water affairs
Department:
Water Affairs
REPUBLIC OF SOUTH AFRICA

# Water Reconciliation Strategy for the Algoa Water Supply Area

## Algoa Reconciliation Strategy


# Status Report 2

September 2012

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# 1. INTRODUCTION

The Algoa Reconciliation Strategy Study was undertaken by the Department of Water Affairs (DWA), in cooperation with the NMBM and other stakeholders in order to secure a sustainable future water supply for NMBM and the other towns served by the Algoa Water Supply System (Algoa WSS). The purpose of the Reconciliation Strategy is to determine the current water balance situation and to develop various possible future water balance scenarios for a 25 year planning horizon. It further aims to describe the proposed strategy, and the associated actions, responsibilities and timing of such actions that are urgently needed to reconcile available resources and requirements, to enable additional interventions to be timeously implemented so as to prevent the risk of a water shortage becoming unacceptable. The Strategy offers a system for the continuous monitoring and updating of the Algoa Reconciliation Strategy into the future. The figure in Appendix A illustrates the extent of the Algoa WSS.

The Strategy was initially completed in early 2010 and was subsequently updated in April 2011 due to emergency interventions planned as a result of the drought, as well as revised Coega IDZ requirements.

The Strategy has since been reviewed and updated by the Algoa Strategy Steering Committee. A Status Report (Status Report 1) was produced by the Strategy Steering Committee in September 2011 which gave a brief overview of the 2010 Strategy Document and updates to the Strategy.

This Status Report (Status Report 2) provides an overview of the September 2012 update to the Strategy.

# 2. PROGRESS WITH IMPLEMENTATION OF THE STRATEGY

## 2.1. Strategy Steering Committee

One of the recommendations of the Reconciliation Strategy Study was that a Strategy Steering Committee (SSC) be formed with a clearly defined mandate and scope of work.

The objectives of the SSC are:

- To ensure and monitor implementation of the recommendations of the Algoa Reconciliation Strategy,
- To ensure that the necessary studies by the responsible institutions identified in the Strategy, are started timeously to ensure continued reconciliation of water supply and requirements,
- To update the Strategy when necessary to ensure that it remains relevant, and
- To ensure that the Strategy, its recommendations and progress with its implementation are appropriately communicated to all stakeholders.

The Algoa Reconciliation SSC has met twice since the Strategy was completed. The Committee is functioning as it was intended and the stakeholders and water users of the Algoa WSS actively partake and provide feedback in the meetings. The list of SSC members is contained in Appendix B.

An Administrative and Technical Support Group (Support Group) was formed to support the SSC. The Support Group consists of representatives from the DWA National Office, DWA Eastern Cape Regional Office, NMBM, Eastern Cape Provincial Government, agriculture and other key organisations. The Support Group meets between the SSC meetings to ensure that the recommendations of the strategy and committee are implemented.

### 2.2. Progress with Implementation of WC/WDM

WC/WDM measures were identified as a key action to reduce water use. The objective of the NMBM WC/WDM Programme is to reduce water use by a minimum of 37.5 Ml/day in 5 years by undertaking repairs to water leaks on municipal water mains and leaks on properties. This was one of the recommendations of the 2009 Algoa Reconciliation Study. Progress is as follows:

Assistance to the Poor (ATTP) **leak repairs** (repairs to private plumbing of poor households): By March 2011, 2803 ATTPs used an average of more than 30 kl/month. A total of 27512 repairs were carried out between March 2011 and August 2012 on ATTP internal plumbing. This program contributes to the reduction of water losses and offers work for the ward-based contractors.

**Schools leak repairs**: There are 384 schools in NMBM of which 210 have been inspected, and a priority school report and recommendations were submitted to NMBM and the Department of Education (DoE). A Memorandum of Agreement was signed by DoE and NMBM to appoint an implementing agent and to repair leaks at schools. Emergency leak repairs were undertaken by NMBM at 10 schools. A budget for school repairs was being finalised by NMBM and DoE. DoE transferred R2.5 million to NMBM in July 2012 to commence with the project. Repairs started during August 2012 to 10 schools in Port Elizabeth and 10 schools in Uitenhage. DWA will provide an additional R2.5 million towards this project.

**Zone Metering**: 203 Zones (districts) were identified, and designs for 31 new installations have been completed. A total of 55 zone meters were replaced.

**Remote Sensing**: A GSM link that sends and receives SMS messages was installed. This link transfers data to the WC/WDM system, as well as trial remote sensing installations on zone meters. A report will be submitted on the trials of the different GSM loggers used.

**Pressure management**: Five trial installations were identified and investigated. The installations at Blikkiesdorp, Bluewater Bay, and Scheepershoogte have been completed. Investigations into Aspen Heights, Wells Estate, Walmer and Walmer Township are at an advanced stage. Installations will be rolled out. A PRV field survey report was completed, and PRVs for repair / replacement were identified. Smart pilot control was being investigated for current installations. The installation at Bluewater Bay resulted in a 79% reduction in the minimum night flows for the suburb. The minimum night flows dropped from 72 kl/h to 12 kl/h.

**Awareness campaign**: Advertising recommenced in newspapers and radio in May 2011, but was halted after all the dams filled up in July 2011.

**Meter replacement programme:** The Water Installation Workshop, with three contractors, replaced 16 200 meters during 2011/12. 6 730 new connections were installed of which 6 430 have flow limiters. The municipality intends to activate the flow limiters as part of reducing non-revenue water and improving payment levels, once a community liaison process has been completed.

**Leak detection and repairs**: The implementation team consists of a consultant and two contractors, for leak detection and repair respectively. The three-year contract for the leakage repair ends in September and a new tender closed on 16 August 2012. The leakage detection contract has been on-going. By 1 August 2012 99 215 connections had been audited, including the top 100 industrial, top 100 commercial and top 100 institutional consumers. Individual results of large consumers have been staggering and revenue has improved. The NMBM has received R7.5 million from the EPWP (Extensive Public Works Program) of which R2 million will be used for leak detection.

**Non-Revenue Water Support structures**: A three-tier approach is used for monitoring, namely project meetings for awarded contracts, the Non-Revenue Water technical team (bi-monthly progress meetings) and Finance and Water Service meetings.

**Promoting the use of rainwater tanks:** A municipal bylaw was promulgated to promote the use of rainwater tanks. The WC/WDM public awareness campaign recommended increased use of rainwater tanks.

**Cost benefit:** The real water losses dropped from 29,3% in 2009/10 to 26,2% in 2010/11 which amounts to a saving of 12,5Ml/day or R27 Million over the 12 months. The same comparison between 2012 and 2012 showed a further decrease in real losses of 10,1 Ml/day. Results can now indicate that the savings in a year match the expenditure required to implement WC/WDM interventions, as well as push out the need to implement new schemes.

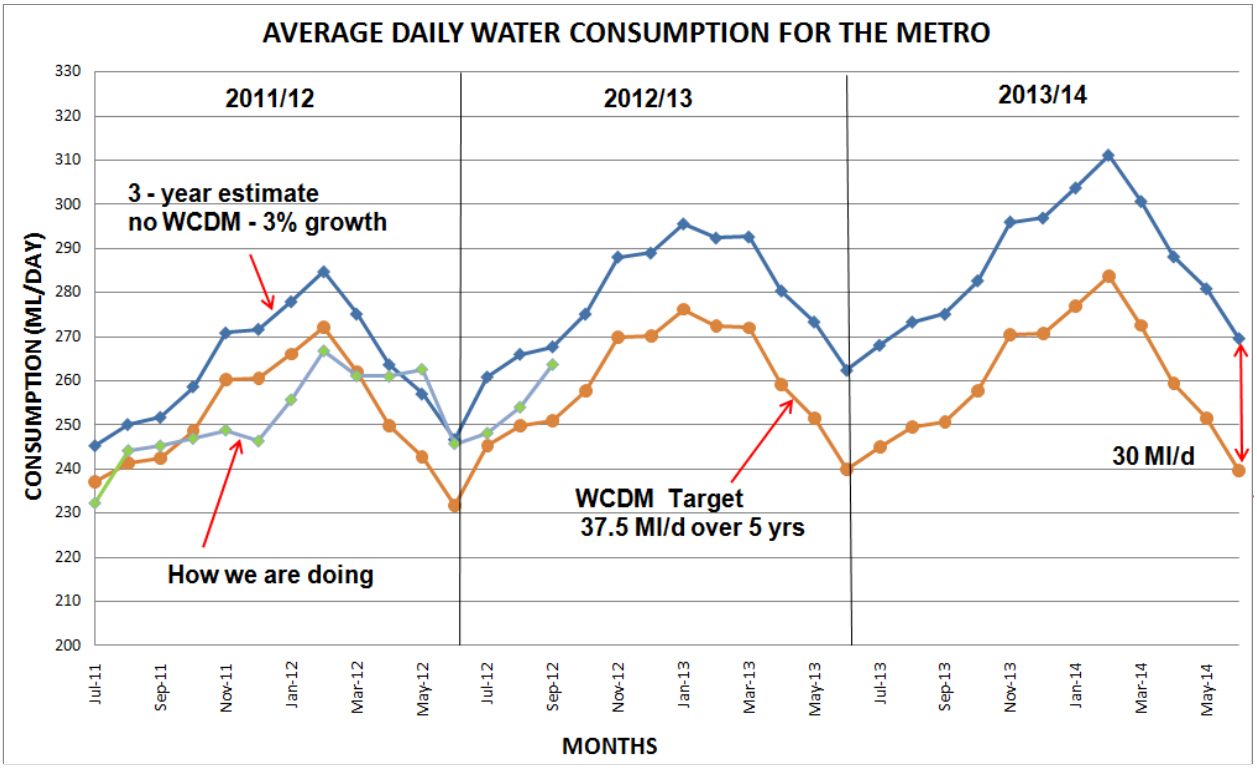



***Figure 2.1: Average NMBM daily use***

The situation may however be better than indicated in the **Figure 1**, due to uncertainty created by changes in the NMBM consumer database.

### 2.3. Progress with other Studies and Activities

In the recommendations of the Reconciliation Strategy Study, a number of interventions were identified as possible future water augmentation schemes that could be implemented after the Nooitgedagt Low-level Scheme. In order to ensure that these interventions are available for implementation when required, DWA and NMBM were assigned the responsibility of initiating feasibility and/or pre-feasibility level studies into these interventions, or to initiate other supporting activities.

This section of the progress report details the progress the DWA and the NMBM have made in the implementation of the supply-side interventions.

### 2.3.1 DWA Studies

**Verification and Validation of Water Use Study of a part of the Kromme and Kouga catchment areas**

Following an invitation for tenders, three tenders were received for this study. Only two were responsive, but the experience and legal background of the responsive tenderers were doubtful. It came to light that the tender advert didn't clearly state this project to be a study and therefore many companies/consultants didn't tender. It was proposed that the tender be re-advertised as the study is very important and should get started as early as possible. The results will be used as input in the update of the water availability assessment study that is urgently required.

**Kouga Dam raising in light of DWA dam safety work**

DWA's Directorate Dam Safety has started an investigation into the rehabilitation and stabilisation of the Kouga Dam wall. If the study points out that significant construction would be needed for the rehabilitation, the dam wall could potentially also be raised at the same time. This will be determined by the investigations and modelling still to be undertaken.

DWA Directorate Dam Safety planned construction activity to start in 2012. It came to light that an EIA is needed before construction can begin, and the EIA is now underway. The planned date for start of construction of the road to the dam is April 2013 with the planned dam safety construction work on the Kouga Dam wall to start in April 2014. On-going liaison is needed with the DWA Directorate Dam Safety to ascertain exactly what will be done and how this could influence the potential raising of the dam. The Kouga River hydrology update is also required to determine whether there would be a benefit to the users to raise the wall.

**Operating capacity of Darlington Dam**

The required operating level for the Darlington Dam needs to be investigated. The Directorate Dam Safety is doing investigations into the replacement of the sluice gates. This could potentially involve the removal of gates, depending on the findings. It needs to be ensured that there are no bottlenecks regarding the transfer of additional Orange River water to NMBM in terms of the additional allocation. DWA is in the process of appointing design engineers.

**Additional storage in the Scheepersvlakte Balancing Dam and canal**

In addition to potentially increasing the balancing capacity of Scheepersvlakte Balancing Dam, attention must also be given to whether there is a need to increase the supply capacity of the Lower Sundays River Government Water Scheme. Downtime at the canal is currently not possible as there is no storage for the water available. It is important that an operating risk assessment be done urgently (no change or progress during the past year).

**Alternative sources for small towns receiving water from the Algoa WSS**

It would be worthwhile to find alternative water sources for smaller towns like Jeffrey's Bay to reduce water use of such towns from the Algoa WSS. The groundwater initiative under way by NMBM *inter alia* addresses this, and relevant forthcoming information is made available.

### 2.3.2 NMBM Studies

**ORP Nooitgedagt Low-Level Scheme**

An additional allocation of water from the Orange River has been approved by DWA and the environmental impact assessment for the scheme has been approved by the Department of Economic Development and Environmental Affairs (DEDEA). The project implementation supported by the

R450 million emergency funding received from National Treasury is progressing well. Progress on the 7 contracts which have been awarded to date, is as follows:

- The rising pipeline to and gravity main from the Olifantskop reservoir site will be completed by November 2012 (2 contracts).
- The first 10 Ml balancing reservoir at the Olifantskop site will be completed by April 2013 (1 contract).
- The Motherwell and Stanford Road booster pump stations will be completed by March 2013 (2 contracts). The completion date for the pump stations have been delayed due to long delivery and testing periods for pumping equipment. The civil work is 80% complete.
- The "emergency "extension at the Nooitgedagt WTW will be completed by November 2012.
- The additional HV/MV transformer will be commissioned by October 2012.

In order to complete the project, a further 4 contracts are required for which some R350 million is still needed. The following contracts are outstanding:

- Extensions to Nooitgedagt WTW (Remainder Civil)
- Extensions to Nooitgedagt WTW (Remainder Mechanical & Electrical)
- 45 Ml Reservoir
- Low Lift Pump Station Mechanical Equipment

The design and tender documentation have been completed and further progress is directly linked to funding availability. Based on present status, completion of the Nooitgedagt Low Level Scheme could be delayed until end 2014.

A supply of water from Olifantskop to the Coega IDZ may be required by end 2013. In order to meet this demand, a cross connection between the high-level and low-level pipelines will be made at Nooitgedagt. Some 20-25 Ml/day can then be "decanted" into the low-level scheme to Olifantskop reservoir. A supply back-up is presently being provided in the design of the Motherwell booster pump station. Reverse flow can be supplied from Chelsea reservoir (TWL 235 mamsl) to Olifantskop reservoir (TWL 150 mamsl).

The NMBM has written a letter to DWA to enquire whether any restrictions will be placed on water transferred from the Gariep Dam.

**Swartkops Drought Emergency seawater desalination plant**

A 30 Ml/d reverse osmosis plant to be located at the old Swartkops Power Station at the Swartkops River was identified as the emergency desalination plant. The anticipated total cost of the 30 Ml/d desalination plant, including all associated infrastructure is R450 million excluding a sea outfall (as studies showed that releases could be made via the existing sea outfall from the Fish Water Flats WWTW). The design of the plant is well advanced and the tender documents have been completed. As the drought is broken, the plant will not be constructed as planned. The option has been shelved as a possible emergency measure during future droughts. The NMBM is nevertheless considering acquiring the land should such a situation arise again. The reason for the shelving of the plant is that the confines of this site might constrain the future extension of the desalination plant to 60 Ml/day, which is the capacity that NMBM considers to be most appropriate for the longer term water requirements of the City.

**Desalination Feasibility Study**

In March 2012 the NMBM has appointed consultants to investigate a new location for a bigger desalination plant preferably to the western side of the Metro. Such a plant will need to be in production by 2017/2018, according to the "Reference" Scenario. The cost of such a plant could be R900 million. The investigation is planned in a phased approach and consists of 2 phases, being Siting Investigation and Detailed Feasibility Investigation. Phase 1 is currently underway and consists of a study to determine the most favourable siting of the proposed desalination plant, to facilitate the Environmental Impact

Assessment and to initiate any specialist studies which might be required. The key deliverables for the Concept and Viability stage (phase 2) would include the preliminary design of the various components of the project, and the incorporation of these into a comprehensive Concept Design for the entire project.

**Coega IDZ Seawater Desalination**

The CDC has confirmed the investment in manufacturing of chlorine from salt, salt which would be extracted from seawater through desalination, is not a short to medium term prospect any more. The desalination of seawater would have potable water as a "by-product" for use by the NMBM as the WSA.

This water source is therefore not available as an economic water supply option.

**Groundwater**

Groundwater can provide affordable and dependable supply and can be implemented very rapidly once the legal requirements, especially water use licenses, have been secured. Most of the groundwater targets lie within a few kilometres from existing bulk supply pipelines or reservoirs which mean that construction times will generally be low once the legal, design and tender processes have been completed. New areas that were investigated during and since the 2010/11 drought have been included in the evaluation. The focus has been on areas owned by the NMBM which include groundwater targets associated with the Coega Fault System and those within the Churchill Dam property. The points below summarise the progress.

i. The Coega Fault: The entire Coega Fault System was investigated. This included three main areas: The Coega Kop area; the Uitenhage area (east of and within Uitenhage); and the Kamesh area (west of Uitenhage). Extensive geophysical surveys were conducted and most of the borehole sites have been "pegged"; the remaining sites will be finalised in August/September 2012. Enough targets have been identified for drilling to start now, and it is expected that up to 30 of the borehole sites may need to be drilled to obtain the target yield. The estimated yield from this aquifer (excluding the Uitenhage Springs) is 8 million $m^3$/a. Most of the borehole sites are within 1 km of bulk supply pipelines or reservoirs.

ii. Churchill Dam area: Geological mapping and geophysical surveys were undertaken and 21 borehole sites were "pegged". Drilling can commence. The estimated yield from this aquifer is 2 - 4 million $m^3$/a (using 3 million $m^3$/a for planning purposes). The furthest borehole site is 6 km from the dam wall and 1.5 km from the Kromme River that feeds the dam.

iii. Bushy Park area: Three existing, privately owned boreholes were test pumped and can provide 0.6 million $m^3$/a. The remainder of the greater Bushy Park area was not investigated. The estimated yield from this area remains unchanged at 2 – 4 million $m^3$/a (using 4 million $m^3$/a for planning purposes – based on the yield of the three tested boreholes).

iv. Jeffrey's Arch (Humansdorp) area: In the previous reconciliation study report, three potential groundwater areas were identified. Following field investigations, an additional five areas were identified, and the combined yield of the eight areas is far greater than previous estimates. The eight areas lie anywhere between 1 and 20 km from the Churchill Dam pipeline. Provisional target areas were identified that require geological mapping and geophysical surveys in order to "peg" drill sites. All sites are on private land. Although public roads pass through some of the areas, it would be necessary to establish whether drilling can take place in road reserves. With the inclusion of the additional areas, the estimated yield has been increased from 3 million $m^3$/a to 6 – 9 million $m^3$/a (using 7 million $m^3$/a for planning purposes).

v. Van Stadens River: As part of the drought-emergency programme, existing, high-yielding boreholes were located in the field. They are all on private land and were not test pumped. No further work was done on quantifying the resource, and thus the estimated yield from this area remains unchanged from the original estimate at 4 million $m^3$/a. The area is generally within 3 km of the Churchill Dam pipeline.

vi. The Gamtoos Valley: This area was added because of its promising geology and the close proximity of the canal system into which groundwater could potentially be pumped. Provisional target areas were identified that require geological mapping and geophysical surveys in order to pinpoint drill sites. All sites are on private land. The estimated yield from this area is 2 – 4 million $m^3$/a (using 3 million $m^3$/a for planning purposes).

vii. The Kruisrivier area: A hydrocensus in the Rooihoogte/Kruisrivier area south west of Uitenhage and west of Kwanobuhle/Gunguluza was done and it was found that groundwater is being under-utilised by ~0.5 million $m^3$/a. This is a conservative estimate as it only covers areas that were previously known to have relatively high-yielding boreholes (boreholes that were investigated for emergency-drought purposes). The estimated available yield from this area is 0.5 – 1 million $m^3$/a (using 0.5 million $m^3$/a for planning purposes).

viii. The Driftsands area: The Driftsands area and the adjacent area near Cape Recife were assessed to establish whether artificial recharge in the sand dunes is possible using treated waste water from the Driftsands Waste WWTW, or the WWTW at Cape Recife. The sands were found to be too thin for this purpose.

ix. Drilling Tender: Drilling is planned for the Coega Fault and Churchill Dam areas. Drilling tenders were advertised twice without any responsive bidders. Following this a request for quotes (modified tender document) was sent to four drilling companies with the experience and equipment to drill on the Coega Fault. One quote was received and a recommendation to NMBM management to use this quote is being drafted. Likewise a recommendation is being drafted to use DWA term tenders for the less complex, shallower boreholes.

x. Water Use License (WUL): Groundwater use licence applications are being prepared for the Coega Fault and Churchill Dam areas.

xi. Environmental Management Plans (EMPs): These are being developed for the Coega Fault and Churchill Dam areas.

**Re-use of water treated to industrial standards – Coega and Fish Water Flats WWTWs**

Recommendations from the Process Upgrade Study of the Fish Water Flats Wastewater Treatment Works (WWTW) for industrial use recommended that part of the works be converted to a membrane bioreactor (MBR) process. A Feasibility Study for re-use of FWF WWTW improved quality effluent as an industrial water supply to Coega IDZ, was completed in 2010. An environmental impact assessment study was undertaken for the proposed scheme and an ROD is expected in October 2012.

In order to advance the project, the CDC has funded the design stage and has appointed the same project team which was under appointment of the NMBM. In the event that industrial standard water is required before re-use water is available from FWF, a submission was made to DEDEA for a variation in the IDZ ROD which stated that re-use of waste water effluent shall be made available to industry in the IDZ. The variation will allow potable water to be used as an interim industrial water supply until the water from FWF become available.

The Loerie Indirect Re-use Scheme was conceptualised during the planning of the implementation of the Fish Water Flats to Coega IDZ industrial water scheme, as it provides the opportunity for 40 Ml/d excess treated water to be conveyed to Loerie Dam for indirect potable re-use. The upgrading of the Fish Water Flats WWTW has been delayed due to NMBM's funding constraints. The Loerie Indirect Re-use scheme is dependent on spare capacity at Loerie WTW as well as a rising main to Summit reservoir. This spare capacity is subject to the Kouga Dam wall strengthening or raising options. In the event of the raising option, additional water supplied to NMBM will take up the spare capacity in the bulk supply system which will render the indirect re-use scheme "un-economic".

**Options to augment or possibly replace Orange River water**

Studies have not yet been initiated for the following options to augment or possibly replace Orange River water if and when needed in the longer term:

- Desalination of Sundays River irrigation return flows. Monitoring at the DWA monitoring station in the Lower Sundays River shows that sufficient water is available to justify a feasibility study.
- Purchase of Orange River water irrigation entitlements. DWA Cradock office provided the Algoa Steering Committee with technical information regarding this issue for consideration.

**Monitoring**

Gauges to monitor flows and quality of WWTW flows for later possible re-use schemes are in place.

Initial data obtained from the Lower Sundays River gauging point (N4L002 – Sundays River, Poplar Grove), confirmed that the minimum volume of irrigation return flows is in the order of 43 million $m^3$/a (120 Ml/day). This volume excludes the flooding periods in the Sundays River system. This takes into account the possibility of leakage from Darlington Dam.

This figure confirms the findings of the Water Research Commission Project No K8/780/2, which *inter alia* entailed the calibration of a yield model for the lower Sundays River. The Project finding was based on multiple hydrological scenarios that were evaluated, and which concluded that 45 million $m^3$/a (123 Ml/day) was identified as "irrigation return flow" in the Lower Sundays River. The final quantum available for abstraction for re-use purposes will be determined by the required ecological flows in the Lower Sunday River estuary.

Water quality in the lower Sundays River has been analysed as follows:

***Table 2.1: Water quality measurements in the lower Sundays River***

| Period | Average (µS/cm) | Max (µS/cm) | Comments |
|---|---|---|---|
| 26 Feb 2010 to 16 Mar 2011 | 2886 | 4250 | Normal flow |
| 16 Mar 2011 to 7 Sep 2011 | 1543 | 2980 | High flows |
| 7 Sep 2011 to 13 Mar 2012 | 2830 | 4340 | Normal flow |

### 2.3.3 Other Municipalities

Progress with regards to WC/WDM implementation needs to be measured and reported. Municipalities need to plan how to reduce their water requirements and become more efficient. Within the Algoa WSS only the Kouga Local Municipality (LM) will need to be monitored.

Concerns were raised regarding the high rate of growth in water requirements for the Kouga LM off the Churchill supply system (**Figure 2.2**). For the period 2000/01 to 2009/10, their requirements from the Churchill system increased at 10.2% per annum, while the predicted growth rate was less than 6.0% as per the NMBM Water Master Plan 2006. High water losses may form part of the abnormal growth, especially when it appeared that little water savings had been achieved during the recent drought period. NMBM has requested Kouga LM to comment on the high growth figures.

Recent updated projected requirements from the Churchill sub-system of the Algoa WSS shows an overall reduction in demand, following on the drought and higher rainfall months (refer to graph). A low scenario of 7.6% growth per annum can be expected.

The combined use of water from the Churchill sub-system and their own groundwater resources as well as system losses, should be further investigated to ensure that Kouga LM applies good WC/WDM principles.

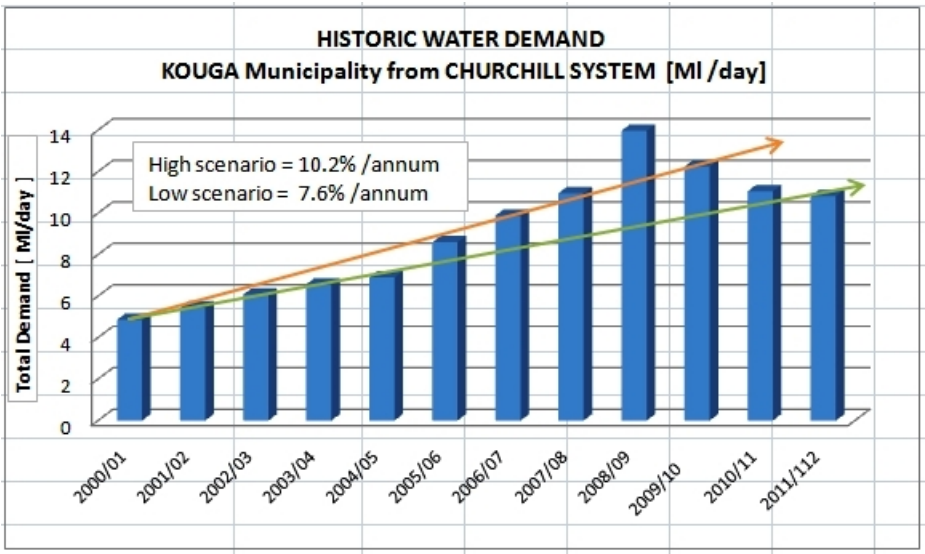



***Figure 2.2: Historic water use of Kouga LM from the Churchill sub-system***

## 3. 2012 STRATEGY UPDATE

### 3.1. Algoa WSS yield

The Algoa WSS currently comprises two major dams in the west, several smaller dams, a spring situated near to NMBM, and an inter-basin transfer scheme from the Orange River via the Fish and Sundays rivers to the east. The main components of the Algoa WSS are shown in Appendix 1.

As part of the Algoa System Annual Operating Analysis Study (2006 – 2009), a report was compiled for DWA in 2010 and applied the 1927 to 1991 hydrology in the Algoa Operational Analysis. Whilst there is more recent (1930 to 1998) hydrology for the Kouga sub-system, the report pointed out that the entire Algoa System must be analysed as a unit since the length of the hydrology time series must be the same throughout, leaving no option other than to use the 1927 to 1991 hydrology. Large and disturbing discrepancies between the period from 1927 to 1991 and more recent hydrology were noted and the need for a detailed investigation, especially given the uncertainty relating to the water use in the upper Kouga River catchment, was made.

The report further highlighted that:

- Estimates of water use in the upper Kouga River varies widely, and
- The Churchill/Impofu catchments' hydrology is based on an unacceptably short period of observed record and urgently needs to be updated.

The updated 1 in 50 year long-term stochastic yields of the various sources of supply available for urban, industrial and agricultural use are shown in the **Table 3.1**, using the yields from the Algoa System Annual Operating Analysis Study 2010 report.

***Table 3.1: Long-term stochastic yields of the Algoa Water Supply System***

| Sources of supply | 1 in 50 year yield or existing allocation/use (million $m^3$/a) |
|---|---|
| NMBM older dams | 3.4 |
| Groendal Dam | 6.8 |
| Uitenhage Springs and boreholes | 2.8 |
| Churchill/Impofu dams | 46 |
| Kouga/Loerie dams | 76 |
| Sundays River GWS transfer | 32.9 |
| Re-use | 1.7 |
| **Combined Total Yield** | **169.6** |

Bulk water planning is generally done at a 1 in 50 year assurance of supply, for urban water supply. For the Algoa WSS urban water use is more than 60% of total use, and is expected to increase. Therefore future evaluation and scenario planning has been based on a 1 in 50 year assurance of supply.

### 3.2. Historical Water Requirements

**Figure 3.1** shows the historical water requirements for the Algoa WSS with 2 years of water requirements added. The depiction of water use has been changed from calendar years to 12-month periods starting in July till June the following year, to correspond with the NMBM and Gamtoos Irrigation Board financial years.

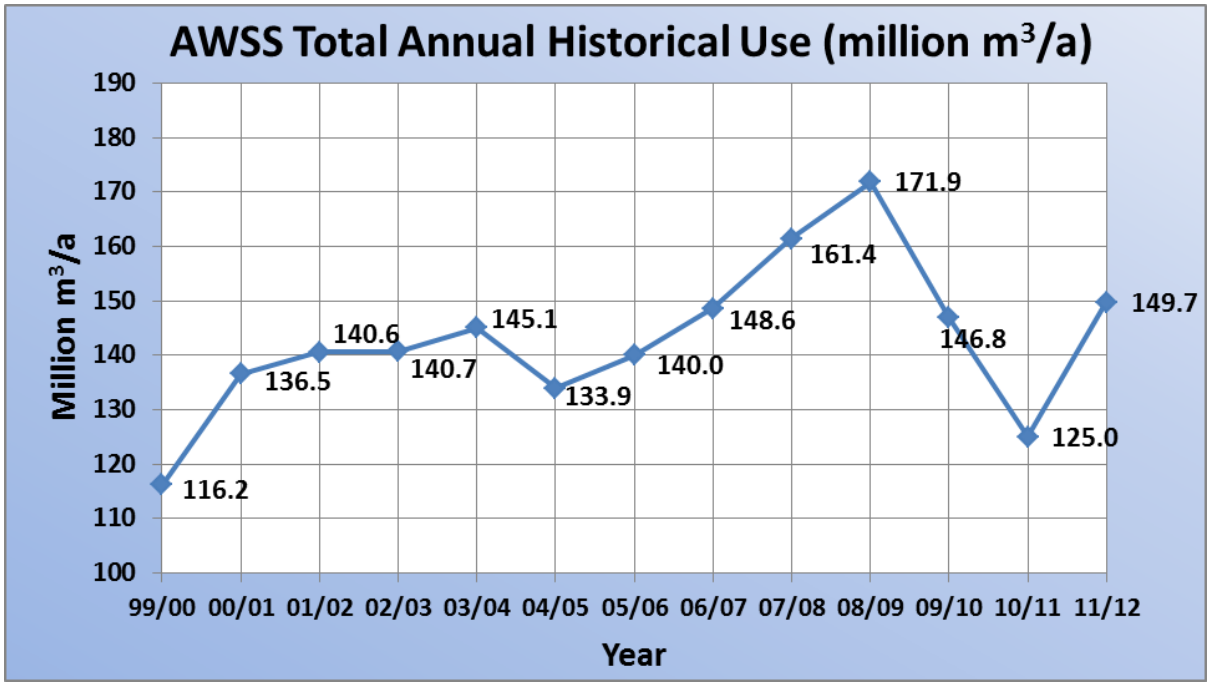



***Figure 3.1: Historical Water Requirements from the Algoa WSS***

**Figure 3.2** shows the composition of the historical water requirements for the Algoa WSS. The graph shows that, while water use is inhibited during a drought (drought restriction years shown by circles) through the implementation of water restrictions, the water requirements growth trend has continued after the droughts were broken.

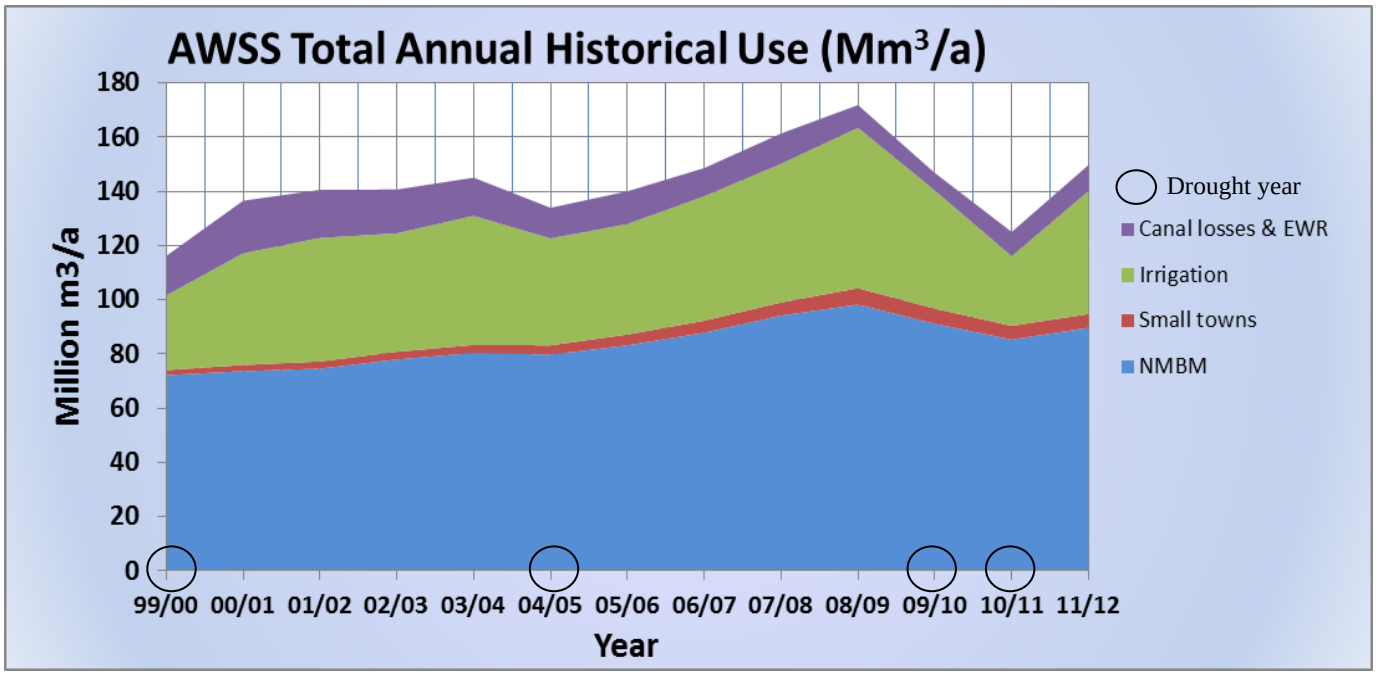



***Figure 3.2: Historical Water Requirements from the Algoa WSS***

Note that water use shown by NMBM in Figures 3.1 and 3.2 above includes potable use by the Coega IDZ.

### 3.3. Current Water Requirements

The total usage of water from the Algoa WSS in 2011/12 was 149.7 million $m^3$/a. This comprises urban use by NMBM and various small towns, Coega IDZ potable use, agricultural water use, losses from the Kouga/Loerie canal, and ecological water requirements. The sectoral water use pattern in the Algoa WSS for 2011/12 was as follows:

| | |
|---|---|
| NMBM | 89.7 million $m^3$/a (59% of the total) |
| Coega IDZ Potable | 2.7 million $m^3$/a (2% of the total) |
| Small towns | 5.1 million $m^3$/a (3% of the total) |
| Irrigation | 45.4 million $m^3$/a (30% of the total) |
| Canal losses | 7.6 million $m^3$/a (5% of the total) |
| Ecological Water Requirements | 2.0 million $m^3$/a (1% of the total) |
| **TOTAL** | **149.7 million $m^3$/a** |

It is important to note that, for water balance calculations, requirements are based on water supplied at a 1 in 50 year assurance of supply (corresponding to 1 failure in 50 years).

Water for irrigation is supplied at a 91% assurance of supply (approximately 1 failure in 10 years). The full allocation to the Gamtoos Irrigation Board (GIB) is 59.36 million $m^3$/a from the Kouga Dam. The combined total usage by agriculture from the Algoa WSS is estimated to be 63.76 million $m^3$/a at a 91% year assurance of supply, excluding irrigation usage from the rivers upstream of the dams that form part of the Algoa WSS.

Various future water requirement scenarios were developed, with the primary considerations being population and economic growth. Two future water requirement scenarios are used for the Algoa Reconciliation Strategy, namely a high-growth and a low-growth scenario. These scenarios do not take account of future water conservation and water demand management measures, as these are included

as interventions that could be selected to reduce the future water requirement. In the scenario development it has been assumed that irrigation usage, total Kouga-Loerie canal losses and environmental water requirements do not change.

### 3.4. Coega IDZ industrial water requirements

The Coega Development Corporation is aiming to have secured total investment of R50 billion (cumulative total) by the end of 2014 with 100 businesses operating in the industrial development zone and the Nelson Mandela Bay Logistics Park. Currently, the IDZ is "home to 21 operational investors" that have invested R1.2 billion, while a further R7.5 billion is at the implementation phase and projects worth R8.1 billion currently are being negotiated. In addition, projects worth R116.3 billion are the subject of feasibility studies.

One of the major investments being sought by the CDC is Project Mthombo, the multi-billion Rand oil refinery that is now the subject of a joint study between PetroSA and the Chinese Petro-chemical Corporation (Sinopec). The CDC has also secured two ferro-manganese smelters with a combined investment of over R8 billion, following the decision by Transnet to relocate the manganese facility in the Port Elizabeth Harbour to Coega and not Saldanha as was initially planned. Transnet will also construct a manganese ore terminal at the Port of Ngqura that will see exports mushroom from the current 4.5 million tons a year to 16 million tons and is to upgrade the rail link with the Northern Cape.

The updated Coega IDZ water requirement estimates (2012), for potable and industrial water use respectively, is shown in **Figure 3.3**.

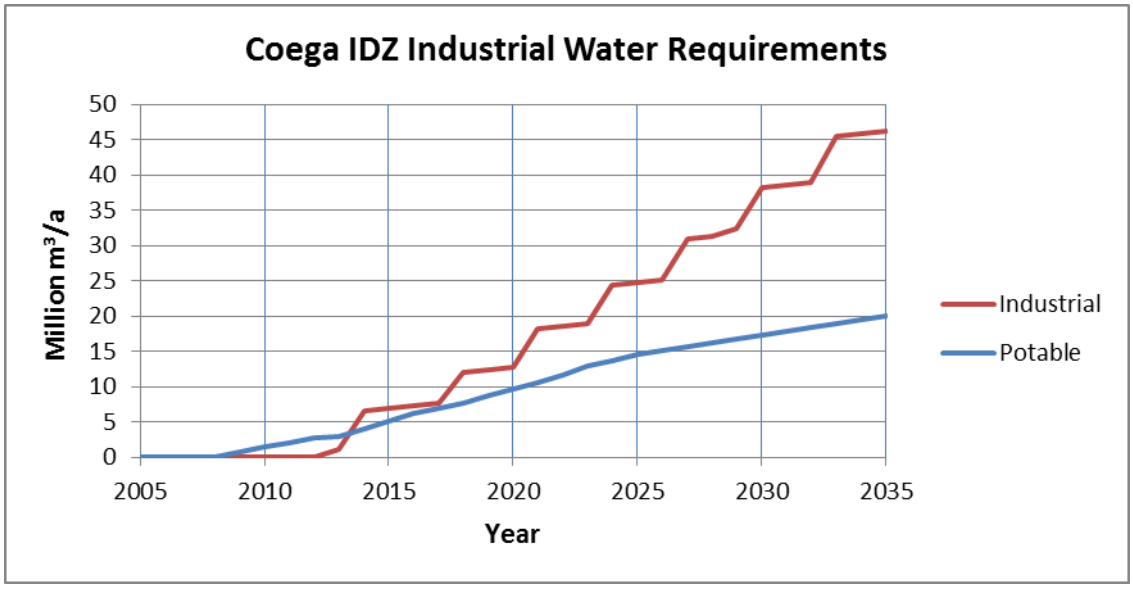



***Figure 3.3: Coega IDZ Water Requirements from the Algoa WSS***

The estimate of industrial water requirement uptake is still very uncertain as new heavy industries have previously committed and then pulled out again – there is thus no clear indication of future uptake. The estimate of potable long-term use is still the same, although the estimated rate of growth has changed.

### 3.5. Future water requirement scenarios

Six future water requirement scenarios have been developed, these being:

a. **High Growth including Coega**: 3.5% linear growth, including Coega potable and industrial standard water requirements;

b. **High Growth Potable**: 3.5% linear growth, including Coega potable water requirements;
c. **Reference - High Growth Potable including Coega industrial standard water to 2018**: 3.5% linear growth, including Coega potable water requirements and Coega industrial standard water requirements up to 2018;
d. **Worst case**: 3.5% linear growth, including Coega potable water and industrial standard water requirements, with climate change and implementation of the Reserve;
e. **Low Growth including Coega**: 1% compound growth, including Coega potable water and industrial standard water requirements;
f. **Coega industrial water requirements**.

## 3.6. CHANGES TO INTERVENTIONS

### 3.6.1 Loerie Indirect Potable Re-use Scheme

The potential Loerie Indirect Potable Re-use Scheme could make use of spare effluent at the Fish Water Flats WWTW for potable indirect re-use. The scheme would comprise pumping treated effluent from the Fish Water Flats WWTW over a 56 km distance to just upstream of Loerie Dam. The capacity of the scheme would match the spare capacity available at Loerie WTW, in addition to the existing water allocation from the Kouga Dam. Such a scheme could be mutually exclusive with a Kouga River surface water scheme.

### 3.6.2 Groundwater

Groundwater yield estimates have changed since the 2010/11 drought. Seven new groundwater target areas have been identified, these being Coega Fault, Churchill Dam, Bushy Park, Jeffreys Arch, Van Stadens, Gamtoos Valley and Kruisrivier. The yields of some of the existing areas have been revised, while in some areas no work was done and the original yield estimates have not been changed. The estimated total groundwater supply from all target areas ranges from 22.4 to 33.5 million $m^3$/a. For planning purposes, it is recommended that 29.5 million $m^3$/a be used (Table 3.1). While some of these yields are based on both potential borehole yield and aquifer yield analyses, and take existing use into account, in some areas, these yields are based primarily on the number of drilling targets and potential borehole yields.

The revised groundwater schemes are the following:

***Table 3.2. Revised groundwater yield estimates***

| Groundwater intervention | Lower estimate million $m^3$/a | Upper estimate million $m^3$/a | Assumed yield million $m^3$/a |
|---|---|---|---|
| Coega Fault | 6 | 8 | 8 |
| Churchill Dam | 2 | 4 | 3 |
| Bushy Park | 2 | 4 | 4 |
| Jeffreys Arch | 6 | 9 | 7 |
| Van Stadens | 4 | 4 | 4 |
| Gamtoos Valley | 2 | 4 | 3 |
| Kruisrivier | 0.4 | 1 | 0.5 |
| **Total** | **22.4** | **34** | **29.5** |

### 3.6.3 Nooitgedagt Low-level Scheme

DWA confirmed in October 2009 that the NMBM water allocation from the Orange River has been increased to 58.4 million $m^3$/a (160 Ml/day). The current yield of Orange River water transferred in has

been increased to 32.9 million $m^3$/a, to account for the actual situation, and shown in Table 3.1. As a result, the yield of the Nooitgedagt Low Level Scheme (Phase 1) has been adjusted to 25.5 million $m^3$/a.

### 3.6.4 Programme changes

The following programme changes were made for interventions:

- The WC/WDM implementation programme has been changed from 2 to 5 years.
- First water from the Nooitgedagt Low Level Scheme has been changed to 2014.
- The programmes of groundwater schemes have been updated.

## 3.7. ADJUSTMENTS TO THE STRATEGY

### 3.7.1 Water balance scenarios

In order to update the 2011 scenario planning, the six water balance scenarios mentioned under Section 3.5 were evaluated, taking account of updated information.

As some of the scenarios are variations and are fairly alike, only the four key future water requirement scenarios, of which the starting point for growth estimation is 2012, are discussed below.

The "***High-Growth including Coega***" scenario is based on high economic and high population growth rates which translate to an average water requirement linear growth rate of 3.5% per annum. The Coega IDZ potable requirements projected growth rate has been used. In this scenario, the potable system water requirements grew from 150 million $m^3$/a in 2012, to 241 million $m^3$/a in 2035. The portion of potable water requirements for the Coega IDZ grew from 2.7 million $m^3$/a in 2012 to 20.1 million $m^3$/a in 2035. Industrial water requirements for the Coega IDZ grew from 0 million $m^3$/a in 2012 to 46.4 million $m^3$/a in 2035.

The "Reference - ***High-growth Potable including Coega Industrial up to 2018***" scenario is based on high economic and high population growth rates which translate to an average water requirement linear growth rate of 3.5% per annum. The Coega IDZ potable requirements projected growth rate has been used. In this scenario, the potable system water requirements grew from 150 million $m^3$/a in 2012, to 241 million $m^3$/a in 2035. The portion of potable water requirements for the Coega IDZ grew from 2.7 million $m^3$/a in 2012 to 20.1 million $m^3$/a in 2035. Industrial water requirements for the Coega IDZ would be supplied up to 2018 from potable water supply.

The "***Coega Industrial Requirements***" scenario is based on industrial water requirements for the Coega IDZ growing from 0 million $m^3$/a in 2012 to 46.4 million $m^3$/a in 2035.

The "***Worst-Case***" scenario is similar to the "*High-Growth including Coega*" scenario, with the addition of climate change (15% reduction in yield over 25 years) and the implementation of the ecological Reserve for existing system dams.

Many possible scenarios exist between the 2012 "Reference" Scenario and the "Worst-Case" Scenario, but if solutions could be found for these two scenarios, all others should be covered. Should the water requirements follow the Low-Growth Water Requirement Curve and not the High-Growth Water Requirement Curve, the required implementation date of interventions would be delayed and therefore more options for implementation would become available to select from.

### 3.7.1 High-Growth including Coega requirements

This Scenario water balance is shown in **Figure 3.4**.

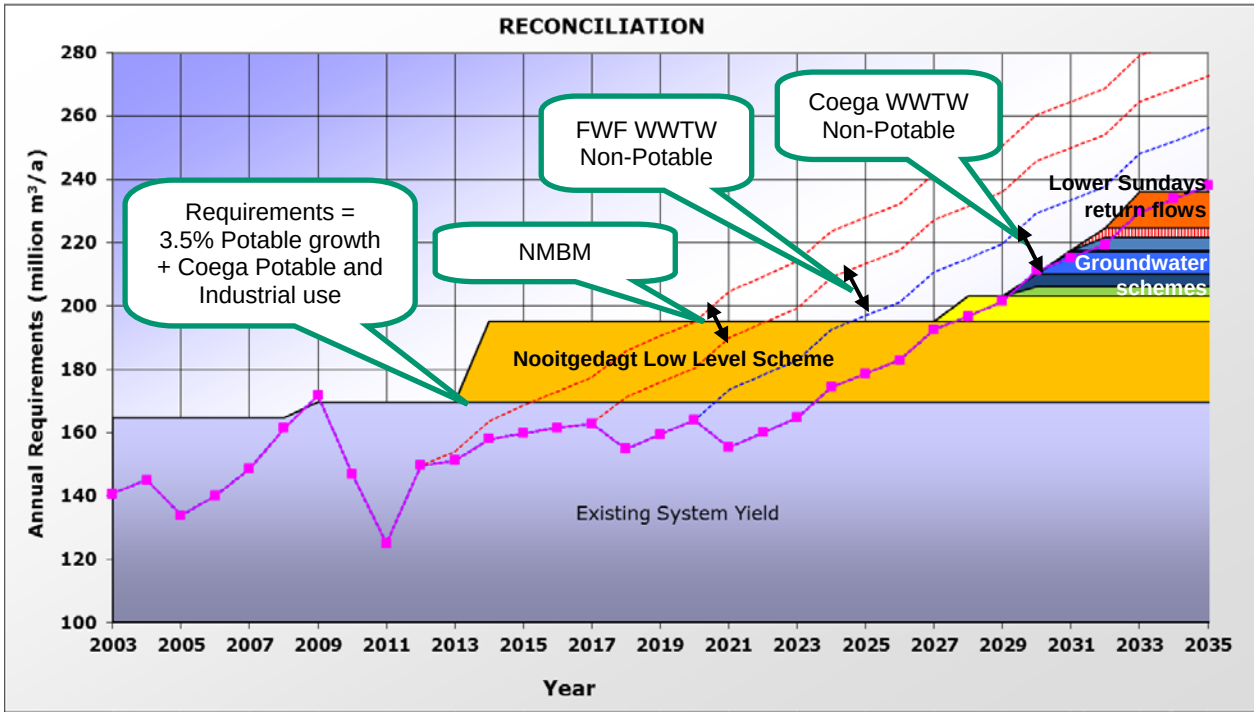



***Figure 3.4: Updated High-Growth including Coega Scenario***

In the updated Scenario:

- The revised groundwater interventions have been included
- The Lower Sundays Return Flows scheme will be implemented after groundwater interventions

In **Table 3.3** the interventions which have been used in **Figure 3.4** are listed.

**Table 3.3 Interventions for High-Growth with Coega Scenario**

| No | Intervention | Year of First Water or Saving | Yield (million $m^3/a$) | Total Lead Time | Revised Study Start Date |
|---|---|---|---|---|---|
| 1 | NMBM WC/WDM programme | 2013 | 14.6 | 0 | - |
| 2 | Nooitgedagt Low-Level Scheme | 2014 | 25.5 | 2 | - |
| 3 | Industrial effluent to Coega - ex FWF | 2018 | 16.4 | 6.25 | - |
| 4 | Industrial effluent to Coega - ex Coega | 2021 | 18.3 | 6.25 | 2015 |
| 5 | Groundwater Coega Fault | 2028 | 8 | 5.75 | 2022 |
| 6 | Groundwater Churchill Dam | 2030 | 3 | 4.75 | 2025 |
| 7 | Groundwater Bushy Park | 2030 | 4 | 7.75 | 2022 |
| 8 | Groundwater Kruisrivier | 2031 | 0.5 | 8.5 | 2022 |
| 9 | Groundwater Jeffreys Arch | 2031 | 7 | 8.75 | 2022 |
| 10 | Groundwater Van Stadens | 2032 | 4 | 7.25 | 2025 |
| 11 | Groundwater Gamtoos Valley | 2032 | 3 | 7.25 | 2025 |
| 12 | Lower Sunday River return flows | 2032 | 11.4 | 6.75 | 2019 |

### 3.7.2 Updated (Reference) Scenario: "High-growth including Coega requirements up to 2018"

The "*Reference*" Scenario water balance is shown in **Figure 3.5**.

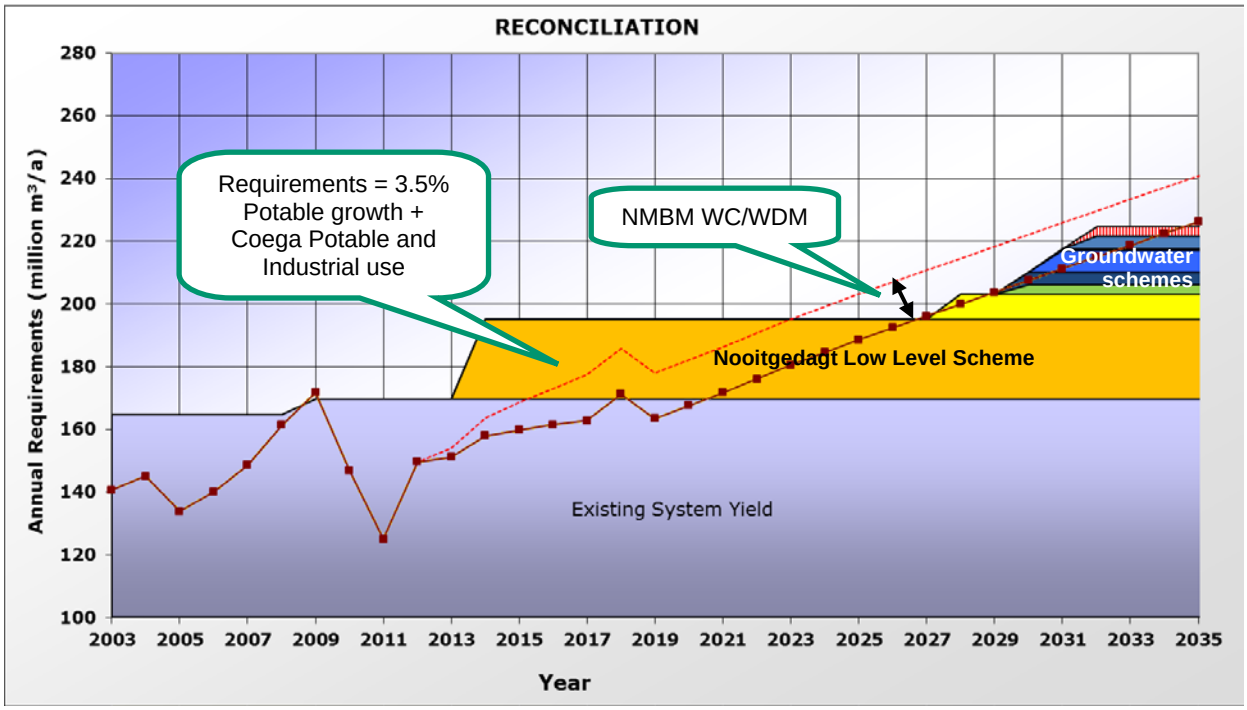



**Figure 3.5: Updated "Reference" Scenario**

In the updated Scenario:

- The revised groundwater interventions have been included

In **Table 3.4** the interventions which have been used in **Figure 3.5** are listed.

**Table 3.4 Interventions for "Reference" Scenario**

| No | Intervention | Year of First Water or Saving | Yield (million $m^3/a$) | Total Lead Time | Revised Study Start Date |
|---|---|---|---|---|---|
| 1 | NMBM WC/WDM programme | 2013 | 14.6 | 0 | - |
| 2 | Nooitgedagt Low-Level Scheme | 2014 | 25.5 | 2 | - |
| 3 | Groundwater Coega Fault | 2028 | 8 | 5.75 | 2022 |
| 4 | Groundwater Churchill Dam | 2030 | 3 | 4.75 | 2035 |
| 5 | Groundwater Bushy Park | 2030 | 4 | 7.75 | 2022 |
| 6 | Groundwater Kruisrivier | 2031 | 0.5 | 8.5 | 2022 |
| 7 | Groundwater Jeffreys Arch | 2031 | 7 | 8.75 | 2022 |
| 8 | Groundwater Van Stadens | 2032 | 4 | 7.25 | 2025 |
| 9 | Groundwater Gamtoos Valley | 2032 | 3 | 7.25 | 2025 |

### 3.7.3 Coega industrial requirements

The "*Reference*" Scenario water balance is shown in **Figure 3.6**.

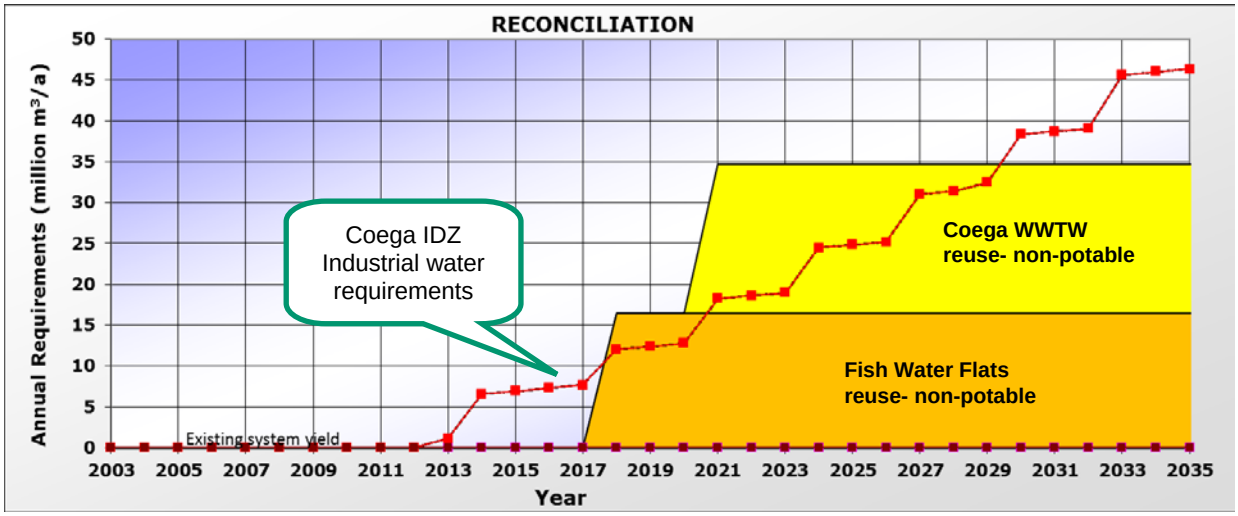



**Figure 3.6: Updated Coega Industrial Scenario**

In **Table 3.5** the interventions which have been used in **Figure 3.6** are listed.

**Table 3.5 Updated 2010 "*Reference*" Scenario interventions**

| No | Intervention | Year of First Water or Saving | Yield (million $m^3/a$) | Total Lead Time | Revised Study Start Date |
|---|---|---|---|---|---|
| 1 | Industrial effluent to Coega - ex FWF | 2018 | 16.4 | 6.25 | - |
| 2 | Industrial effluent to Coega - ex Coega | 2021 | 18.3 | 6.25 | 2015 |

### 3.7.4 Updated "Worst-Case" Scenario for potable supply

The "Worst-Case Scenario" for High-Growth water requirements shows a reduction in the yield available from all existing sources of supply including the Orange River due to the implementation of the ecological Reserve for existing system dams. It has been assumed that the ecological Reserves for these schemes will be implemented over 3 years commencing in 2015. It has further been assumed that Climate Change would reduce the yields of existing local sources by 10%. This would necessitate the earlier implementation of additional schemes as shown in **Figure 3.7**.

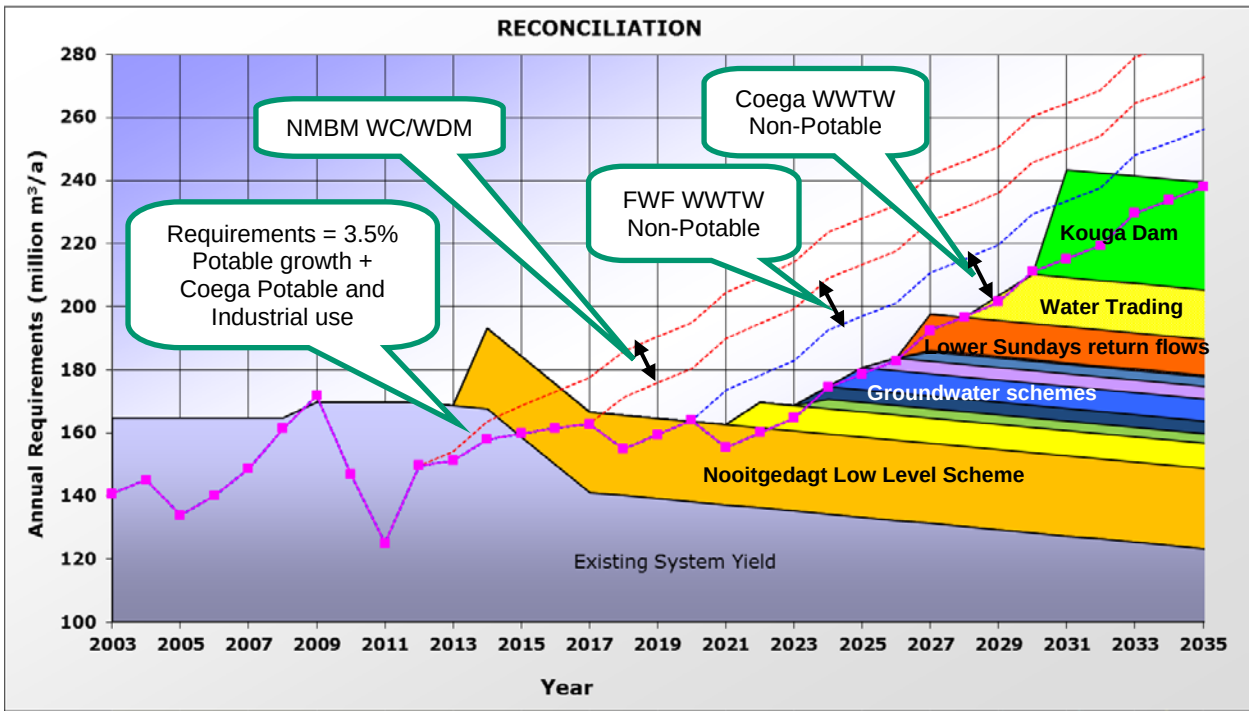



**Figure 3.7: Updated "Worst-case" Scenario**

**Table 3.6** lists the interventions which have to be implemented in order to ensure the reconciliation of supply and requirement up to 2035 for the Worst-Case Scenario as shown in **Figure 3.7**.

**Table 3.6: Updated "Worst-case" Scenario for potable supply**

| No | Intervention | Year of First Water or Saving | Yield (million $m^3/a$) | Total Lead Time | Revised Study Start Date |
|---|---|---|---|---|---|
| 1 | NMBM WC/WDM programme | 2013 | 14.6 | 0 | - |
| 2 | Nooitgedagt Low-Level Scheme Ph1 | 2014 | 25.5 | 2 | - |
| 3 | Industrial effluent to Coega - ex FWF | 2018 | 16.4 | 6.25 | - |
| 4 | Industrial effluent to Coega - ex Coega | 2021 | 18.3 | 6.25 | 2015 |
| 5 | Groundwater Coega Fault | 2022 | 8 | 5.75 | 2016 |
| 6 | Groundwater Churchill Dam | 2024 | 3 | 4.75 | 2019 |
| 7 | Groundwater Bushy Park | 2024 | 4 | 7.75 | 2016 |
| 8 | Groundwater Jeffreys Arch | 2025 | 7 | 8.75 | 2016 |
| 9 | Groundwater Van Stadens | 2026 | 4 | 7.25 | 2019 |
| 10 | Groundwater Kruisrivier | 2027 | 0.5 | 8.5 | 2018 |
| 11 | Groundwater Gamtoos Valley | 2027 | 3 | 7.25 | 2020 |
| 12 | Lower Sunday River return flows | 2027 | 11.4 | 6.75 | 2020 |
| 13 | Water trading - Upper Fish | 2029 | 15.8 | 2.75 | 2026 |
| 14 | Kouga Dam replacement and raising | 2031 | 34 | 10.5 | 2020 |

### 3.8. IMPLICATIONS HIGHLIGHTED BY THE UPDATED SCENARIO PLANNING

In the updated 2012 "Reference" Scenario for potable supply, it is evident that implementation of the Nooitgedagt Low-level Scheme should proceed as planned. Allowance has been made for groundwater interventions to be implemented thereafter, and the on-going groundwater study should proceed and be implemented. It is essential that the NMBM WC/WDM Strategy implementation should proceed as planned and receive the necessary high-level support and funding from NMBM.

The effect of the 2009/10 drought on the system water requirements has resulting in a 2011/12 water use that is still much lower than the 2008/09 water use. Because all future water requirements are projected from 2012, this has resulted in much lower future water requirements than before the drought. Care must be taken not to underrate the extent of planning needed because of this. Given the significant influence that the Algoa WSS water use of the starting year (2012 in this case) has on the scenario planning and interventions required to meet potential demand, it is recommended that various feasibility studies proceed, to allow for additional interventions that can be considered for implementation if needed.

## 4. KEY MESSAGES

The following key messages (conclusions) can be taken from the comparison of water supply and requirement and the scenario planning undertaken for the September 2012 Strategy Steering Committee meeting:

**Message 1: *Concerns about assurance of supply of the Algoa WWS***
Concerns about the accuracy of the assurance of supply values provided from the system modelling should be addressed, in light of the regular restrictions needed for the Algoa WSS. The risk of planning according to system yields that are outdated could be significant.

**Message 2: *Successful implementation of WC/WDM is critical***
It is essential that political and funding support for the NMBM WC/WDM implementation continues at the same level, especially in terms of awareness creation. Measuring and reporting of the results obtained remains important. WC/WDM at smaller towns must also be implemented, measured and reported.

**Message 3: *Re-use of water is an important intervention***
This option will be implemented to provide industrial quality water to the Coega IDZ in future, although uncertainty about their future requirements and implementation timing remains.

**Message 4: T*he Nooitgedagt Low-level Scheme must be completed***
Construction of the scheme is underway. Outstanding funding requirements to complete the project during the next two financial years must be sourced by NMBM. Conditions around the Orange River water allocation to NMBM and measures if the additional allocation remains temporary needs to be further addressed. Potential operating bottlenecks for delivery needs to be evaluated.

**Message 5: *Groundwater is both a good back-up option and a good permanent bulk supply option***
Investigations into groundwater availability should continue at the most promising sites, and test boreholes should be drilled to establish potential yields. This will provide an option for quick implementation when needed. The feasibility of supplying the Kouga LM towns with groundwater should also be assessed.

**Message 6: *Consideration of Nooitgedagt Low-level Scheme Phase 2***
A feasibility study into a Nooitgedagt Phase 2 Scheme should be considered, depending on whether the additional Orange River water allocation can be made permanent. Such a scheme will include use of water to be traded with irrigators in the upper Fish River, as well as the use of desalinated lower Sundays River return flows.

**Message 7: *The feasibility of seawater desalination should be investigated further***
The feasibility study investigation into seawater desalination for NMBM should continue. Desalination is seen as the ultimate future augmentation solution for the area.
**Message 8: *The feasibility of a larger dam on the Kouga River needs to be addressed***
In light of the planned dam safety construction work at Kouga Dam, this option needs to be addressed, dependent on preliminary findings on the possibility of raising the dam.
**Message 9: *Choice of intervention will be dependent on growth in water requirements***
If the actual growth in water requirements is lower than the high-growth water requirement curve, it will be possible to delay implementation of interventions after the Nooitgedagt Low-level Scheme is completed. If however the water requirements keep on growing at the current rate, it is important to continue with feasibility studies of the recommended range of interventions.
**Message 10: *Monitoring is very important***
It remains important to implement a system to monitor desalination intake seawater quality, potential indicators for climate change and to monitor the NMBM's success in implementing their WC/WDM Strategy measures.

## 5. RECOMMENDATIONS

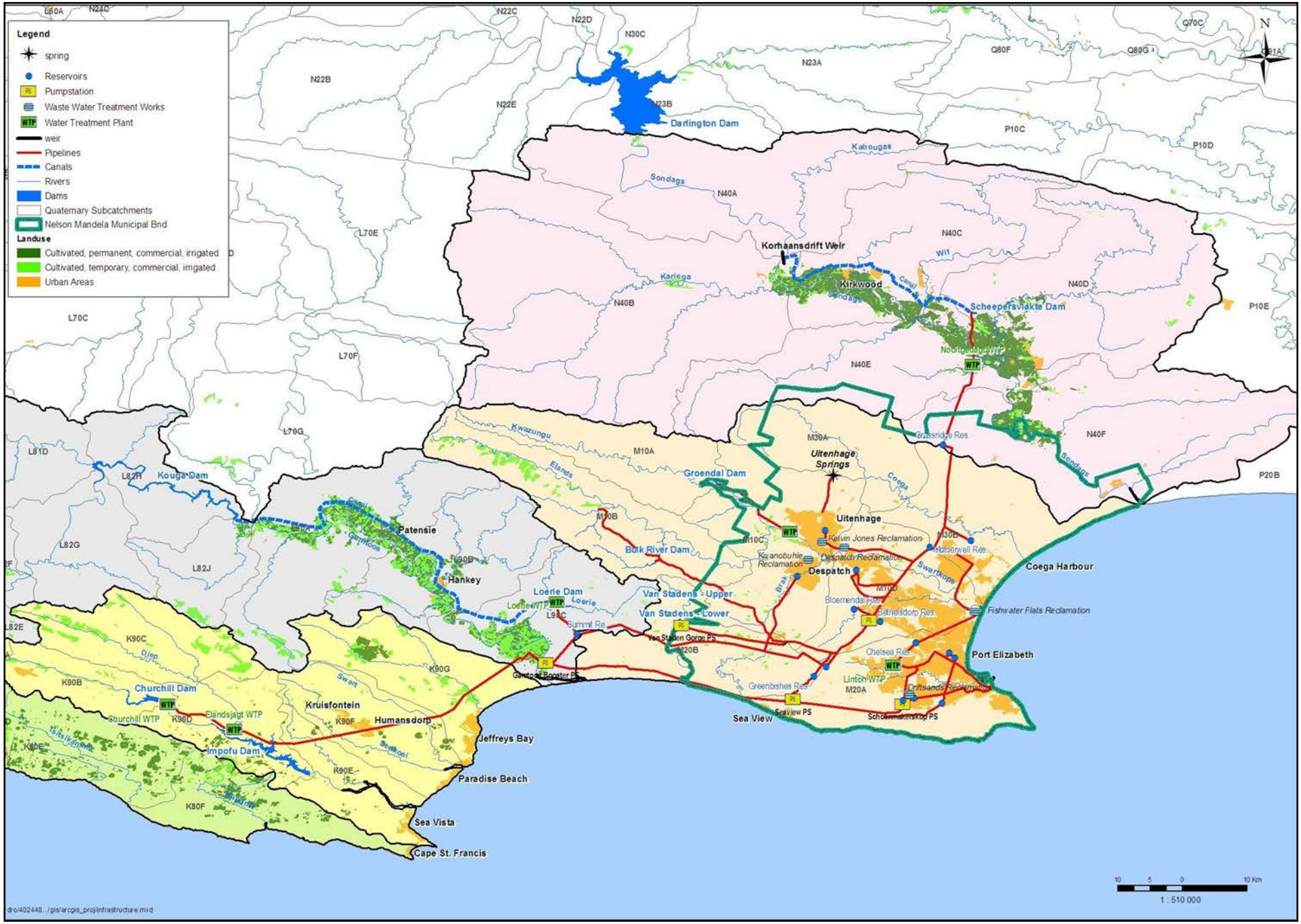
The following recommendations follow from the assessment of the current water requirements and updated scenario planning:

1) NMBM should submit a water use licence application to DWA for the additional water use from Loerie Dam.
2) DWA should get the Kouga/Loerie and Churchill/Impofu systems Verification and Validation Study underway, to be followed by a Water Availability Assessment Study (WAAS), including irrigation and urban uses, to address uncertainty regarding the hydrology and assurance of supply. Relevant findings from the Algoa Bridging Study should be incorporated.
3) The NMBM must continue with the implementation of their WC/WDM strategy.
4) NMBM should source outstanding funding and complete the implementation of the Nooitgedagt Low-level Scheme. NMBM should further have discussions with DWA regarding their request to make the additional Orange River water allocation permanent. Until this is finalised, investigations on water trading and desalination of Sundays River return flows are on hold.
5) DWA should ensure that there are no bottlenecks regarding the transfer of additional Orange River water to NMBM. DWA should initiate an investigation into the required operating level for Darlington Dam and potentially increasing the balancing and supply capacity of the Lower Sundays River Government Water Scheme, addressing the operating risk assessment.
6) NMBM should continue groundwater studies, particularly those close to and easily integrated into the existing infrastructure, to determine potential yields.
7) NMBM should continue evaluating re-use alternatives for supplying industrial requirements of the Coega IDZ and the study on water re-use and implementation from the Fish Water Flats WWTW.
8) NMBM should continue with the feasibility study on seawater desalination, and keep abreast of development plans at the Coega IDZ and a potential associated desalination plant;
9) The possibility of raising the Kouga Dam must be investigated, in the light of the planned dam safety construction work.
10) Clearing of invasive alien plants in the catchments of Algoa WSS dams by the Gamtoos IB should and will continue.
11) DWA should initiate a study to develop a strategy for the implementation of the Reserve for existing Algoa WSS dams.

12) DWA should initiate an impact assessment study to determine the expected regional impact of climate change on the Algoa WSS water balance.
13) A monitoring system should be put in place to be able to quantify and measure the success of the WC/WDM interventions which are being implemented. DWA should be responsible for monitoring water availability and the NMBM should be responsible for monitoring the success of implementation of WC/WDM. DWA will monitor quantity and quality of the Sundays River WUA return flows. NBMM should address monitoring of water quality at potential desalination plant intakes.
14) The high growth water requirement scenario will still be used as basis for future scenario planning. Water requirements must be monitored and the projected water requirement curves should be updated if the current assumptions used are deemed to be no longer valid. In light of the uncertainty of growth in requirements due to the recent restrictions, future water requirement curves will be projected from the latest annual water use available.
15) The Algoa Water Supply System Reconciliation Strategy should be re-assessed in March 2013 and adjusted if required.

# Appendix A

EXTENT OF THE ALGOA WSS


Legend
spring
Reservoirs
Pumpstation
Waste Water Treatment Works
Water Treatment Plant
weir
Pipelines
Canals
Rivers
Dams
Quaternary Subcatchments
Nelson Mandela Municipal Bnd
Landuse
Cultivated, permanent, commercial, irrigated
Cultivated, temporary, commercial, irrigated
Urban Areas
N
Darlington Dam
Korhaansdrift Weir
Kirkwood
Scheepersvlakte Dam
Kouga Dam
Patensie
Hankey
Groendal Dam
Uitenhage Springs
Uitenhage
Despatch
Bulk River Dam
Loerie Dam
Van Stadens - Upper
Van Stadens - Lower
Churchill Dam
Kruisfontein
Humansdorp
Impofu Dam
Jeffreys Bay
Paradise Beach
Sea Vista
Cape St. Francis
Sea View
Port Elizabeth
Coega Harbour
Fishwater Flats Reclamation
10 5 0 10 Km
1 : 510 000

# Appendix B

REPRESENTATION ON THE STRATEGY COMMITTEES

# REPRESENTATION ON STRATEGY COMMITTEES

## STRATEGY STEERING COMMITTEE

| Contact Person | Organisation | Telephone | Cell | Email |
|---|---|---|---|---|
| **DWA NATIONAL OFFICE** | | | | |
| Mabuda, Solly (Mr) | CD: IWRP | 012-336 8244 | 082 703 5742 | MabudaS@dwa.gov.za |
| Van Niekerk, Peter (Mr) | CD: IWRP | 012-336 8762 | 082 807 4981 | niekerk@dwa.gov.za |
| Van Rooyen, Johan (Mr) | D: NWRP | 012-336 8814 | 082 808 5652 | VanRooyenJA@dwa.gov.za |
| Herbst, Paul (Mr) | D: WUE | 012 336 8086 | 082 804 3002 | herbstp@dwa.gov.za |
| Mwaka, Beason (Dr) | D: WRPS | 021-336 8188 | 082 807 6621 | Mwakab@dwa.gov.za |
| Coetzee, Dewald (Mr) | DWA: NWRI | 041 508 9702 | 083 627 5920 | CoetzeeD@dwa.gov.za |
| **DWA EASTERN CAPE** | | | | |
| Makhanya, Portia (Ms) | CD: EC RO | | | makhanyap@dwa.gov.za |
| Kama, Bolekwa (Ms) | CMA Manager | 043-701 0376 | 082 887 6425 | kamab@dwa.gov.za |
| Mbambisa, Galelo(Mr) | D: Water sector support | 043-604 5402 | 083 627 5929 | MbambiG@dwa.gov.za |
| Lucas, Andrew (Mr) | D: Water quality management | 043-722 3805 | 082 802 8564 | lucasa@dwa.ecape.gov.za |
| **NMBM** | | | | |
| Martin, Barry (Mr) | NMBM | 041-506 5435 | | bmartin@mandelametro.gov.za |
| Counselor Mfunda | NMBM | | | ntiti@mandelametro.gov.za |
| **AGRICULTURE** | | | | |
| Joubert, Pierre (Mr) | Gamtoos IB | 042-283 0329 | 082 553 0947 | pjoubert@lantic.net |
| du Plessis, Harms (Mr) | Lower-Sundays IB | 042-2340038 | 082 824 1548 | info@sundaysriverwater.co.za |
| Joubert, Kowie (Mr) | Prov Dept Agriculture and Land Affairs | 043-683 4019 | 083 286 0363 | kowie.joubert@agr.ecprov.gov.za |
| Marais, Annelie (Ms) Secundus | Prov Dept Agriculture and Land Affairs | 040-609 3488 | 072 172 3980 | annalie.marais@agr.ecprov.gov.za |
| **E CAPE PROVINCIAL GOVERNMENT** | | | | |
| Govender, J (Mr) | Dept Econ Dev and Env Affairs &Tourism | 041-508 5800 | 071 674 9710 | dayalan.govender@deaet.ecape.gov.za |
| Sogoni, Mbulelo (Mr) | Director General, Premier's Office | 040-609 6382 | | Babalwa.shushu@otp.ecprov.gov.za |
| Madini,Vuyo (Mr) | EC Prov Dept of Local Govt & Traditional Affairs | 040-609 3440 | | Vuyo.mandini@eclgta.gov.za |
| Panda, Bogumsa (Mr) | EC Prov Dept of Human Settlement | 041-404 0749 | | pandab@ecdhs.gov.za |
| **OTHER** | | | | |
| Nkantsu, K (Mr) | SALGA Eastern Cape | | | knkantsu@salga.org.za |
| Mpulampula, Z (Mr) | SALGA Eastern Cape | | | zmpulampula@salga.org.za |
| Clarke, Angus (Mr) | NMBM Business Chamber | 041 403 3031 | | angus.clark@gm.com |
| Snyman, Piet (Mr) | Cacadu DM | 041 508 7335 | 083 453 8119 | psnyman@cacadu.co.za |
| Olivier, Willie (Mr) | Coega IDC | 041-403 0400 | 083 593 5506 | willie.olivier@coega.co.za |

| Contact Person | Organisation | Telephone | Cell | Email |
|---|---|---|---|---|
| Taylor, Graham (Mr) | Coega IDC | 041-403 0454 | 083 228 3055 | graham.taylor@coega.co.za |
| Botha, Reg (Mr) | Kouga LM | 042-200 8353 | 082 894 6582 | rbotha@ec108.org.za |
| Chapman, Nick (Mr) | VWSA | 041-994 5553 | 082 377 5598 | chapman@vwsa.co.za |
| Dyala, MK (Mr) | NAVCOC | | | mkdyala@gmail.com/ nafcocnmb@gmail.com |

## ADMINISTRATIVE AND TECHNICAL SUPPORT GROUP

| Contact Person | Organisation | Telephone | Cell | Email |
|---|---|---|---|---|
| **DWA NATIONAL OFFICE** | | | | |
| Thompson, Isa (Ms) | D: NWRP CE: South | 012-336 8647 | 082 805 2158 | thompsoni@dwa.gov.za |
| Mugumo, Menard (Mr) | CE: OA | 012 336 6838 | 082 804 5162 | mugumom@dwa.gov.za |
| Viljoen, Pieter (Mr) | D: WRPS | 012-336 7500 | 082 808 0497 | ViljoenP@dwa.gov.za |
| Nel, Elias (Mr) | D:WRPS | 012-336 7882 | | NelE2@dwa.gov.za |
| Pashkin, Jenny (Ms) | D: WRPS | 012-336 8695 | 082 804 3143 | PashkinJ@dwa.gov.za |
| Ntuli, Celiwe (Ms) | D: WRPS | 012-336 7618 | 082885 1942 | NtuliC@dwa.gov.za |
| Fourie, Fanus (Mr) | D: WRPS Groundwater | 012-336 6731 | 082 801 5598 | fourief@dwa.gov.za |
| **DWA EASTERN CAPE** | | | | |
| Geldenhuys, Theo (Mr) | CE: Water resources management | 048-881 3005 | 082 808 0499 | geldent@dwa.gov.za |
| Labuschagne, Martin (Mr) | WR&U-WUE | 048-881 3005 | 083 627 5925 | labuschagnem@dwa.gov.za |
| Mullineux, Stephen (Mr) | DCE: Water regulation and use (WR&U) | 048-881 3005 | 082 809 5687 | mullins@dwa.gov.za |
| Viljoen, Koos (Mr) | Southern Operations (NWRI) | 041-508 9703 | 082 804 1790 | Viljoenk@dwa.gov.za |
| Blie, Siziwe (Ms) | DD: IE | 043-701 0376 | 082 652 7983 | blies@dwa.gov.za |
| **NMBM** | | | | |
| Groenewald, Stan (Mr) | NMBM | 041-506 2258 | 079 490 0716 | stan@mandelametro.gov.za |
| A**GRICULTURE** | | | | |
| Colesky, Rienette (Ms) | Gamtoos IB | 042 283 0329 | 083 703 0428 | gamtoos@lantic.net |

## STUDY TEAM

| Contact Person | Organisation | Telephone | Cell | Email |
|---|---|---|---|---|
| van der Berg, Erik (Mr) | Aurecon | 021-526 5790 | 082 553 5795 | Erik.vanderberg@aurecongroup.com |
| van Reenen, Dup (Mr) | AfriCoast Engineers SA | 041-505 8000 | 082 785 3838 | dupva@africoast.com |
| Zastron, Reina (Ms) | Aurecon | 041-503 3921 | 083 297 9454 | Reina.Zastron@aurecongroup.com |