2.247	2.269	2.292	2.315	2.338
36	At Steenbokpan	Municipal demand Steenbokpan				0.001	0.155	1.238	1.694	2.539	2.956	3.019	3.346	4.667	5.522	5.598	5.253	5.252	5.206	5.146	5.156	5.181	5.205	5.257	5.310
37	Power stations																								
38	Medupi	Municipal demand Lephalale				0.334	0.521	0.509	0.497	0.485	0.473	0.460	0.447	0.445	0.449	0.454	0.459	0.463	0.468	0.472	0.477	0.482	0.487	0.492	0.497
39	Power station 3	Municipal demand Steenbokpan						0.636	0.988	1.129	1.375	1.328	1.289	1.283	1.296	1.309	1.322	1.336	1.349	1.362	1.376	1.390	1.404	1.418	1.432
40	Power station 4	Municipal demand Steenbokpan										0.552	0.853	0.841	1.100	1.207	1.270	1.283	1.296	1.309	1.322	1.336	1.349	1.362	1.376
41	Power station 5	Municipal demand Steenbokpan														0.526	0.841	1.100	1.256	1.259	1.270	1.283	1.296	1.309	1.322
42	Mining (Exxaro) (incl on mine potable)	Municipal demand Lephalale	0.341	0.789	1.216	1.799	2.692	2.828	3.683	5.581	5.847	5.893	5.905	6.007	6.098	6.161	6.223	6.285	6.348	6.412	6.476	6.541	6.607	6.673	6.740
43	Mining (Exxaro) (Steenbokpan)	Municipal demand Steenbokpan					0.277	1.350	1.394	1.347	1.541	2.425	2.410	2.374	2.376	2.395	2.419	2.443	2.442	2.376	2.395	2.419	2.443	2.468	2.493
44	Temporary Construction Workers																								
45	At Lephalale	Municipal demand Lephalale	0.633	1.339	1.343	1.609	1.715	1.316	1.227	0.833	0.209	0.064													
46	At Steenbokpan	Municipal demand Steenbokpan				0.006	0.399	3.275	4.594	4.619	2.613	1.193	1.844	3.737	3.738	3.231	1.493	1.068	0.616	0.327	0.192	0.098			
47	Mafutha Town (Sasol) at Steenbokpan	Municipal demand Steenbokpan								2.993	5.823	5.667	5.508	8.131	10.855	10.964	11.074	11.185	11.298	11.411	11.526	11.641	11.758	11.876	11.995
48	Mafutha 1&2 (Plant Potable)	Municipal demand Steenbokpan				0.023	0.063	0.094	0.219	0.313	1.516	2.023	2.031	2.219	2.297	2.313	3.516	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000
49	**Sub-Total (Municipal)**		**4.870**	**6.375**	**6.870**	**8.288**	**10.557**	**15.873**	**19.032**	**24.863**	**27.206**	**27.388**	**28.325**	**34.403**	**38.478**	**38.950**	**38.711**	**39.306**	**39.218**	**39.063**	**39.231**	**39.460**	**39.689**	**40.048**	**40.409**
50	**Peak factor**		**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
51	**Sub-Total Peaks Included (Municipal)**		**4.870**	**6.375**	**6.870**	**8.288**	**10.557**	**15.873**	**19.032**	**24.863**	**27.206**	**27.388**	**28.325**	**34.403**	**38.478**	**38.950**	**38.711**	**39.306**	**39.218**	**39.063**	**39.231**	**39.460**	**39.689**	**40.048**	**40.409**
52	**Total Demand Excluding Irrigation (+Peaks)**		**12.131**	**13.747**	**14.597**	**20.252**	**28.025**	**39.629**	**50.402**	**73.209**	**109.983**	**128.512**	**133.332**	**146.132**	**155.829**	**164.357**	**190.916**	**207.080**	**211.796**	**216.665**	**218.767**	**218.996**	**219.225**	**219.584**	**219.945**
53	**Irrigation allocation**		**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**
54	**TOTAL: SCENARIO 8**		**22.531**	**24.147**	**24.997**	**30.652**	**38.425**	**50.029**	**60.802**	**83.609**	**120.383**	**138.912**	**143.732**	**156.532**	**166.229**	**174.757**	**201.316**	**217.480**	**222.196**	**227.065**	**229.167**	**229.396**	**229.625**	**229.984**	**230.345**
55	Water available from Mokolo Dam		39.100	39.100	39.100	39.100	39.100	39.100	39.100	39.100	39.100	39.100	39.100	39.100	39.100	39.100	39.100	39.100	39.100	39.100	39.100	39.100	39.100	39.100	39.100
56	Potential return flow (50%)									8.469	8.627	9.252	9.471	10.158	10.794	11.221	11.314	11.526	11.653	11.662	11.756	11.861	11.966	12.086	12.207
57	Return flows used by Sosol on plant											5.000	5.000	5.000	5.000	5.000	5.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000
58	Water to be transferred from Crocodile River (West)							11.017	21.813	36.199	72.693	90.632	95.191	107.365	116.432	124.461	150.943	166.916	171.487	176.342	178.310	178.435	178.560	178.798	179.038
59	Demands used for URV calculation								**21.813**	**44.668**	**81.321**	**99.884**	**104.662**	**117.523**	**127.226**	**135.683**	**162.257**	**178.442**	**183.139**	**188.004**	**190.067**	**190.296**	**190.525**	**190.884**	**191.245**
60																									
61	**Lephalale/Steenbokpan Split (Delivery through pipe)**	**Delivery Area**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
62			**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**
63	**Lephalale Demand Centre**	Municipal demand Lephalale	4.870	6.375	6.870	8.258	9.664	9.281	10.143	11.923	11.383	11.180	11.043	11.151	11.294	11.408	11.523	11.639	11.755	11.873	11.993	12.113	12.235	12.357	12.481
64		Industrial Exxaro Lephalale	2.785	3.053	3.414	4.239	5.413	6.914	8.845	14.451	20.480	21.611	21.816	21.816	21.816	21.816	21.816	21.816	21.816	21.816	21.816	21.816	21.816	21.816	21.816
65		Industrial Eskom Lephalale	4.476	4.319	4.313	5.375	6.530	8.685	13.000	17.092	17.600	17.600	17.600	17.600	17.600	17.600	17.600	17.600	17.600	17.600	17.600	17.600	17.600	17.600	17.600
66	**Sub-total**		**12.131**	**13.747**	**14.597**	**17.872**	**21.606**	**24.880**	**31.988**	**43.466**	**49.463**	**50.391**	**50.459**	**50.567**	**50.710**	**50.824**	**50.939**	**51.055**	**51.171**	**51.289**	**51.409**	**51.529**	**51.651**	**51.773**	**51.897**
67	**Steenbokpan Demand Centre**	Municipal demand Steenbokpan				0.030	0.893	6.593	8.889	12.940	15.824	16.207	17.282	23.252	27.185	27.542	27.188	27.667	27.463	27.190	27.238	27.347	27.455	27.690	27.928
68		Industrial Exxaro Steenbokpan					0.045	0.137	0.262	1.290	2.055	2.867	3.322	4.200	4.890	5.430	5.460	5.845	6.120	6.120	6.120	6.120	6.120	6.120	6.120
69		Industrial Sasol				1.250	2.750	4.500	5.750	8.000	28.500	38.250	39.250	43.500	44.000	45.000	65.750	74.000	74.000	74.000	74.000	74.000	74.000	74.000	74.000
70		Industrial Eskom Steenbokpan					0.431	0.719	0.713	3.513	8.041	13.497	15.719	15.713	18.944	23.760	28.779	33.513	38.041	43.066	45.000	45.000	45.000	45.000	45.000
71		Industrial other mines				1.100	2.300	2.800	2.800	4.000	6.100	7.300	7.300	8.900	10.100	11.800	12.800	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000
72	**Sub-total**					**2.380**	**6.419**	**14.749**	**18.414**	**29.743**	**60.520**	**78.121**	**82.873**	**95.565**	**105.119**	**113.532**	**139.977**	**156.026**	**160.624**	**165.375**	**167.358**	**167.467**	**167.575**	**167.810**	**168.048**
73	**Total**		**12.131**	**13.747**	**14.597**	**20.252**	**28.025**	**39.629**	**50.402**	**73.209**	**109.983**	**128.512**	**133.332**	**146.132**	**155.829**	**164.357**	**190.916**	**207.080**	**211.796**	**216.665**	**218.767**	**218.996**	**219.225**	**219.584**	**219.945**
74																									
75	**Demand on Mokolo Dam**		**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
76			**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**
77	Interim (deliver period up to December 2014)		22.544	24.163	25.007	30.708	38.510	50.117	60.913	83.768															
78	Possible minimum demand (recovery periods)		26.970	28.475	28.970	26.229	26.932	26.740	26.012	26.723	26.183	25.980	25.843	25.951	26.094	26.208	26.323	26.439	26.555	26.673	26.793	26.913	27.035	27.157	27.281
83	Long term demand (up to December 2030)		22.531	24.147	24.997	28.272	31.814	32.381	33.243	35.023	34.483	34.280	34.143	34.251	34.394	34.508	34.623	34.739	34.858	34.973	35.093	35.213	35.335	35.457	35.581
88																									
89	**Pipelines from Mokolo Dam (Installed capacity)**		**13.500**	**13.500**	**13.500**	**29.102**	**45.902**	**50.402**	**50.402**	**50.402**	**50.402**	**50.402**	**50.402**	**50.402**	**50.402**	**50.402**	**50.402**	**50.402**	**50.402**	**50.402**	**50.402**	**50.402**	**50.402**	**50.402**	**50.402**
90	Existing Exxaro Pipeline		13.500	13.500	13.500	4.500																			
91	Interim Pipeline					24.602	36.902	36.902	36.902	36.902	36.902	36.902	36.902	36.902	36.902	36.902	36.902	36.902	36.902	36.902	36.902	36.902	36.902	36.902	36.902
92	Refurbished Exxaro Pipeline						9.000	13.500	13.500	13.500	13.500	13.500	13.500	13.500	13.500	13.500	13.500	13.500	13.500	13.500	13.500	13.500	13.500	13.500	13.500

	A	B	HK	HL	HM	HN	HO	HP	HQ	HR	HS	HT	HU	HV	HW	HX	HY	HZ	IA	IB	IC	ID	IE	IF	IG
1	**MCWAP Technical Module: Water demand tables**																								
2	**Date: 25 August 2008**																								
3																									
4	**Water requirements for Scenario 4: Matimba power station (FBC), Medupi power station (FC**																								
5	**Peaks Indicated**																								
6	**Unit: million m^3/annum or million m^3/month**																								
7																									
8	**USER**	**Delivery Area**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
9			**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**
10	**ESKOM INDUSTRIAL DEMAND**																								
11	Matimba Power Station	Industrial Eskom Lephalale	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600	3.600
12	Medupi Power Station (with FGD)	Industrial Eskom Lephalale	0.876	0.719	0.713	1.775	2.930	5.085	9.400	13.492	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000
13	Future Eskom Power Station 3 (CF-2 with FGD)	Industrial Eskom Steenbokpan					0.431	0.719	0.713	3.513	8.041	13.066	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000
14	Future Eskom Power Station 4 (CF-3 with FGD)	Industrial Eskom Steenbokpan										0.431	0.719	0.713	3.513	8.041	13.066	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000
15	Future Eskom Power Station 5 (CF-4 with FGD)	Industrial Eskom Steenbokpan													0.431	0.719	0.713	3.513	8.041	13.066	15.000	15.000	15.000	15.000	15.000
16	**Sub-Total (Eskom)**		**4.476**	**4.319**	**4.313**	**5.3748**	**6.9606**	**9.404**	**13.714**	**20.605**	**25.641**	**31.097**	**33.319**	**33.313**	**36.544**	**41.360**	**46.379**	**51.113**	**55.641**	**60.666**	**62.600**	**62.600**	**62.600**	**62.600**	**62.600**
17	**Peak factor**		**1.000**	**1.000**	**1.000**	**1.0000**	**1.0000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
18	**Sub-Total Peaks Included (Eskom)**		**4.476**	**4.319**	**4.313**	**5.3748**	**6.9606**	**9.404**	**13.714**	**20.605**	**25.641**	**31.097**	**33.319**	**33.313**	**36.544**	**41.360**	**46.379**	**51.113**	**55.641**	**60.666**	**62.600**	**62.600**	**62.600**	**62.600**	**62.600**
19	**COAL MINES INDUSTRIAL DEMAND**																								
20	Exxaro																								
21	Mining activities near Lephalale	Industrial Exxaro Lephalale	2.785	3.053	3.414	4.239	5.413	6.914	8.845	14.451	20.480	21.611	21.816	21.816	21.816	21.816	21.816	21.816	21.816	21.816	21.816	21.816	21.816	21.816	21.816
22	Mining activities near Steenbokpan	Industrial Exxaro Steenbokpan					0.045	0.137	0.262	1.290	2.055	2.867	3.322	4.200	4.890	5.430	5.460	5.845	6.120	6.120	6.120	6.120	6.120	6.120	6.120
23	Mine for Eskom Power Station 3	Industrial other mines				1.100	2.300	2.800	2.800	4.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000
24	Mine for Eskom Power Station 4	Industrial other mines									1.100	2.300	2.300	2.800	2.800	4.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000
25	Mine for Eskom Power Station 5	Industrial other mines												1.100	2.300	2.800	2.800	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000
26	**Sub-Total (Coal Mines)**		**2.785**	**3.053**	**3.414**	**5.3390**	**7.7580**	**9.851**	**11.907**	**19.741**	**28.635**	**31.778**	**32.438**	**34.916**	**36.806**	**39.046**	**40.076**	**42.661**	**42.936**	**42.936**	**42.936**	**42.936**	**42.936**	**42.936**	**42.936**
27	**SASOL INDUSTRIAL DEMAND**																								
28	Construction	Industrial Sasol																							
29	CTL Facility (Mafutha 1 + Mafutha 2)	Industrial Sasol																							
30	Coal mining and beneficiation	Industrial Sasol																							
31	**Sub-Total (Sasol)**																								
32	**MUNICIPAL DEMAND**																								
33	Current households (including Marapong)	Municipal demand Lephalale	3.127	3.215	3.175	3.111	3.046	2.978	2.910	2.839	2.767	2.692	2.617	2.604	2.630	2.657	2.683	2.710	2.737	2.765	2.793	2.821	2.849	2.877	2.906
34	Industrial/Commercial/Educational Development																								
35	At Lephalale	Municipal demand Lephalale	0.769	1.033	1.136	1.404	1.689	1.650	1.827	2.185	2.087	2.071	2.074	2.095	2.116	2.137	2.159	2.180	2.202	2.224	2.247	2.269	2.292	2.315	2.338
36	At Steenbokpan	Municipal demand Steenbokpan					0.092	0.649	0.892	0.965	1.030	1.480	1.647	1.653	1.614	1.776	1.972	2.062	1.985	1.892	0.473	0.474	0.475	0.476	0.478
37	Power stations																								
38	Medupi	Municipal demand Lephalale				0.334	0.521	0.509	0.497	0.485	0.473	0.460	0.447	0.445	0.449	0.454	0.459	0.463	0.468	0.472	0.477	0.482	0.487	0.492	0.497
39	Power station 3	Municipal demand Steenbokpan						0.636	0.988	1.129	1.375	1.328	1.289	1.283	1.296	1.309	1.322	1.336	1.349	1.362	1.376	1.390	1.404	1.418	1.432
40	Power station 4	Municipal demand Steenbokpan										0.552	0.853	0.841	1.100	1.207	1.270	1.283	1.296	1.309	1.322	1.336	1.349	1.362	1.376
41	Power station 5	Municipal demand Steenbokpan														0.526	0.841	1.100	1.256	1.259	1.270	1.283	1.296	1.309	1.322
42	Mining (Exxaro) (incl on mine potable)	Municipal demand Lephalale	0.341	0.789	1.216	1.799	2.692	2.828	3.683	5.581	5.847	5.893	5.905	6.007	6.098	6.161	6.223	6.285	6.348	6.412	6.476	6.541	6.607	6.673	6.740
43	Mining (Exxaro) (Steenbokpan)	Municipal demand Steenbokpan					0.277	1.350	1.394	1.347	1.541	2.425	2.410	2.374	2.376	2.395	2.419	2.443	2.442	2.376	2.395	2.419	2.443	2.468	2.493
44	Temporary Construction Workers																								
45	At Lephalale	Municipal demand Lephalale	0.633	1.339	1.343	1.609	1.715	1.316	1.227	0.833	0.209	0.064													
46	At Steenbokpan	Municipal demand Steenbokpan					0.124	0.771	1.290	1.362	1.035	1.167	1.310	1.297	0.888	0.791	1.062	1.068	0.616	0.327					
47	Mafutha Town (Sasol) at Steenbokpan	Municipal demand Steenbokpan																							
48	Mafutha 1&2 (Plant Potable)	Municipal demand Steenbokpan																							
49	**Sub-Total (Municipal)**		**4.870**	**6.375**	**6.870**	**8.258**	**10.156**	**12.686**	**14.707**	**16.726**	**16.363**	**18.132**	**18.553**	**18.599**	**18.568**	**19.411**	**20.409**	**20.931**	**20.699**	**20.398**	**18.829**	**19.015**	**19.202**	**19.391**	**19.582**
50	**Peak factor**		**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
51	**Sub-Total Peaks Included (Municipal)**		**4.870**	**6.375**	**6.870**	**8.258**	**10.156**	**12.686**	**14.707**	**16.726**	**16.363**	**18.132**	**18.553**	**18.599**	**18.568**	**19.411**	**20.409**	**20.931**	**20.699**	**20.398**	**18.829**	**19.015**	**19.202**	**19.391**	**19.582**
52	**Total Demand Excluding Irrigation (+Peaks)**		**12.131**	**13.747**	**14.597**	**18.972**	**24.875**	**31.941**	**40.328**	**57.072**	**70.639**	**81.007**	**84.310**	**86.829**	**91.918**	**99.818**	**106.865**	**114.705**	**119.276**	**124.000**	**124.365**	**124.551**	**124.738**	**124.927**	**125.118**
53	**Irrigation allocation**		**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**	**10.400**
54	**TOTAL: SCENARIO 4**		**22.531**	**24.147**	**24.997**	**29.372**	**35.275**	**42.341**	**50.728**	**67.472**	**81.039**	**91.407**	**94.710**	**97.229**	**102.318**	**110.218**	**117.265**	**125.105**	**129.676**	**134.400**	**134.765**	**134.951**	**135.138**	**135.327**	**135.518**
55	Water available from Mokolo Dam		39.100	39.100	39.100	39.100	39.100	39.100	39.100	39.100	39.100	39.100	39.100	39.100	39.100	39.100	39.100	39.100	39.100	39.100	39.100	39.100	39.100	39.100	39.100
56	Potential return flow (50%)		2.435	3.188	3.435	4.129	5.016	5.958	6.708	7.682	7.664	8.482	8.622	8.651	8.840	9.310	9.674	9.931	10.042	10.035	9.415	9.507	9.601	9.696	9.791
57	Water to be transferred from Crocodile River (West)							3.302	11.733	20.771	34.345	43.896	46.986	49.476	54.467	61.866	68.539	76.134	80.576	85.302	86.251	86.343	86.437	86.532	86.627
58	Demands used for URV calculation							**9.260**	**18.442**	**28.453**	**42.009**	**52.378**	**55.608**	**58.127**	**63.307**	**71.177**	**78.212**	**86.065**	**90.618**	**95.337**	**95.665**	**95.851**	**96.038**	**96.227**	**96.418**
59																									
60	**Lephalale/Steenbokpan Split (Delivery through pipe)**	**Delivery Area**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
61			**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**
62	**Lephalale Demand Centre**	Municipal demand Lephalale	4.870	6.375	6.870	8.258	9.664	9.281	10.143	11.923	11.383	11.180	11.043	11.151	11.294	11.408	11.523	11.639	11.755	11.873	11.993	12.113	12.235	12.357	12.481
63		Industrial Exxaro Lephalale	2.785	3.053	3.414	4.239	5.413	6.914	8.845	14.451	20.480	21.611	21.816	21.816	21.816	21.816	21.816	21.816	21.816	21.816	21.816	21.816	21.816	21.816	21.816
64		Industrial Eskom Lephalale	4.476	4.319	4.313	5.375	6.530	8.685	13.000	17.092	17.600	17.600	17.600	17.600	17.600	17.600	17.600	17.600	17.600	17.600	17.600	17.600	17.600	17.600	17.600
65	**Sub-total**		**12.131**	**13.747**	**14.597**	**17.872**	**21.606**	**24.880**	**31.988**	**43.466**	**49.463**	**50.391**	**50.459**	**50.567**	**50.710**	**50.824**	**50.939**	**51.055**	**51.171**	**51.289**	**51.409**	**51.529**	**51.651**	**51.773**	**51.897**
66	**Steenbokpan Demand Centre**	Municipal demand Steenbokpan					0.493	3.405	4.564	4.803	4.980	6.952	7.510	7.448	7.274	8.003	8.886	9.292	8.948	8.525	6.837	6.902	6.967	7.034	7.101
67		Industrial Exxaro Steenbokpan					0.045	0.137	0.262	1.290	2.055	2.867	3.322	4.200	4.890	5.430	5.460	5.845	6.120	6.120	6.120	6.120	6.120	6.120	6.120
68		Industrial Sasol																							
69		Industrial Eskom Steenbokpan					0.431	0.719	0.713	3.513	8.041	13.497	15.719	15.713	18.944	23.760	28.779	33.513	38.041	43.066	45.000	45.000	45.000	45.000	45.000
70		Industrial other mines				1.100	2.300	2.800	2.800	4.000	6.100	7.300	7.300	8.900	10.100	11.800	12.800	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000
71	**Sub-total**					**1.100**	**3.269**	**7.062**	**8.339**	**13.606**	**21.176**	**30.616**	**33.851**	**36.262**	**41.208**	**48.993**	**55.926**	**63.651**	**68.105**	**72.710**	**72.957**	**73.022**	**73.087**	**73.154**	**73.221**
72	**Total**		**12.131**	**13.747**	**14.597**	**18.972**	**24.875**	**31.941**	**40.328**	**57.072**	**70.639**	**81.007**	**84.310**	**86.829**	**91.918**	**99.818**	**106.865**	**114.705**	**119.276**	**124.000**	**124.365**	**124.551**	**124.738**	**124.927**	**125.118**
73																									
74	**Demand on Mokolo Dam**		**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
75			**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**
76	Interim (deliver period up to December 2014)		22.544	24.163	25.007	29.427	35.339	42.402	50.833	67.553															
77	Possible minimum demand (recovery periods)		26.970	28.475	28.970	30.358	31.764	31.381	27.985	26.723	26.183	25.980	25.843	25.951	26.094	26.208	26.323	26.439	26.555	26.673	26.793	26.913	27.035	27.157	27.281
82	Long term demand (up to December 2030)		22.531	24.147	24.997	28.272	31.814	32.381	33.243	35.023	34.483	34.280	34.143	34.251	34.394	34.508	34.623	34.739	34.855	34.973	35.093	35.213	35.333	35.457	35.581
87																									
88	**Pipelines from Mokolo Dam (Installed capacity)**		**13.500**	**13.500**	**13.500**	**22.385**	**35.828**	**40.328**	**40.328**	**40.328**	**40.328**	**40.328**	**40.328**	**40.328**	**40.328**	**40.328**	**40.328**	**40.328**	**40.328**	**40.328**	**40.328**	**40.328**	**40.328**	**40.328**	**40.328**
89	Existing Exxaro Pipeline		13.500	13.500	13.500	4.500																			
90	Interim Pipeline					17.885	26.828	26.828	26.828	26.828	26.828	26.828	26.828	26.828	26.828	26.828	26.828	26.828	26.828	26.828	26.828	26.828	26.828	26.828	26.828
91	Refurbished Exxaro Pipeline						9.000	13.500	13.500	13.500	13.500	13.500	13.500	13.500	13.500	13.500	13.500	13.500	13.500	13.500	13.500	13.500	13.500	13.500	13.500

Appendix B

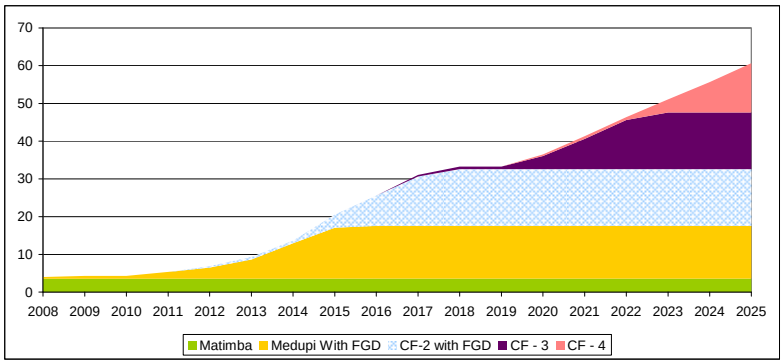
Eskom Water Use Projections (16 June 2008)

Water Requirements (million m^3/a)

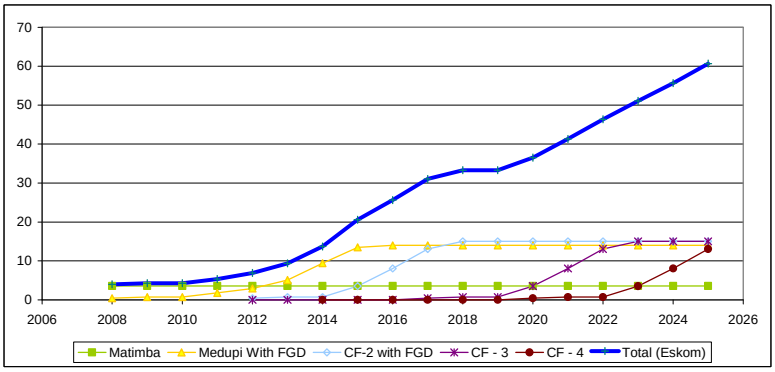
Summary

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Matimba	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
Medupi With FGD	0.4	0.7	0.7	1.8	2.9	5.1	9.4	13.5	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
CF-2 with FGD					0.4	0.7	0.7	3.5	8.0	13.1	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
CF - 3					0.0	0.0	0.0	0.0	0.0	0.4	0.7	0.7	3.5	8.0	13.1	15.0	15.0	15.0
CF - 4							0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.7	0.7	3.5	8.0	13.1
Total (Eskom)	4.0	4.3	4.3	5.4	6.9	9.4	13.7	20.6	25.6	31.1	33.3	33.3	36.5	41.3	46.4	51.1	55.6	60.7

(million m^3/a)



(million m^3/a)



Year	Month	Date	Medupi with FGD	**Comment (Medupi only)**	CF-2 (Coal 3) with FGD	Medupi Water Use		CF-2 (Coal 3)		(million m^3/
						per month	per year	per month	per year	
2008	7	Jul-08	0.89			0.074		0.000		
	8	Aug-08	0.89			0.074		0.000		
	9	Sep-08	0.89			0.074		0.000		
	10	Oct-08	0.83			0.069		0.000		
	11	Nov-08	0.83			0.069		0.000		
	12	Dec-08	0.83			0.069	0.43	0.000		
2009	1	Jan-09	0.78			0.065		0.000		
	2	Feb-09	0.78			0.065		0.000		
	3	Mar-09	0.78			0.065		0.000		
	4	Apr-09	0.78			0.065		0.000		
	5	May-09	0.78			0.065		0.000		
	6	Jun-09	0.78			0.065		0.000		
	7	Jul-09	0.67			0.056		0.000		
	8	Aug-09	0.67			0.056		0.000		
	9	Sep-09	0.67			0.056		0.000		
	10	Oct-09	0.65			0.054		0.000		
	11	Nov-09	0.65			0.054		0.000		
	12	Dec-09	0.65			0.054	0.719178	0.000		
2010	1	Jan-10	0.65			0.054		0.000		
	2	Feb-10	0.65			0.054		0.000		
	3	Mar-10	0.65			0.054		0.000		
	4	Apr-10	0.65			0.054		0.000		
	5	May-10	0.65			0.054		0.000		
	6	Jun-10	0.65			0.054		0.000		
	7	Jul-10	0.65			0.054		0.000		
	8	Aug-10	0.65			0.054		0.000		
	9	Sep-10	0.65			0.054		0.000		
	10	Oct-10	0.90			0.075		0.000		
	11	Nov-10	0.90			0.075		0.000		
	12	Dec-10	0.90			0.075	0.71347	0.000		
2011	1	Jan-11	0.90			0.075		0.000		

	2	Feb-11	0.90			0.075		0.000	
	3	Mar-11	0.90			0.075		0.000	
	4	Apr-11	1.74	U 6 Full Load		0.145		0.000	
	5	May-11	1.84			0.153		0.000	
	6	Jun-11	1.96			0.164		0.000	
	7	Jul-11	2.00			0.166		0.000	
	8	Aug-11	2.07			0.172		0.000	
	9	Sep-11	2.10	U6 Commercial		0.175		0.000	
	10	Oct-11	2.20	U5 Full Load		0.184		0.000	
	11	Nov-11	2.28			0.190		0.000	
	12	Dec-11	2.40			0.200	1.77	0.000	
2012	1	Jan-12	2.17			0.181		0.000	
	2	Feb-12	2.17			0.181		0.000	
	3	Mar-12	2.17	U5 Commercial		0.181		0.000	
	4	Apr-12	2.62	U4 Full Load		0.218		0.000	
	5	May-12	3.05			0.254		0.000	
	6	Jun-12	3.05			0.254		0.000	
	7	Jul-12	3.05		0.89	0.254		0.074	
	8	Aug-12	3.05		0.89	0.254		0.074	
	9	Sep-12	3.05	U4 Commercial	0.89	0.254		0.074	
	10	Oct-12	3.39	U3 Full Load	0.83	0.283		0.069	
	11	Nov-12	3.69		0.83	0.308		0.069	
	12	Dec-12	3.69		0.83	0.308	2.93	0.069	0.43
2013	1	Jan-13	4.40		0.78	0.366		0.065	
	2	Feb-13	4.40		0.78	0.366		0.065	
	3	Mar-13	4.40	U3 Commercial	0.78	0.366		0.065	
	4	Apr-13	4.40	U2 Full Load	0.78	0.366		0.065	
	5	May-13	4.40		0.78	0.366		0.065	
	6	Jun-13	4.40		0.78	0.366		0.065	
	7	Jul-13	4.64		0.67	0.387		0.056	
	8	Aug-13	4.64		0.67	0.387		0.056	
	9	Sep-13	6.17	U2 Commercial & 1st FGD In Service	0.67	0.514		0.056	
	10	Oct-13	6.40	U1 Full Load	0.65	0.533		0.054	
	11	Nov-13	6.40		0.65	0.533		0.054	
	12	Dec-13	6.40		0.65	0.533	5.08	0.054	0.72
2014	1	Jan-14	7.91	2nd FGD in Service	0.65	0.659		0.054	
	2	Feb-14	7.91		0.65	0.659		0.054	
	3	Mar-14	7.91	U 1 Commercial	0.65	0.659		0.054	
	4	Apr-14	7.91		0.65	0.659		0.054	
	5	May-14	9.33	3rd FGD in Service	0.65	0.777		0.054	
	6	Jun-14	9.33		0.65	0.777		0.054	
	7	Jul-14	9.33		0.65	0.777		0.054	
	8	Aug-14	9.33		0.65	0.777		0.054	
	9	Sep-14	10.96	4th FGD in Service	0.65	0.913		0.054	
	10	Oct-14	10.96		0.90	0.913		0.075	
	11	Nov-14	10.96		0.90	0.913		0.075	
	12	Dec-14	10.96		0.90	0.913	9.40	0.075	0.71
2015	1	Jan-15	12.48	5th FGD in Service	0.90	1.040		0.075	
	2	Feb-15	12.48		0.90	1.040		0.075	
	3	Mar-15	12.48		0.90	1.040		0.075	
	4	Apr-15	12.48		3.47	1.040		0.289	
	5	May-15	14.00	6th FGD in Service	3.58	1.167		0.298	
	6	Jun-15	14.00		3.71	1.167		0.309	
	7	Jul-15	14.00	Long Term Steady State	3.75	1.167		0.312	
	8	Aug-15	14.00		3.82	1.167		0.318	
	9	Sep-15	14.00		3.92	1.167		0.327	
	10	Oct-15	14.00		5.64	1.167		0.470	
	11	Nov-15	14.00		5.72	1.167		0.477	
	12	Dec-15	14.00		5.86	1.167	13.49	0.488	3.51
2016	13	Jan-16	14.00		5.60	1.167		0.467	
	14	Feb-16	14.00		5.60	1.167		0.467	
	15	Mar-16	14.00		5.60	1.167		0.467	
	16	Apr-16	14.00		7.70	1.167		0.641	
	17	May-16	14.00		8.17	1.167		0.681	

	18	Jun-16	14.00		8.17	1.167		0.681	
	19	Jul-16	14.00		8.17	1.167		0.681	
	20	Aug-16	14.00		8.17	1.167		0.681	
	21	Sep-16	14.00		8.17	1.167		0.681	
	22	Oct-16	14.00		10.16	1.167		0.847	
	23	Nov-16	14.00		10.49	1.167		0.874	
	24	Dec-16	14.00		10.49	1.167	14.00	0.874	8.04
2017	25	Jan-17	14.00		11.26	1.167		0.938	
	26	Feb-17	14.00		11.26	1.167		0.938	
	27	Mar-17	14.00		11.26	1.167		0.938	
	28	Apr-17	14.00		12.87	1.167		1.072	
	29	May-17	14.00		12.87	1.167		1.072	
	30	Jun-17	14.00		12.87	1.167		1.072	
	31	Jul-17	14.00		13.14	1.167		1.095	
	32	Aug-17	14.00		13.14	1.167		1.095	
	33	Sep-17	14.00		13.14	1.167		1.095	
	34	Oct-17	14.00		15.00	1.167		1.250	
	35	Nov-17	14.00		15.00	1.167		1.250	
	36	Dec-17	14.00		15.00	1.167	14.00	1.250	13.07
2018	37	Jan-18	14.00		15.00	1.167		1.250	
	38	Feb-18	14.00		15.00	1.167		1.250	
	39	Mar-18	14.00		15.00	1.167		1.250	
	40	Apr-18	14.00		15.00	1.167		1.250	
	41	May-18	14.00		15.00	1.167		1.250	
	42	Jun-18	14.00		15.00	1.167		1.250	
	43	Jul-18	14.00		15.00	1.167		1.250	
	44	Aug-18	14.00		15.00	1.167		1.250	
	45	Sep-18	14.00		15.00	1.167		1.250	
	46	Oct-18	14.00		15.00	1.167		1.250	
	47	Nov-18	14.00		15.00	1.167		1.250	
	48	Dec-18	14.00		15.00	1.167	14.00	1.250	15.00
2019	49	Jan-19	14.00		15.00	1.167		1.250	
	50	Feb-19	14.00		15.00	1.167		1.250	
	51	Mar-19	14.00		15.00	1.167		1.250	
	52	Apr-19	14.00		15.00	1.167		1.250	
	53	May-19	14.00		15.00	1.167		1.250	
	54	Jun-19	14.00		15.00	1.167		1.250	
	55	Jul-19	14.00		15.00	1.167		1.250	
	56	Aug-19	14.00		15.00	1.167		1.250	
	57	Sep-19	14.00		15.00	1.167		1.250	
	58	Oct-19	14.00		15.00	1.167		1.250	
	59	Nov-19	14.00		15.00	1.167		1.250	
	60	Dec-19	14.00		15.00	1.167	14.00	1.250	15.00

Appendix C

Sasol Water Use Projections (26 June 2008)

Sasol Project Mafutha water requirement projections

26-Jun-08

Rev.3

Water requirement in mil.m3/a (average requirement per quarter)

Project element	**Mafutha 1 Construction Phase**												**Mafutha 1 Commissioning Phase**							
	Jan-11	**Apr-11**	**Jul-11**	**Oct-11**	**Jan-12**	**Apr-12**	**Jul-12**	**Oct-12**	**Jan-13**	**Apr-13**	**Jul-13**	**Oct-13**	**Jan-14**	**Apr-14**	**Jul-14**	**Oct-14**	**Jan-15**	**Apr-15**	**Jul-15**	**Oct-15**
Mafutha 1 CTL facility	0.25	0.25	0.5	0.5	1	1	1	1	1	1.5	1.5	2	2	2	5	5	8	8	10	10
Mafutha 1 Mine	0.25	0.25	0.5	0.5	0.5	0.5	1	1	1	1	1	1	1	2	3	3	3	3	3	3
Mafutha 1 Town	0.5	0.5	1	1	2	2	2.5	2.5	3	3	4	4	6	6	6	6	8	8	8	8
Mafutha 2 CTL facility																				
Mafutha 2 Mine																				
Mafutha 2 Town																				
Total gross water requirement	**1**	**1**	**2**	**2**	**3.5**	**3.5**	**4.5**	**4.5**	**5**	**5.5**	**6.5**	**7**	**9**	**10**	**14**	**14**	**19**	**19**	**21**	**21**
Domestic effluent re-use	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*4*	*4*	*4*	*4*
Total nett water requirement	**1**	**1**	**2**	**2**	**3.5**	**3.5**	**4.5**	**4.5**	**5**	**5.5**	**6.5**	**7**	**9**	**10**	**14**	**14**	**15**	**15**	**17**	**17**

Assumptions

1. Potable water requirement for CTL & Mine included in Town requirement (1 mil.m3/a for CTL & 1 mil.m3/a for Mine)
2. Construction of Town & Mine assumed to be completed before CTL
3. Two production phases (50% capacity each) assumed for CTL Mafutha 1
4. Completion of domestic effluent treatment plant assumed before final completion of CTL (1 year), enabling effluent re-use
5. 50% of potable water assumed to be available as domestic effluent for re-use
6. CTL water requirement based on worst case model results from FW, 18 May 08
7. Town water requirement based on projections for 60 000 people for each phase + CTL & Mine potable requirement
8. Mine in 50% production to support commissioning and supply power block, 100% at Mafutha 1, phase 2
9. Early construction peak at Jan 12
10. Town is 80% occupied and sewerage treatment is running early 2015

				Mafutha 2 Construction Phase													**Mafutha 2 Commissioning Phase**																					
				Mafutha 1 Operational Phase																																	
Jan-16	**Apr-16**	**Jul-16**	**Oct-16**	**Jan-17**	**Apr-17**	**Jul-17**	**Oct-17**	**Jan-18**	**Apr-18**	**Jul-18**	**Oct-18**	**Jan-19**	**Apr-19**	**Jul-19**	**Oct-19**	**Jan-20**	**Apr-20**	**Jul-20**	**Oct-20**	**Jan-21**	**Apr-21**	**Jul-21**	**Oct-21**	**Jan-22**	**Apr-22**	**Jul-22**	**Oct-22**	**Jan-23**	**Apr-23**	**Jul-23**	**Oct-23**	**Jan-24**	**Apr-24**	**Jul-24**	**Oct-24**	**Jan-25**	**Apr-25**	**Jul-25**	**Oct-25**
15	30	35	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37
4	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
				0.25	0.25	0.5	0.5	0.5	0.5	0.5	0.5	1	1	1	1	2	2	5	5	8	8	10	10	15	30	35	37	37	37	37	37	37	37	37	37	37	37	37	37
				0.25	0.25	0.5	0.5	0.5	0.5	1	1	1	1	1	1	1	2	3	3	3	3	3	3	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5
				0.5	0.5	1	1	2	2	2.5	2.5	3	3	4	4	6	6	6	6	8	8	8	8	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
29	**44**	**49**	**52**	**53**	**53**	**54**	**54**	**55**	**55**	**56**	**56**	**57**	**57**	**58**	**58**	**61**	**62**	**66**	**66**	**71**	**71**	**73**	**73**	**81**	**96**	**102**	**104**	**104**	**104**	**104**	**104**	**104**	**104**	**104**	**104**	**104**	**104**	**104**	**104**
5	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*9*	*9*	*9*	*9*	*10*	*10*	*10*	*10*	*10*	*10*	*10*	*10*	*10*	*10*	*10*	*10*	*10*	*10*	*10*	*10*
24	**39**	**44**	**47**	**48**	**48**	**49**	**49**	**50**	**50**	**51**	**51**	**52**	**52**	**53**	**53**	**56**	**57**	**61**	**61**	**62**	**62**	**64**	**64**	**71**	**86**	**92**	**94**	**94**	**94**	**94**	**94**	**94**	**94**	**94**	**94**	**94**	**94**	**94**	**94**

Appendix D

Exxaro Water Use Projections (24 July 2008)

Water Requirements (million m³/month)

2008												
Month	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08
Exsisting mine	195	195	195	195	200	210	210	220	220	220	220	220
Project A					3	13	15	18	20	22	24	26
Project B												
Project C												
Project D												
Project E												
Project F												
Project G												
Project H												
Project I												
Project J												
Project K												
High Case (per month)	195	195	195	195	203	223	225	238	240	242	244	246
Low Case (per month)	195	195	195	195	195	195	195	195	195	195	203	223
Base Case (per month)	195	195	195	195	203	223	225	238	240	242	244	246
Base Case (per annum)	2.340	2.340	2.340	2.340	2.436	2.676	2.700	2.856	2.880	2.904	2.928	2.952

2009												
Month	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09
Exsisting mine	220	220	220	220	220	220	220	220	220	220	220	220
Project A	26	26	26	26	26	26	26	26	26	26	26	26
Project B	2	4	4	5	5	6	6	7	7	8	8	9
Project C							2	2	2	3	3	3
Project D							2	2	2	3	3	3
Project E												
Project F												
Project G												
Project H												
Project I												
Project J												
Project K												
High Case (per month)	248	250	250	251	251	252	259	260	260	265	265	266
Low Case (per month)	225	238	240	242	244	246	248	250	250	251	251	252
Base Case (per month)	248	250	250	251	251	252	256	257	257	260	260	261
Base Case (per annum)	2.976	3.000	3.000	3.012	3.012	3.024	3.072	3.084	3.084	3.120	3.120	3.132

2010												
Month	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10
Exsisting mine	220	220	220	220	220	220	220	220	220	220	220	220
Project A	26	26	26	26	26	26	26	28	28	30	30	30
Project B	9	10	12	14	16	18	20	21	22	23	24	25
Project C	4	4	5	6	7	8	9	10	10	12	12	12
Project D	4	4	5	6	7	8	9	10	10	11	12	12
Project E												
Project F						5	5	5	5	5	5	5
Project G												
Project H												
Project I												
Project J												
Project K												
High Case (per month)	269	270	276	282	287	298	303	310	311	319	322	323
Low Case (per month)	254	255	255	257	257	258	259	260	263	266	269	275
Base Case (per month)	263	264	268	272	276	285	289	294	295	301	303	304
Base Case (per annum)	3.156	3.168	3.216	3.264	3.312	3.420	3.468	3.528	3.540	3.612	3.636	3.648

2011												
Month	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11
Exsisting mine	220	220	220	220	220	220	220	220	220	220	220	220
Project A	30	30	30	30	30	30	30	30	30	30	30	30
Project B	26	28	30	32	34	36	38	40	43	45	48	50
Project C	15	15	20	25	30	40	40	45	45	45	50	50
Project D	15	17	18	19	20	21	22	23	24	25	26	26
Project E						5	5	5	5	5	5	5
Project F	5	5	5	5	5	5	5	5	5	5	5	5
Project G						2	2	2	3	3	3	3
Project H												
Project I												
Project J												
Project K												
High Case (per month)	335	341	353	366	379	408	412	424	430	434	448	450
Low Case (per month)	278	282	283	287	289	290	294	297	302	307	312	324
Base Case (per month)	311	315	323	331	339	359	362	370	375	378	387	389
Base Case (per annum)	3.732	3.780	3.876	3.972	4.068	4.308	4.344	4.440	4.500	4.536	4.644	4.668

2012												
Month	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12
Exsisting mine	220	220	220	220	220	220	220	220	225	225	225	225
Project A	30	30	30	30	30	30	30	35	40	40	42	45
Project B	55	60	65	70	72	75	80	85	90	95	98	100
Project C	50	50	55	55	55	60	66	66	66	67	68	70
Project D	27	27	28	28	28	28	28	30	30	30	30	32
Project E	5	5	5	5	5	5	5	8	9	10	10	10
Project F	5	5	5	5	5	5	5	8	9	10	10	10
Project G	4	4	5	5	5	5	10	15	20	25	30	30
Project H												
Project I												
Project J							3	5	8	9	10	10
Project K												
High Case (per month)	458	463	479	484	486	498	522	549	574	589	601	614
Low Case (per month)	327	332	336	339	345	347	353	358	367	372	374	380
Base Case (per month)	396	401	413	418	420	428	447	472	497	511	523	532
Base Case (per annum)	4.752	4.812	4.956	5.016	5.040	5.136	5.364	5.664	5.964	6.132	6.276	6.384

2013											
Jan-13	Feb-13	Mar-13	Apr-13	May-13	Jun-13	Jul-13	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13
225	225	225	225	225	225	225	225	225	225	225	225
48	50	50	52	52	52	52	52	52	52	52	52
105	110	112	115	118	120	125	130	135	138	140	145
72	73	74	74	75	75	76	77	78	79	80	80
32	32	32	33	33	33	34	35	35	35	35	36
10	10	13	14	15	17	18	20	20	20	20	20
12	13	14	15	15	17	18	20	20	20	20	20
30	30	30	30	30	30	30	30	30	30	30	30
						3	3	5	5	5	5
10	10	10	10	10	12	12	12	12	13	13	13
627	637	645	654	659	667	681	694	702	708	712	719
396	417	442	454	466	473	483	491	496	502	507	513
544	553	560	568	573	581	593	604	612	617	620	626
6.528	6.636	6.720	6.816	6.876	6.972	7.116	7.248	7.344	7.404	7.440	7.512

2014											
Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14
230	230	230	230	230	230	230	230	235	240	250	255
52	52	52	52	52	52	52	52	52	52	52	52
188	188	188	188	188	188	188	188	188	188	188	188
81	81	82	82	83	83	84	85	85	86	86	87
36	36	36	37	37	37	37	37	38	38	38	38
20	20	20	20	20	20	20	25	35	45	55	65
20	20	20	20	20	40	60	80	100	120	140	160
30	30	30	30	30	30	30	30	30	30	30	30
5	5	5	5	7	7	10	15	18	20	22	23
						3	3	5	5	5	7
15	15	18	18	18	18	20	20	20	20	30	50
771	771	775	777	781	801	832	864	906	945	997	1058
520	528	534	538	541	546	597	597	600	601	601	611
677	677	681	682	685	705	734	765	806	844	896	955
8.124	8.124	8.172	8.184	8.220	8.460	8.808	9.180	9.672	10.128	10.752	11.460

2015											
Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15
260	265	270	275	280	285	290	295	300	300	300	300
52	52	52	52	52	52	52	52	52	52	52	52
188	188	188	188	188	188	188	188	188	188	188	188
88	88	89	89	90	90	91	91	92	92	93	93
38	38	38	38	39	39	39	40	40	40	40	41
75	85	95	105	115	125	135	145	155	165	175	185
190	220	250	280	310	340	370	400	430	460	490	520
30	30	30	30	30	30	30	30	30	30	30	30
25	26	27	27	27	27	27	27	27	27	27	27
7	7	7	7	7	7	8	8	8	8	10	10
80	85	90	95	100	105	110	115	120	125	130	135
1137	1188	1240	1290	1344	1394	1447	1499	1551	1596	1645	1692
624	638	660	682	719	761	818	850	882	914	946	978
1033	1084	1136	1186	1238	1288	1340	1391	1442	1487	1535	1581
12.396	13.008	13.632	14.232	14.856	15.456	16.080	16.692	17.304	17.844	18.420	18.972

2016											
Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16
300	300	300	300	300	300	300	300	300	300	300	300
52	52	52	52	52	52	52	52	52	52	52	52
188	188	188	188	188	188	188	188	188	188	188	188
95	95	95	96	96	97	97	98	98	99	99	100
41	41	42	42	42	42	43	43	43	44	44	44
195	205	215	225	235	245	245	245	245	245	245	245
550	580	610	640	670	700	720	720	720	720	720	720
30	30	30	30	30	30	30	30	30	30	30	30
27	27	27	27	27	27	27	27	27	27	27	27
30	50	60	70	70	70	70	70	70	70	70	80
140	145	150	155	160	165	170	175	180	185	190	195
						3	5	8	9	10	10
1769	1842	1903	1963	2008	2055	2086	2096	2105	2115	2121	2142
1010	1042	1074	1101	1128	1155	1183	1210	1237	1264	1291	1318
1648	1713	1769	1825	1870	1916	1945	1953	1961	1969	1975	1991
19.776	20.556	21.228	21.900	22.440	22.992	23.340	23.436	23.532	23.628	23.700	23.892

2017											
Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17
300	300	300	300	300	300	300	300	300	300	300	300
52	52	52	52	52	52	52	52	52	52	52	52
188	188	188	188	188	188	188	188	188	188	188	188
100	101	101	102	102	103	103	104	104	105	106	107
44	44	45	45	45	45	45	47	47	47	47	48
245	245	245	245	245	245	245	245	245	245	245	245
720	720	720	720	720	720	720	720	720	720	720	720
30	30	30	30	30	30	30	30	30	30	30	30
27	27	27	27	27	27	27	27	27	27	27	27
80	80	80	80	80	80	100	100	100	100	100	100
200	205	210	215	220	225	230	235	240	245	250	255
10	10	10	10	10	12	12	12	12	13	13	13
2147	2154	2161	2168	2173	2182	2215	2226	2231	2239	2246	2254
1333	1339	1344	1350	1355	1360	1365	1371	1376	1382	1387	1392
1996	2002	2008	2014	2019	2027	2052	2060	2065	2072	2078	2085
23.952	24.024	24.096	24.168	24.228	24.324	24.624	24.720	24.780	24.864	24.936	25.020

2018											
Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18
300	300	300	300	300	300	300	300	300	300	300	300
52	52	52	52	52	52	52	52	52	52	52	52
188	188	188	188	188	188	188	188	188	188	188	188
108	108	108	108	108	108	108	108	108	108	108	108
48	48	48	48	48	48	48	48	48	48	48	48
245	245	245	245	245	245	245	245	245	245	245	245
720	720	720	720	720	720	720	720	720	720	720	720
30	30	30	30	30	30	30	30	30	30	30	30
27	27	27	27	27	27	27	27	27	27	27	27
100	100	100	100	100	100	100	100	100	100	100	100
255	255	255	255	255	255	255	255	255	255	255	255
15	15	18	18	18	18	20	20	20	20	30	50
2259	2259	2263	2263	2263	2263	2266	2266	2266	2266	2280	2308
1397	1404	1409	1414	1420	1426	1426	1426	1426	1426	1426	1426
2088	2088	2091	2091	2091	2091	2093	2093	2093	2093	2103	2123
25.056	25.056	25.092	25.092	25.092	25.092	25.116	25.116	25.116	25.116	25.236	25.476

2019											
Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19
300	300	300	300	300	300	300	300	300	300	300	300
52	52	52	52	52	52	52	52	52	52	52	52
188	188	188	188	188	188	188	188	188	188	188	188
108	108	108	108	108	108	108	108	108	108	108	108
48	48	48	48	48	48	48	48	48	48	48	48
245	245	245	245	245	245	245	245	245	245	245	245
720	720	720	720	720	720	720	720	720	720	720	720
30	30	30	30	30	30	30	30	30	30	30	30
27	27	27	27	27	27	27	27	27	27	27	27
100	100	100	100	100	100	100	100	100	100	100	100
255	255	255	255	255	255	255	255	255	255	255	255
80	80	80	80	85	90	95	100	105	110	115	120
2350	2350	2350	2350	2357	2364	2371	2378	2385	2392	2399	2406
1426	1426	1426	1426	1426	1426	1426	1426	1426	1426	1426	1426
2153	2153	2153	2153	2158	2163	2168	2173	2178	2183	2188	2193
25.836	25.836	25.836	25.836	25.896	25.956	26.016	26.076	26.136	26.196	26.256	26.316

2020											
Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20
300	300	300	300	300	300	300	300	300	300	300	300
52	52	52	52	52	52	52	52	52	52	52	52
188	188	188	188	188	188	188	188	188	188	188	188
108	108	108	108	108	108	108	108	108	108	108	108
48	48	48	48	48	48	48	48	48	48	48	48
245	245	245	245	245	245	245	245	245	245	245	245
720	720	720	720	720	720	720	720	720	720	720	720
30	30	30	30	30	30	30	30	30	30	30	30
27	27	27	27	27	27	27	27	27	27	27	27
100	100	100	100	100	100	100	100	100	100	100	100
255	255	255	255	255	255	255	255	255	255	255	255
125	130	135	140	145	150	155	160	165	170	175	180
2413	2420	2427	2434	2441	2448	2455	2462	2469	2476	2483	2490
1426	1426	1426	1426	1426	1426	1426	1426	1426	1426	1426	1426
2198	2203	2208	2213	2218	2223	2228	2233	2238	2243	2248	2253
26.376	26.436	26.496	26.556	26.616	26.676	26.736	26.796	26.856	26.916	26.976	27.036

2021											
Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21
300	300	300	300	300	300	300	300	300	300	300	300
52	52	52	52	52	52	52	52	52	52	52	52
188	188	188	188	188	188	188	188	188	188	188	188
108	108	108	108	108	108	108	108	108	108	108	108
48	48	48	48	48	48	48	48	48	48	48	48
245	245	245	245	245	245	245	245	245	245	245	245
720	720	720	720	720	720	720	720	720	720	720	720
30	30	30	30	30	30	30	30	30	30	30	30
27	27	27	27	27	27	27	27	27	27	27	27
100	100	100	100	100	100	100	100	100	100	100	100
255	255	255	255	255	255	255	255	255	255	255	255
185	190	195	200	200	200	200	200	200	200	200	200
2497	2504	2511	2518	2518	2518	2518	2518	2518	2518	2518	2518
1426	1426	1426	1426	1426	1426	1426	1426	1426	1426	1426	1426
2258	2263	2268	2273	2273	2273	2273	2273	2273	2273	2273	2273
27.096	27.156	27.216	27.276	27.276	27.276	27.276	27.276	27.276	27.276	27.276	27.276

2022											
Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22
300	300	300	300	300	300	300	300	300	300	300	300
52	52	52	52	52	52	52	52	52	52	52	52
188	188	188	188	188	188	188	188	188	188	188	188
108	108	108	108	108	108	108	108	108	108	108	108
48	48	48	48	48	48	48	48	48	48	48	48
245	245	245	245	245	245	245	245	245	245	245	245
720	720	720	720	720	720	720	720	720	720	720	720
30	30	30	30	30	30	30	30	30	30	30	30
27	27	27	27	27	27	27	27	27	27	27	27
100	100	100	100	100	100	100	100	100	100	100	100
255	255	255	255	255	255	255	255	255	255	255	255
200	200	200	200	200	200	200	200	200	200	200	200
2518	2518	2518	2518	2518	2518	2518	2518	2518	2518	2518	2518
1426	1426	1426	1426	1426	1426	1426	1426	1426	1426	1426	1426
2273	2273	2273	2273	2273	2273	2273	2273	2273	2273	2273	2273
27.276	27.276	27.276	27.276	27.276	27.276	27.276	27.276	27.276	27.276	27.276	27.276

2023											
Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23
300	300	300	300	300	300	300	300	300	300	300	300
52	52	52	52	52	52	52	52	52	52	52	52
188	188	188	188	188	188	188	188	188	188	188	188
108	108	108	108	108	108	108	108	108	108	108	108
48	48	48	48	48	48	48	48	48	48	48	48
245	245	245	245	245	245	245	245	245	245	245	245
720	720	720	720	720	720	720	720	720	720	720	720
30	30	30	30	30	30	30	30	30	30	30	30
27	27	27	27	27	27	27	27	27	27	27	27
100	100	100	100	100	100	100	100	100	100	100	100
255	255	255	255	255	255	255	255	255	255	255	255
205	210	215	220	225	230	235	240	245	250	255	255
2525	2532	2539	2546	2553	2560	2567	2574	2581	2588	2595	2595
1426	1426	1426	1426	1426	1426	1426	1426	1426	1426	1426	1426
2278	2283	2288	2293	2298	2303	2308	2313	2318	2323	2328	2328
27.336	27.396	27.456	27.516	27.576	27.636	27.696	27.756	27.816	27.876	27.936	27.936

2024											
Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24	Jul-24	Aug-24	Sep-24	Oct-24	Nov-24	Dec-24
300	300	300	300	300	300	300	300	300	300	300	300
52	52	52	52	52	52	52	52	52	52	52	52
188	188	188	188	188	188	188	188	188	188	188	188
108	108	108	108	108	108	108	108	108	108	108	108
48	48	48	48	48	48	48	48	48	48	48	48
245	245	245	245	245	245	245	245	245	245	245	245
720	720	720	720	720	720	720	720	720	720	720	720
30	30	30	30	30	30	30	30	30	30	30	30
27	27	27	27	27	27	27	27	27	27	27	27
100	100	100	100	100	100	100	100	100	100	100	100
255	255	255	255	255	255	255	255	255	255	255	255
255	255	255	255	255	255	255	255	255	255	255	255
2595	2595	2595	2595	2595	2595	2595	2595	2595	2595	2595	2595
1426	1426	1426	1426	1426	1426	1426	1426	1426	1426	1426	1426
2328	2328	2328	2328	2328	2328	2328	2328	2328	2328	2328	2328
27.936	27.936	27.936	27.936	27.936	27.936	27.936	27.936	27.936	27.936	27.936	27.936

2025												
Jan-25	Feb-25	Mar-25	Apr-25	May-25	Jun-25	Jul-25	Aug-25	Sep-25	Oct-25	Nov-25	Dec-25	2025 m³ /annum
300	300	300	300	300	300	300	300	300	300	300	300	3600
52	52	52	52	52	52	52	52	52	52	52	52	624
188	188	188	188	188	188	188	188	188	188	188	188	2256
108	108	108	108	108	108	108	108	108	108	108	108	1296
48	48	48	48	48	48	48	48	48	48	48	48	576
245	245	245	245	245	245	245	245	245	245	245	245	2940
720	720	720	720	720	720	720	720	720	720	720	720	8640
30	30	30	30	30	30	30	30	30	30	30	30	360
27	27	27	27	27	27	27	27	27	27	27	27	324
100	100	100	100	100	100	100	100	100	100	100	100	1200
255	255	255	255	255	255	255	255	255	255	255	255	3060
255	255	255	255	255	255	255	255	255	255	255	255	3060
2595	2595	2595	2595	2595	2595	2595	2595	2595	2595	2595	2595	31138
1426	1426	1426	1426	1426	1426	1426	1426	1426	1426	1426	1426	17116
2328	2328	2328	2328	2328	2328	2328	2328	2328	2328	2328	2328	
27.936	27.936	27.936	27.936	27.936	27.936	27.936	27.936	27.936	27.936	27.936	27.936	

REPORT DETAILS PAGE

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