water & sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

CONTINUATION OF THE INTEGRATED VAAL RIVER SYSTEM RECONCILIATION STRATEGY STUDY (PHASE 2)

STATUS REPORT 1

April 2018

FC/02377.cdr

water & sanitation
Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

DIRECTORATE: NATIONAL WATER RESOURCE PLANNING

STRATEGY STEERING COMMITTEE FOR THE CONTINUATION OF THE VAAL RIVER SYSTEM RECONCILIATION STRATEGY STUDY (PHASE 2)

STATUS REPORT 1

APRIL 2018

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Title:	***Status Report 1***
Authors:	*Study Team*
Project Name:	*WP11182:* ***Continuation of the Integrated Vaal River system Reconciliation Strategy (Phase 2)***
Status of Report:	*Final Draft*
First Issue:	*April 2018*

Consultants: BATATISE/UWP/WRP Joint Venture

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LIST OF ABBREVIATIONS AND ACRONYMS

AMD	Acid Mine Drainage
AOA	Annual Operating Analysis
BID	Background Information Document
DWS	Department of Water and Sanitation
EIA	Environmental Impact Assessment
EWR	Environmental/Ecological Water Requirements
IVRS	Integrated Vaal River System
LHWP	Lesotho Highlands Water Project
NWRP	National Water Resource Planning
PSP	Professional Service Provider
RWQO	Resource Water Quality Objective
SSC	Strategy Steering Committee
TSG	Technical Support Group
WC/WDM	Water Conservation and Water Demand Management
WRPM	Water Resources Planning Model
WWTP	Waste Water Treatment Plant

1 INTRODUCTION

The Department of Water and Sanitation (DWS) has commissioned a three-year study (2018 - 2020), the Continuation of the Vaal River System Reconciliation Strategy Study (Phase 2). The study was commissioned as a further endeavour to reconcile the current and future water requirements with the available water by implementing appropriate interventions to increase the available water, conserve water through conservation and water demand management measures as well as improve the water quality in the river systems.

The objective of the study is to track progress with the implementation of the strategy actions, review key factors that influence the projected water balance and identify further water resource planning and management interventions deemed necessary to maintain a positive water balance for the next 30 years.

The study area comprises the Vaal River Catchment and all the adjacent water resource systems linked though conveyance systems as depicted in the study area geographical map shown in **Figure 1-1**.

On 27 February 2018, the DWS convened the first meeting of the Vaal River Strategy Steering Committee (SSC) of Continuation of the Vaal River System Reconciliation Strategy Study (Phase 2) (twelfth meeting overall) with the purpose to:

- Introduce the Integrated Vaal River System Reconciliation Strategy Study – Phase 2 study to the SSC.
- Confirm the role of the SSC.
- Provide an overview of the study activities.
- Provide a perspective on the current water balance status.
- Obtain feedback on progress with the strategy interventions.
- Confirmation of SSC membership.

A Background Information Document (BID) for the study and a Terms of Reference for the Vaal River System SSC was prepared and distributed prior to the meeting. The meeting was attended by stakeholders representing key national and provincial government departments, municipalities, water service providers, industry and civic organisations as well as agriculture. The SSC, is expected to meet approximately every six months during the course of the study.

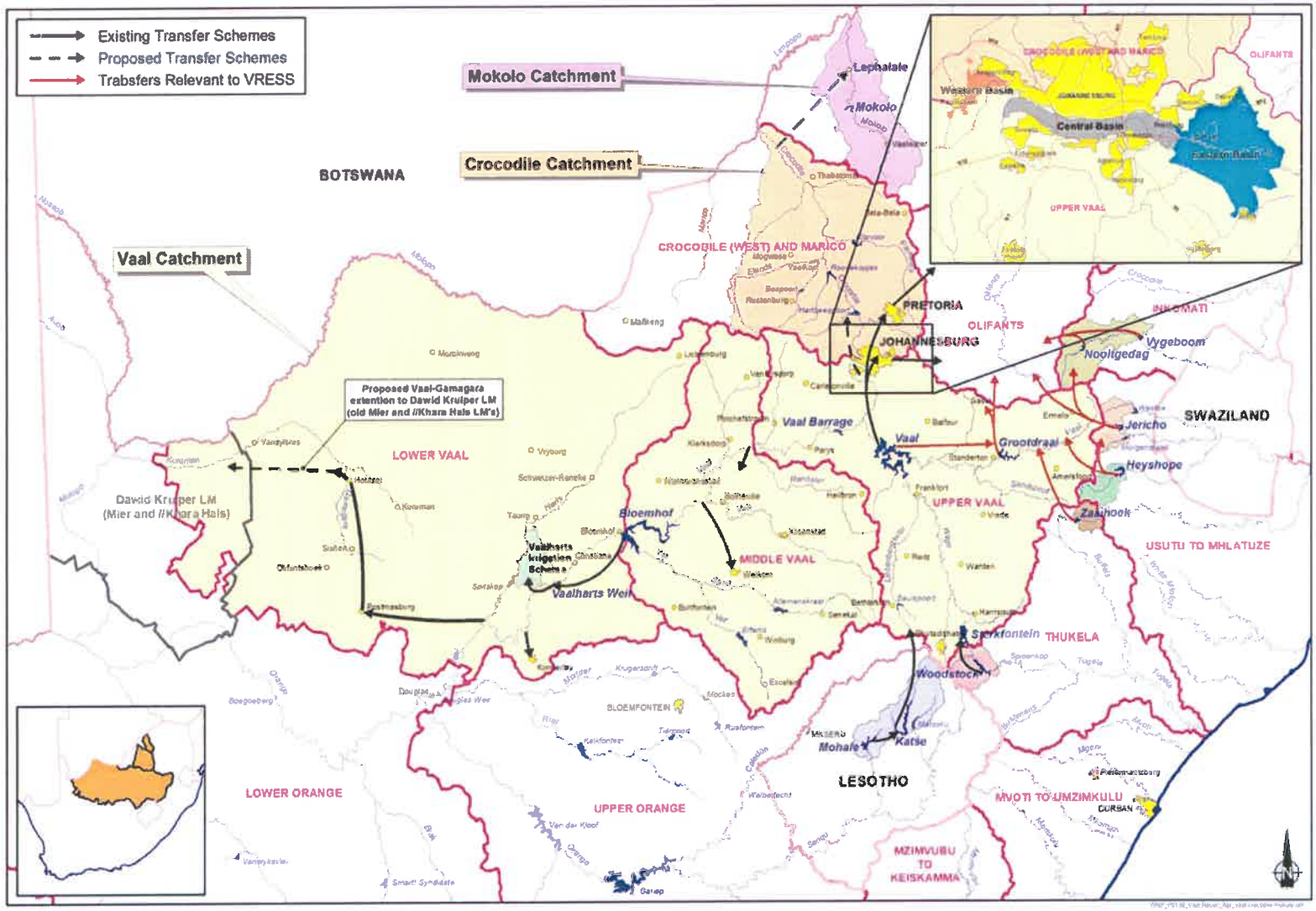

Figure 1-1: Study Area

1.1 Purpose and layout of this report

The primary purpose of this report is to document the status of the Reconciliation Strategy as it was presented and discussed on the twelfth SSC meeting. It is however deemed appropriate to present a brief background in Chapter 2 of past planning activities and processes leading up to the present.

2 BACKGROUND

2.1 Brief planning history of past three decades

Table 2-1 presents a summary of pertinent water resource planning activities carried out over the past three decades to demonstrate the rational, sequence of events and decisions leading up to the current water resource management status of the Integrated Vaal River System.

Table 2-1: Summary of planning activities during the past three decades.

Year	Activity	Comment
1983	Drought Analysis	• Performed cursory hydrological simulations using HEC model to assist with the management of the drought during the early eighties.
1990	Vaal River System Analysis	• Configures integrated system analysis models. • Multi-catchment stochastic flow generation model enabling sophisticated hydrological risk analysis.
Since 1989	Vaal River Annual Operating Analysis	• Application of the system model for risk base system operations planning.
1996	Vaal Augmentation Planning Study (VAPS)	• Evaluate, compare and shortlist water resource infrastructure development options to augment the Vaal River System. • Recommended that a further phase of the LHWP and the Thukela Water Projects are comparable and should be investigated further.

2001	Vaal River System Analysis Update Study (VRSAU)	• Updated the systems models including full recalibration of the hydrology and water quality (salinity) models.
2001	Thukela Water Project Feasibility Study	• Selection of most feasible infrastructure water resource development option in the Thukela River System to augment the Vaal River System.
2003	Thukela Water Project Decision Support Phase	• Bridging study incorporating the Ecological Water Requirements determined for the Thukela River.
2004	Internal Strategic Perspectives (ISP)	• Document DWAF's perspective on water resource management for all catchments in South Africa.
2004	Vaal River Eastern Subsystem Augmentation Project (VRESAP)	• Compared various water resource infrastructure options to augment the Vaal River Eastern Sub-system. • Lead to the implementation of the Vaal River Eastern Subsystem Augmentation Pipeline.
2007	Potential Savings Through WC/WDM in the Upper and Middle Vaal WMA	• Detail investigation into the potential to reduce water use by implementing WCWDM interventions. • Birth of Project 15% - one of the pillars of the Reconciliation Strategy.
2009	Vaal River System: Large Bulk Water Supply Reconciliation Strategy	• Formulation of the Reconciliation Strategy Study.
2009	Development of an Integrated Water Quality Management Plan for the Vaal River System.	• Formulation of a system wide water quality management plan.
2009 to 2015	Maintenance of the Vaal River Reconciliation Strategy.	• Predecessor of the current study and first strategy implementation phase.
2010	Comprehensive Reserve Determination: Integrated Vaal River System.	• Giving effect to Part 3 the National Water Act (Act No 36 of 1998) for the Integrated Vaal River System
2010	Comparative Study Between LHWP Phase II and Thukela Water Project	• This lead to the decision to implement Phase 2 of the LHWP.
2011	Extension of hydrological records	• ORASECOM Basin-Wide Integrated Water Resource

	up to the year 2004.	Management Plan. • Extension of hydrological records to cover the period 1920 to 2004.
2012	Classification of Significant Water Resources (WMA 8,9,10)	• Following the promulgation of the National Water Resource Classification System in September 2010.
2013	Feasibility Study for the Long-Term Solution to address the AMD from the Eastern, Central & Western mining basins.	• Lead to the decision to implement desalination as the long term solution to manage Acid Mine Drainage of the indicated underground basins.
2015	Continuation of the IVRS Reconciliation Strategy Study (Phase 1)	• Final SSC meeting was held in June 2015.
2016	Define the Resource Quality Objectives of Water Resources for Catchments in the Upper, Middle and Lower Vaal.	• Provide numerical and/or descriptive statements about the biological, chemical and physical attributes that characterise a resource for the level of protection defined by its Class.
2018	Vioolsdrift/Noordoewer Dam Feasibility Study in the Lower Orange.	Asses the feasibility of yield replacement options in the Orange to offset the yield reduction of Polihali Dam (Phase 2 of the LHWP) on the Orange River Project.

2.2 Reconciliation Strategy Background

The initial Reconciliation Strategy for the Vaal River System was developed in 2009 and was a culmination of the three parallel processes listed below and summarised in subsequent sections:

- Development of an Integrated Water Quality Management Plan (**DWAF, 2008c**).
- Determine the Potential Savings through Water Conservation and Water Demand Management (WC/WDM) in the Upper and Middle Vaal Water Management Areas (**DWAF, 2006b**).
- Development of Large Bulk Water Supply Reconciliation Strategy for the Vaal River System **(DWAF, 2009)**

A summary of the key findings from the above three processes are presented in the following sections.

2.2.1 Integrated Water Quality Management Plan:

The overall conclusions of the Integrated Water Quality Management Plan are as follows:

- 'The traditional approach of implementing Vaal River Augmentation Schemes to supply water and address water quality issues is still appropriate and economically attractive.
- The treatment and re-use of selected high concentration discharge streams is a favourable scenario.
- The treatment and reclamation of selected high salinity mine waters and industrial effluents are becoming increasingly more attractive.
- The simulations highlighted the development of the excess water volume in Bloemhof Dam due to the increased return flows and the dilution water.
- Many other water resource management policy and management considerations over and above the economic aspects, drive the implementation of the saline mine/industrial effluent reclamation schemes. Some of these include:
    - Best use of local water resources.
    - Application of the "polluter pays" principle.
    - Reduced reliance on transferred water.
    - Use of good quality water to dilute pollution.

Salinity Management Strategy

The strategy for the management of salinity is summarised as follows:

- The current salinity status in the Vaal Dam and Grootdraai Dam Catchments should be maintained. This will involve careful and diligent management of the upstream mining activities in particular post closure.
- The short term strategy for the middle reaches from Vaal Barrage to Bloemhof Dam is to implement. The release of dilution water from Vaal Dam to dilute the outflow from the Vaal Barrage to 600 mg/ℓ. The implementation of this scenario does not meet the initial set of Resource Water Quality Objectives (RWQOs) set for the Vaal River main stem, but does result in an improvement in the water quality in the middle reaches of the Vaal

River. The water users will incur economic dis-benefits due to the salinity levels and a waste discharge charge should be used to compensate for these dis-benefits.

- The medium to long term management strategy is to implement the treatment and reclamation of saline mine water streams. This will have a direct benefit in reducing salinity in the Vaal Barrage and middle Vaal River.
- The release of Vaal Dam dilution water is feasible until 2014, after which excess water will start accumulate in Bloemhof Dam. By 2014, a plan to use the excess water needs to have been developed. The plan could be to support the lower Orange from Bloemhof Dam, transfer to the Crocodile West catchment or treat and re-use in the Vaal River System.
- The short term RWQOs for the Vaal River main stem and for the tributaries should be established and compliance monitoring reported against the RWQOs. The tributary catchments must be managed to meet the RWQOs established at the downstream point of the catchment.
- The current water quality monitoring programme must be expanded, according to the monitoring programme developed as part of the study.
- The impact of the salinity management strategy selected for the Vaal River on the Orange River must be investigated. Before a final decision is made, consideration must be given to the water quality impact on the Lower Orange River of the preferred management option and the RWQOs established. The impact of the releases to support the Lower Orange River reaches on water quality need to be investigated as well as the impact of the next augmentation scheme.

Nutrient Management Strategy

The strategy for the nutrient management is summarised as follows:-

- The Waterval Catchment Management Strategy developed by the DWS which includes the improved management of the WWTP to meet the phosphorus RWQO set for the Waterval River should be implemented. This will reduce the nutrient loads reporting to Vaal Dam and should improve the trophic status of Vaal Dam.
- Flow manipulation along the Middle Vaal during the months of September through October will be used to manage the risk of algal blooms in the middle reaches of the Vaal River from Vaal Barrage to Bloemhof Dam in the short term. The Vaal Dam release will be piloted, the impacts monitored and the release protocols documented. This will involve

the release of water from the Vaal Barrage (augmented from Vaal Dam) to reduce residence times and improve mixing. The initial release proposed is:-

- Base flow 15 m^3/s for 28 days - giving a total release volume of 36.3 million m^3.
- 100 m^3/s for 48 hours - giving a total release volume of 17.3 million m^3.
- Total of 53.6 million m^3 will be released during the annual flow manipulation programme.
- The recommended flow manipulation recommended will be considered with the Reserve scenarios to ensure the alignment to the ecological water requirements.

- Phosphorus has been selected as the limiting nutrient for the management of eutrophication. A set of RWQOs for phosphorus was developed for the main stem of the Vaal River. The proposed RWQOs are based on an analysis of the available nutrient and algal database.
- The operations and maintenance of many of the WWTP are poor and poor quality effluents are discharged. In many cases, the WWTP are not able to handle the hydraulic or the organic loads. As a result, the installed treatment technology is not always working to specification. An audit of the WWTP, especially draining to the Vaal Barrage, is required to determine the works that are not working to specification and develop a programme to retrofit and upgrade these works.
- The medium to long term strategy will be the further management of phosphorus by reducing the load discharged from point sources. A better understanding of the nutrient balance in the Vaal Barrage and the Vaal River main stem from the Vaal Barrage to Bloemhof Dam is required, before revised discharge standards can be set. A nutrient balance study is therefore proposed which will result in a better understanding of the sources and fate of nutrients (phosphorus and nitrogen).
- A perspective is needed on the extent and costs of the measures needed (such as banning phosphorus containing detergents) to reduce the phosphorus loads received at the wastewater treatment works.
- The results of the Water Research Commission project aimed at developing a perspective on the economics of eutrophication on the water users. This should include recreational impacts as well as water treatment costs.

Microbiological Quality Management Strategy

The strategy for improving the microbiological water quality is related to getting the WWTP operating to their specifications and meeting their licence conditions specifically in terms of discharge quality. The strategy is similar to the nutrient management strategy in that the wastewater treatment works must be audited and the "hot spot" areas identified. Plans must be developed in consultation with the local municipalities to retrofit the works in these target areas.

Institutional

A strategy steering committee is to be established to oversee the further development and implementation of the reconciliation and the water quality management strategies. The details and proposed functions of the strategy steering committee are discussed under implementation. In association with the strategy steering committee the timeframes associated with implementation actions will be specified by the DWS.'

2.2.2 Potential Savings through WC/WDM in the Upper and Middle Vaal Water Management Areas (DWAF, 2009)

'It is deemed practical to successfully implement measures to save 15% within this time period, but not the larger 30% (that may only be achievable over the longer term) and in this strategy it is assumed that the 15% saving scenario will be achieved.

However, successful implementation is going to be very challenging. The users are spread out over a very large area with many metros and municipalities involved, as well as a number of water boards.

The responsibility for the implementation of WC/WDM measures reside primarily with the municipalities and their water service providers. DWAF and provincial government should provide an active supporting role by engaging with municipalities to overcome their constraints and possibly provide resources to implement WC/WDM measures in the supply area.

The report "*Potential Savings through WC/WDM in the Upper and Middle Vaal Water Management Areas*", provides detail information on the types of WC/WDM measures that should be considered in each target municipality. This serves as a point of departure for the development of projects and securing the required finances to implement WC/WDM measures.'

2.2.3 Vaal River Reconciliation Strategy (DWAF, 2009)

During the formulation of the Strategy a substantive stakeholder engagement process was followed (**DWAF, 2006**) which encompassed several stakeholder engagement events aimed at soliciting contribution from a wide range of institutions that are involved in managing various elements of the water provisioning cycle.

The strategy development process entailed detail assessments of the following aspects:

- Urban Water Requirement and Return Flow Scenario Development.
- Identification of water re-use options.
- Water resource analysis.
- Dolomitic Groundwater Assessment.
- Updating of the Irrigation Water Requirements and Return Flows.
- Reconciliation for a Preliminary Reserve Scenario.
- Update the Bulk Industrial Water Requirements.

There were five key actions identified in the 2009 Reconciliation strategy namely:

- Apply all the necessary resources to eradicate the unlawful water use as a national priority by 2011.
- Implement Water Conservation and Water Demand Management measures to reduce losses and reduce the urban demand by at least 15% by 2014.
- Undertake a feasibility study into the use of the excess water, with as first priority the water pumped from the gold mines.
- Implement the next infrastructure option (Phase 2 of LHWP)
- Constitute the Strategy Steering Committee.

Following the Strategy development phase, DWAF (now DWS) commissioned the Maintenance of the Vaal River Reconciliation Strategy towards the end of 2009 and converted the Study Steering Committee into a Strategy Steering Committee to oversee the implementation of the Strategy actions.

3 WATER BALANCE STATUS

A summary of the reconciliation scenario review from the SSC Meeting 11 held in June 2015 is described as the departure point for the current phase of the study. Updated water requirement projections, timing of intervention options, and risk analysis results were used to provide a preliminary revised water balance as described in **Section 3.1.**

3.1 Water Balance Status (SSC June 2015)

The June 2015 reconciliation scenario was prepared based on the current state of water in storage in the system and detailed risk analyses undertaken with the latest water requirements and intervention options details at that stage. The results informed the simplified water balances and the setting of revised targets for the Reconciliation Strategy actions.

3.1.1 Water Requirements

The Rand Water supply area water requirement projection scenarios are presented in **Figure 3-1** below. The October 2014 projection scenarios i.e. excluding and including WC/WDM (Project 15%) and the implementation of re-use by the City of Tshwane (solid red and green lines respectively) were applied in the June 2015 scenario. The dotted lines indicate the scenarios prepared for the January 2014 Strategy Steering Committee (10th meeting) and it can be seen that the updated water requirement projection is noticeably higher than the January 2014 projection.

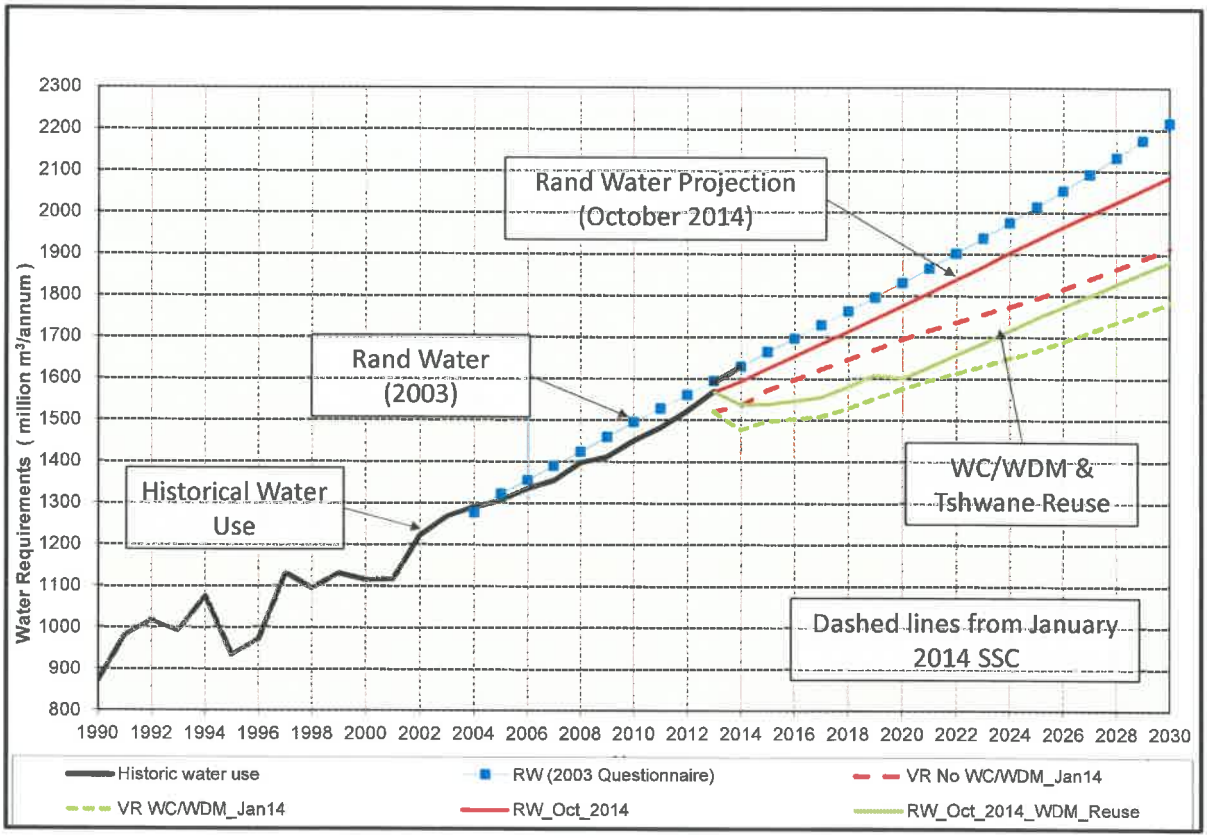

Figure 3-1: Rand water supply area water requirement projection scenarios

The total system net water requirement scenarios are summarised in **Figure 3-2**. The solid lines show the October 2014 projections while the dotted lines indicate the scenarios prepared for the January 2014 Strategy Steering Committee (10th meeting).

The blue lines represent the High Water Requirement Scenarios for the condition where the projections include the removal of unlawful irrigation water use (Scenario A). The October 2014 projection is higher than the January 2014 largely due to the higher Rand Water projection.

The green line accounts for the additional (remaining) savings to be achieved through WC/WDM measures (Project 15%) as well as the implementation of the City of Tshwane re-used initiative (Scenario B).

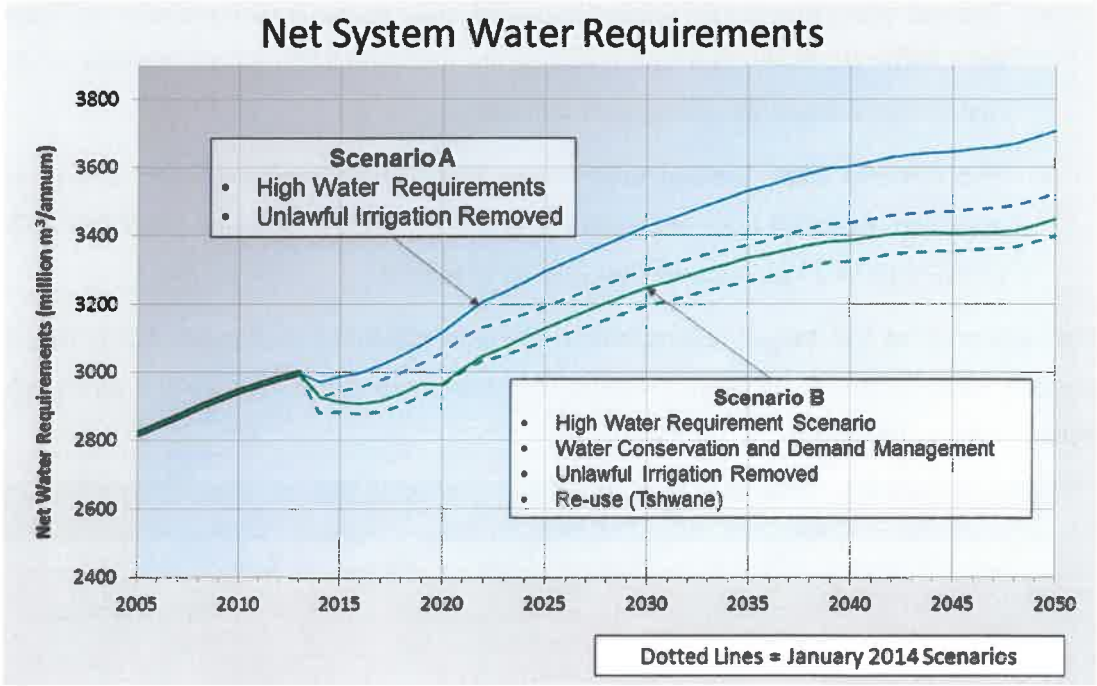

Figure 3-2: Total IVRS net water requirement scenarios

3.1.2 Water Balance of Target Scenario

The water balance and target reconciliation scenario (including all interventions) is shown in **Figure 3-3**, where the following can be observed:

- The discharge of high salinity mine water will increase once the underground compartments filled and this will require large volumes of releases from Vaal Dam for dilution, which reduces the system yield due to excessive spills and wastage from Bloemhof Dam.
- Desalination and use of the mine effluent prevent these wastages and the system yield remains at about 3 000 million m³/annum.
- The water used in 2014 (end of the black line) exceeds the long-term sustainable yield of the system and drought restrictions are being avoided only due the current high water levels in the dams.
- The eradication of unlawful irrigation water use by 2015 and the savings through WC/WDM will maintain a positive water balance until 2021.

- The red shaded area highlights the period, prior to the implementation of Phase II of the LHWP (Polihali Dam and conveyance infrastructure), where the risk of drought restrictions exceed the acceptable criteria.
- The red and white hashed area shows that, if the target WCWDM saving are not achieved, elevated risks of drought restriction will occur between 2020 and 2025 until LHWP Phase 2 can increase delivery as indicated.

The outcome of the target reconciliation scenario resented in **Figure 3-3** shows that a positive water balance can be maintained until and beyond the year 2050 if all the strategy actions are implemented.

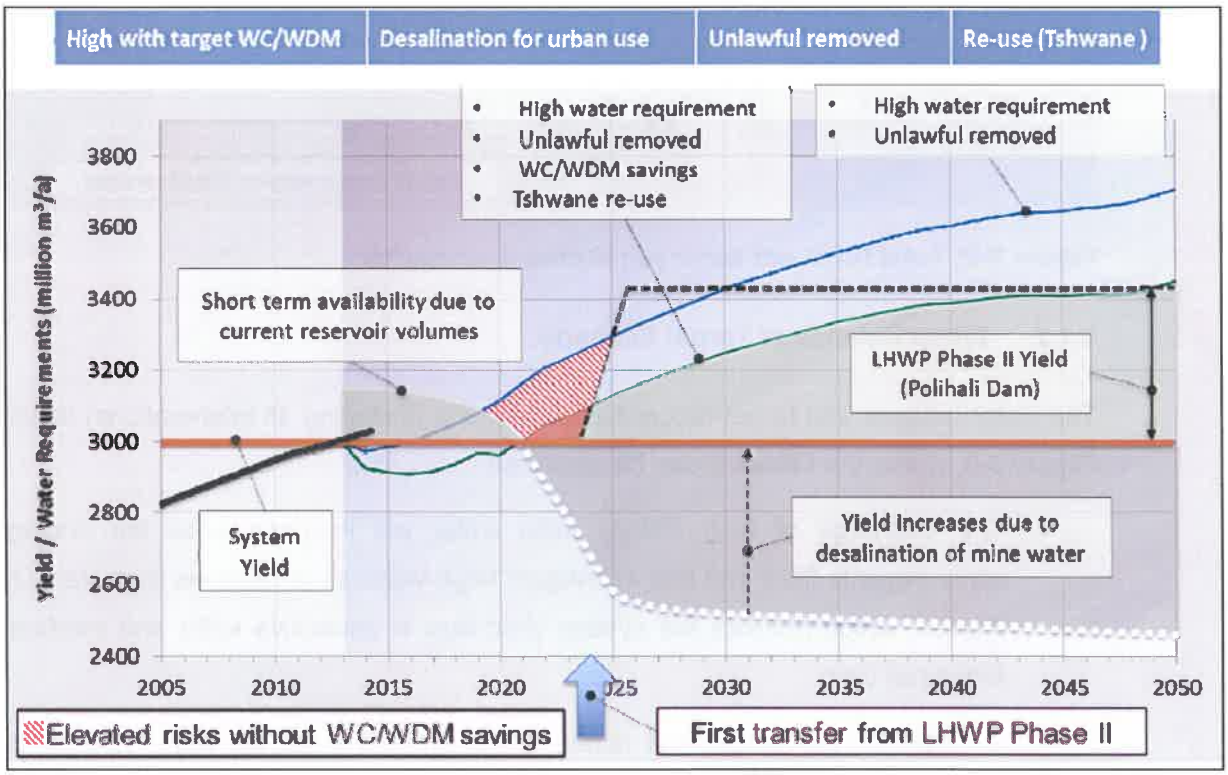

Figure 3-3: System balance for target reconciliation scenario (June 2015)

3.1.3 Strategic Interventions

The following strategic interventions and target implementation dates (where applicable) were identified:

- Eradication of unlawful water use by 2015.
- Implementation of WC/WDM (project 15%) and target savings to be achieved by 2017.

- Implement phase 2 of LHWP by 2023.
- Desalination and re-use of mine water effluent treatment by 2018.
- City of Tshwane water augmentation project (re-use).
- Plan yield replacement scheme in the Orange River System.
- Implementation of the Integrated Water Quality Management Plan, developed in 2009.

3.1.4 Reconciliation Perspectives

WC/WDM (Project 15%), eradication of unlawful water use in the irrigation sector, desalination of mine water and the re-use of water (Tshwane Project) are essential interventions to limit the risk of drought restrictions until LHWP Phase 2 can be implemented in the year 2023.

The risk of needing to implement drought restrictions in the Vaal River System will increase until Phase 2 of the LWHP can deliver water into Vaal Dam. Appropriate preparedness plans need to be put in place in all sectors and at all levels of the water supply chain to ensure consumption can be reduce when droughts occur as a measure to prevent complete failure in supply and before dams are depleted and empty.

3.2 Preliminary Revised Water Balance (February 2018)

Updated water requirement projections, timing of intervention options, and risk analysis results were used to provide a preliminary update of the water balance status. The updated revised balance is regarded as preliminary as the balance that has been prepared based on difference analysis. Detailed risk analysis will be undertaken in the subsequent phases of the study to verify the projected water balance.

3.2.1 Water Requirements

The Rand Water supply area water requirement projection scenarios are presented in **Figure 3-4** below. The reduction in actual water use in 2016 can be accounted to the restrictions that were implemented in that period. The later 2017/2018 Annual Operating Analysis (AOA) projection (purple line) is higher than the projection applied in the June 2015 scenario (red line).

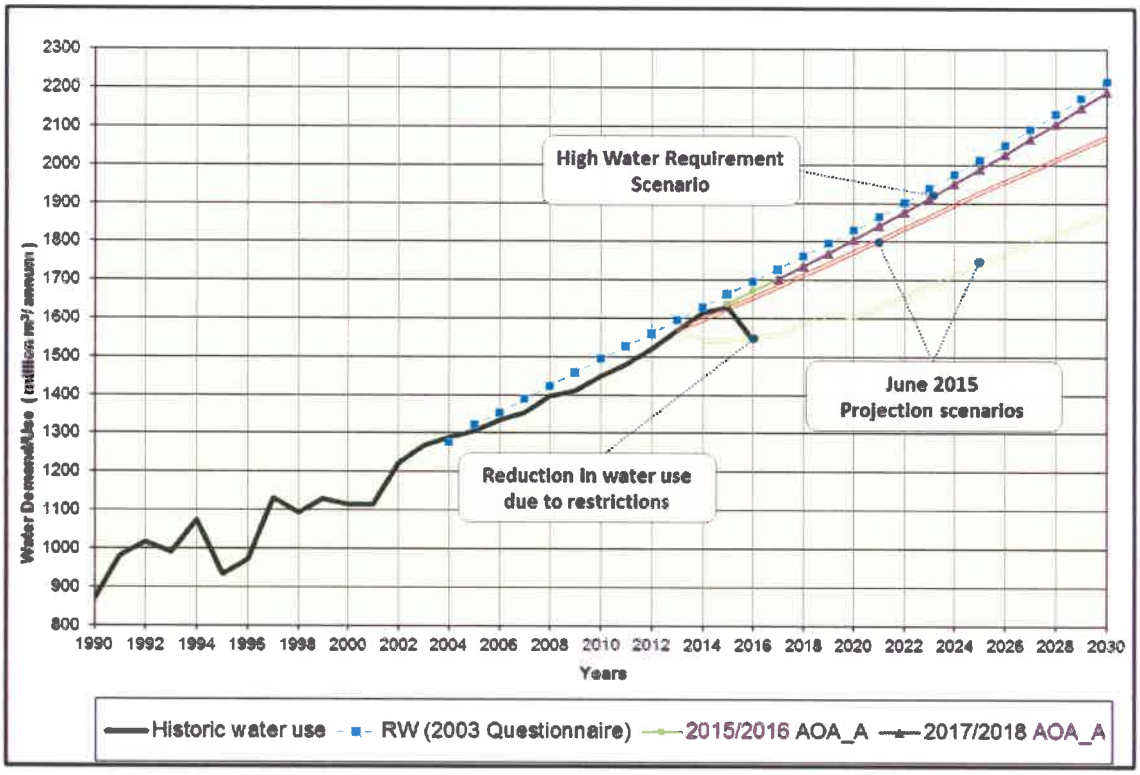

Figure 3-4: Rand water supply area water requirement projection (2017/2018 AOA)

The Eskom water requirement projections for the total IVRS are presented in **Figure 3-5**. The peak of the 2015 projection (green line (Apr-15H)) was extended in the June 2015 analysis due to the uncertainty as to when the actual drop in requirements can be expected. The 2016 projection (red line (Apr-16 B)) showed an earlier reduction on water requirements with a lower peak. The latest 2017 projection (blue line (Apr-17 B)) showed an even earlier reduction over the 2018-2020 period with a further reduction from 2028 onwards and is approximately 180 million m^3/a lower than the 2015 projection by 2035, which is a noticeable reduction.

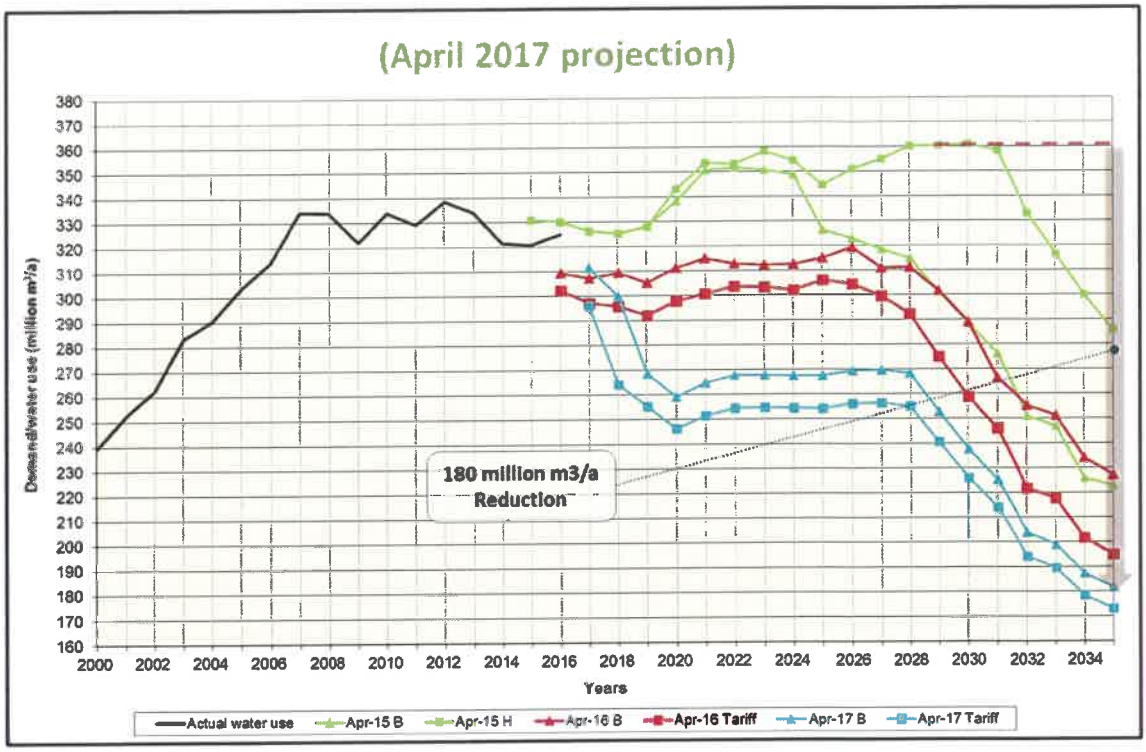

Figure 3-5: Eskom water requirement projection (April 2017) for the total Integrated Vaal River System

The June 2015 total system net water requirement scenarios were updated with the latest Rand Water and Eskom Projections applied in the 2017/2018 (AOA). A comparison of the June 2015 (dotted lines) and the updated total system net water requirement projections (solid lines) for the two scenarios are summarised in **Figure 3-6**. It can be seen that the updated water requirement projections are lower in the short to medium planning horizon but slightly higher in the long-term planning horizon.

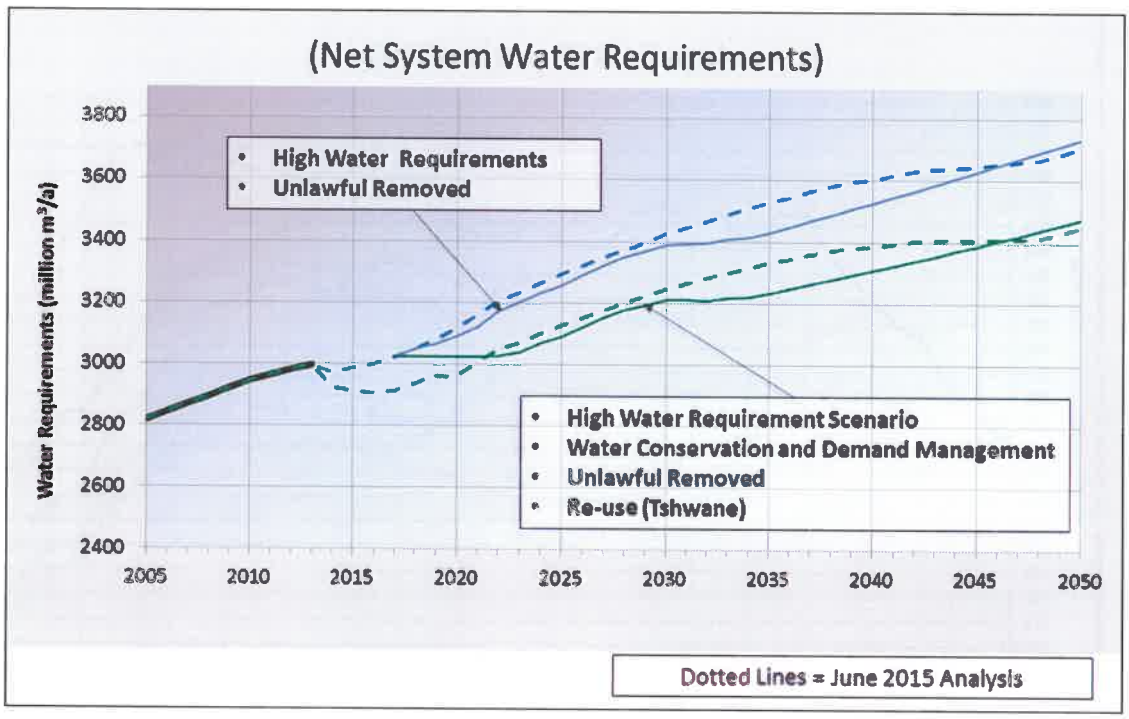

Figure 3-6: Total IVRS net water requirement scenarios

3.2.2 Status of Intervention Options

Updated implementation dates for the strategy interventions were sourced and summarised are summarised below:

- Implementation of WC/WDM (project 15%) over the next 5 years (June 2015 date for savings to be achieved was 2017).
- Implement phase 2 of LHWP by 2025 (June 2015 implementation date was 2023).
- Desalination and re-use of mine water effluent treatment by January 2022 (June 2015 implementation date was 2018).
- Implementation of a yield replacement dam in the Orange River System by 2030.

3.2.3 2017/2018 AOA Risk Analysis

Risk analyses were undertaken as part of the 2017/2018 AOA with the Water Resource Planning Model (WRPM) as configured for the entire IVRS by simulating the water balance on a monthly time step and the simulations commenced with the reservoir storages as it was on the first of May 2017 (simulation starting storages).

The analysis applied 1000 stochastic sequences of plausible flow time series that are synthetically generated and replicate the historically statistical characteristics of the runoff from the various catchments in the system. The primary measure for comparing the scenario result was to assess the risk of drought curtailments for each scenario.

The updated water requirement projection scenarios presented in **Section 3.2.1** were applied in the risk analysis. The impact of the reduced Eskom water requirement projections can be clearly seen in the storage projection of the Komati System (**Figure 3-7**) which consists of Vygeboom and Nooitgedacht Dams and supports the Arnot, Hendrina, Komati and Duvha power stations and 3rd party users. The unutilized yield at a 1 in 100 years recurrence interval (99% assurance of supply) is shown in the figure which increases from 26 million m^3/a in 2020 to 65 million m^3/a by 2035.

Options as to how the surplus could be utilised within the IVRS or neighbouring Olifants River Catchment should be investigated. It must however be noted that the illustrated surplus yield will depend on whether the 2017 Eskom projections can be sustained and whether these will realise in future.

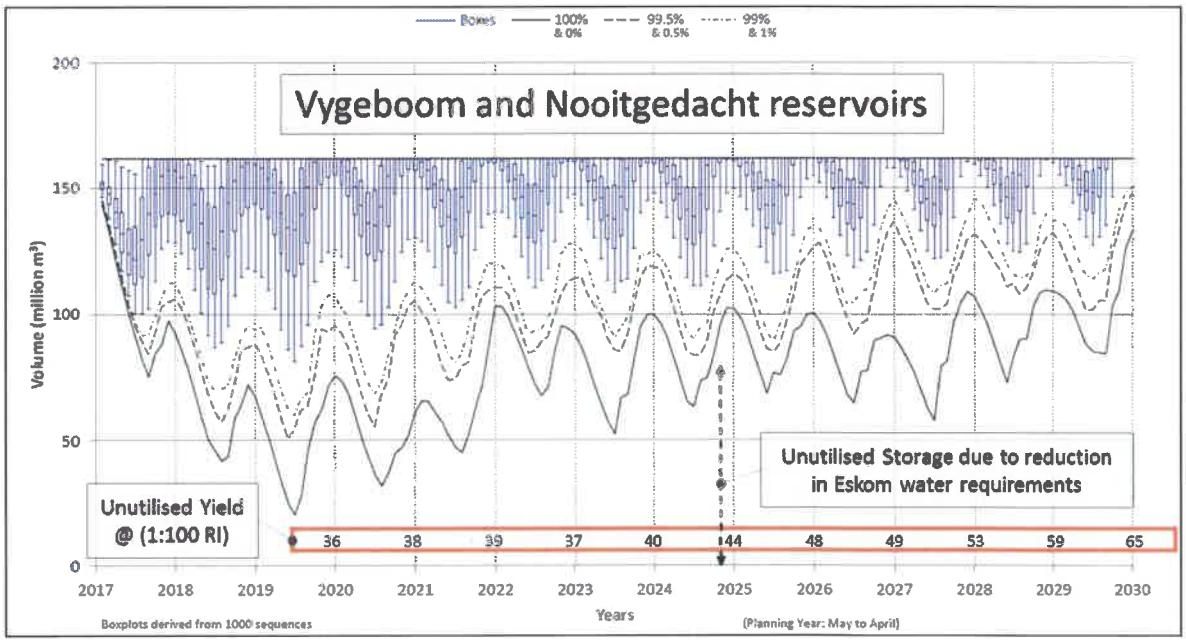

Figure 3-7: Storage projection of the Komati System

The storage projection of Bloemhof Dam in the lower Vaal is presented in **Figure 3-8**. The dilution rule was applied throughout the analysis period where water is released from Vaal Dam to maintain the total major salts in and downstream of the Vaal Barrage to levels below

600mg/l. The dilution rule has the effect that during the period of neutralisation and discharge (May 2017 to January 2022), large quantities of dilution releases are made from Vaal Dam to dilute the substantial pollution load from AMD, which then ends up in Bloemhof Dam.

This increases the risk of Bloemhof Dam spilling and concomitant water losses (wastage) from the Vaal River System during the indicated period and the excess storage in Bloemhof Dam storage volume projection up to January 2022 when the desalination of AMD is implemented, which is clearly illustrated in **Figure 3-8**. The AMD pollution load is reduced through desalination, thus reducing the dilution releases and Bloemhof Dam no longer has a surplus volume as a result.

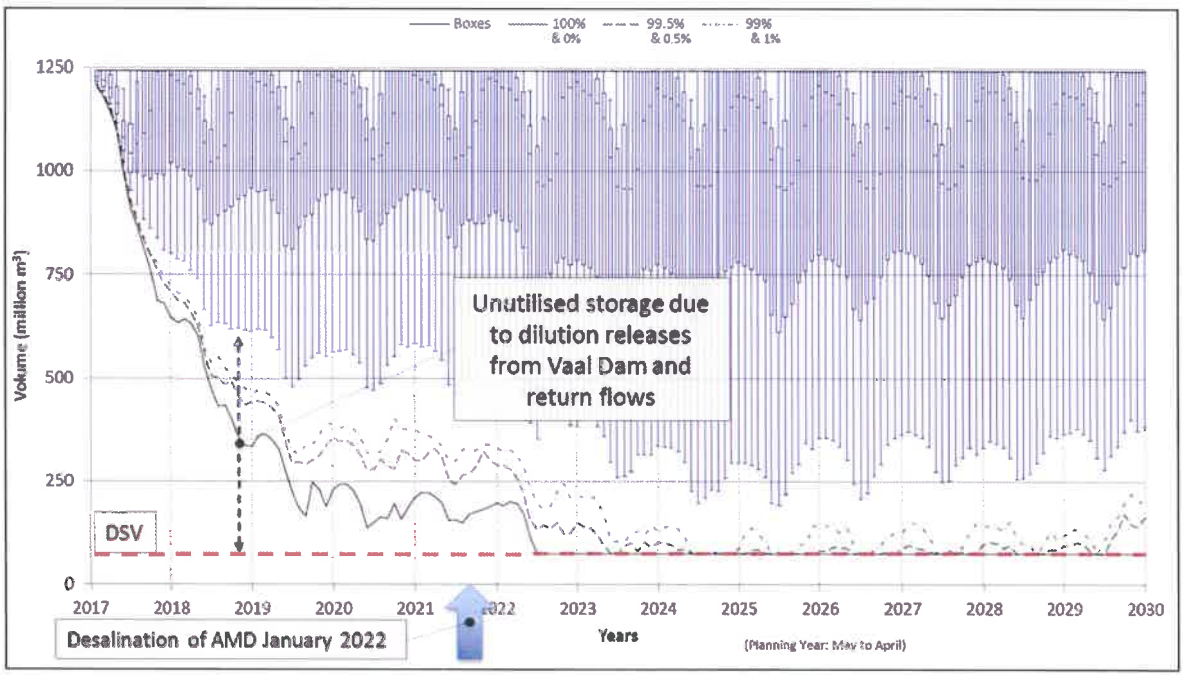

Figure 3-8: Storage projection of Bloemhof Dam

The risk of drought curtailments for the high water requirements projection scenario, desalination of AMD implemented by January 2022 and with the Lesotho Highlands Water Project not implemented is presented in **Figure 3-9**. The system is capable of supplying the projected water requirements up to the year 2019 with the risk of drought curtailments in the year 2020 exceeding the risk criteria as indicated by the annotation note and the red shaded areas.

This is five years prior to the latest date Phase 2 of the LHWP is scheduled to deliver water to the Vaal River System (2025). The presented results are for the overall IVRS i.e. combination of all the main dams in the system. This implies that the surplus storage in the Komati System (**Figure 3-7**) and the initial surplus storage in Bloemhof Dam (**Figure 3-8**) are

included in the results. The results thus require an adjustment, where the surplus storage of these two systems is removed, which will worsen the presented picture and increase the risk of restrictions.

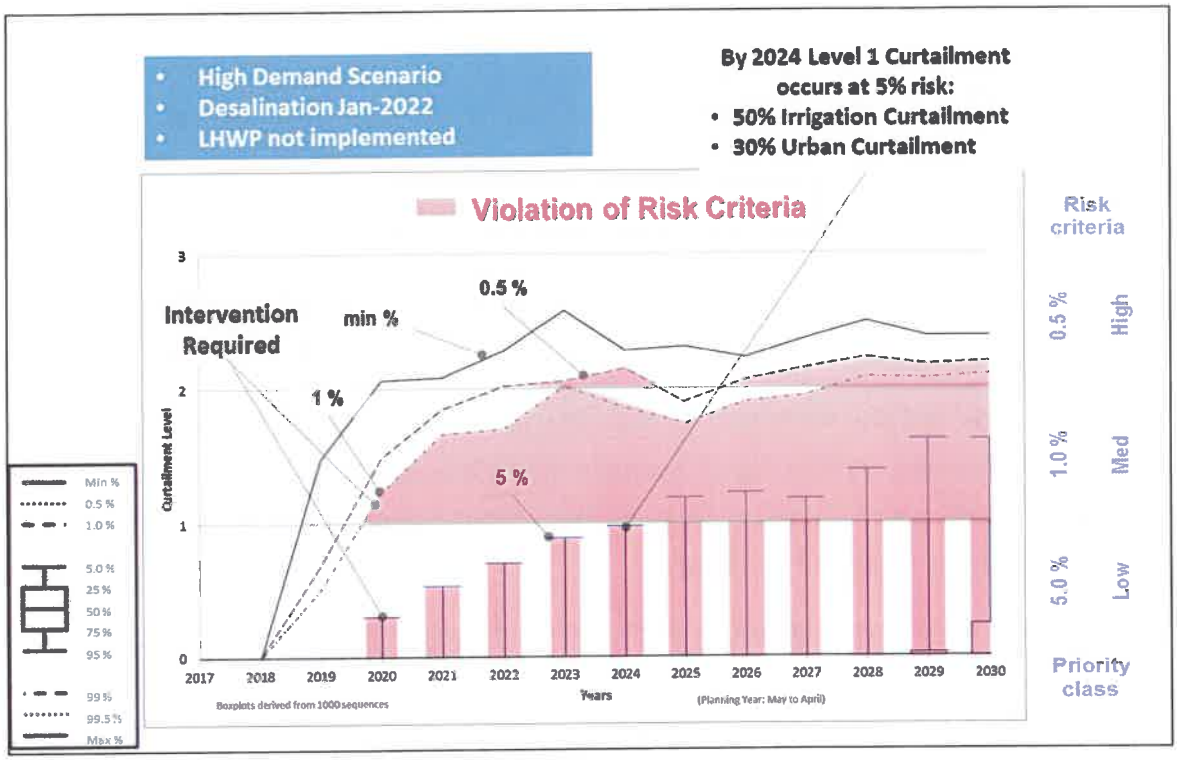

Figure 3-9: Risk of drought restrictions

3.2.4 Preliminary Updated Water Balance

The preliminary updated water balance is shown in **Figure 3-10**, where the following can be observed:

- The discharge of high salinity mine water will require large volumes of releases from Vaal Dam for dilution, which reduces the system yield due to excessive spills and wastage from Bloemhof Dam. Desalination and use of the mine effluent prevent these wastages.
- The illustrated system yield reduction is due to the excessive dilution releases resulting in surplus storage in Bloemhof Dam prior to the implementation of the desalination of mine effluent in January 2022 as well as the increase in surplus storage in the Komati System.

- The water used in 2017 (end of the black line) exceeds the long-term sustainable yield of the system and drought restrictions are being avoided only due the current high water levels in the dams.
- The red shaded area highlights the period, prior to the implementation of Phase II of the LHWP (Polihali Dam and conveyance infrastructure) and from 2043 onwards, where the risk of drought restriction are exceeding the acceptable criteria for the high water requirement scenario where the removal of unlawful water use, WC/WDM savings and the City of Tshwane re-use initiatives are implemented. The implementation of Polihali Dam will reduce of the yield of the Orange River Systems and as a result only the reduced net yield is available to the IVRS until a yield replacement dam in the Orange River System is implemented in 2030, after which the full yield is available as illustrated.
- The red and white hashed area shows that, if the target WC/WDM savings are not achieved and the City of Tshwane re-use initiative is not implemented, elevated risks of drought restriction will occur throughout the projection period, even with LHWP Phase 2 in place as indicated.

The outcome of the target reconciliation scenario (unlawful removed, WC/WDM, desalination of AMD by January 2022, City of Tshwane re-use) shows that a positive water balance can be only be maintained once both the LHWP Phase 2 and a yield replacement dam in the Orange River System have been implemented, after which the system is in need of further augmentation (Tugela Water Project) from 2043 onwards.

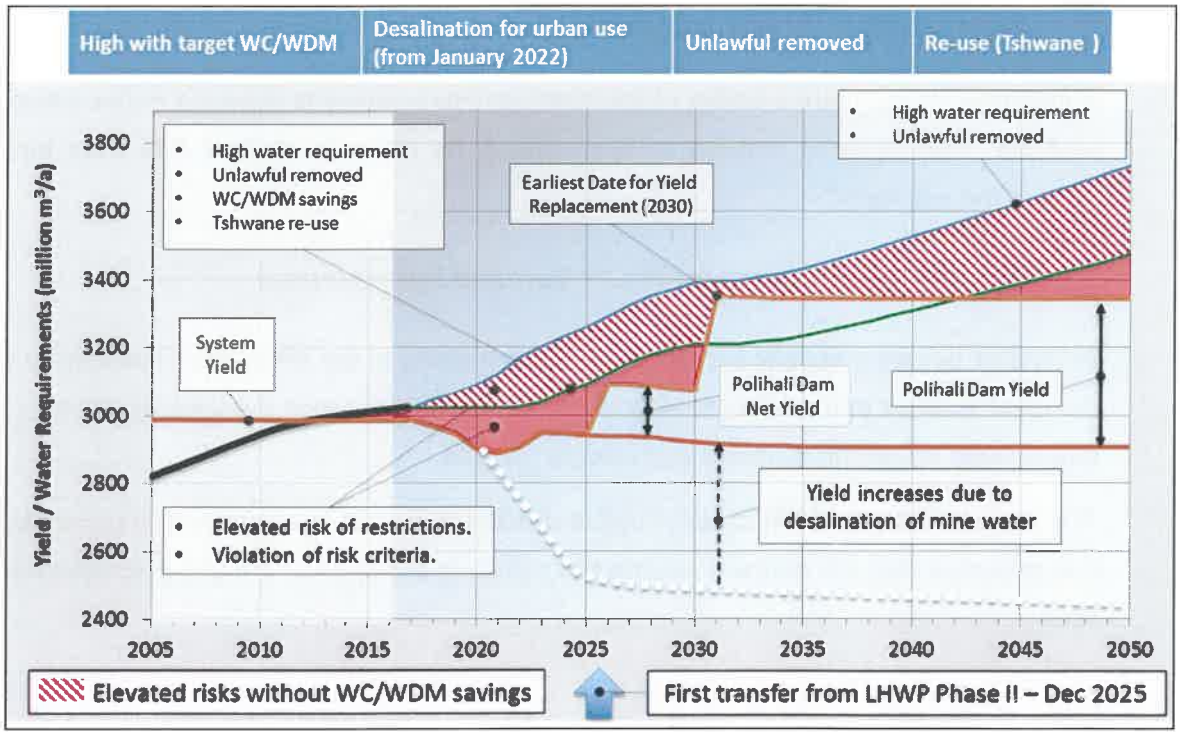

Figure 3-10: System balance for target reconciliation scenario (February 2018)

4 RECONCILIATION PERSPECTIVES:

WC/WDM, eradication of unlawful water use, desalination of AMD and re-use of mine water and the City of Tshwane re-use initiative are essential interventions to reduce the risk of drought restrictions which exceeds the criteria until LHWP Phase 2 delivers water.

After implementation of the LHWP Phase 2 and the yield replacement dam in the Orange River System the risk of drought restrictions exceed the acceptable criteria from 2043 onwards, indicating the need for further augmentation from the Thukela Water Project. It is recommended that the Thukela Water Project Feasibility is revived for future implementation.

Appropriate preparedness plans need to be put in place in all sectors and at all levels of the water supply chain to ensure consumption can be reduce when droughts occur as a measure to prevent complete failure in supply and before dams are depleted and empty.

5 STRATEGY INTERVENTIONS

A summary of the current status of the strategy interventions is provided in the subsequent sections. The reader is referred to **Appendix A** for the presentations that were made for each of the sub-items.

5.1 Water Conservation and Water Demand Management

WC/WDM targets originally set for metro municipalities in the IVRS have not met by any of the municipalities in the relevant area. Most of the municipalities are tracking the high water requirement projection scenario excluding WC/WDM.

The experienced reduction in water use is due to the restrictions that were implemented and it is expected that the demand returned to previous levels once the water restrictions were lifted

5.2 Rand Water Project 1600

Rand Water has initiated Project 1600 with the aim of providing guidance, support and oversight of progress made by the municipal sector to reduce the Rand Water demand to comply with the limit of 1600 million m³/a until the LHWP Phase 2 is implemented. Key initiatives include:

- A regional forum (IVRS Project 1600 WDM) was established with DWS, Municipalities, COGTA and SALGA has been established and quarterly meetings are being held.
- Municipalities were given supply targets per bulk meter based on efficiency model in September 2017.
- Performance of municipalities against their respective license target are monitored on a monthly basis and feedback is provided to municipalities on the 2nd week of every new month. General observations have been documented since December 2017.
- Municipalities have been requested to provide action plans for meters that exceed the license target (3 metros, Govan Mbeki and Mogale City presented action plans at the December 2017 meeting).

The next meeting is scheduled for 15 March 2018

5.3 City of Tshwane Water Resources Masterplan Implementation

The City of Tshwane Water Resources Masterplan implementation (re-use) is currently not on track and implementation cannot be expected before 2022.

5.4 Implementation of Lesotho Highlands Water Project Phase 2

The plans to implement LHWP Phase 2 have been delayed and the project is expected to deliver water by December 2025, as applied in the presented preliminary water balance analysis. The milestone forecast summary for each of the major components is presented in **Table 5-1**.

Table 5-1: LHWP Phase 2 milestone forecast

Milestone	Forecast
Advanced Infrastructure Commences	March 2018
Dam Impoundment Commence	November 2023
Dam Complete	December 2024
Tunnel Complete	December 2025
Water Delivery	From end December 2025

5.5 Implementation of the AMD Long-Term Solution

A professional service provider (PSP) for the design and optimisation of the long-term intervention has been identified following an open bidding process. The TCTA is to consider and the identified PSP for appointment before the end of February 2018.

The Environmental Impact Assessment (EIA) PSP was appointed in September 2017 and the EIA is underway. The formal application for the EIA is dependent on the availability of the project designs and it is thus important for the design PSP to be appointed, to mitigate delays.

The target commissioning date for the long-term solution is November 2020 (optimistic). A realistic commissioning date is January 2022, which was used in the presented preliminary water balance analysis.

5.6 Noordoewer/Vioolsdrift Dam Feasibility Study (Yield Replacement Option)

The feasibility identified the following two options (**Figure 5-1**):

- Option 1: Noordoewer/Vioolsdrift Dam

- Option 2: Combination of Verbeeldingskraal Dam and a smaller Noordoewer/Vioolsdrift Dam

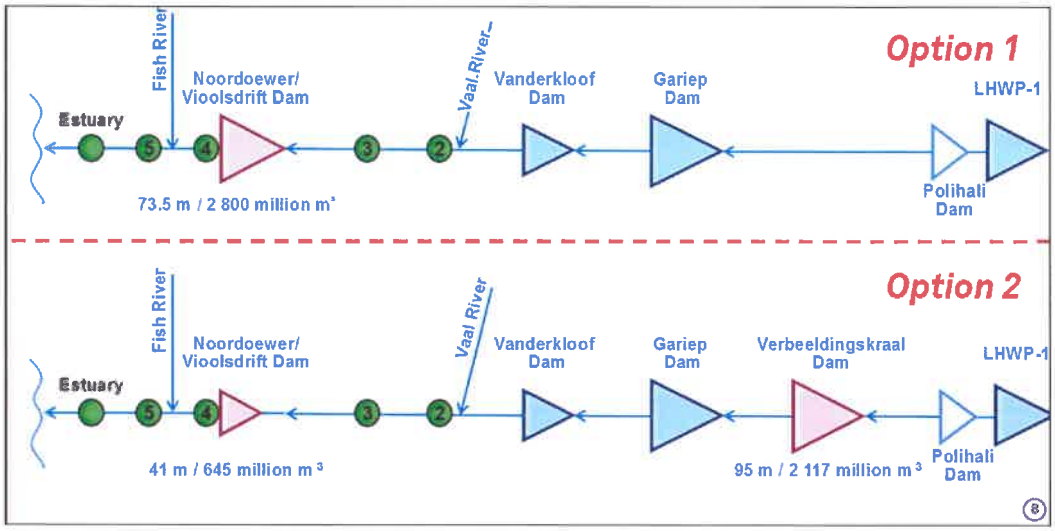

Figure 5-1: Alternative dam options

The study is in the process of being finalised in order to identify the best option (Noordoever/Vioolsdrift Dam size) for implementation and engagements between South Africa and Namibia are currently underway on the optimum development option. The EIA will be undertaken for the identified optimal development option. The implementation timeframe for the project is 2030, which was used in the presented preliminary water balance analysis.

6 GENERAL INFORMATION

Detailed progress reports on the water resource management strategies of the previous study phases and related studies can be found at the following link: http://www.dwa.gov.za/Projects/VaalWRMS/documents.aspx.

The Study Manager for this project is Mr. Seef Rademeyer, Chief Engineer at the Directorate: National Water Resource Planning (Central).

7 REFERENCES

DWAF, 2006 — Department of Water Affairs and Forestry, South Africa, Report No. P RSA C000/00/4405/02. **Potential Savings through WCWDM in the Upper and Middle Vaal Water Management Areas**. Compiled by WRP Consulting Engineers (Pty) Ltd, DMM Development Consultants, and PD Naidoo on behalf of the Directorates: Water Use Efficiency and National Water Resource Planning, 2006.

DWAF, 2008 — Department of Water Affairs and Forestry, South Africa. Reports of the **Integrated Water Quality Management Plan.** Study compiled by Zitholele Consulting, Golder Associates, DMM & WRP consultants on behalf of the Directorate: National Water Resource Planning, 2008

DWAF, 2009 — Department of Water Affairs and Forestry, DWAF Report Number: P RSA C000/00/4406/08. ***Vaal River System: Large Bulk Water Supply Reconciliation Strategy***: **Second Stage Reconciliation Strategy (March 2009).** *Prepared by:* DMM Development Consultants, Golder Associates Africa, SRK, WRP Consulting Engineers and Zitholele Consulting.

APPENDIX A

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CONTINUATION OF THE INTEGRATED VAAL RIVER SYSTEM RECONCILIATION STRATEGY STUDY – PHASE 2

Strategy Steering Committee Meeting 1

DWS Chair: L Mabuda
Chief Director: Integrated Water Resources Planning

Tuesday, 27 February 2018

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Continuation of the Integrated Vaal River System Reconciliation Strategy Study: Phase2

Item 3: Acceptance of Agenda

Tuesday, 27 February 2018

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AGENDA

09:00	1. WELCOME AND INTRODUCTION OF MEMBERS	DWS Chair: L Mabuda
09:15	2. ATTENDANCE AND APOLOGIES	Chair
09:20	3. ACCEPTANCE OF AGENDA	Chair
09:25	4. PURPOSE OF THE MEETING	Chair
09:30	5. ROLE OF THE STRATEGY STEERING COMMITTEE (SSC)	Chair
09:50	6. BACKGROUND AND INTRODUCTION OF THE STUDY • Background • Objective of the study • Appointed PSP	S Rademeyer
10:15	7. OVERVIEW OF STUDY ACTIVITIES	PSP
10:30	Tea (15 minutes)	
10:50	8. WATER BALANCE STATUS	PSP
11:10	9. STRATEGY INTERVENTIONS	Chair
11:15	9.1 WATER CONSERVATION / WATER DEMAND MANAGEMENT 9.1.1 Current status	W Wegelin
11:30	9.2 RAND WATER PROJECT 1600 9.2.1 Current status	S Gow

AGENDA

11:50	9.3 City of Tshwane Water Resources Master Plan Implementation 9.3.1 Current status	City of Tshwane (T
12:05	9.4 ERADICATION OF UNLAWFUL IRRIGATION 9.4.1 Current status	M Mokgwabone
12:20	9.5 IMPLEMENTATION OF INFRASTRUCTURAL AUGMENTATION OPTION (LHWP Phase 2) 9.5.1 Current status	L Tromp
12:35	9.6 IMPLEMENTATION OF THE AMD LONG-TERM SOLUTION 9.6.1 Current status	J van Wyk
12:45	9.7 NOORDOEVER/VIOOLSDRIFT DAM FEASIBILITY STUDY 9.7.1 Current status	S Rademeyer
12:55	10. DISCUSSION AND COMMENTS	Chair
13:05	11. COMMUNICATION AND CONFIRMATION OF SSC MEMBERSHIP	Chair
13:15	12. DATE OF NEXT MEETING	Chair
13:20	13. WAY FORWARD AND CLOSURE	Chair
13:25	LUNCH	

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Continuation of the Integrated Vaal River System Reconciliation Strategy Study: Phase2

Item 4: Purpose of the Meeting

Tuesday, 27 February 2018

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PURPOSE OF THE MEETING

- Introduce the study to all stakeholders
- Establish and define the role of the Strategy Steering Committee (SSC)
- Overview of study activities and water balance status
- Feedback on Strategy interventions
- Confirmation of SSC Membership

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Continuation of the Integrated Vaal River System Reconciliation Strategy Study: Phase2

Item 5: Role of the Strategy Steering Committee (SSC)

Tuesday, 27 February 2018

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ROLE OF THE SSC

- Provide executive guidance to the direction and outcomes of the study
- Make available supplementary information and input from a local and regional perspective
- Facilitate strategic linkages with other initiatives
- Disseminate information from study into the relevant organisations
- Incorporate strategies' recommendations into development plans such as IDPs etc;
- Ensure the implementation of the Strategy recommendations.

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Continuation of the Integrated Vaal River System Reconciliation Strategy Study: Phase2

Item 6: Background and Introduction of the Study

Tuesday, 27 February 2018

RECONCILIATION STRATEGY - WHAT IS IT?

- Plans of action or policy designed to ensure sufficient water is made available to towns over the next +-20 years.
- Uses existing information collected (building blocks) on:
  - Water requirements
  - Water use and infrastructure
  - Water resources
  - WC/WDM
- Develop scenarios to meet water requirements for current and future use, including optimisation of local resources, improved water services and water resource management.

RECONCILIATION STRATEGY - WHAT IS IT?

- It aims to answer the following questions:
  - How must water is needed? - now and in the future
  - What water resources are available or can be made available?
  - Which interventions can be consider to achieve a balance between water needs and supply?
- Focuses on the projected annual water balance.
- Also considers the accuracy of all the components that make up the water balance.

VAAL WATER RESOURCE MANAGEMENT HISTORY

1983	Drought Analysis (before systems & stochastic models)
1990	Vaal River System Analysis
Since 1989	Vaal River Annual Operating Analysis
1996	Vaal Augmentation Planning Study (VAPS)
2001	Vaal River System Analysis Update Study (VRSAU)
2001	Thukela Water Project Feasibility Study
2003	Thukela Water Project Decision Support Phase
2004	Internal Strategic Perspectives (ISP)
2004	Vaal River Eastern Subsystem Augmentation Project (VRESAP)
2007	Potential Savings Through WC/WDM in the Upper and Middle Vaal WMA
2009	**Vaal River System: Large Bulk Water Supply Reconciliation Strategy**
2009	Development of an Integrated Water Quality Management Plan for the Vaal River System
2010	Comprehensive Reserve Determination: Integrated Vaal River System
2010	Comparative Study Between LHWP Phase II And Thukela Water Project
2012	Classification of Significant Water Resources (WMA 8,9,10)
2013	Feasibility Study for the Long-Term Solution to address the AMD from the Eastern, Central & Western mining basins
2015	**Continuation of the IVRS Reconciliation Strategy Study (Phase 1)**
2016	Classes and Resource Quality Objectives of Water Resources for Catchments of the Upper, Middle and Lower Vaal
Current	This Study

OUTCOMES OF PREVIOUS ASSIGNMENT (2015)

- Options for reconciling increasing water requirements with the current supply in the Integrated Vaal River System:
  - WC/WDM (Project 15%)
  - Eradication of unlawful water use in the irrigation sector
  - Desalination of mine water
  - Re-use of water (Tshwane Project)
  - Lesotho Highlands Water Project Phase 2

WHY CONTINUATION OF A STRATEGY? (THIS STUDY)

- Water balances need to be continuously monitored / investigated and the strategy regularly updated to remain technically relevant.
- Ensures that intervention planning can be implemented taking into account any changes that may impact on the projected water balance.
- **Study Objective:** In-depth review, systematically update and improve the water resource reconciliation strategy so that it remains **relevant, technically sound, economically viable, socially acceptable and sustainable** and thus **enabling the implementation of the strategy by the relevant authorities.**

APPOINTED PSP

- The Professional Service Provider (PSP) appointed to undertake the study : **Batatise Consulting Engineers** in association with **UWP Consulting Engineers** and **WRP Consulting Engineers** (Joint Venture).

DWS Enquiries	Technical Enquiries	
Seef Rademeyer Chief Engineer: NWRP (Central) Tel: (012) 336 7500 Email: rademeyerS@dws.gov.za	**Leon de Jager** Batatise/UWP/WRP Tel: (012) 424 9700 Email: leondj@uwp.co.za	**Sibusiso Sithole** Batatise/UWP/WRP Tel: 082 921 1600 Email: sibusisos@romh.co.za

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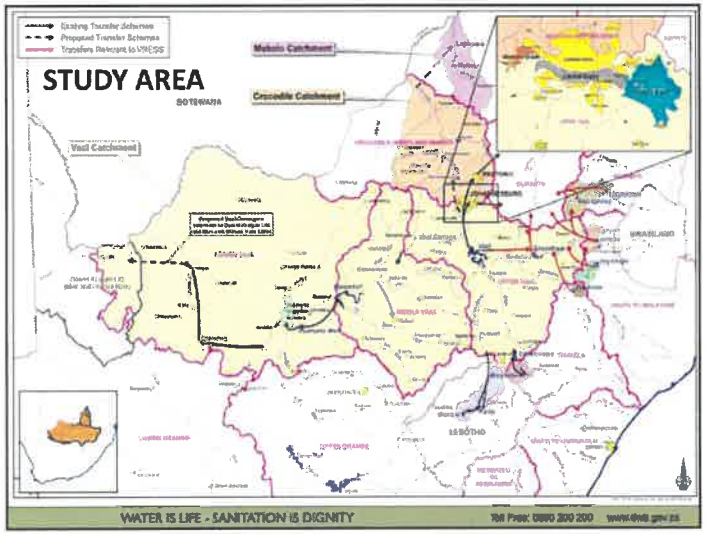
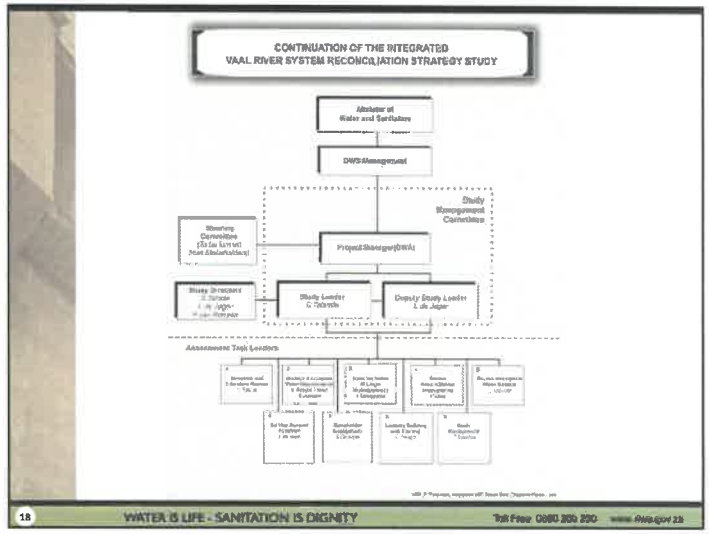
CONTINUATION OF THE INTEGRATED VAAL RIVER SYSTEM RECONCILIATION STRATEGY STUDY – PHASE 2

Item 7: Overview of Study Activities

Tuesday, 27 February 2018





STUDY TASKS

TASK NUMBER	TASK DESCRIPTIONS
1	Inception and literature review
2	Monitor and compare water requirements and return flow
3	Track Water Conservation and Water Demand Management
4	Review reconciliation interventions: • Bloemhof Dam excess utilisation investigation • Acid Mine Drainage (AMD) management option implementation monitoring • Evaluate the need to activate further planning of Thukela Water Project if required • Implications of reduced operational capacity on sustainable yield • Monitor/Track Progress: WCWDM, Eradication of unlawful irrigation, Implementation programme of LWHP Phase 2, Planning in the Crocodile (West) and Olifants River system that may influence this Reconciliation Strategy

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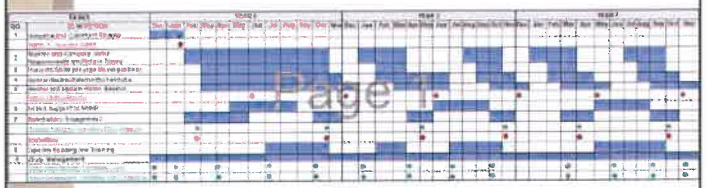
STUDY TASKS

TASK NUMBER	TASK DESCRIPTIONS
5	Review and update water balance
6	Stakeholder engagement
7	Capacity building and training
8	Ad Hoc Support
9	Study management

20 WATER IS LIFE - SANITATION IS DIGNITY

STUDY PROGRAMME



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Continuation of the Integrated Vaal River System Reconciliation Strategy Study: Phase2

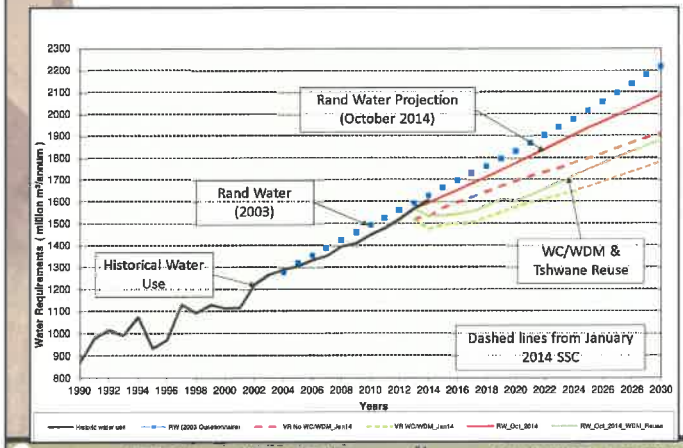
Item 8: Water Balance Status

Tuesday, 27 February 2018

Presentation Layout

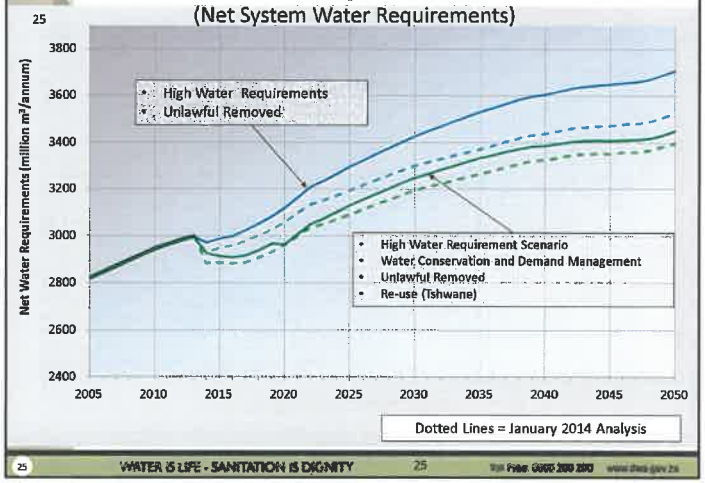
- **Water balance status - SSC June 2015 recap**
- **Revised information:**
  - Information from Annual Operating Analysis 2017:
    - AMD Desalination date – January 2022
    - High Water Requirement Scenarios - Rand Water
    - Risk analysis of projected drought water restrictions
  - Eskom water requirement projections - April 2017
  - LHWP Phase 2 – transfer water by December 2025
- **Preliminary revised water balance**
  - Risk and difference analysis

Rand Water Supply Area Scenarios (2015)

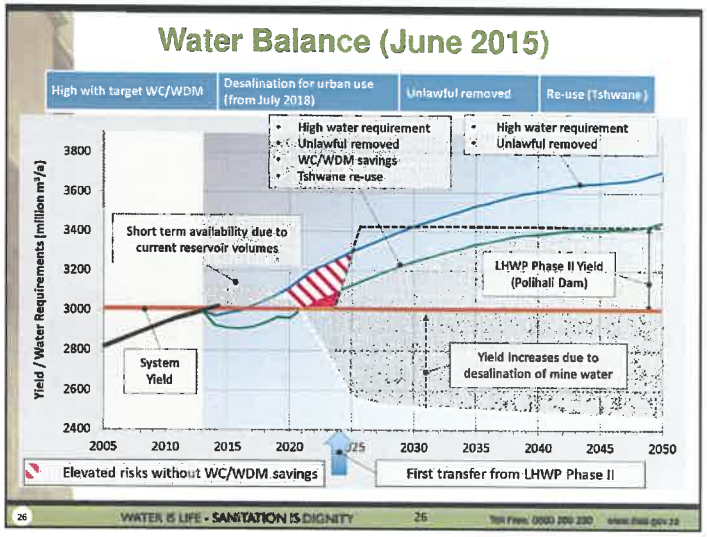


Water Requirements

(Net System Water Requirements)



Water Balance (June 2015)



Reconciliation Perspectives (2015)

The following are essential to maintain balance Until LHWP Phase 2 can deliver water:

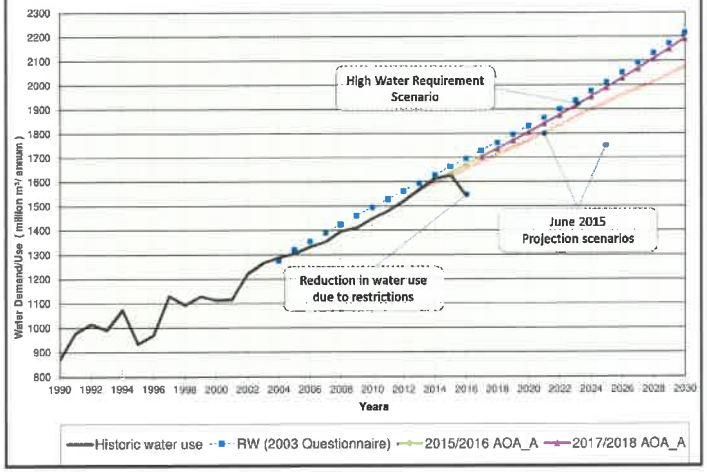
- **Water Conservation & Water Demand Management**
- **Eradication of Unlawful Use**
- **Desalination and Re-use of Mine Water**
- **Tshwane Re-use Project**

Strategic Interventions (2015)

- **Eradication of unlawful water use by 2015.**
- **Implementation of WC/WDM (project 15%) – achieve target savings by 2017.**
- **Implement phase 2 of LHWP by 2023.**
- **Mine water effluent treatment and use by 2018.**
- **Tshwane water augmentation project (re-use).**
- **Plan yield replacement scheme in Orange.**
- **Manage uncertainties: Vaal, Crocodile and Olifants.**
- **Implementation of integrated water quality management plan.**

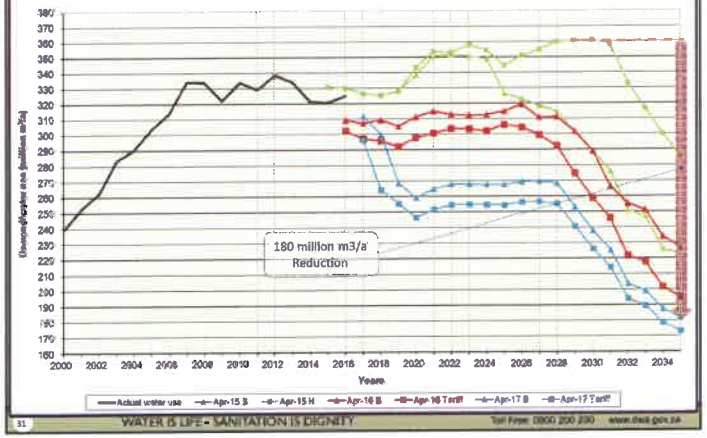
Preliminary revised water balance (February 2018)

Rand water demand projections for 2017/2018 AOA



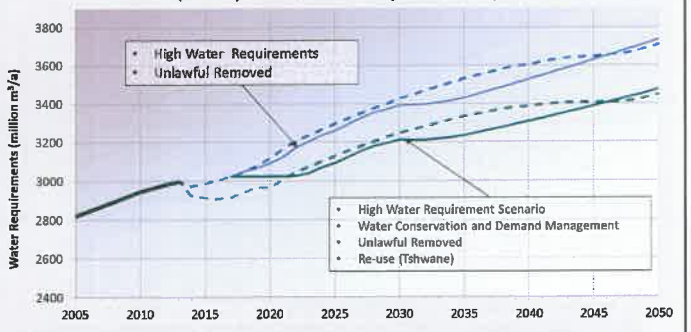
Eskom (Total for Integrated Vaal River System)

(April 2017 projection)

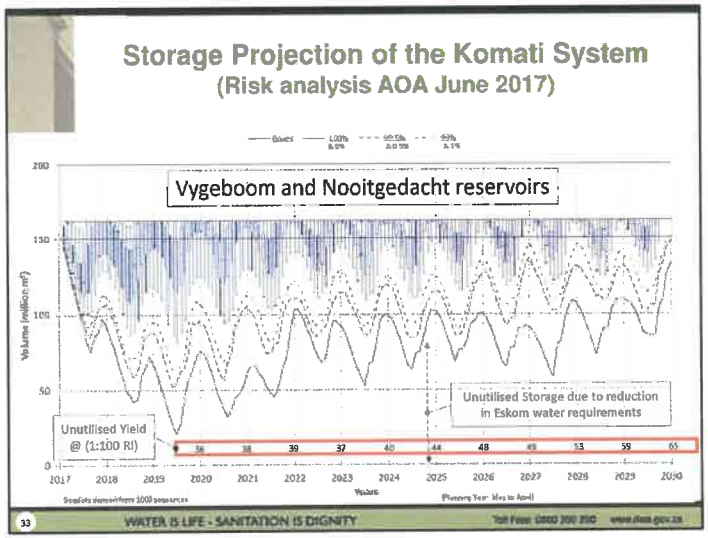


Water Requirements (2015)

(Net System Water Requirements)



Dotted Lines = June 2015 Analysis


Storage Projection of the Komati System
(Risk analysis AOA June 2017)
Vygeboom and Nooitgedacht reservoirs
Unutilised Storage due to reduction in Eskom water requirements
Unutilised Yield @ (1:100 RI)
Volume (million m³)
Years
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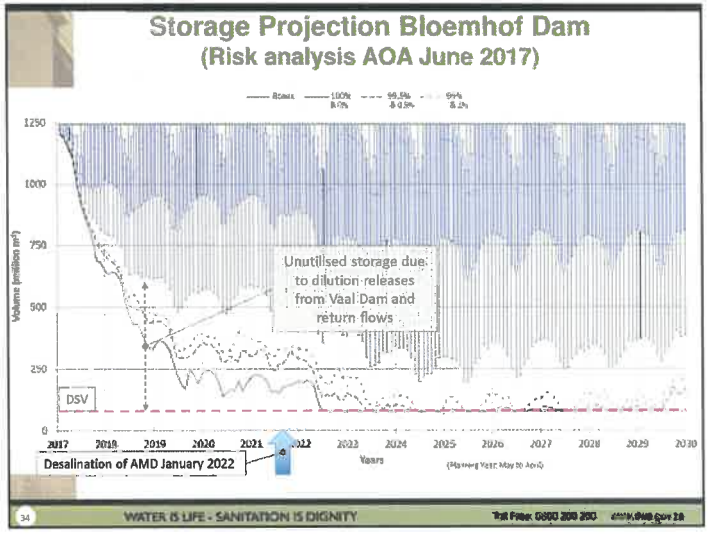
Storage Projection Bloemhof Dam
(Risk analysis AOA June 2017)
Unutilised storage due to dilution releases from Vaal Dam and return flows
DSV
Desalination of AMD January 2022
Volume (million m³)
Years
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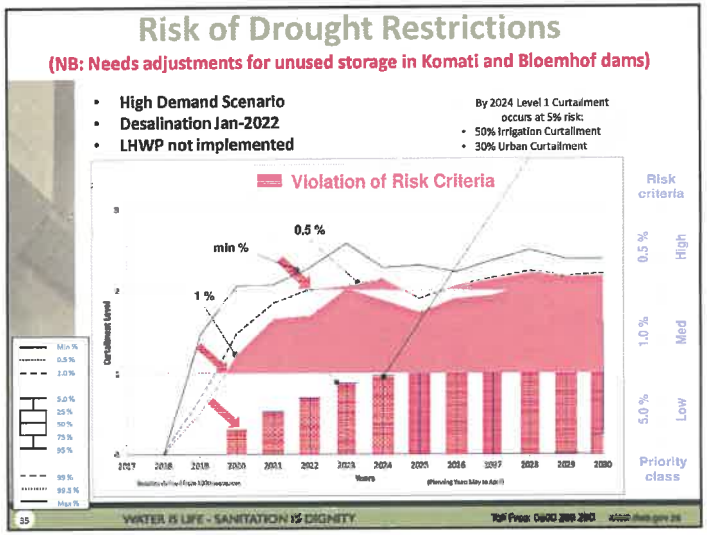
Risk of Drought Restrictions
(NB: Needs adjustments for unused storage in Komati and Bloemhof dams)
High Demand Scenario
Desalination Jan-2022
LHWP not implemented
By 2024 Level 1 Curtailment occurs at 5% risk:
50% Irrigation Curtailment
30% Urban Curtailment
Violation of Risk Criteria
min %
0.5 %
1 %
Risk criteria
High
Med
Low
Priority class
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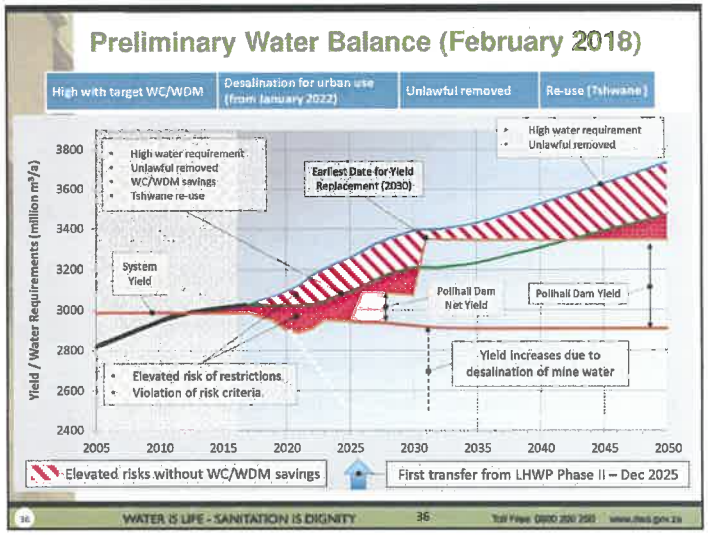
Preliminary Water Balance (February 2018)
High with target WC/WDM
Desalination for urban use (from January 2022)
Unlawful removed
Re-use (Tshwane)
High water requirement
Unlawful removed
WC/WDM savings
Tshwane re-use
Earliest Date for Yield Replacement (2030)
System Yield
Polihali Dam Net Yield
Polihali Dam Yield
Yield increases due to desalination of mine water
Elevated risk of restrictions
Violation of risk criteria
Yield / Water Requirements (million m³/a)
Elevated risks without WC/WDM savings
First transfer from LHWP Phase II – Dec 2025
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Observations

- **Reduction in system yield due to:**
  - Excessive dilution releases from Vaal Dam until desalination of AMD (January 2022.)
  - Unused yield in Komati Subsystem due to reduction in Eskom power station water requirements.
- **Elevated risks of restrictions prior to implementation of LHWP Phase 2.**
- High Water Requirement Scenario exceeds risk criteria throughout the planning period.
- Further augmentation needed by 2043 - High Water Requirement Scenario with WC\WDM savings

Reconciliation Perspectives (2015)

- **Water Conservation & Water Demand Management, Eradication of Unlawful Use, Desalination and Re-use of Mine Water as well as Tshwane Re-use Project are all essential to reduce the risk of restrictions Until LHWP Phase 2 can deliver water.**
- **Prepare for augmentation from the Thukela Water Project.**
  - Revive Feasibility Study

Activities

- **Update irrigation water use with current V&V information.**
- **Review yield capability of Thukela Water Project.**
- **Track progress of interventions:**
  - Implementation of LHWP Phase 2.
  - Mine water effluent treatment.
  - Tshwane water augmentation project (re-use).
  - WC/WDM savings.
- **Plan yield replacement scheme in Orange.**
- **Integration with Crocodile (west) and Olifants reconciliation interventions.**
- **Implement integrated water quality management plan.**

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Continuation of the Integrated Vaal River System Reconciliation Strategy Study: Phase2

Item 9: Strategy Interventions

Tuesday, 27 February 2018

9.1: Water Conservation / Water Demand Management

Background

- Baseline study completed in 2004/2005
- An estimated 196 million m^3 or 15% could be saved over a period of 10 years
- Average consumption was expected to reduce from 330 ℓ/c/d to 290 ℓ/c/d
- The four biggest municipalities were expected to contribute 94.3% of the total saving
- The targets set in 2005 were revised in 2010 and 2012

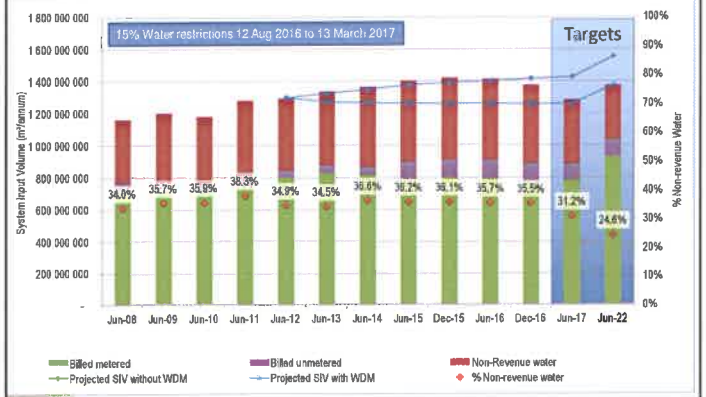
Expected Savings per Municipality

Area	2008/09 Annual Demand (million m³/a)	Current Non-Revenue Water (million m³/a)	2005/06 Possible Savings (million m³/a)	% Contribution of total saving	% Reduction
City of Johannesburg	502.7	160.9	110.2	56.2%	21.9%
Ekurhuleni	326.8	124.2	28.3	14.4%	8.6%
City of Tshwane	214.2	62.1	20.4	10.4%	9.5%
Emfuleni	77.1	31.6	26.1	13.3%	33.9%
Rustenburg	27.9	9.8	3.0	1.5%	10.6%
Mogale	26.4	7.1	1.7	0.9%	6.6%
Govan Mbeki	20.4	5.9	1.5	0.8%	7.5%
Matjhabeng	18.9	6.6	4.3	2.2%	22.9%
Randfontein	8.7	2.6	0.4	0.2%	4.1%
Total	1 223.0	410.8	195.9	100%	16%

Summary of Data Submissions

Municipality	Last submission
City of Johannesburg	November 2016
City of Tshwane	April 2017
Emfuleni LM	June 2017
Ekurhuleni MM	November 2017
Lesedi LM	April 2017
Merafong LM	June 2017
Midvaal LM	October 2017
Mogale City LM	December 2016
Rand West City LM (Randfontein Region)	June 2017
Rand West City LM (Westonaria Region)	November 2017

Integrated Vaal River System



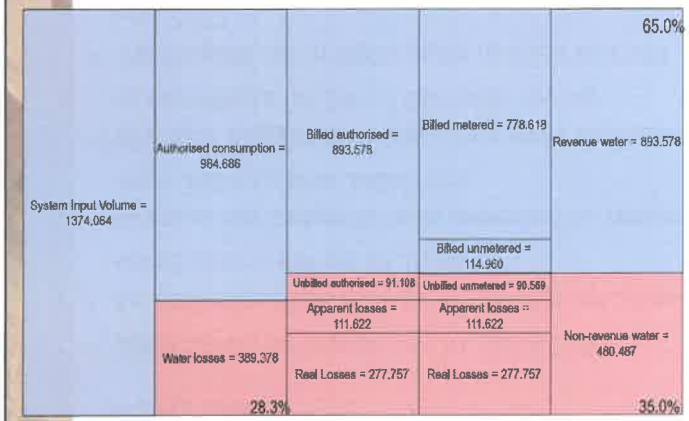
Total Targeted vs Actual Savings

Year ending	Projected SIV without WDM (X) kl/annum	Projected SIV with WDM (Z) kl/annum	Projected % savings (X – Z) / X * 100	Actual demand (Y) kl/annum	Actual % savings (X - Y) / X * 100
Jun-12	1 300 613 343	1 300 613 343	0.0%	1 296 073 215	0.3%
Jun-13	1 325 208 539	1 273 402 875	3.9%	1 337 536 245	-0.9%
Jun-14	1 350 262 570	1 268 011 188	6.1%	1 365 380 179	-1.1%
Jun-15	1 375 784 167	1 262 935 804	8.2%	1 403 523 126	-2.0%
Dec-15	1 388 841 060	1 261 797 859	9.1%	1 420 101 889	-2.3%
Jun-16	1 401 897 953	1 260 659 914	10.1%	1 413 031 287	-0.8%
Dec-16	1 414 954 845	1 259 521 968	11.0%	1 374 064 291	2.9%
Jun-17	1 424 217 581	1 261 854 997	11.4%		
Jun-22	1 554 334 603	1 373 114 426	11.7%		

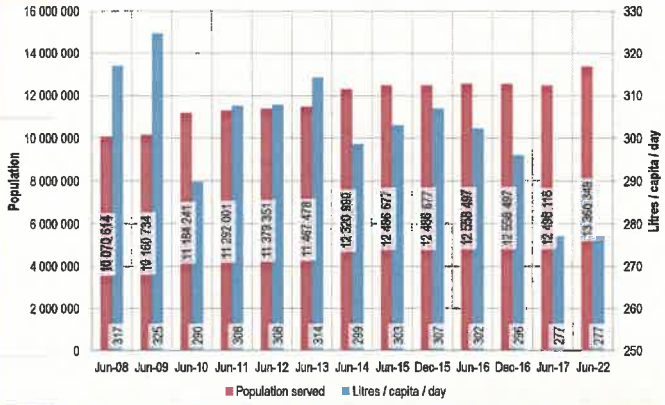
Dec 2016 Summary of Targeted vs Actual Savings

System	Projected SIV without WDM (X) kl/annum	Projected SIV with WDM (Z) kl/annum	Projected % savings (X – Z) / X * 100	Actual demand (Y) kl/annum	Actual % savings (X - Y) / X * 100
Johannesburg	588 066 982	493 829 325	16.0%	573 852 765	2.4%
Tshwane	341 884 714	327 517 148	4.2%	332 387 892	2.8%
Ekurhuleni	369 315 955	346 720 055	6.1%	352 297 242	4.6%
Emfuleni	93 946 677	70 942 157	24.5%	95 965 374	-2.1%
Midvaal	14 756 008	13 853 121	6.1%	12 639 915	14.3%
Lesedi	6 984 510	6 660 163	4.6%	6 921 103	0.9%
Mogale City*	29 553 459	27 943 452	5.4%	33 408 509	-13.0%
Randfontein*	9 903 720	9 589 349	3.2%	9 668 710	2.4%
Westonaria*	7 192 187	6 460 157	10.2%	0	
Merafong City*	13 324 128	12 056 011	9.5%	13 476 658	-1.1%
Total	**1 474 928 340**	**1 315 570 936**	**10.8%**	**1 430 618 168**	**3.0%**
*Total excl West Rand DM	**1 414 954 845**	**1 259 521 968**	**11.0%**	**1 374 064 291**	**2.9%**

2016 IVRS Water Balance



IVRS litres/capita/day



Conclusions

- Updated water balance information required to assess the status quo.
- It is expected that the demand returned to previous levels once the water restrictions were lifted
- It is unlikely that municipalities in the IVRS have been able to reduce their consumption by 112 million m^3/a or 9% to achieve the 2017 target
- Most municipalities are tracking the High demand – no WCWDM scenario

9.2: Rand Water Project 1600

RAND WATER

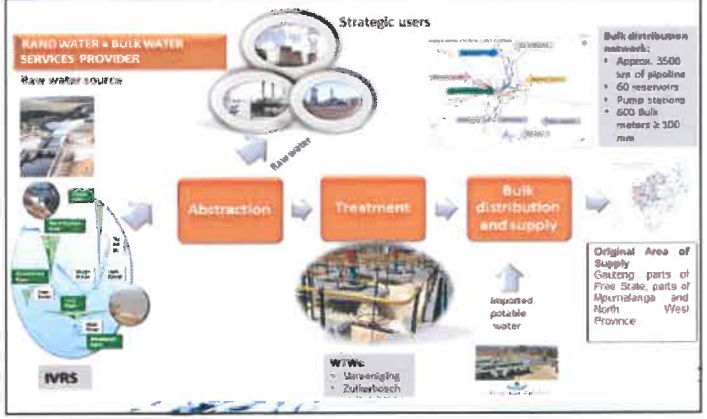
A Key initiative implemented by Rand Water and customers: Project 1600

Strategy Steering Committee Meeting: 27 February 2018

Department of Water and Sanitation

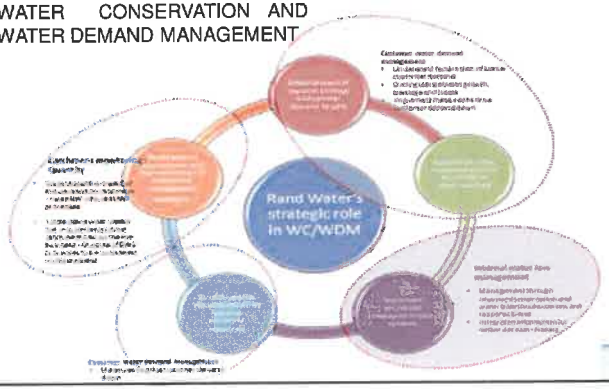
Presentation by:
Shuntelle Gow
Rand Water
Water Cycle Management

Background

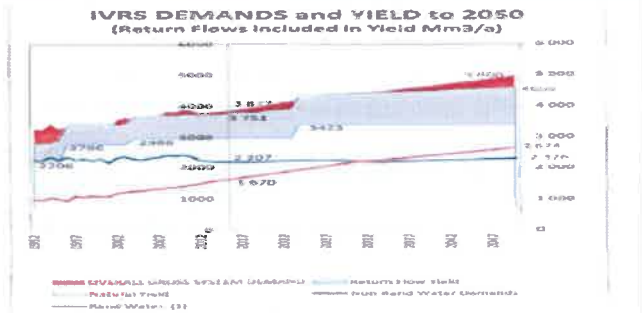


Background

NATIONAL STRATEGY FOR WATER CONSERVATION AND WATER DEMAND MANAGEMENT

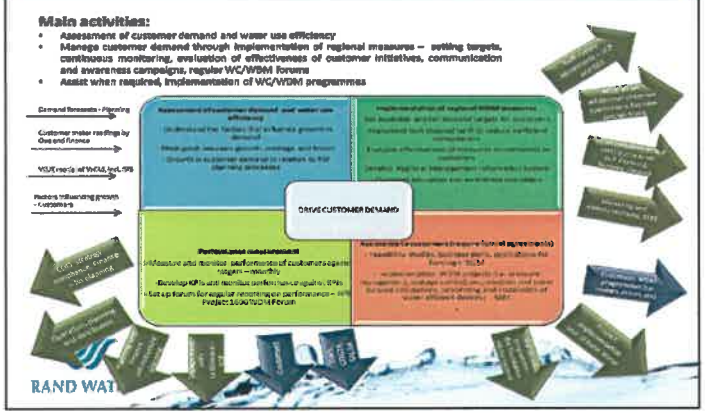


Background



RAND WATER

RW approach to managing customer demand



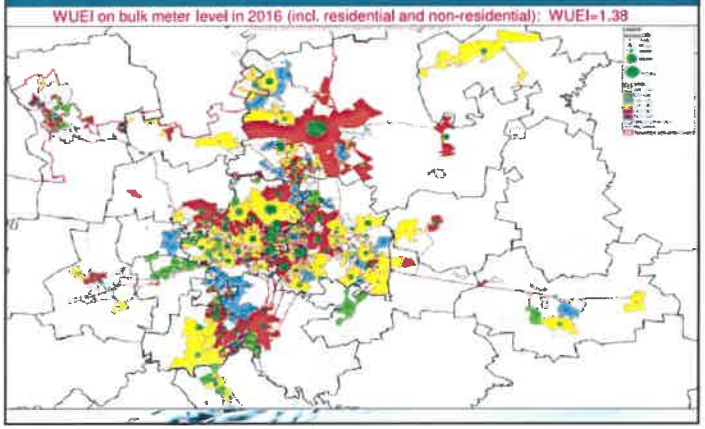
Assessment of water use efficiency

- Water use efficiency model developed by Rand Water
- Based on the scientific determination of a normal/expected demand and comparison with actual consumption
- Developed **300** categories and assigned a normal consumption to each
- Ratio of current/actual consumption to normal demand is defined as water use efficiency index (WUEI) and colour graded as follows:

Water use efficiency index	Colour coding	Classification
> 0.7		To be investigated, supply constraints
0.7 - 0.9		High efficiency
0.91 - 1.1		Normal efficiency
1.1 - 1.5		Low efficiency
1.51 - 2.5		No efficiency
-> 2.5		Grossly inefficient/data error, for further investigation

RAND WATER

Assessment of water use efficiency



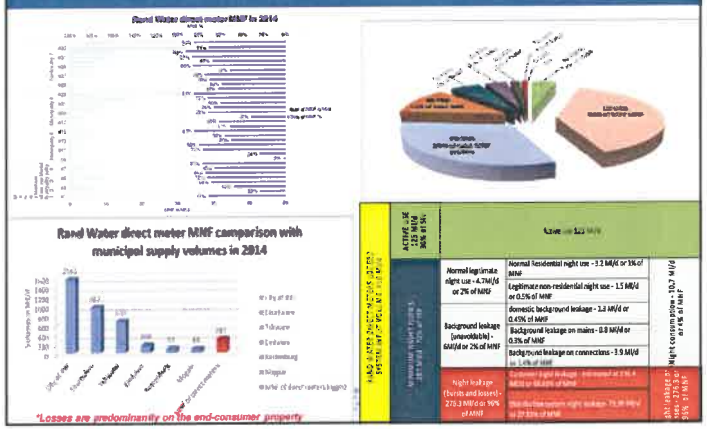
End consumer consumption patterns

Minimum Night Flow (MNF) analysis

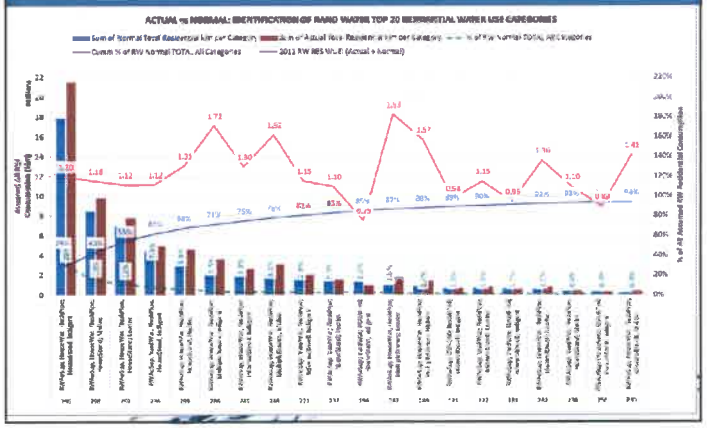
- MNF analysis is a common method used to evaluate water losses in a water network.
- The ratio of MNF to average daily flow is often used as a rough indicator of leakage levels.
- A target value of around 20% would normally be considered in the industry as acceptable

RAND WATER

Analysis of MNF on RW direct meters



Further analysis



Appropriate interventions

Based on the assessments:

- Need to re-align water demand management programmes and prioritize interventions that target the on-property leakages of end-consumers:
  - Retroffiting of plumbing fittings at houses
  - Installation of water efficient devices
  - Water wise gardening practices

The importance of the war-on-leaks type projects implemented at households should not be underestimated

RAND WATER

Key initiative by RW and customers: Project 1600

- Established a regional forum (IVRS Project 1600 WDM) with DWS, Municipalities, COGTA and SALGA- quarterly meetings:
- Aims to provide guidance, support, oversight of progress made by municipal sector to reduce their water demand in order for Rand Water to comply with the abstraction limit of 1600 Mm³/annum until next phase of Lesotho Highlands Scheme

Date of meeting	Main purpose
17 May 2017	Introduction of Project 1600 and ToR
13 September 2017	Adoption of ToR and Determination of targets, performance measurement
7 December 2017	Performance update and presentation of municipal action plans

- Municipalities were given supply targets per bulk meter based on efficiency model in September 2017
- Measuring the performance of municipalities against their respective license target on a monthly basis - spreadsheets are sent to municipalities during the 2nd week of new month
- Included general observations column since December 2017
- Reporting at the IVRS Project 1600 WDM Committee on a quarterly basis
- Requested municipalities to provide action plans for meters that exceed the license target (3 metros, Govan Mbeki and Mogale City presented action plans at meeting in Dec 2017)
- Next meeting scheduled for 15 March 2018

Determination of supply targets

RAND WATER MUNICIPAL CUSTOMER DEMAND TARGETS-OVERALL

RAND WATER

Performance of municipalities against license target

RAND WATER OVERALL SUPPLY TO MUNICIPALITIES
Perfomance against IVRS license target

Projected Aug 2018	8%					
Jul 17	0%	Oct 17	7%	Jan 18	8%	Apr 18
Aug 17	9%	Nov 17	7%	Feb 18		May 18
Sep 17	6%	Dec 17	3%	Mar 18		Jun 18
Aug YTD	3%					

Results

Results

TOTAL RAND WATER SUPPLY VOLUMES

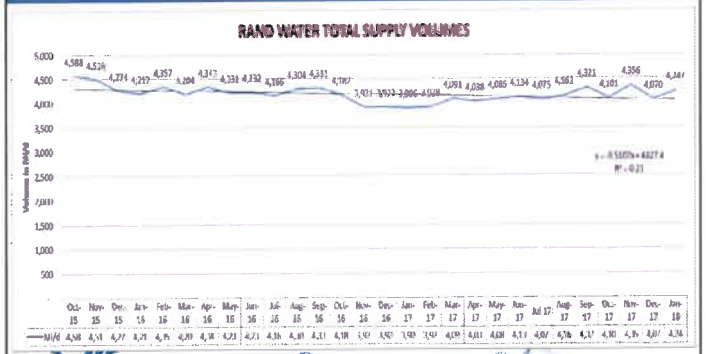
2012	2013	2014	2015	2016	2017	YTD 2018 (Jul 17 - Jan 18)
3 978	4 083	4 183	4 285	4 323	4 084	4 188

y = 27.825x + 4050
R² = 0.2416
Gradient : 0.66%

Volumes in kl/month

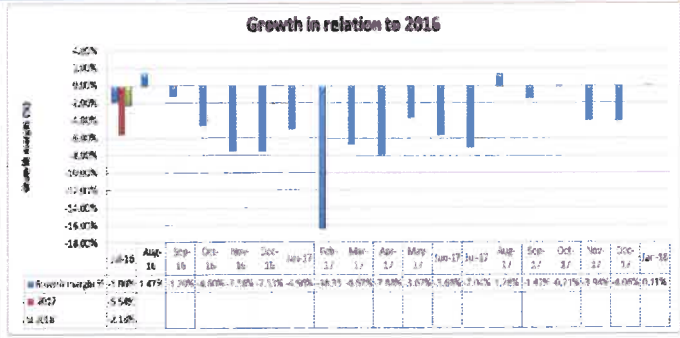
RAND WATER

Results



RAND WATER

Results



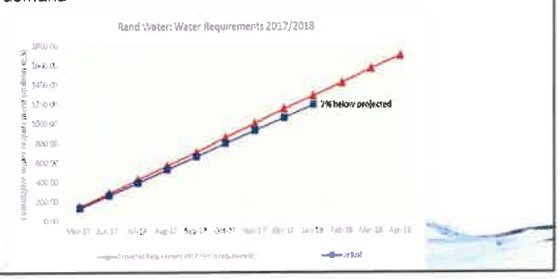
RAND WATER

Result

- Projected demand

	Projected demands in million cubic meters per annum									
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Rand Water (1)	1583.1	1712.9	1746.2	1780.2	1814.8	1850.1	1886.1	1922.8	1960.2	1990.8

- Current demand



RAND WATER

Reduction in demand

Factors influencing the reduction of Rand Water's demand from IVRS - Reduction in demand from Rand Water's customers

- **Weather** – need to determine and separate effect of weather in comparison to human intervention (lower temperatures in latter part and higher rainfall)
- **Restrictions** imposed since August 2016 to March 2017- measures included physical rationing of bulk meters, performance measurement on weekly basis
- Some restrictions **measures remained in place** (munics reported that where the measures did not adversely affect sustainable supply, these were kept in place)
- **Project 1600** - Rand Water provided bulk meter targets, monitoring on a monthly basis and meeting quarterly
- Some munics communicated that their **lower levels of restrictions remained in place** – specifically the Metros
- End-consumer **behaviour still affected by the restrictions** that were implemented
- **Credit control measures** were implemented by Rand Water on the supply to the relevant municipalities

RAND WATER

Development and implementation of regional WC/WDM measures

WDM initiatives that are being explored on a bulk supply level:

- Applications for new connections – Include water use efficiency as an additional criterion – discussion at the next Project 1600 committee meeting in March 2018
- Development of bulk stepped tariff aimed at penalizing inefficient water use
- Review of bulk supply agreements – e.g. to include steps to be taken by Rand Water in the event that the customers consumption exceeds their respective license targets
- Development and implementation of a Regional Management Information System

RAND WATER

Conclusion

- Reduction in demand from IVRS is noted
- The sustainability of the reductions needs to be assessed
- Rand Water to review the impact of current status on its projected demands for the Annual Operating Analysis of DWS, scheduled for May 2018

RAND WATER

THANK YOU

RAND WATER

9.3: City of Tshwane Water Resources Master Plan Implementation

9.4: Eradication of Unlawful Irrigation

9.5: Implementation of Infrastructural Augmentation Option (LHWP Ph2)

PROJECT MANAGEMENT UNIT (PMU)

The following project management activities are on-going:

1. Procurement activities for consultancy services contracts.
2. Procurement activities for the construction contracts.
3. Contract administration of all awarded contracts in Phase II.

Procurement Summary

Phase II Procurement Status (December 2017):

1. 13 contracts, mostly designs and Environmental & Social studies are complete.
2. 23 Contracts have been awarded and are in force. **Of significance are the dam and tunnel consultancy contracts**
3. 10 contracts are in evaluation and approval stages.
4. No contracts are at the bidding/tendering stage.

Procurement Summary

5. Bids for the first 3 construction contracts (North East Access Road, Polihali Village civil works and the Polihali Dam Diversion Tunnel around the dam wall) currently under evaluation –awarded by end March 2018.
6. Geotechnical drilling (investigations for the Polihali Dam and Polihali – Katse Tunnel) at an advance stage. Will be complete in time for the Dam design and Tunnel design consultants to factor into the designs.

Procurement Millstones

Rev 10.9	Forecast
Advanced Infrastructure commence	Mar 18
Impoundment commence	Nov 23
Dam Complete	Dec 24
Tunnel Complete	Dec 25
Water Delivery	From end Dec 2025

9.6: Implementation of the AMD Long-Term Solution

1. Progress with LTS Commissioning

- PSP for designing/ optimising the STI into an LTS (i.e. Desalination) has been identified following an open bidding process; and
- TCTA to consider identified PSPs before end February 2018 and ratify decision on appointment.

2. Progress with EIA

- EIA Practitioner (Nemai Consulting) appointed in Sep 2017;
- Nemai Consulting, DWS and TCTA met with DEA in Nov 2017 to discuss project and map way forward; and
- Formal application for LTS EIA dependent on project designs being available (hence LTS design PSP should be appointed a.s.a.p.).

3. Funding Options

- Funding still via fiscus with 1/3 recovery form Vaal River Tariff; and
- Future funding stream could be revenue generated from sale of desalinated AMD to bulk water user, environmental levy and/or WDCS.

4. Potential Off-takers

- Engagements with potential bulk off-takers such as Ekurhuleni and City of Jo'burg, as well as Sasol is on-going;
- Aside from economic issues, the actual determination of suitable off-taker will be guided by project design and optimisation (further motivating that LTS design PSP should be appointed a.s.a.p.);
- No significant deviations from LTS Feasibility Study fundamentals anticipated; and
- Target commission date for the LTS is Oct-Nov 2020.

9.7: Noordoever/Vioolsdrift Dam Feasibility Study

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REPUBLIC OF SOUTH AFRICA

NOORDOEWER / VIOOLSDRIFT DAM FEASIBILITY STUDY

Presented by
Seef Rademeyer
Department of Water and Sanitation

Date: 27 February 2018

NOORDOEWER/VIOOLSDRIFT DAM FEASIBILITY STUDY

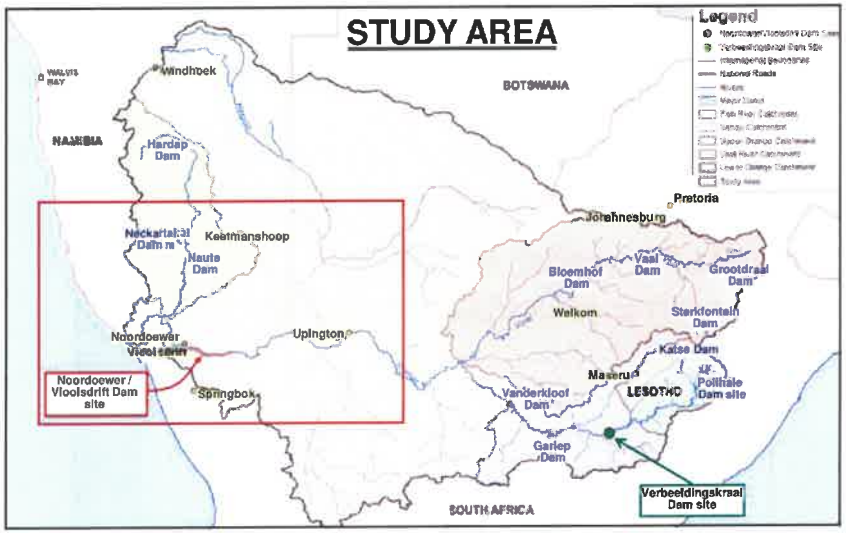
Main purpose of Study:

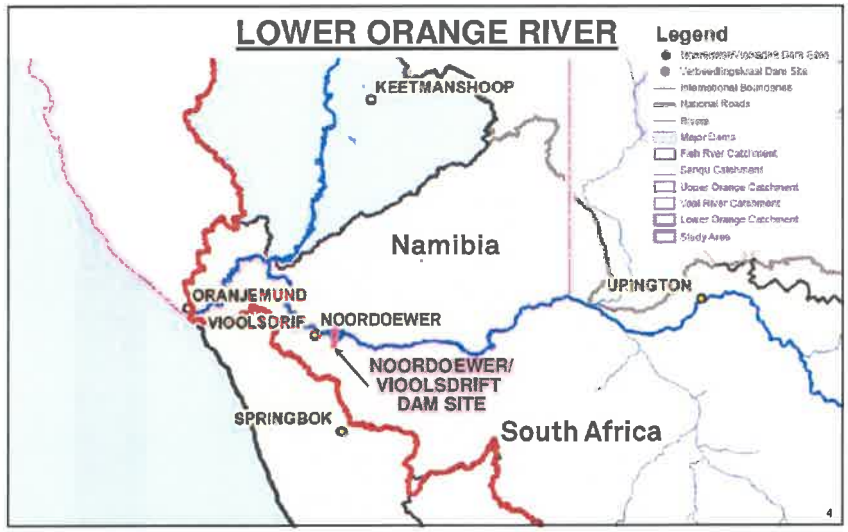
- Feasibility Design of the Noordoewer/Vioolsdrift Dam (NVD) on Orange River between Namibia & RSA

Purpose of Noordoewer/Vioolsdrift Dam (NVD):

- Serve as **re-regulating and/or storage dam** to improve water resources availability in Lower Orange River, supplying:
  - **Ecological water requirements (EWRs)** of the Orange River and Estuary
  - **Domestic** water requirements
  - **Industrial** water requirements
  - **Mining** water requirements
  - **Irrigation** water requirements

2



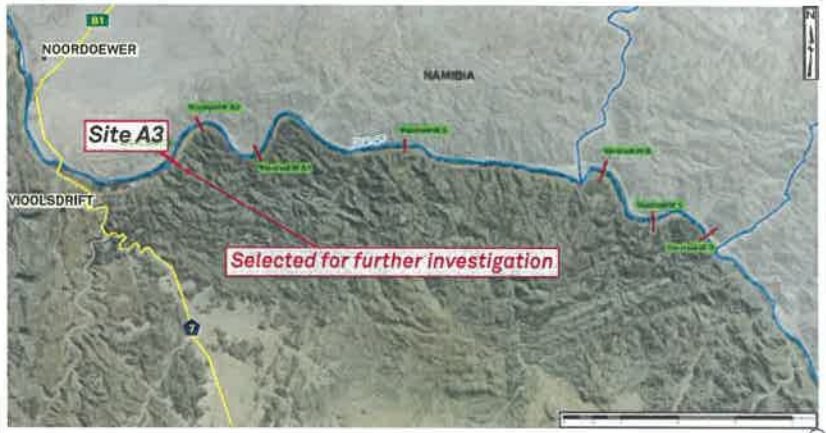


PURPOSE OF THE STUDY
Main study objectives

- Update the water requirement projections in Orange River System
- Determine optimum site and size for NVD
- Finalise purpose and timing of NVD for re-regulation, for larger storage and/or for both in single/phased approach
- Determine timing and most appropriate development option after NVD
- Conduct feasibility study on selected NVD site and size to ensure technical, financial, operational and institutional feasibility
- Conduct Environmental Impact Assessment (EIA) to ensure environmental and social feasibility

5

POSSIBLE NVD SITES



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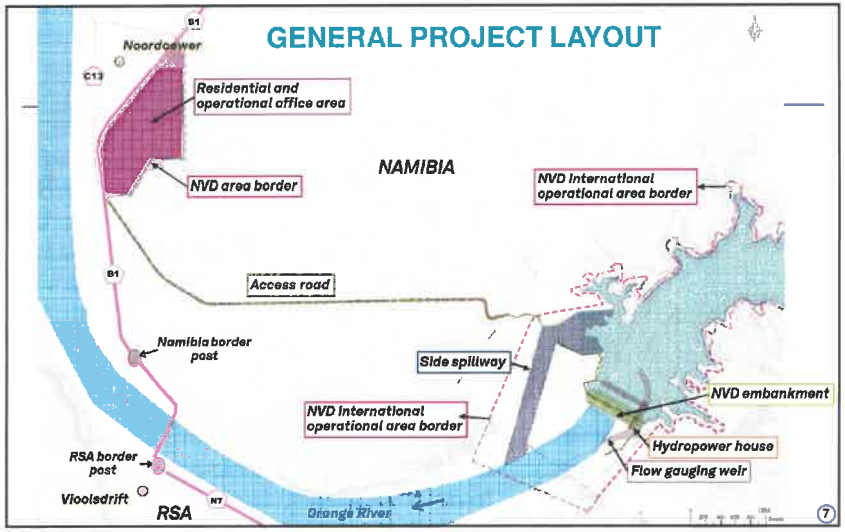
GENERAL PROJECT LAYOUT



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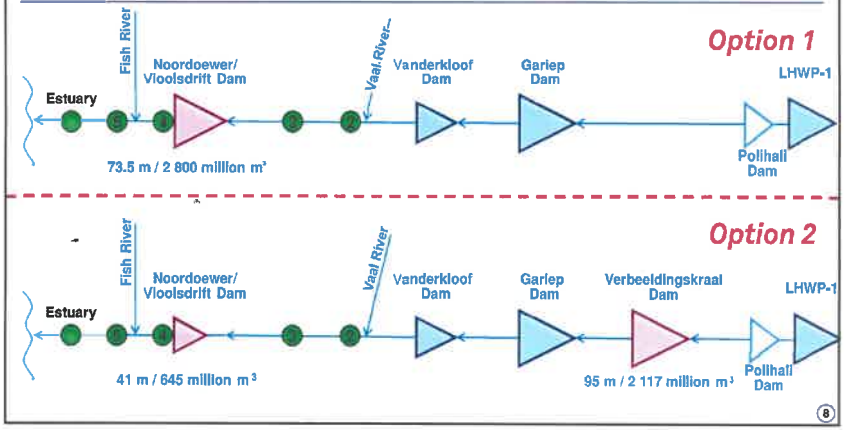
OPTIMUM NOORDOEWER/VIOOLSDRIFT DAM SIZE
Alternative dam development options



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AREA TO BE INUNDATED BY OPTION 1

AREA TO BE INUNDATED BY OPTION 2

OPTIMUM NOORDOEWER/VIOOLSDRIFT DAM SIZE
Alternative dam development options

Option	Option 1	Option 2
Implementation/commissioning	2024	2024
NVD height to full supply level (FSL)	70.0 m	41.5 m
NVD capacity	2 800 million m^3	645 million m^3
Yield benefit @ 2024	666 million m^3/a	408 million m^3/a
Implementation date of next scheme (Verbeeldingskraal Dam)	2045 (21 years after NVD)	2032* (8 years after NVD)
Benefit-cost ratio (6% discount rate)	1.34	1.50
Hydropower generation at NVD	17 MWc	8 MWc
Additional hydropower generation in ORS	12 MWc	50 MWc

** No feasibility study conducted yet for Verbeeldingskraal Dam*

⑪

OPTIMUM NOORDOEWER/VIOOLSDRIFT DAM SIZE
Other practical considerations

- **Verbeeldingskraal Dam**
  - To implement will take about 15 years to go through feasibility (including assessment of EWRs), design and construction phases
  - Separate EIA process required
  - Flooding of Lesotho area – negotiation period
  - Raise capital for 2 large dams
  - Cost apportionment negotiations with Namibia for all dams
  - URV for Verbeeldingskraal Dam is lower than raising of Gariep Dam

⑫

CONCLUSIONS

Study to be finalised regarding the best option (NVD size) for implementation

Engagement currently underway between South Africa and Namibia on the optimum development option

EIA to be conducted as per chosen best development option

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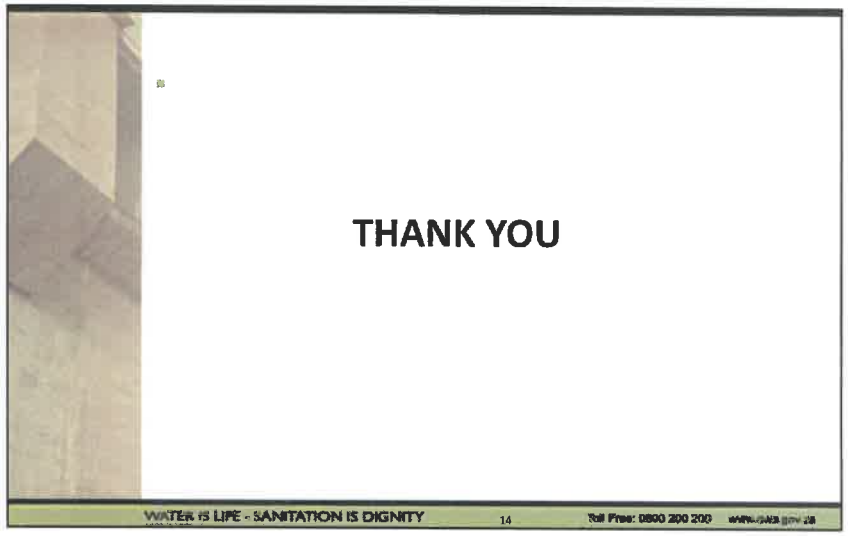

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REPUBLIC OF SOUTH AFRICA

Continuation of the Integrated Vaal River System Reconciliation Strategy Study: Phase2

Item 10: Discussion and Comments

Tuesday, 27 February 2018

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REPUBLIC OF SOUTH AFRICA

Continuation of the Integrated Vaal River System Reconciliation Strategy Study: Phase2

Item 11: Communication and confirmation of SSC membership

Tuesday, 27 February 2018

Communication

A SSC meeting will be held ~ 6 months

After each meeting SSC members will be provided with:

- Minutes of the SSC meeting
- Status Report
- Media release

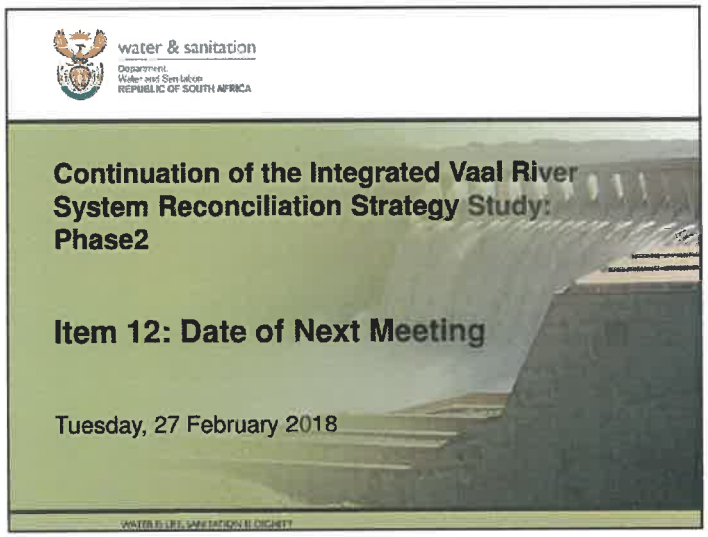
As members of the SSC your responsibility is to:

- Disseminate information into the relevant departments / organisations
- Incorporate strategies' recommendations into development plans

Web site: Please visit: http://www.dwa.gov.za/projects.aspx for all project related information

SSC membership

- **~ 270 stakeholders on the database**
- **Representative of all relevant sectors in the study area – refer to Terms of Reference**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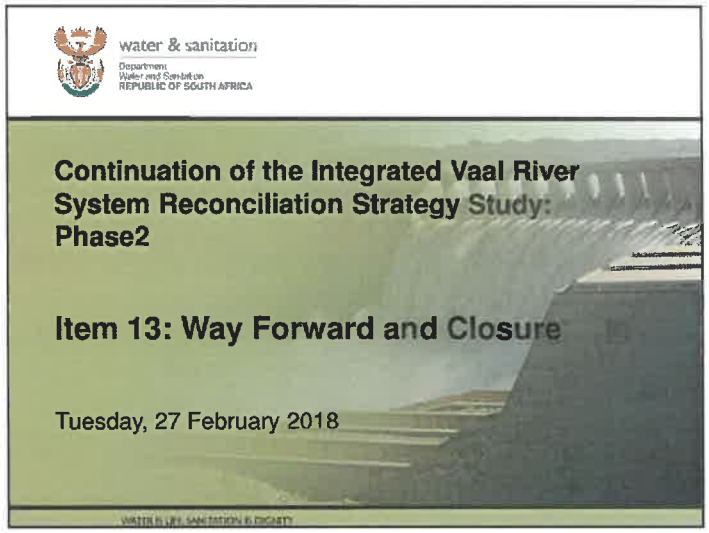
Continuation of the Integrated Vaal River System Reconciliation Strategy Study: Phase2
Item 12: Date of Next Meeting
Tuesday, 27 February 2018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Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA
Continuation of the Integrated Vaal River System Reconciliation Strategy Study: Phase2
Item 13: Way Forward and Closure
Tuesday, 27 February 2018