

## MCWAP DISCUSSION DOCUMENT

<b>To</b>	: <b>MCWAP TECHNICAL TASK TEAM</b>	<b>From</b>	: Johan Pienaar
<b>Attention</b>	: DWAF – Ockie van den Berg Eskom – Ian Midgley Exxaro – Wolfie Jahn Sasol – Andries Meyer TCTA – David Keyser	<b>Ref no</b>	: 104194/DES/SC10
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<b>Subject</b>	: <b>MCWAP Scenario 10 Analysis</b>		

### 1. PURPOSE

To agree the total water requirement, design parameters and design capacity for drafting of the Record of Implementation Decisions for the Mokolo Crocodile River (West) Water Augmentation Project in view of uncertainty on the extent whereto bulk users can commit to entering into Water User Agreements.

The following are presented for discussion:

- Scenario 10 water requirement cases a to d
- Transfer capacities for Phase 1 and 2a for each of the above cases and estimated commissioning dates
- First order cost estimates for the scenarios
- Conclusions and recommendations

### 2. SCENARIO 10 WATER REQUIREMENTS

Water requirements curve was produced using adjusted demand projections provided by the large users Eskom, Exxaro and Sasol during June 2009. The projected water requirements for the Municipality were derived using existing households in Lephalale, known number of households per mine/plant/power station (provided by large users) and using unit consumption rates.

Note: Further to the adjusted water requirement projections provided by the users, the start dates for the following projects were delayed to coincide with the Phase 1 water delivery date.

**Eskom:** CF3 and associated mine start date moved out from July 2011 to January 2013

**IPP's:** IPP's and associated mine start date moved out from January 2011 to January 2013

**Sasol:** Mafutha 1 CTL plant and associated coal mine adjusted from January 2012 to start January 2013

**Municipality:** Town development associated with above projects adjusted accordingly

It has transpired that the status of planned developments are such that bulk users may not be able to commit to entering into Water User Agreements at this stage, for the full range of developments included in Scenarios 9 and 10. The following scenarios were therefore constructed for analyses:

**Scenario 10a:** Full demand and adjusted for Phase 1 delivery date as indicated above; Eskom up to CF6, IPP's, Mafutha 1 only

**Scenario 10b:** Eskom up to CF3 and IPP's

**Scenario 10c:** Eskom up to CF3, IPP's and Mafutha 1

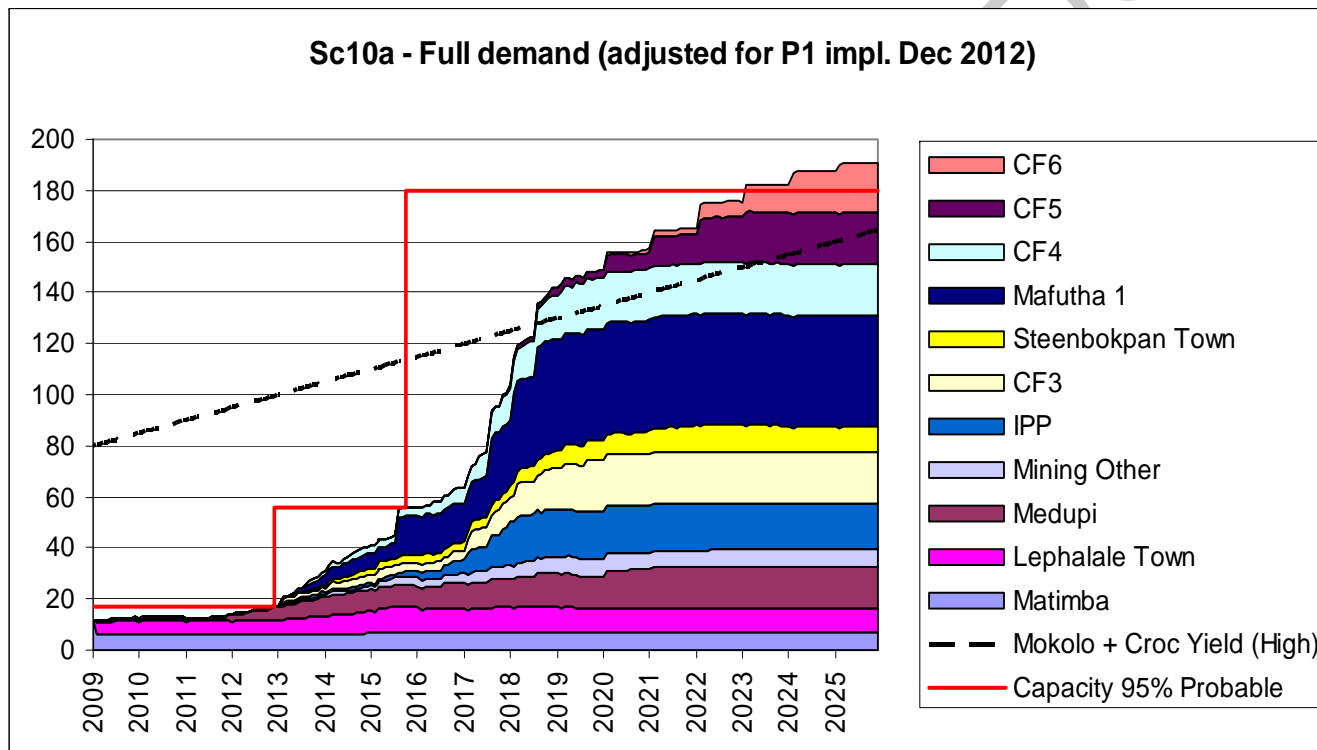
**Scenario 10d:** Eskom up to CF6, IPP's

The resultant water requirement curves and annual average volumes are indicated below.

**Table 2-1: Scenario 10a - adjusted annual water requirements for projects in the Lephalale and Steenbokpan area up to CF6 + Mafutha 1 (Million m<sup>3</sup> per annum)**

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030
Matimba	6.2	6.2	6.2	6.3	6.3	6.4	7.0	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2
Medupi	0.8	0.7	1.1	3.8	6.4	8.3	8.3	9.1	10.7	12.2	13.0	15.4	16.3	16.3	16.3	16.3	16.3	16.3
CF3	0.0	0.0	0.0	0.0	1.5	2.9	3.5	3.6	8.3	14.0	18.7	20.0	20.0	20.0	20.0	20.0	20.0	20.0
CF4	0.0	0.0	0.0	0.0	0.7	2.3	3.1	5.0	9.4	14.5	19.3	20.0	20.0	20.0	20.0	20.0	20.0	20.0
CF5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.9	2.9	6.3	11.4	17.6	20.0	20.0	20.0	20.0
CF6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	2.4	6.1	10.8	16.5	19.5	20.0
IPP	0.0	0.0	0.0	0.0	0.9	1.1	1.6	3.6	11.4	18.3	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4
Mining Other	0.2	0.3	0.4	0.5	0.9	1.2	2.9	3.5	4.6	6.0	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8
Mafutha 1	0.0	0.0	0.0	0.0	1.8	5.5	10.7	15.3	20.9	39.6	43.5	43.5	43.5	43.5	43.5	43.5	43.5	43.5
Lephalale Town	5.5	5.7	5.2	5.4	6.8	9.2	9.7	9.1	9.5	10.0	10.0	8.8	8.9	8.9	8.9	9.0	9.0	9.2
Steenbokpan Town	0.0	0.0	0.0	0.3	1.1	2.4	3.2	3.7	4.5	6.8	8.5	9.5	10.2	10.6	10.7	9.7	9.9	9.4
<b>Total</b>	<b>12.7</b>	<b>13.0</b>	<b>12.9</b>	<b>16.2</b>	<b>26.4</b>	<b>39.3</b>	<b>49.8</b>	<b>60.1</b>	<b>86.6</b>	<b>130.5</b>	<b>148.3</b>	<b>157.2</b>	<b>165.1</b>	<b>175.3</b>	<b>182.7</b>	<b>187.3</b>	<b>190.6</b>	<b>190.7</b>

**Graph 2-1: Scenario 10a - Water Requirement Projection and planned transfer capacity**



**Notes:**

**Phase 1:**

- Planned commission date **December 2012**
- Combined size = 56Mm<sup>3</sup>/a

**Phase 2a:**

- Planned commission date **October 2015**; can be delayed until January 2016
- Size = 153 Mm<sup>3</sup>/a
- Return flows fully utilised

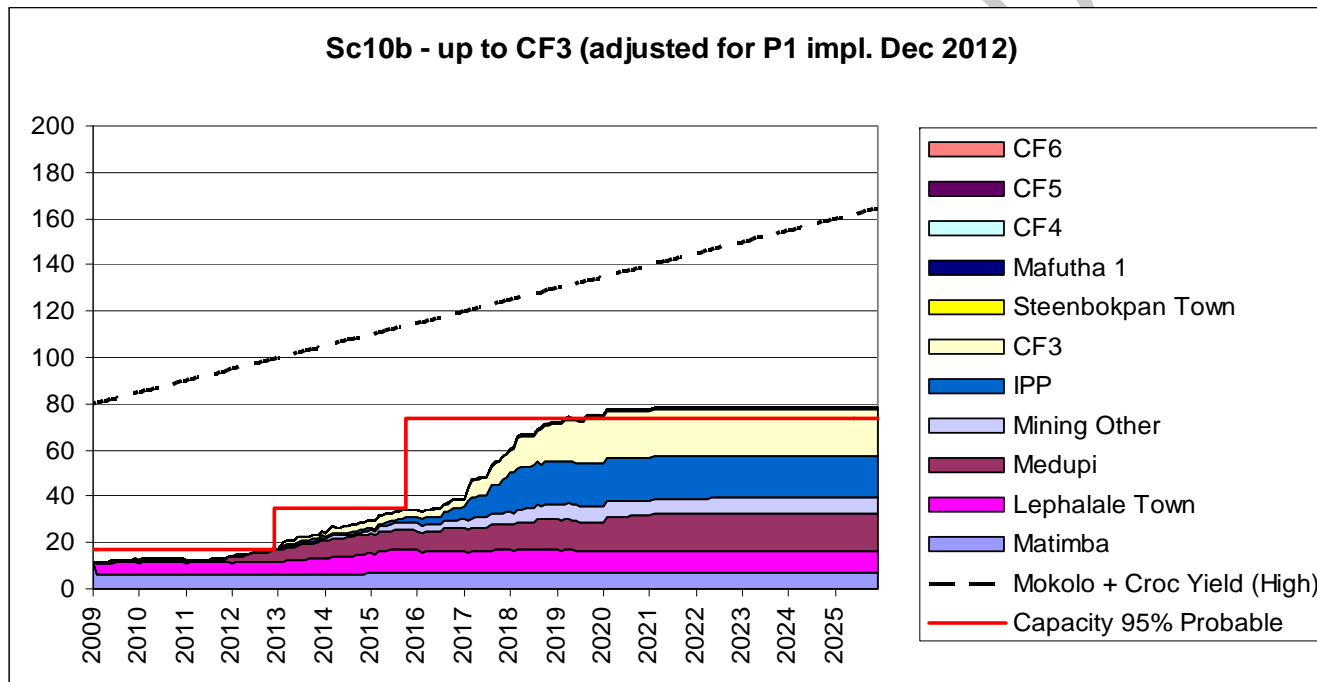
**Phase 4 and 2b:**

- Long term Yield Mokolo Dam = 28.7 Mm<sup>3</sup>/a
- **Assumed** current surplus in Crocodile = ±50 Mm<sup>3</sup>/a and growing by 5 Mm<sup>3</sup>/a
- Demand will exceed combined yield of Mokolo Dam and Crocodile River (West) in **July 2018**
- Capacity required = 33 Mm<sup>3</sup>/a without considering any emergency peaks or future growth in the total water required
- Phase 2b only required if further growth exceeds 152.6 + 28.7 = 181.3 Mm<sup>3</sup>/a

**Table 2-2: Scenario 10b - adjusted annual water requirements for projects up to CF3 (Million m<sup>3</sup> per annum)**

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030
Matimba	6.2	6.2	6.2	6.3	6.3	6.4	7.0	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2
Medupi	0.8	0.7	1.1	3.8	6.4	8.3	8.3	9.1	10.7	12.2	13.0	15.4	16.3	16.3	16.3	16.3	16.3	16.3
CF3	0.0	0.0	0.0	0.0	1.5	2.9	3.5	3.6	8.3	14.0	18.7	20.0	20.0	20.0	20.0	20.0	20.0	20.0
CF4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CF5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CF6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
IPP	0.0	0.0	0.0	0.0	0.9	1.1	1.6	3.6	11.4	18.3	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4
Mining Other	0.2	0.3	0.4	0.5	0.9	1.2	2.9	3.5	4.6	6.0	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8
Mafutha 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lephalale Town	5.5	5.7	5.2	5.4	6.8	9.2	9.7	9.1	9.5	10.0	10.0	8.8	8.9	8.9	8.9	9.0	9.0	9.2
Steenbokpan Town	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.6	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
<b>Total</b>	<b>12.7</b>	<b>13.0</b>	<b>12.9</b>	<b>15.9</b>	<b>22.8</b>	<b>29.0</b>	<b>33.0</b>	<b>36.2</b>	<b>51.9</b>	<b>68.3</b>	<b>74.9</b>	<b>77.5</b>	<b>78.4</b>	<b>78.4</b>	<b>78.4</b>	<b>78.5</b>	<b>78.5</b>	<b>78.7</b>

**Graph 2-2: Scenario 10b - Water Requirement Projection for projects up to CF3**



**Notes:**

**Phase 1:**

- Planned commission date **December 2012**
- Combined size = 34.7 Mm<sup>3</sup>/a

**Phase 2a:**

- Planned commission date **October 2015**; can be delayed until May 2016
- Size = 44.8 Mm<sup>3</sup>/a
- Return flows fully utilised

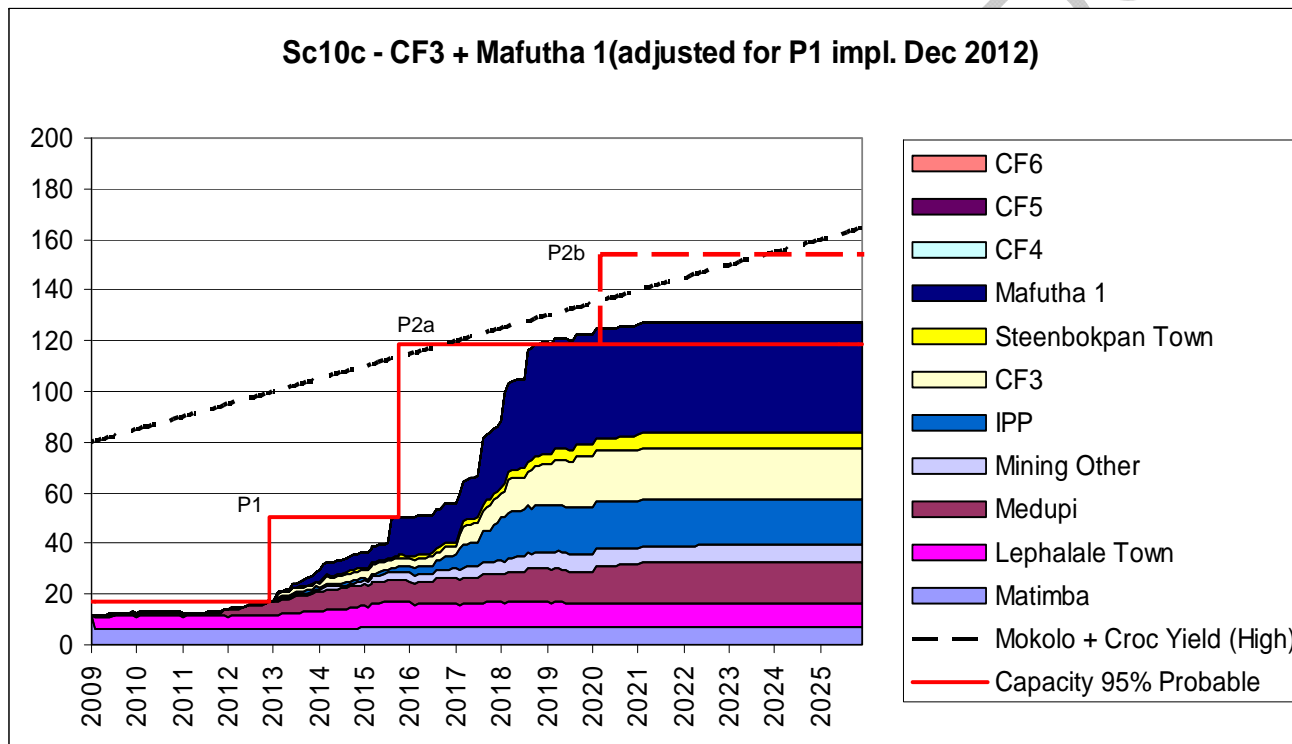
**Phase 4 and 2b:**

- Long term Yield Mokolo Dam = 28.7 Mm<sup>3</sup>/a
- **Assumed** current surplus in Crocodile = ±50 Mm<sup>3</sup>/a and growing by 5 Mm<sup>3</sup>/a
- Demand will not exceed combined yield of Mokolo Dam and Crocodile River (West)
- Phase 2b only required if further growth exceeds 44.8 + 28.7 = 73.5 Mm<sup>3</sup>/a
- Phase 4 only required if future growth exceeds available water in the Crocodile

**Table 2-3: Scenario 10c - adjusted annual water requirements for projects up to CF3 + Mafutha 1 (Million m<sup>3</sup> per annum)**

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030
Matimba	6.2	6.2	6.2	6.3	6.3	6.4	7.0	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2
Medupi	0.8	0.7	1.1	3.8	6.4	8.3	8.3	9.1	10.7	12.2	13.0	15.4	16.3	16.3	16.3	16.3	16.3	16.3
CF3	0.0	0.0	0.0	0.0	1.5	2.9	3.5	3.6	8.3	14.0	18.7	20.0	20.0	20.0	20.0	20.0	20.0	20.0
CF4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CF5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CF6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
IPP	0.0	0.0	0.0	0.0	0.9	1.1	1.6	3.6	11.4	18.3	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4
Mining Other	0.2	0.3	0.4	0.5	0.9	1.2	2.9	3.5	4.6	6.0	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8
Mafutha 1	0.0	0.0	0.0	0.0	1.8	5.5	10.7	15.3	20.9	39.6	43.5	43.5	43.5	43.5	43.5	43.5	43.5	43.5
Lephalale Town	5.5	5.7	5.2	5.4	6.8	9.2	9.7	9.1	9.5	10.0	10.0	8.8	8.9	8.9	8.9	9.0	9.0	9.2
Steenbokpan Town	0.0	0.0	0.0	0.3	0.8	1.0	1.3	1.9	2.9	4.2	5.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
<b>Total</b>	<b>12.7</b>	<b>13.0</b>	<b>12.9</b>	<b>16.2</b>	<b>25.4</b>	<b>35.5</b>	<b>44.9</b>	<b>53.3</b>	<b>75.4</b>	<b>111.5</b>	<b>122.5</b>	<b>126.1</b>	<b>127.0</b>	<b>127.1</b>	<b>127.1</b>	<b>127.1</b>	<b>127.2</b>	<b>127.3</b>

**Graph 2-3: Scenario 10c - Water Requirement Projection for projects up to CF3 and including Mafutha 1**



**Notes:**

**Phase 1:**

- Planned commission date **December 2012**
- Combined size = 50.6 Mm<sup>3</sup>/a

**Phase 2a:**

- Planned commission date **October 2015**; can be delayed until January 2016
- Size = 90.9 Mm<sup>3</sup>/a
- Return flows fully utilised

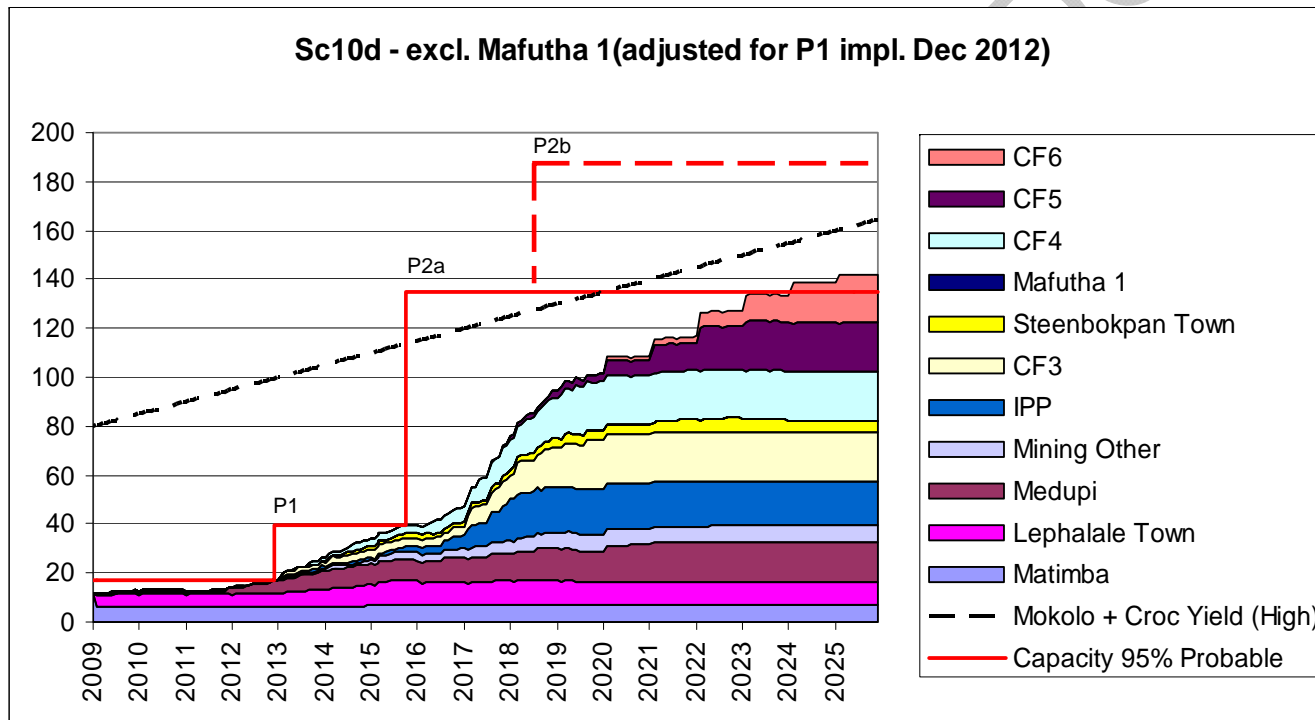
**Phase 4 and 2b:**

- Long term Yield Mokolo Dam = 28.7 Mm<sup>3</sup>/a
- **Assumed** current surplus in Crocodile = ±50 Mm<sup>3</sup>/a and growing by 5 Mm<sup>3</sup>/a
- Demand will not exceed combined yield of Mokolo Dam and Crocodile River (West)
- Phase 2b only required if further growth exceeds 90.9 + 28.7 = 119.6 Mm<sup>3</sup>/a
- Phase 2b “boosting capacity” 125 + 28.7 = 153.7 Mm<sup>3</sup>/a
- Phase 4 only required if future growth exceeds available water in the Crocodile

**Table 2-4: Scenario 10d - adjusted annual water requirements for projects up to CF6 and excluding Mafutha 1 (Million m<sup>3</sup> per annum)**

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030
Matimba	6.2	6.2	6.2	6.3	6.3	6.4	7.0	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2
Medupi	0.8	0.7	1.1	3.8	6.4	8.3	8.3	9.1	10.7	12.2	13.0	15.4	16.3	16.3	16.3	16.3	16.3	16.3
CF3	0.0	0.0	0.0	0.0	1.5	2.9	3.5	3.6	8.3	14.0	18.7	20.0	20.0	20.0	20.0	20.0	20.0	20.0
CF4	0.0	0.0	0.0	0.0	0.7	2.3	3.1	5.0	9.4	14.5	19.3	20.0	20.0	20.0	20.0	20.0	20.0	20.0
CF5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.9	2.9	6.3	11.4	17.6	20.0	20.0	20.0	20.0
CF6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	2.4	6.1	10.8	16.5	19.5	20.0
IPP	0.0	0.0	0.0	0.0	0.9	1.1	1.6	3.6	11.4	18.3	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4
Mining Other	0.2	0.3	0.4	0.5	0.9	1.2	2.9	3.5	4.6	6.0	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8
Mafutha 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lephalale Town	5.5	5.7	5.2	5.4	6.8	9.2	9.7	9.1	9.5	10.0	10.0	8.8	8.9	8.9	8.9	9.0	9.0	9.2
Steenbokpan Town	0.0	0.0	0.0	0.0	0.3	1.4	1.9	1.9	2.0	3.2	4.4	4.4	5.1	5.5	5.6	4.6	4.8	4.2
<b>Total</b>	<b>12.7</b>	<b>13.0</b>	<b>12.9</b>	<b>15.9</b>	<b>23.8</b>	<b>32.8</b>	<b>37.8</b>	<b>43.0</b>	<b>63.1</b>	<b>87.3</b>	<b>100.7</b>	<b>108.6</b>	<b>116.5</b>	<b>126.7</b>	<b>134.0</b>	<b>138.7</b>	<b>142.0</b>	<b>142.1</b>

**Graph 2-4: Scenario 10d - Water Requirement Projection for projects up to CF6 and excluding Mafutha 1**



**Notes:**

**Phase 1:**

- Planned commission date **December 2012**
- Combined size = 39.7 Mm<sup>3</sup>/a

**Phase 2a:**

- Planned commission date **October 2015**; can be delayed until December 2015
- Size = 106.6 Mm<sup>3</sup>/a
- Return flows fully utilised

**Phase 4 and 2b:**

- Long term Yield Mokolo Dam = 28.7 Mm<sup>3</sup>/a
- **Assumed** current surplus in Crocodile = ±50 Mm<sup>3</sup>/a and growing by 5 Mm<sup>3</sup>/a
- Demand will not exceed combined yield of Mokolo Dam and Crocodile River (West)
- Phase 2b only required if further growth exceeds 106.6 + 28.7 = 134.6 Mm<sup>3</sup>/a
- Phase 2b “boosting capacity” 156 + 28.7 = 184.7 Mm<sup>3</sup>/a
- Phase 4 only required if future growth exceeds available water in the Crocodile

### 3. COMPONENT SIZING AND COST ESTIMATES

The following parameters were applied to size the infrastructure components and to determine the capital cost for Scenarios 10a to d:

- Infrastructure component were sized using hydraulic principles, but not optimised
- Reliability and redundancy principle that have been agreed for the MCWAP applies i.e. pipelines and pump stations sized for 20% emergency peaking capacity and 18 days terminal storage
- Pipe lengths according to the most recent routing
- The capital cost estimates are derived as follows:
  - Capital cost estimates are done for each of the scheme components using April 2008 base rates; real terms
  - Allowance for contingencies 20%
  - Allowance for planning, design and supervision 15%

The annual average requirements at the projected commissioning dates for the project phases are summarised below. The below figures assumes that the full development scenario for the Lephalale/Steenbokpan area is limited to Eskom CF6 and Mafutha 1, and all associated developments.

#### Scenario 10a:

- Full growth 190.7 Mm<sup>3</sup>/a
- Return flows 9.3 Mm<sup>3</sup>/a
- Phase 1 56 – 14.4 = 41.6 Mm<sup>3</sup>/a; commissioned December 2012
- Phase 2a 153 Mm<sup>3</sup>/a; commissioned in October 2015
- Phase 2b Not required
- Phase 4 33 Mm<sup>3</sup>/a; required in June 2018

#### Scenario 10b:

- Full growth 78.7 Mm<sup>3</sup>/a
- Return flows 5 Mm<sup>3</sup>/a
- Phase 1 34.7 – 14.4 = 20.3 Mm<sup>3</sup>/a; commissioned December 2012
- Phase 2a 44.8 Mm<sup>3</sup>/a; commissioned in October 2015
- Phase 2b 107.8 Mm<sup>3</sup>/a; required in March 2017 for the development in addition to that planned for in Phase 2a i.e. further power stations and Mafutha 1 continue as planned
- Phase 4 33 Mm<sup>3</sup>/a; required in June 2018

#### Scenario 10c:

- Full growth 127.3 Mm<sup>3</sup>/a
- Return flows 7.6 Mm<sup>3</sup>/a
- Phase 1 50.6 – 14.4 = 36.2 Mm<sup>3</sup>/a; commissioned December 2012
- Phase 2a 90.9 Mm<sup>3</sup>/a; commissioned in October 2015
- Phase 2b 125 Mm<sup>3</sup>/a boosting option; required in December 2019 for development in addition to that planned for in Phase 2a i.e. up to CF4
- Phase 4 10 Mm<sup>3</sup>/a, December 2019 if CF4 is constructed; Not a logical option

#### Scenario 10d:

- Full growth 142.1 Mm<sup>3</sup>/a
- Return flows 6.7 Mm<sup>3</sup>/a
- Phase 1 39.7 – 14.4 = 25.3 Mm<sup>3</sup>/a; commissioned December 2012
- Phase 2a 106.6 Mm<sup>3</sup>/a; commissioned in October 2015
- Phase 2b 156 Mm<sup>3</sup>/a boosting option; can meet demand up to CF6; required in June 2018
- Phase 4 33 Mm<sup>3</sup>/a, June 2018 if projects up to CF6 is constructed

The capital cost associated with each of the above scenarios are summarised in the table below. Note that the capital cost for Phase 4 is based on a scheme with a 60 Mm<sup>3</sup>/a capacity, which is 45% more than the 33 Mm<sup>3</sup>/a required to be transferred. The capacity of the Phase 4 infrastructure is based on the estimated effluent available at the Goudkoppies WWTP and will therefore allow for further growth in the Lephalale area.

**Table 3-1: Capital Cost Summary for Scenarios 10a to d**

Scenario	Phase 1	Phase 2a	Phase 4	Total
10a	R 2 068 152 822	R 9 626 005 250	R 1 810 760 954	R 13 504 919 026
10b	R 1 410 303 027	R 5 726 336 258	-	R 7 136 639 285
10c	R 1 848 056 976	R 7 237 696 285	-	R 9 085 753 261
10d	R 1 819 759 895	R 7 718 665 856	-	R 9 538 425 752

Table 3-2 below lists the costs associated with future expansion of these scenarios i.e. for the Scenario 10a requirement. The upgrades schemes are termed Scenario 10bb,10cc and 10dd.

**Table 3-2: Capital cost associated with Scenarios 10bb to 10dd**

Scenario	Phase 1	Phase 2a	Phase 2b	Phase 4	Total
10bb	R 1 410 303 027	R 5 726 336 258	R 5 978 296 335	R 1 810 760 954	R 14 925 696 575
10cc	R 1 848 056 976	R 7 237 696 285	R 1 341 410 155	R 1 810 760 954	R 12 237 924 371
10dd	R 1 819 759 895	R 7 718 665 856	R 1 518 044 720	R 1 810 760 954	R 12 867 231 427

For comparison purposes, the Present Costs and Unit Revenue Values were determined for each of these Scenarios using an 8% discount rate. The results for Scenarios 10a -10d is presented in Table 3-3. Table 3-4 presents the present costs and URVs for Scenarios 10bb to 10dd.

**Table3-3: Present Cost and URV's**

Scenario	Present Cost	URV
10a	R 9 485 829 923	R 7.98
10b	R 5 229 473 239	R 9.47
10c	R 6 663 796 685	R 7.67
10d	R 6 981 877 116	R 8.01

**Table3-4: Present Cost and URV for upgrades**

Scenario	Present Cost	URV
10a	R 9 485 829 923	R 7.98
10bb	R 9 742 898 465	R 8.20
10cc	R 8 364 596 809	R 7.04
10dd	R 8 782 218 673	R 7.39

#### 4. CONCLUSIONS

The following conclusions are presented for discussion:

- Scenario 10a
  - Has the highest total capacity (181 Mm<sup>3</sup>/a) and a Present Cost at R9.5 billion
  - Has a URV that is comparable to that of 10c and 10d
  - Will be the preferred option if all projects up to CF6 will continue as scheduled and if further development in addition to CF6 is anticipated. The system configuration will allow for boosting up to 40% more.
- Scenario 10b
  - Has the lowest Present Cost (R5.2 billion), but a limited capacity of 73.5 Mm<sup>3</sup>/a
  - Future upgrading of Scenario 10b (to 10bb with a capacity of 181 Mm<sup>3</sup>/a), will increase the Present Cost to R14.9 billion.
  - The URVs for both 10b and 10bb are comparably the highest i.e. the least cost efficient scheme.
  - Scenario 10b is therefore only an option should projects CF4, CF5, CF6 and Mafutha 1 be stopped or delayed for the next 10 years.
- Scenario 10c
  - Has the second lowest Present Cost (R6.6 billion) and the lowest URV (R7.67)
  - Also 10cc has the lowest Present Cost (R8.4 billion) and lowest URV (R7.04)
  - The capacity of 10cc is limited to 153.7 Mm<sup>3</sup>/a, which is sufficient for projects up to CF4
- Scenario 10d
  - The Present Costs and URVs for Scenarios 10d and 10dd compare well with that of 10c/10cc
  - The upgrade scheme has a capacity of 184 Mm<sup>3</sup>/a, which is sufficient for projects up to CF6.
  - This will be the preferred option should (i) all project up to CF3 + Mafutha1 or (ii) all projects up to CF6 and excluding Mafutha 1 be committed for construction.

### Comparison of User Requirement Scenarios 8, 9,10 and 10a

