water affairs
Department:
Water Affairs
REPUBLIC OF SOUTH AFRICA

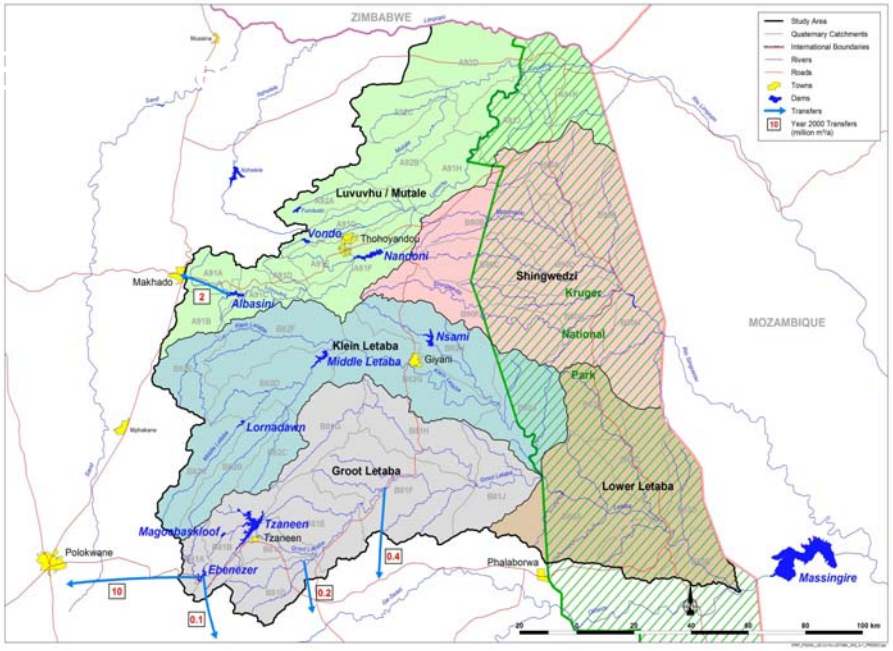
Development of Reconciliation Strategies for Large Bulk Water Supply Systems of the Luvuvhu and Letaba Water Supply SystemStudy Steering Committee Meeting No 4

21 November 2013

Preliminary Reconciliation Strategy (Letaba River System) (Item 9)

Outline of Presentation

- Water requirement scenarios
- Yield analysis and results
- Options for reconciliation
- Water balance individual dams/systems
  - Reconciliation scenarios
- Preliminary Reconciliation Strategy (Letaba River System)
- Recommendations



Urban Water Requirement Scenarios: Method

- High and low population scenarios
- Calibrate per capita consumption based on current water use and Level of Service (LOS)
- Apply high population scenario for balances (conservative target for planning purposes)
- Expansion of the LOS, two scenarios:
  - Rapid increase in the LOS
  - Gradual increase in the LOS

Water Requirement Scenarios

Irrigation based on current use and scheme allocations

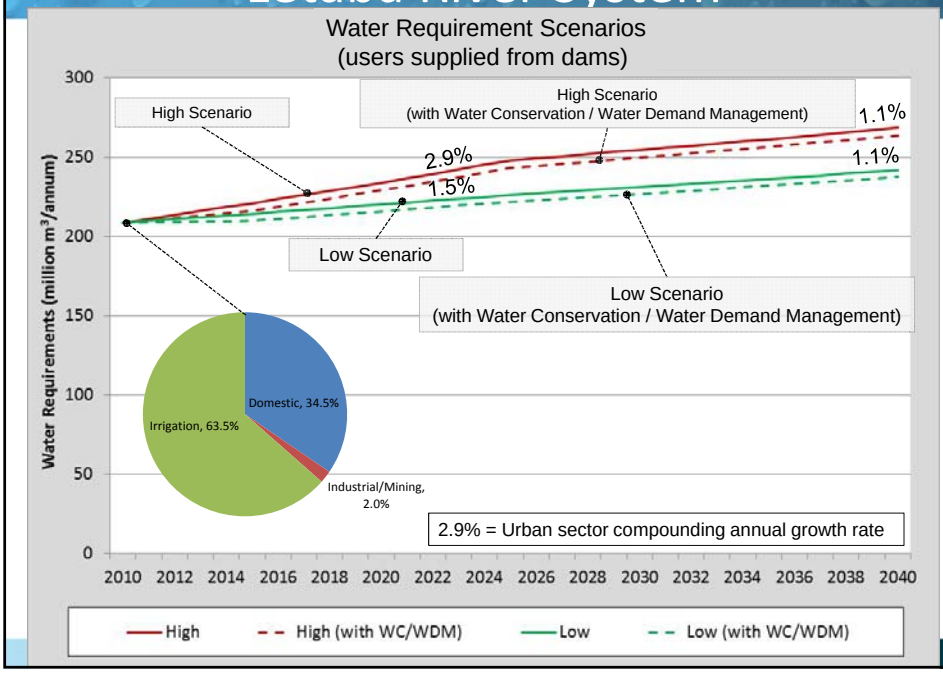
High Scenario

- High Demographic Scenario
- Rapid implementation of increase in Levels of Service (LOS)

Low Scenario

- High Demographic Scenario
- Gradual implementation of increase in Levels of Service (LOS)

Letaba River System



Summary of Water Requirements

Sector	Requirements in 2010	Future requirements (2040)	
		High growth	Low growth
Irrigation	132.6	132.6	132.6
Urban	72.0	131.8	105.2
Mining/Industrial	4.1	4.1	4.1
TOTAL	208.7	268.4	241.9

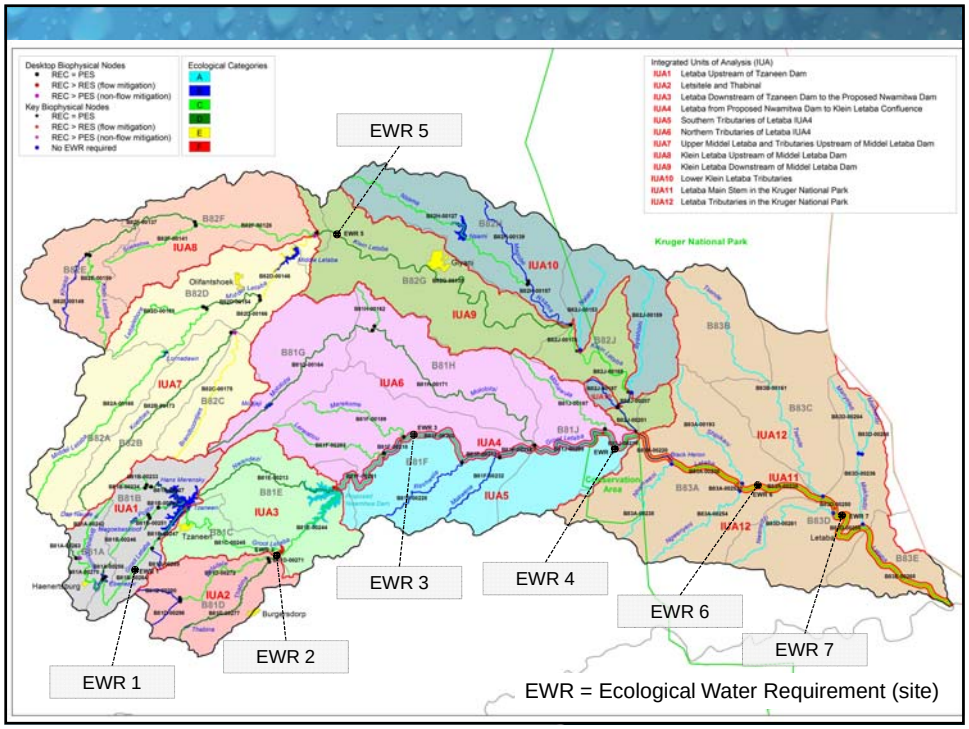
Water requirements supplied from dams / systems.

Ecological Water Requirements

- Classification of water resource in accordance with the promulgated guidelines – parallel process underway
- Ecological Water Requirements determined for 62 biophysical nodes, including 7 sites
- Same hydrology and system model
- Scenario assessment:
  - Apply same options in evaluations
- Consider different levels of ecological protection to derive the desirable balance

Ecological Water Requirement Scenarios

- A: Current operating method allowing minimum flow of 0.6 m^3/s at EWR site 4.
- B: Releases in accordance with the Present Ecological State (PES) requirement once large developments are implemented (low flows).
- C: Release in accordance with total Recommended Ecological Water Requirements (REC).



Ecological Water Requirement Scenarios

EWR Site	Mean Annual Runoff (million m^3/annum)	Ecological Water Requirements (Percentage of Mean Annual Runoff)			
		Present Ecological Category (PES)		Recommended Ecological Category (REC)	
		Low flows only		*Total flow*	
1	99.7	C	10.83	C	20.1
2	114.3	D	14.32	D	21.7
3	390.5	C	7.14	B	15.6
4	436.7	C	8.16	B	20.9
5	123.3	C/D	2.83	C/D	13.7
7	639.8	C	6.65	B	17.6

Yield Analysis: Methodology

- Applied the Water Resources Yield Model
  - Monthly time step, network simulation model
- Historical analysis:
  - High assurance yield: Historical Firm Yield
    (maximum abstraction without failure in supply)
  - Low assurance yield: Apply curtailment rules
    (Reference assurance criteria determined)
- Stochastic risk analysis will be carried out in subsequent work for final strategy.

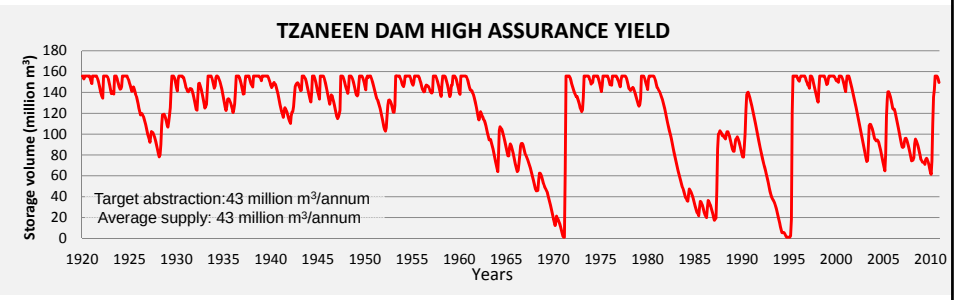
Groot Letaba System Requirements and Tzaneen Dam Restriction Rule

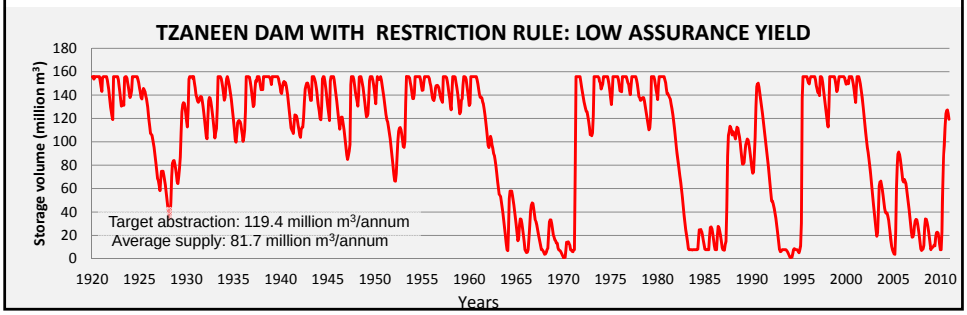
- Rule: below 95% irrigators cut to 50% allocation, reviewed incrementally as dam recovers above 95%
- Below 5% irrigators get 0%, urban cut to 70%
- Irrigation:
  - Noord Kanaal: 28.8 million m^3/a
  - N&N Kanaal: 13.03 million m^3/a
  - Main River Tzaneen: 27.85 million m^3/a
  - Resource Poor Farmers: 33.1 million m^3/a
  - **Total: 102.9** million m^3/a
- 0.6 m^3/s must pass Letaba Ranch, released from Tzaneen when incremental insufficient
- Urban demands: Tzaneen town, Ritivi 1 & 2, Ba Phalaborwa: 16.48 million m^3/a

WATER IS LIFE - RESPECT IT, CONSERVE IT, ENJOY IT.

High vs. Low Assurance Yield

Constant Development Level Analysis





System Yield Results

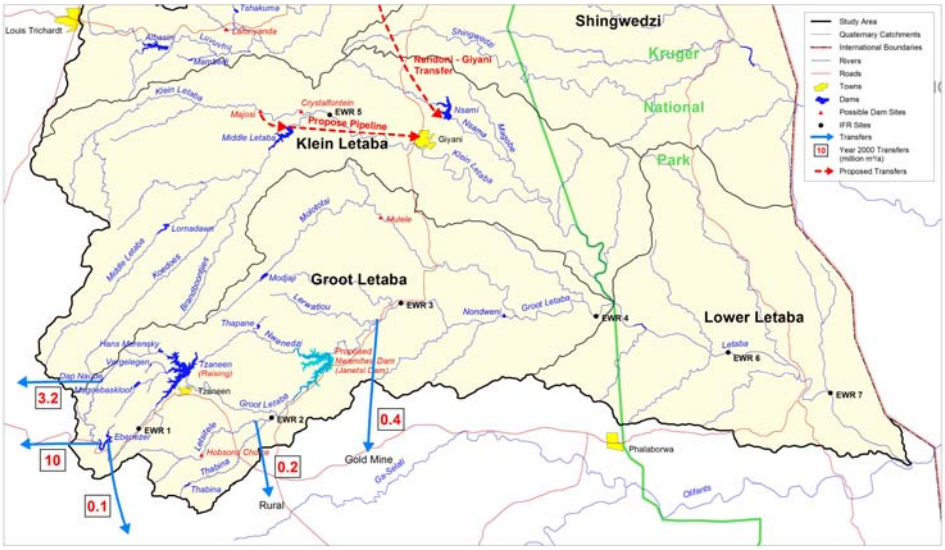
System / dam	Yield (million m³/annum)			Confidence Rating
	High assurance	Low and High assurance	Groundwater	
Dap Naude	3.1	-	-	Medium
Ebenezer	32.0	38.0	-	High
Hans Merensky	3.4	4.3	-	Medium
Magoebaskloof / Vergelegen	7.2	15.1	-	Medium
Tzaneen	43.0	81.7	1.0	High
Thabina	1.0	-	2.3	Low
Modjadji	0.4	-	-	Low
Thapane	0.1	-	0.3	Low
Middel Letaba	21.0	-	3.3	High
Nsami	0.2	-		Medium

Groot Letaba Catchment Options

(Screening Workshop: April 2012)

- **GL1: Raising of Tzaneen Dam.**
- **GL2: Construction of Nwamitwa Dam.**
- **GL3: Bulk Water Supply Infrastructure from Nwamitwa Dam.**
- **GL5: Artificial recharge at Mulele on Molototsi River.**
- **GL6: Groundwater regional scheme in conjunction with surface scheme.**

Groot and Klein Letaba

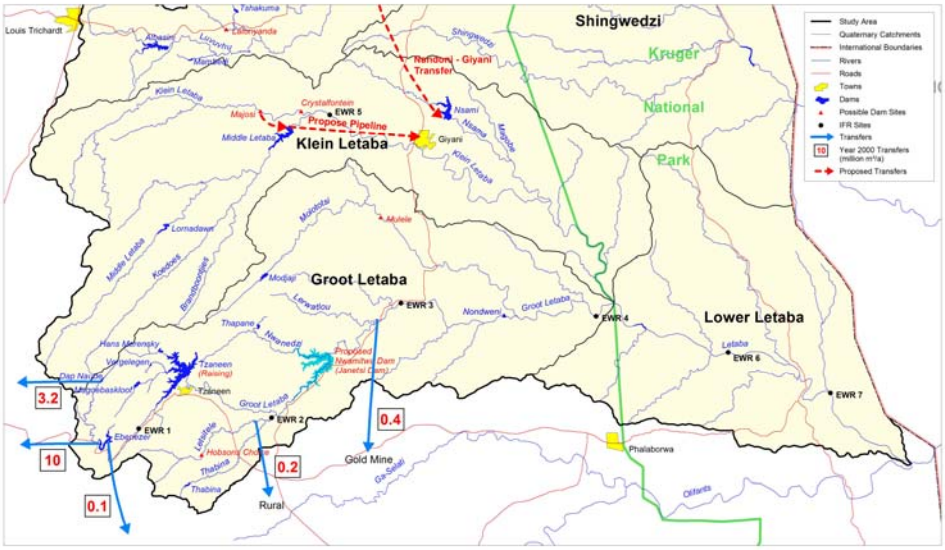


Middel & Klein Letaba Catchment

(Screening Workshop: April 2012)

- **MKL1: Water Conservation & Water Demand Management.**
- **MKL2: Development of groundwater resource.**
- **MKL3: Replacement of Middel Letaba canal with pipeline.**
- **MKL4: Transfer Scheme from Nandoni Dam.**
- **MKL5: Construction of new dam on Klein Letaba River:**
  - **Majosi Dam**
  - **Crystalfontein Dam**

Middel and Klein Letaba



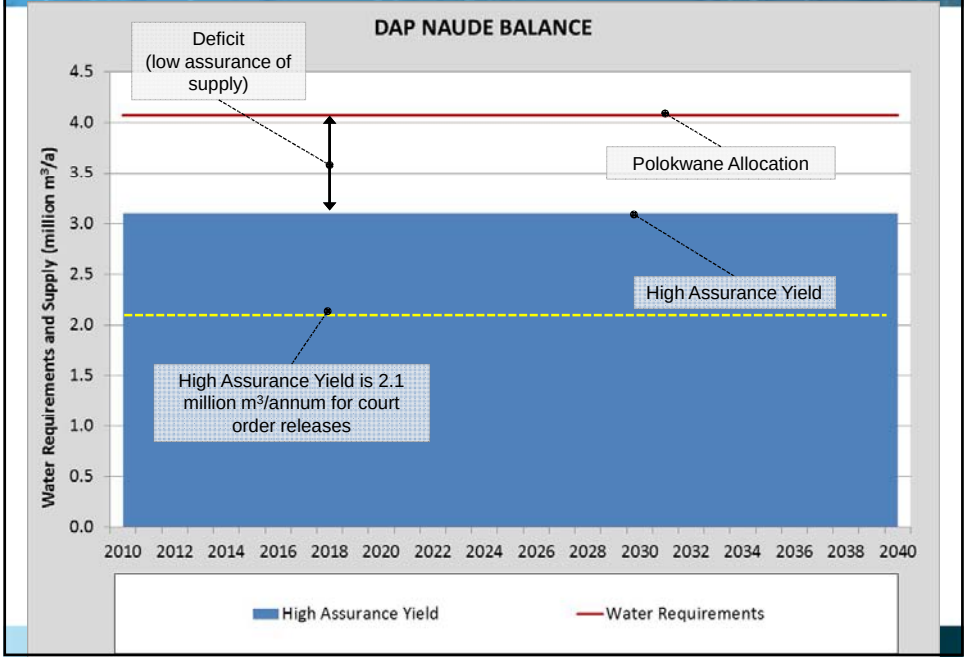
Reconciliation Scenario 1

Assumptions:

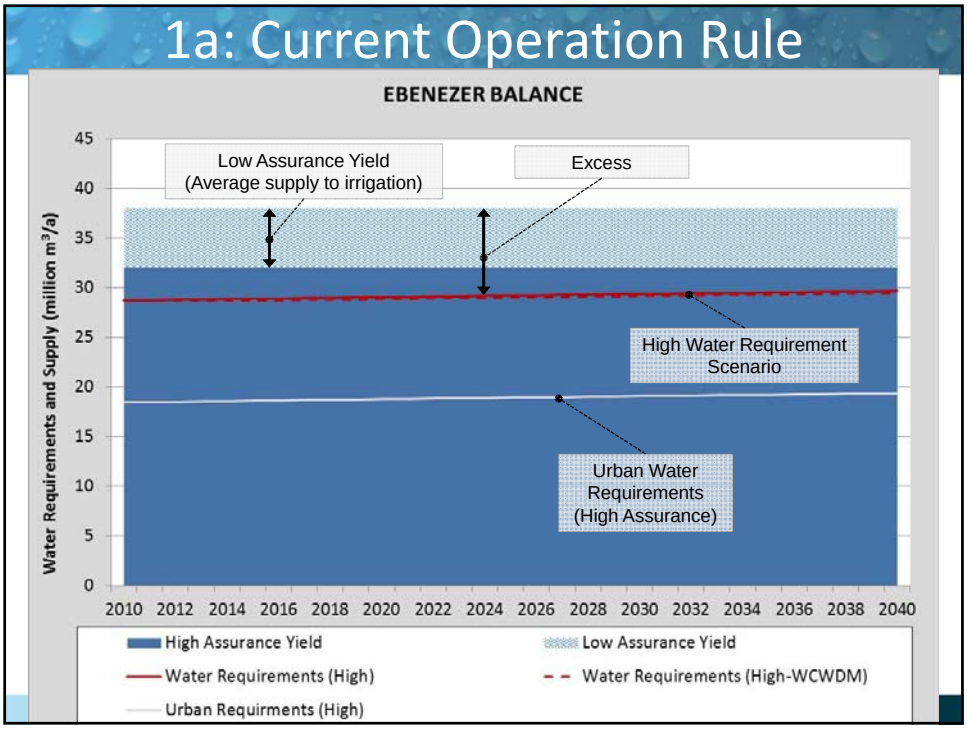
- High population scenario
- Rapid increase in Level of Service – urban sector
- Irrigation allocations exercised
- Consider cascading excess in upstream dams to supplement downstream shortages
- Apply identified augmentation options
- EWR releases – PES low flows
- Provide perspective on licence applications from:
  - Ebenezer Dam
  - Magoebaskloof / Vergelegen dams

EWR = Ecological Water Requirements
PES = Present Ecological State

Reconciliation Scenario 1



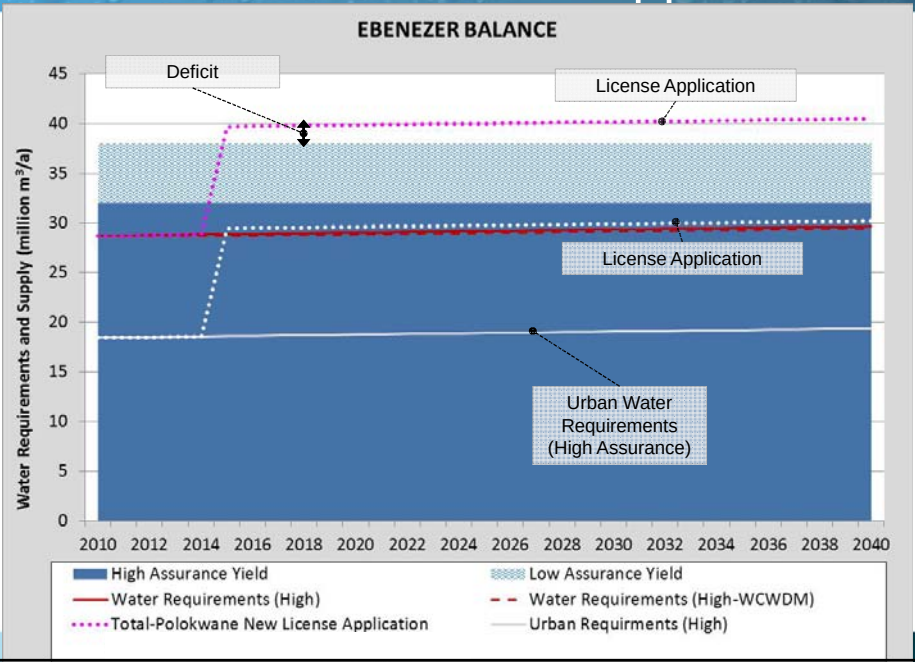
1a: Current Operation Rule



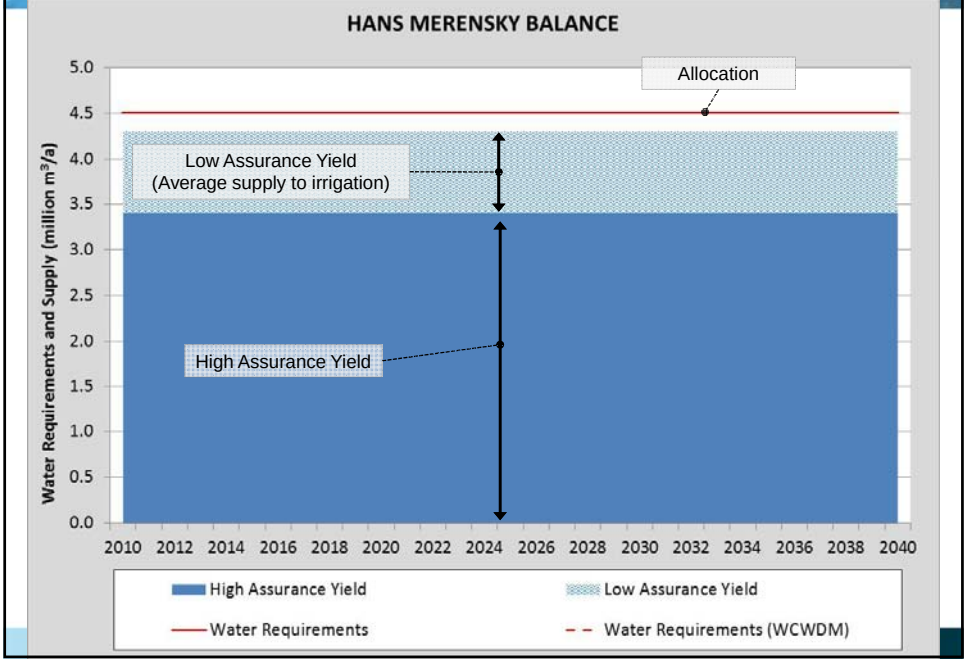
Possible utilisation of excess in Ebenezer Dam

- Additional transfer to Polokwane
  - Licence application by Lepelle Northern Water
- Support users on Tzaneen Dam
  - Rule applied historically during severe drought periods

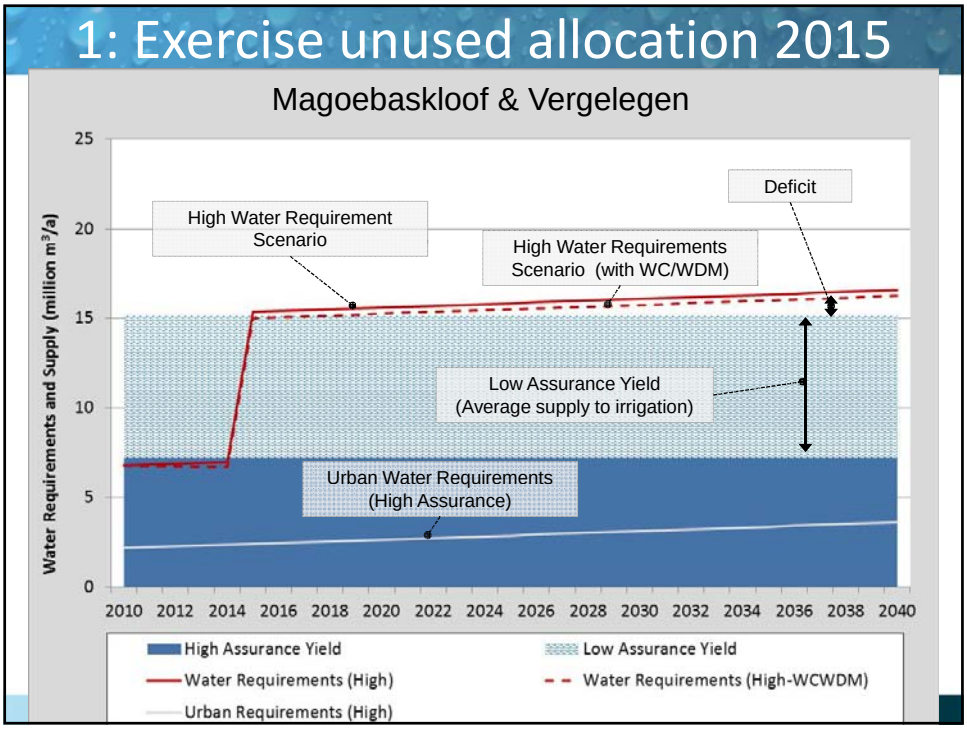
1a: Additional Licence Application



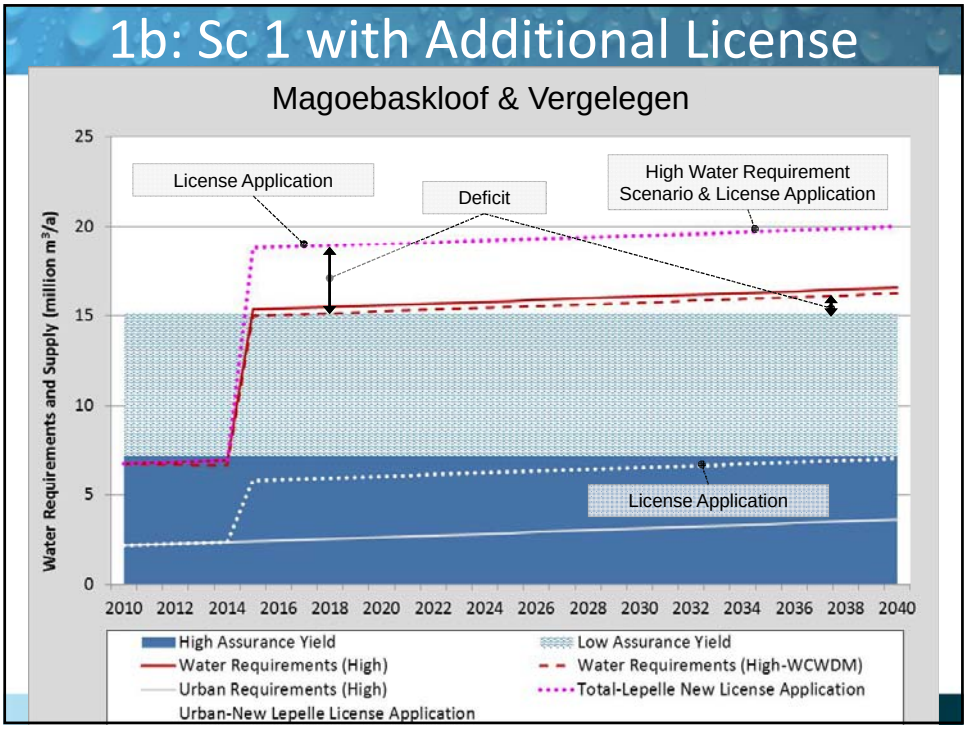
Reconciliation Scenario 1



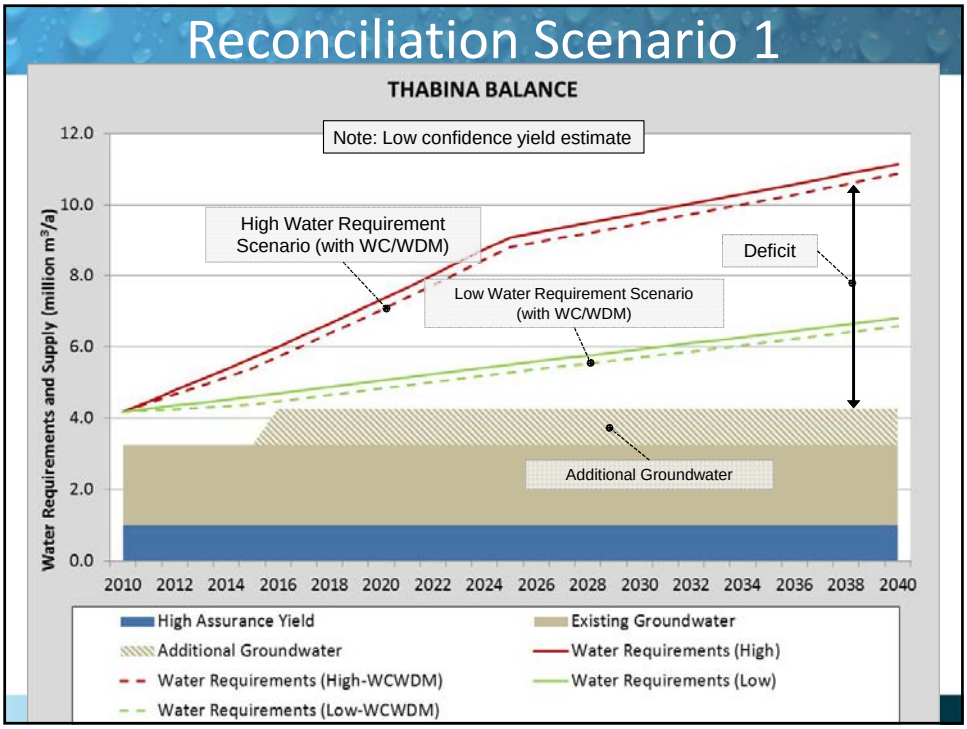
1: Exercise unused allocation 2015



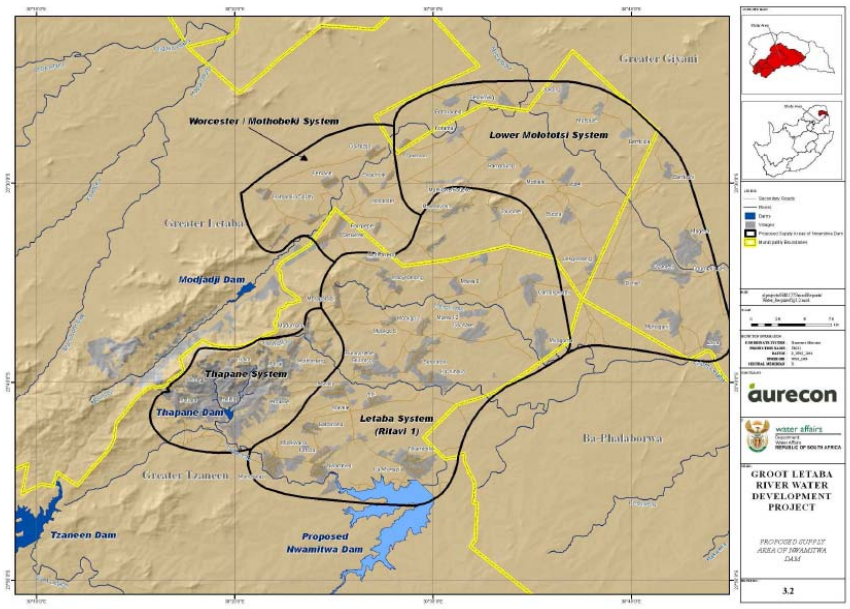
1b: Sc 1 with Additional License



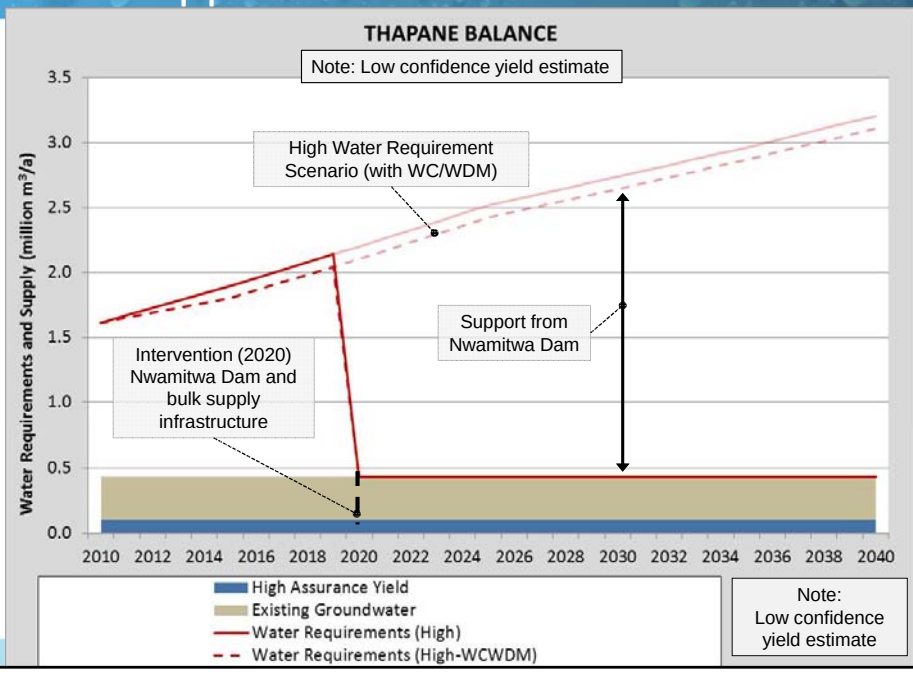
Reconciliation Scenario 1



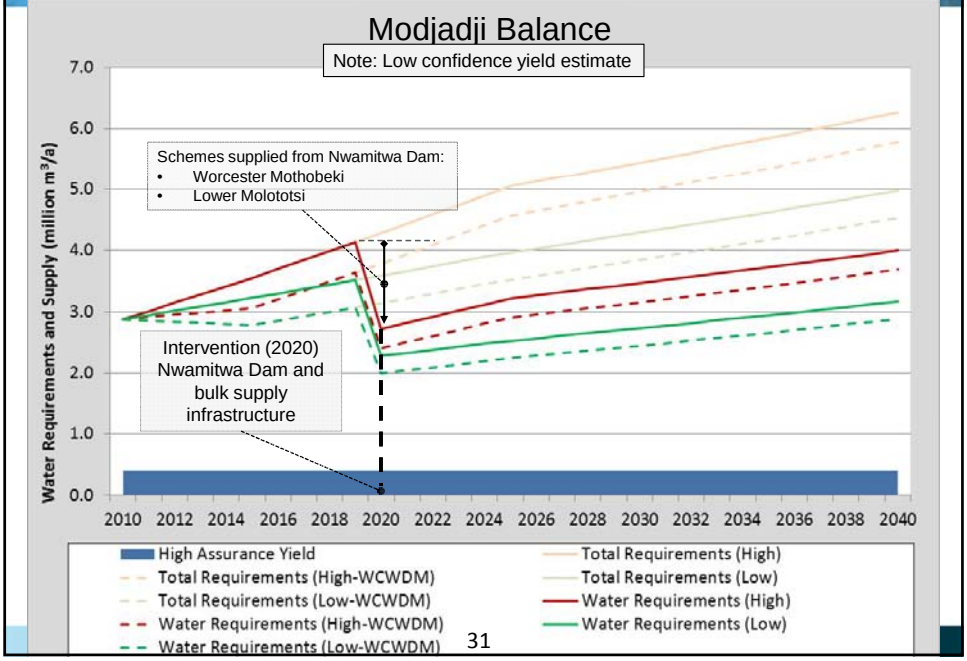
Target Supply Area from proposed Nwamitwa Dam



1: Support shortfall from Nwamitwa



1: Augmented from Nwamitwa Dam



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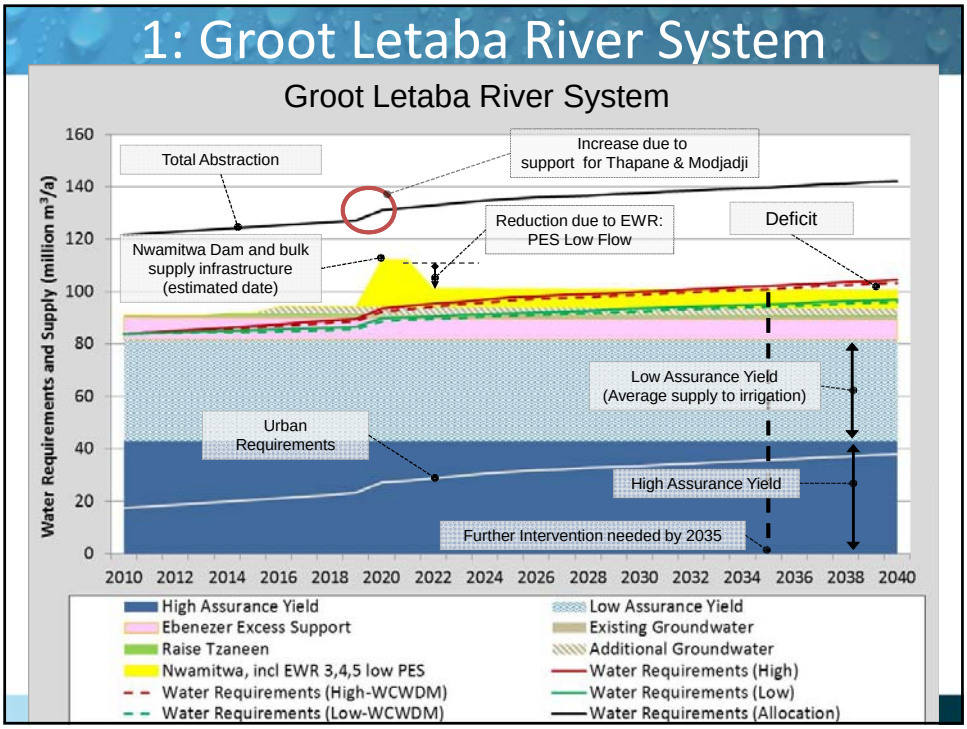
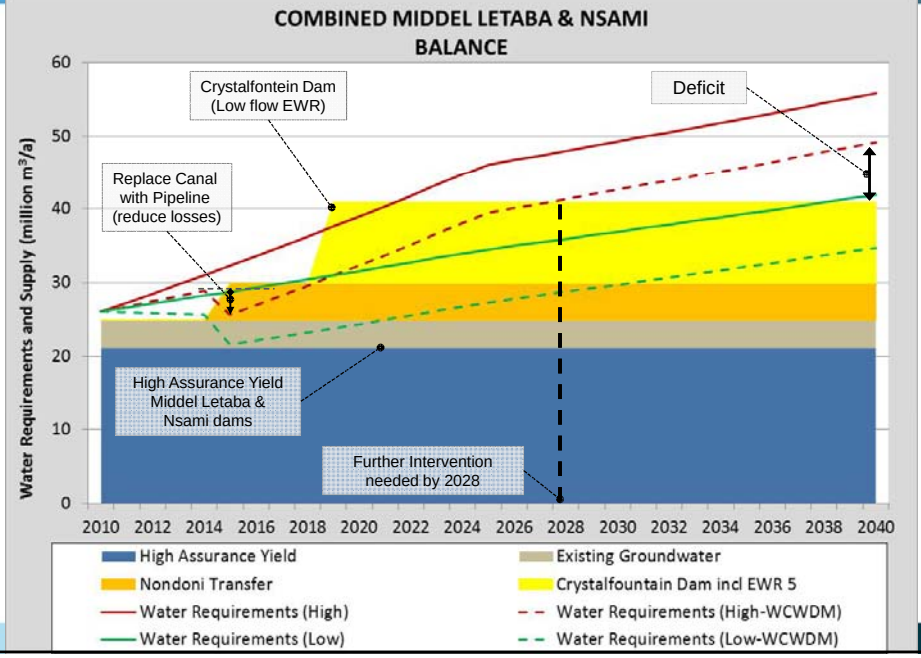
1: Groot Letaba River System



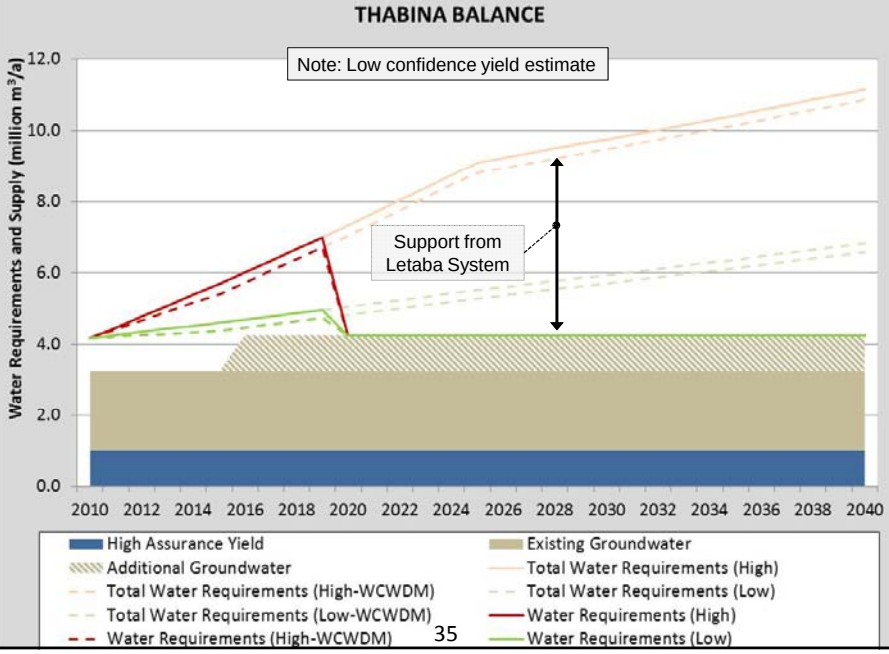
1: Middel Letaba and Nsami System



Reconciliation Scenario 2

- Same as Scenario 1 with the following changes:
- Supply Shortfalls in Modjadji Dam and Thabina Dam systems from the Groot Letaba System when Nwamitwa Dam is implemented

2: Augment from Letaba River



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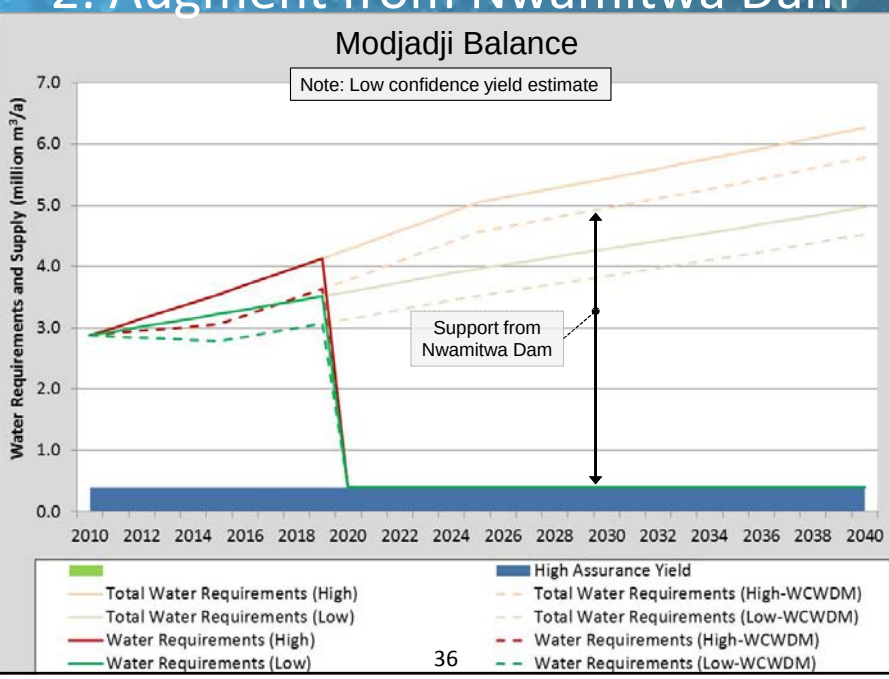
2: Augment from Nwamitwa Dam



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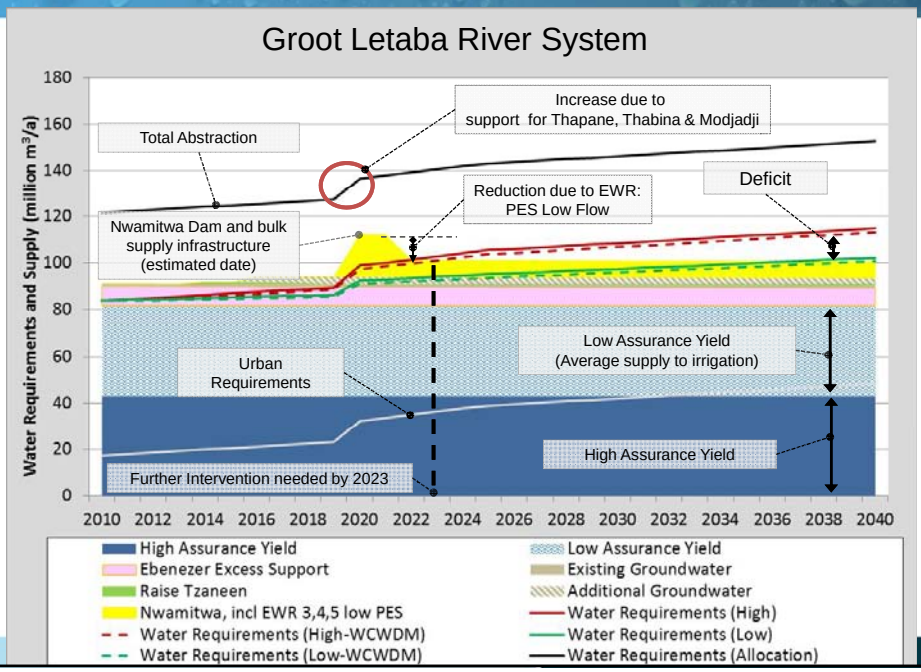
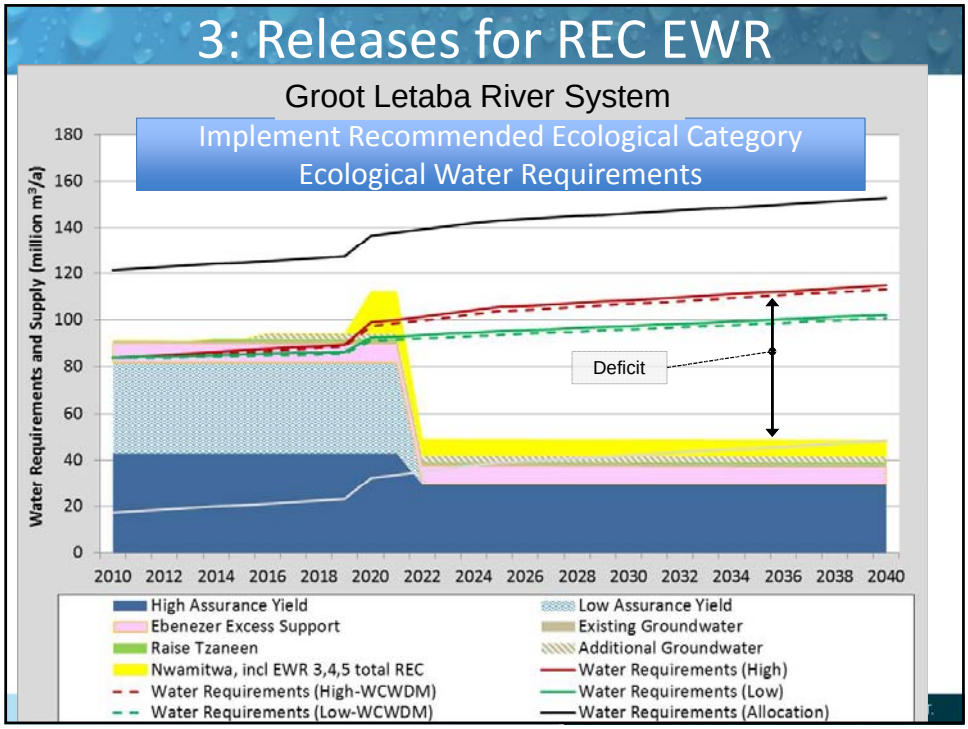
2: Augment Thabina and Modjaji systems



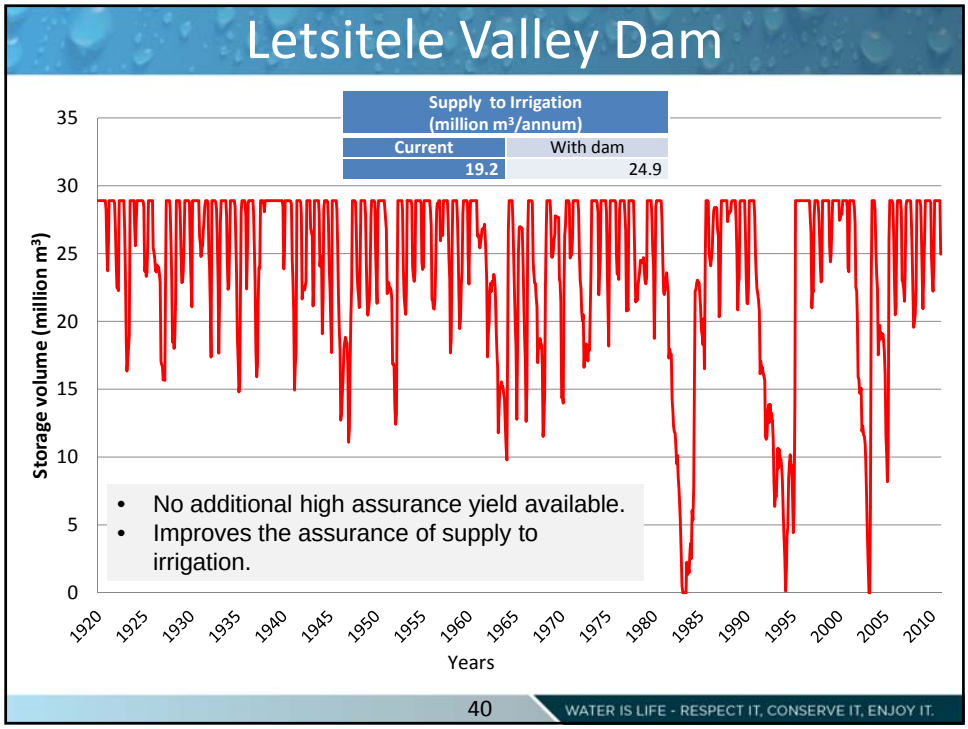
Reconciliation Scenario 3

- Same as Scenario 2 with the following changes:
- Implement the Ecological Water Requirements (EWR) in accordance with the Recommended Ecological Category (REC).

3: Releases for REC EWR



Letsitele Valley Dam



Reconciliation Strategy (1 of 6)

- No additional transfers out of the Letaba River System, Polokwane should be augmented from the Olifants River System.
- Additional monitoring of flows and dam balances required to improve the confidence in the yield estimates of Thabina, Modjadji, and Thapane dams.
- Groundwater important source towards reconciliation, currently fully utilised in many areas.
- Augmentation required from Groot Letaba System for area receiving water from Thabina and Modjadji.
- Monitor water use to confirm water requirement projections before implementing options.

Reconciliation Strategy (2 of 6)

Middel Letaba & Nsami system:

- All water requirements can be supplied up to the year 2028 by implementation the following interventions:

Intervention	Contribution (million m^3/annum)	Date	Remark
Water Conservation and Water Demand Management in Urban Sector	2.6	2015	Saving
Pipeline to replace canal between Middel Letaba and Nsami dams	5	2015	Saving in losses
Dam development on Klein Letaba River	11	2019(1)	Additional yield

Notes: (1) Estimated date when then dam development is operational.

Reconciliation Strategy (3 of 6)

Groot Letaba River system:

- All water requirements can be supplied up to the year 2028 by implementation the following interventions:

Intervention	Contribution (million m³/annum)	Date	Remark
Water Conservation and Water Demand Management in Urban Sector	0.8	2015	Saving
Raising of Tzaneen Dam	1	2017	Additional yield, improved assurance of supply
Implement Nwamitwa Dam	7	2019(1)	Additional yield
Support Tzaneen Dam from Ebenezer Dam during drought periods	8.1	2013	Augmentation (need operating rule)
Additional groundwater development	2.5	2016	Additional yield

Notes: (1) Estimated date when Nwamitwa Dam is operational.

Reconciliation Strategy (4 of 6)

Thabina Dam system:

- All water requirements can be supplied up to the year 2040 by implementation the following interventions:

Intervention	Contribution (million m³/annum)	Date	Remark
Water Conservation and Water Demand Management in Urban Sector	0.3	2015	Saving
Additional groundwater development	1	2016	Additional yield
Bulk supply Infrastructure to augment from Groot Letaba System	6.6	2016(1)	Indicated volume required by 2040

Notes: (1) Pending confirmation of additional groundwater date can be optimised

Reconciliation Strategy (5 of 6)

Thapane Dam system:

- All water requirements can be supplied up to the year 2040 by implementation the following interventions:

Intervention	Contribution (million m³/annum)	Date	Remark
Water Conservation and Water Demand Management in Urban Sector	0.1	2015	Saving
Bulk supply Infrastructure to augment from Groot Letaba System	2.7	2019(1)	Indicated volume required by 2040

Notes: (1) Estimated date when Nwamitwa Dam is operational.

Reconciliation Strategy (6 of 6)

Modjaji Dam system:

- All water requirements can be supplied up to the year 2040 by implementation the following interventions:

Intervention	Contribution (million m³/annum)	Date	Remark
Water Conservation and Water Demand Management in Urban Sector	0.3	2015	Saving
Bulk supply Infrastructure to augment from Groot Letaba System	3.3	2019(1)	Indicated volume required by 2040

Notes: (1) Estimated date when Nwamitwa Dam is operational.

Further Work to finalise Reconciliation Strategy

- Incorporate comments from SSC.
- Consider information from the water use validation and verification study as an estimate of possible unlawful water use.
- Undertake system yield risk analysis and refine balances.
- Compare development options economically:
  - Determine Unit Reference Values
- Develop Reconciliation Strategy for Luvuvhu River System.
- Coordination with the Classification Study.

Thank You