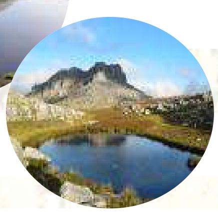
Cape Town

DESALINATION – OPTION ANALYSIS

- supply side option
- demand side option
- Environmental – reserve option
  - Enviro water quantum
  - Enviro water quality
- Cost analysis



True Capex cost of water

- **Cost of dam –**
  - **Enviro cost of dam – longer term effects**
  - **Cost of works**
  - **Cost of translocation – bulky infrastructure design**
- **Cost of desal plant**
  - **Enviro cost of plant**
  - **Cost of plant**
    - less than dam
    - Easily upgradable
  - **Cost of translocation –**
    - Less pumping – less energy demand
    - closer to demand
    - Smaller pipes from dam

True Capex cost of water

- **Cost analysis**
  - **Enviro capex of abstraction**
  - **Enviro capex of discharge**
  - **Capex cost of - plant**
    - translocation

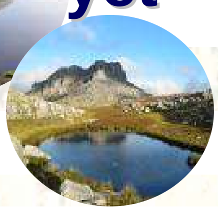
WESTERN CAPE SYSTEM RECONCILIATION STRATEGY

Opex cost of water

- Dams further from point of demand
- Desal plants closer to point of demand
- Less pumping costs
- Less large piping costs
- Less water loss
- Desal plant operated when needed
- Operated 24/7/365 if need be
- Favourable replacement cost
- Favourable upgrading costs

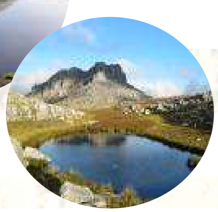
Enviro cost of abstraction

- Less water abstracted from rivers – improved reserve
- Abstracting water from impacted resource - exacerbating resource quality and quantity
- Raw water exchange for recycled water or blended water for agric or industry
- more raw water for primary use such as domestic - human consumption
- More water for equity – those not having water as yet



Enviro cost of discharge

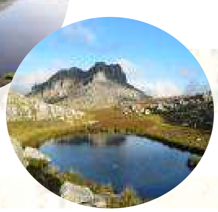
- less water discharged into rivers in coastal areas – better reserve quality of rivers – better estuaries – river and groundwater health for recreation and tourism.
- Coastal areas and inland areas
- Curtailing low quality discharge to resource



Desal Supply side option

Groundwater

- **brackish/ saline waters in use at Bitterfontein on West Coast**
- **Viable option limited to availability of groundwater**
- **Near point of demand**
- **Can be used conjunctively**
  - Increasing water security
  - Reducing risk of restrictions
  - Drought management option
  - Emergency supply
  - Minimal evaporation – excess water stored for later use
  - Artificial recharge of brackish groundwater with less saline effluent – to be extracted again for desal – closed loop



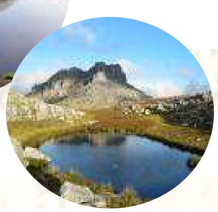
Desal Supply side option (Cont)

- **Cost of water produced is also directly depended on the recovery rate. For sea water recovery is around 50%. Rest go to brine resulting in water double seawater quality!).**

- **For brackish groundwater such as Bitterfontein, recovery can be around 75%. For treated wastewater to make it almost potable - recovery can be up to 90%.**

Supply side option – sea water

- **In 2006, the cost of water from the desalination plant in Perth, Western Australia was approximately R5/m3.**
- **The desalination plant planned for the Australian Gold Coast has an estimated cost of approx R9/m3.**

Supply side option – sea water

- A recent WRC Report (WRC Report TT 266/06 dated July 2006) calculated the unit production cost of desalination on the Cape West Coast at R7/m3.

- A figure of R6/m3 was used in the Recon Strategy for Cape Town as the approximate cost of desalination.

Desal for recycling

- **Desal for recycling –up to 90% returns**
- **Can augment raw water supplies for**
  - **agric**
  - **Industry**
- **Improve river reserve**
- **Improve water security especially for coastal areas**
- **Improve growth and development prospects**

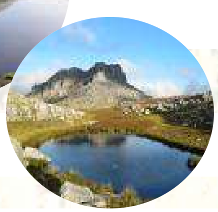
Desal option
Supply side management

Recycling

- Most readily available
- Cheapest water
- Highest assurance of supply
- Water with invested costs of treatment
- Water with invested costs of translocation
- Highest assurance of quality
- Desalination is additional cost realising maximum returns of 80/20

Desal option
Demand side management

- **Reducing water use by reuse of fresh water containing salts – sewage effluents**
  - Industrial effluent – desalinate for production water in exchange for municipal potable water
  - Water savings on supply side as well as savings on waste water generation
  - Less environmental costs

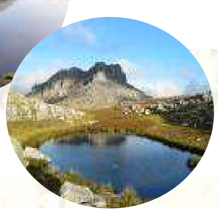


Desal option
Demand side management

- **Desal for recycling replaces parallel supply to serial supply options**
  - **Doubling or tripling savings on quantum of supply: eg parallel supply to**
    - water to domestic
    - Water to agric
    - Water to industry
  - **serialising supply of water for domestic – treated for supply to agric – further treated for supply to industry**

Desal option
Demand side management

- Irrigation – desalinate at sewage plants for crop production as appropriate
- Supply to agric eg Western Cape – WUA utilising treated effluent for fruit trees – health precautions
- Coastal cities to utilise recycled effluent or blended with raw water rather than raw water from resource – guaranteed better quality and assurance of supply
- Higher water security
- Better food security

Spatial Desal potential mapping

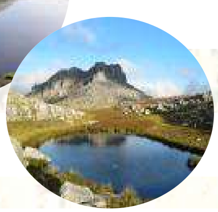
- **Desal potential map for SA based on spatial offsets:**
  - **Environmental cost of water**
  - **water quality requirements**
  - **value add to water**
  - **sole source of water**
  - **food production**
  - **Industrial**
  - **etc**

Desal - mining

- Mine water – high enviro costs – desal to low enviro costs
- This desal water then utilised for domestic or industrial use
- This is total cost benefit of desal and not just cost of treatment of desal
- Total cost being
  - Enviro cost
  - Translocation cost
  - capex
  - Opex

Desal as contingency supply

- **Drought management option**
- **Ready supply**
- **No lead times on start up**
- **plug and play option**
- **Portable and flexible on size of turnkey project**



Desalination as climate change risk management option

- In CC induced water stress – immediate start up option
- Back up option
- Risk management for growth and development
- Disaster management option
- Influx/outflux option

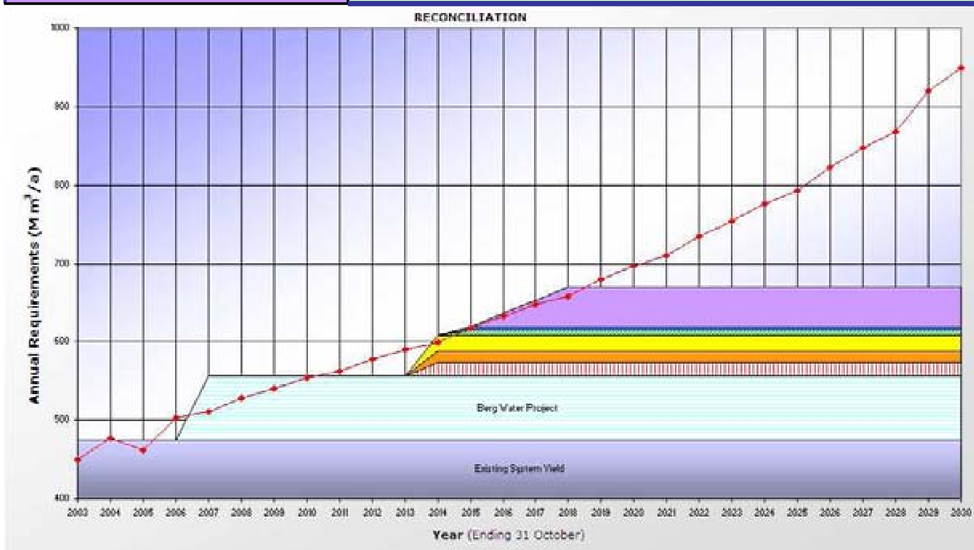
Scenario 1

Scenario 2

Scenario 3

Illustrates importance of WC/WDM in timeously meeting future water requirements


SCENARIO	DESCRIPTION
Scenario1	No WC/WDM. All supply interventions can be implemented
	Objective: To determine the impact of not implementing WC/WDM

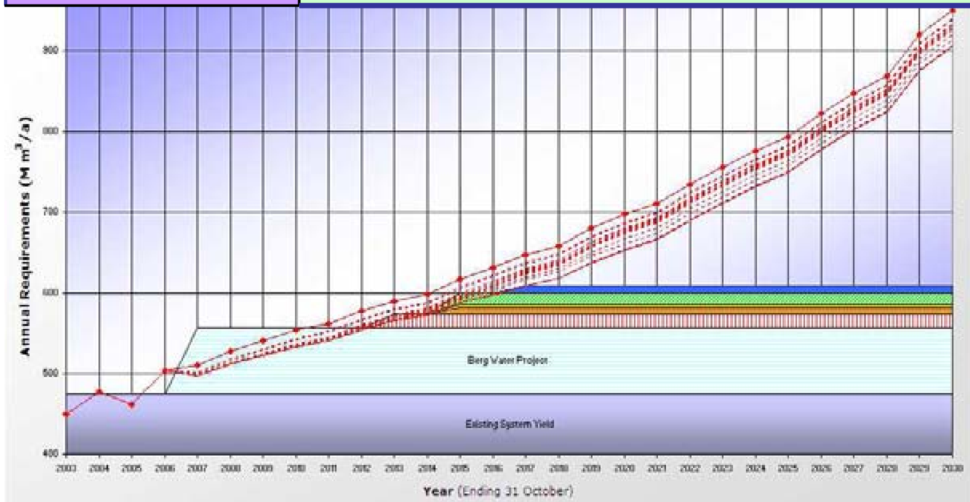


Intervention	Date Study Required	Study Level Required
“fast tracked” TMG	**2007**	**Feasibility**
Newlands Aquifer	**2007**	**Pre feasibility**
Cape Flats Aquifer	**2007**	**Feasibility**

KEY FINDINGS

- Supply Intervention required by 2011 (after Berg Water Project)
- Due to long lead times earliest supply intervention could only be implemented by 2014
- To achieve this date the TMG scheme would have to be “fast tracked”
- Shortfall in supply for between 2011 and 2014

SCENARIO	DESCRIPTION
Scenario 2	CCT WC/WDM strategy & prog. implemented. All supply interventions can be implemented.
	Objective: To determine the impact of implementing the CCT's WC/WDM strategy

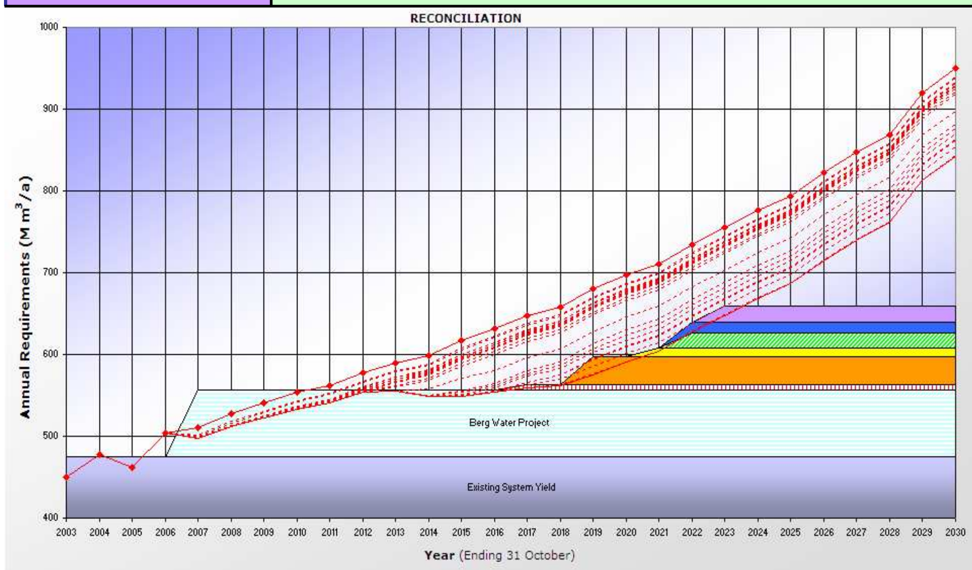


Intervention	Date Study Required	Study Level Required
Newlands Aquifer	**2007**	**Pre feasibility**
Upper Wit River Diversion	**2007**	**Feasibility**
Cape Flats Aquifer	**2007**	**Feasibility**
DWAF: West Coast Aquifers	**2008**	**Pre feasibility**

KEY FINDINGS

- Supply intervention required by 2013 (after Berg Water Project)
- Implementation of CCT's WDM strategy and programme allows supply interventions to be implemented without "fast tracking" or reducing implementation lead times.

SCENARIO	DESCRIPTION
Scenario 3	CCT WC/WDM strategy and programme implemented as well as additional longer term WC/WDM interventions. All supply interventions can be implemented
	Objective: To determine the impact of implementing all the WC/WDM interventions



Intervention	Date Study Required	Study Level Required
(Longer term WC/WDM)	**2007**	**Feasibility**
Voëlvlei Phase 1	**2007**	**Feasibility**
Mitchells Pass Diversion	**2007**	**Pre feasibility**
Newlands Aquifer	**2009**	**Pre feasibility**
Upper Wit River Diversion	**2010**	**Feasibility**

KEY FINDINGS

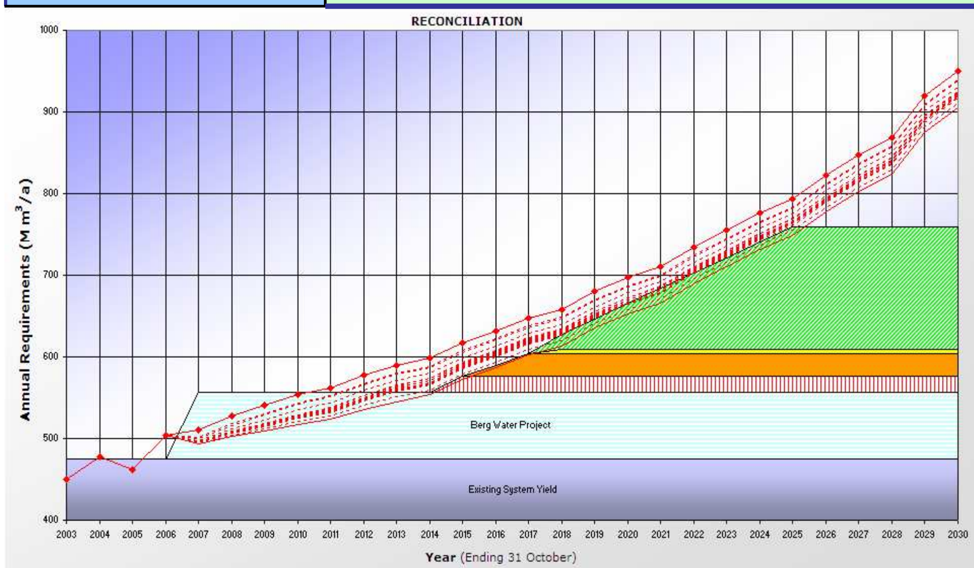
- Implementation of CCT's WDM Strategy and Programme, as well as longer term WC/WDM initiatives allows the next supply intervention to be delayed until 2017 with no restriction on implementation lead time
- Comprehensive WC/WDM (100% successful implementation) can effect a saving of approx 100 million m^3 of water per annum by 2017
- 50% successful WC/WDM will delay next intervention till approx 2014
- Low Water Requirement curve and 100% successful WC/WDM will delay supply intervention till 2029
- No restriction on implementation lead times

Scenario 5

Scenario 6

Illustrates impact of effluent re-use and desalination interventions in lieu of surface water

SCENARIO	DESCRIPTION
Scenario 5 (a&b)	CCT WC/WDM strategy and programme implemented. Only effluent re-use interventions can be implemented.
	Objective: To determine how effluent re-use interventions could meet future demand requirements

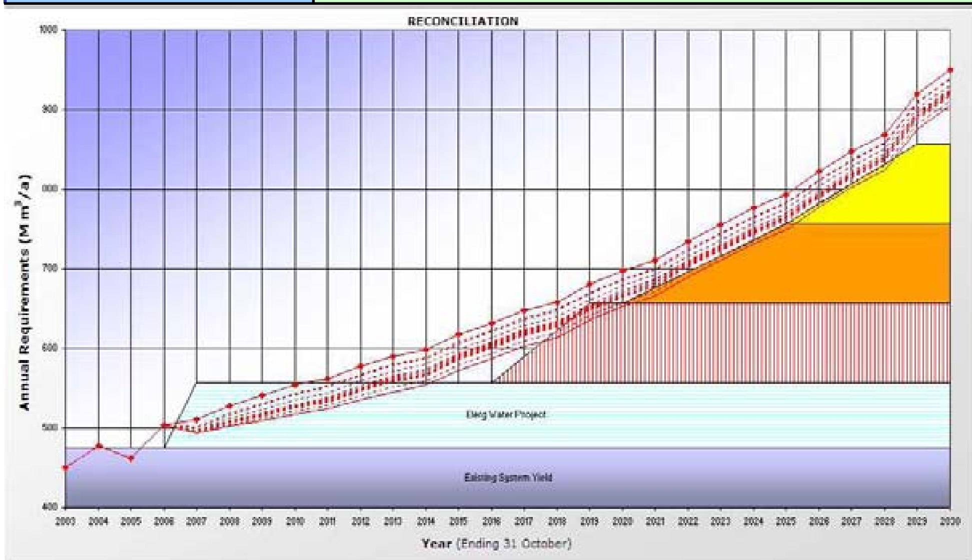


Intervention	Date Study Required	Study Level Required
Re-use irrigation/industrial	**2007**	**Feasibility**
Dual Reticulation	**2007**	**Feasibility**
Commercial Irrigation exchange	**2007**	**Feasibility**
Treated effluent re-use to potable standards	**2007**	**Feasibility Study**
Treated effluent re-use to potable standards (reduced implementation time)	**2009**	**Feasibility Study**

KEY FINDINGS

- Treated effluent re-use schemes could be implemented to meet the increasing water demand until 2018. Thereafter there would be a potential shortfall in supply for one year prior to a treated effluent re-use intervention to potable standards being commissioned.
- In order to implement a treated effluent re-use scheme to potable standards by 2018, one would have to reduce the implementation lead times.
- Effluent re-use needs a comprehensive study to conceptualise schemes and determine full potential

SCENARIO	DESCRIPTION
Scenario 6	CCT WC/WDM strategy and programme implemented. Only desalination implemented.
	Objective: To determine how desalination interventions could meet future demand requirements



Intervention	Date Study Required	Study Level Required
Desalination with shortened lead time	**2007**	**Feasibility**

KEY FINDINGS

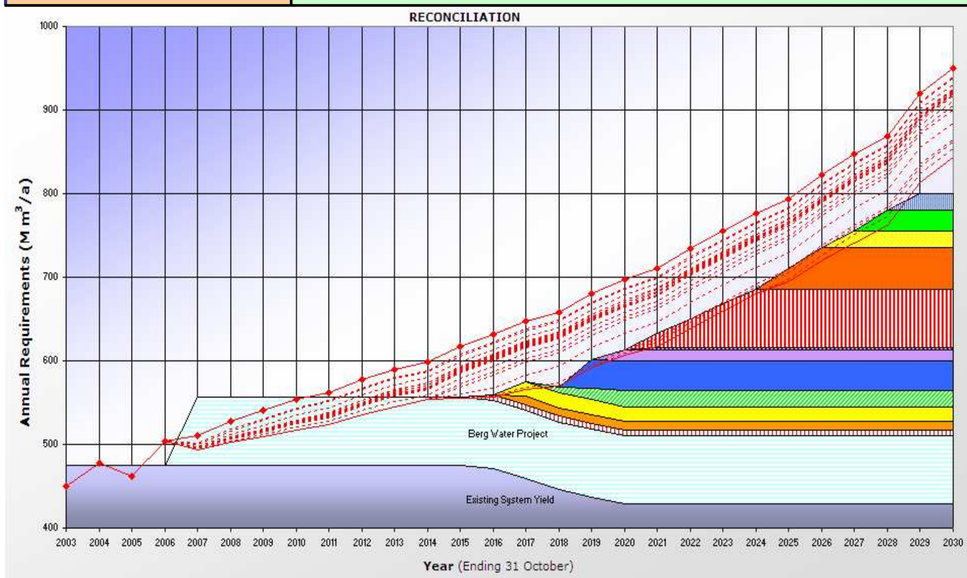
- Shortfall in supply from 2013 to 2016, prior to a desalination plant being commissioned. Implementation lead time would have to be reduced to implement a desalination plant by 2016
- Effluent re-use to potable standards more cost effective but has potential social impacts
- Based on the implementation timeframes of the Perth desalination plant, it may be possible to "fast track" implementation of a desalination plant by 2013

Scenario 8

Scenario 9

Illustrates impact of implementing ecological Reserve as well as potential impact of climate change

SCENARIO	DESCRIPTION
Scenario 8	CCT WC/WDM strategy and programme implemented. Thereafter selection based on URV (Scenario 7) with the ecological Reserve being phased in for existing water resources
	Objective: To determine how the implementation of the ecological Reserve will impact on the selection of interventions

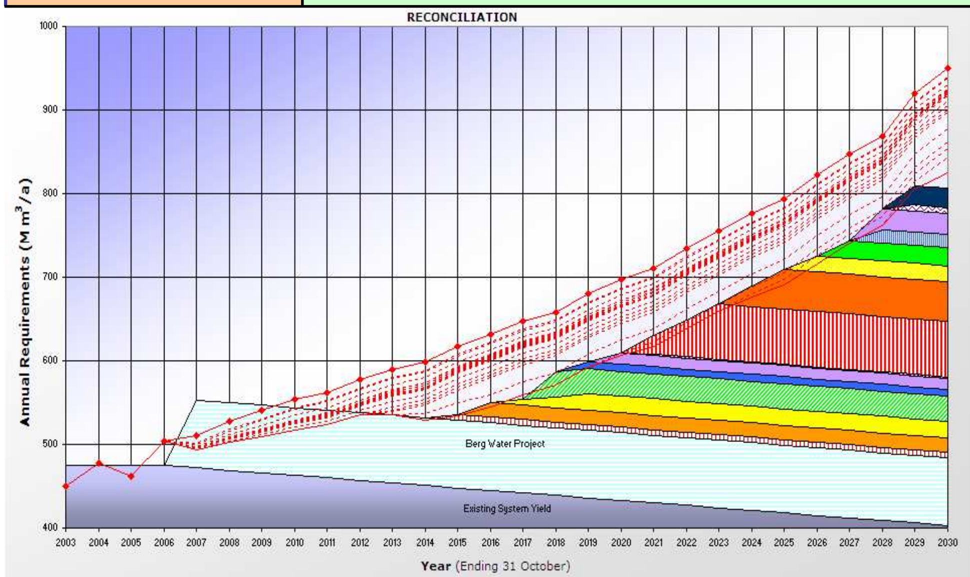


Intervention	Date Study Required	Study Level Required
(Longer term WC/WDM)	**2007**	**Feasibility**
Voëlvlei Phase 1	**2007**	**Feasibility**
Mitchells Pass Diversion*	**2007**	**Pre feasibility**
Upper Wit River Diversion	**2007**	**Feasibility**
Newlands Aquifer	**2008**	**Pre feasibility**
Re-use irrigation/industrial	**2009**	**Feasibility**

KEY FINDINGS

- The yield of the existing water resources decreased by approx. 46 million m^3.
- A mix of supply and demand interventions are available for selection in order to offset the anticipated shortfall in supply in 2103 and beyond.
- No restriction on implementation lead times
- Net present value of this option is R 4 472 million. The cost of implementing additional interventions in order to offset the anticipated decrease in system yield is approximately R 637 million in todays terms.

SCENARIO	DESCRIPTION
Scenario 9	CCT WC/WDM strategy and programme implemented. Thereafter selection based on URV (Scenario 7) with the potential for climate change being factored in
	Objective: To determine how climate change could impact on the selection of interventions



Intervention	Date Study Required	Study Level Required
(Longer term WC/WDM)	2007	Feasibility
Voëlvlei Phase 1	2007	Feasibility
Mitchells Pass Diversion*	2007	Pre feasibility
Upper Wit River Diversion	2008	Feasibility
Newlands Aquifer	2007	Pre feasibility
Cape Flats Aquifer	2009	Feasibility
Re-use irrigation/industrial	2008	Feasibility

KEY FINDINGS

•The yield from the existing water resources and future water resources was assumed to be decreased by approx. 107 million m^3.

•A mix of supply and demand interventions are available for selection in order to offset the anticipated shortfall in supply in 2103 and beyond.

•No restriction on implementation lead times

•Net present value of this option is R 6 571 million. The cost of implementing additional interventions in order to offset the anticipated decrease in system yield is approximately R 2 736 million in todays terms.

INTERVENTION	REQUIRED STUDY START DATE FOR SCENARIOS											
	1	2	3	4	5(a)&(b)	6	7	8	9	10(a)	10(b)	11
CCT WC/WDM strategy and programme		2007	2007	2007	2007	2007	2007	2007	2007	2007	2007	2007
Long Term WC/WDM interventions			2007				2007	2007	2007			2007
Voëlvlei Phase 1			2007				2007	2007	2007	***2007***	***2007***	2007
Mitchells Pass Diversion			2007				2007	2007	2007	***2007***	***2007***	2007
Newlands Aquifer	2007	2007	2009	2007			2007	2008	2007			
Cape Flats Aquifer	2007	2007		2007					2009			
DWAF West Coast Aquifers		2008		2007								
"fast tracked" TMG	***2007***			***2009***						***2008***	***2007***	
Upper Wit River Diversion		2007	2010				2007	2007	2008			
Raising Steenbras Lower										***2009***	***2007***	
Lourens River Diversion											2007	
Upper Molenaars											2007	
Re-use irrigation/industrial					2007			2009	2008	2007	***2007***	
Dual Reticulation					2007							
Commercial Irrigation Exchange					2007							
Treated Effluent to Potable Standards					***2007***						2007	
Desalination						**2007**						

Notes:
1) Only study start dates between 2007 and 2009 are shown
2) Voëlvlei Phase 1 and Mitchells Pass are mutually exclusive schemes

(light blue)	Indicates Pre feasibility level study required
(light green)	Indicates Feasibility level study required
Date	Indicates a "fast tracked" or reduced implementation time

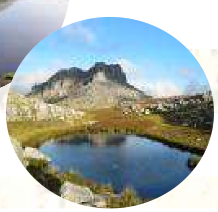
Summary of Study Start Dates

Conclusion

1. **Desal is definitely a serious option for water security**
   - **Coastal town water regimen/ conjunctive use of fresh, groundwater and sea waters –stormwater may also be considered.**

2. **Desal for unlocking other sources of water - brackish alternate sources such as brackish waters inland and coastal**

3. **Desal for improving Resource Quality objectives**

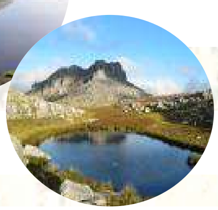



Conclusion

4. **Desal for recycling of effluent should begin sooner than later**
   - Equity
   - Reserve
   - Food
   - Jobs

5. **Desal for extending life of existing infrastructure**
   - Hydraulic load
   - Type of infrastructure needs

6. **unlock water for: Growth and development**



The end