



water & forestry

Department:
Water Affairs and Forestry
REPUBLIC OF SOUTH AFRICA

Water Reconciliation Strategy Study for the Kwazulu-Natal Coastal Metropolitan Areas

Water Quality and Re-use Task

28 February 2008



Water Quality Assessment

- **Presentation contents**
 - **Water Quality Overview**
 - **Re-use Options**
 - **Desalination**

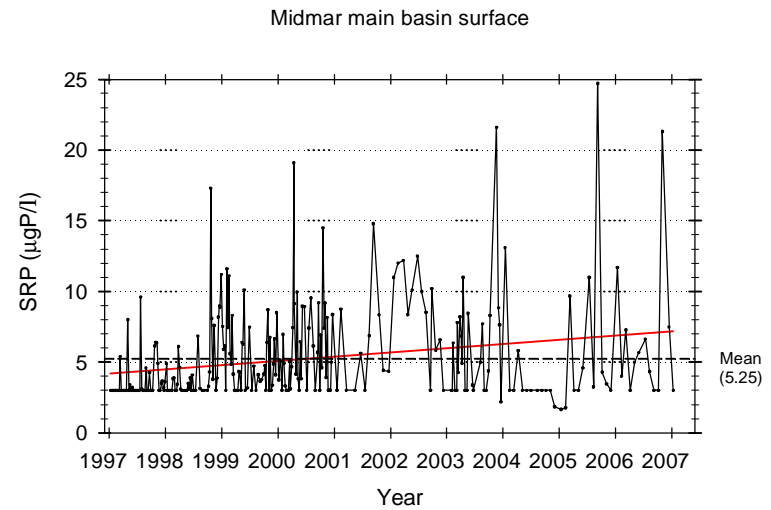
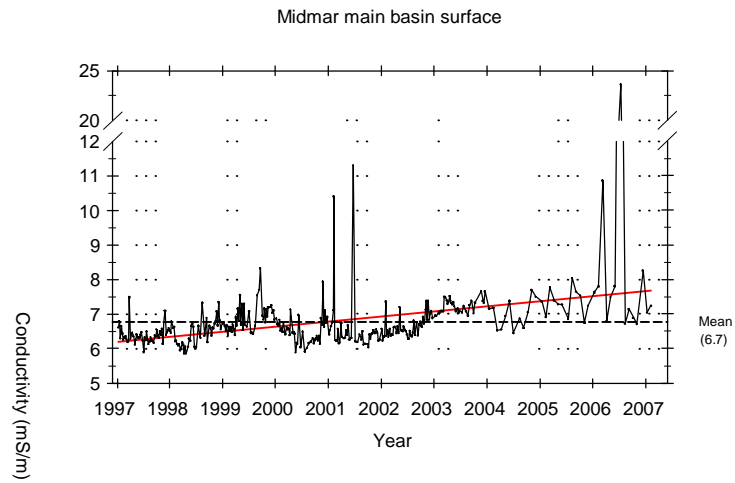
Water Quality Overview

- **Water Quality Guidelines**
 - **Dissolved salts**
 - **EC 70 mS/m upper bound of Class 0 drinking water**
 - **Eutrophication**
 - **Average concentration SRP < 0.005 mg/L - Oligotrophic**
 - **Average concentration SRP < 0.025 mg/L – Mesotrophic**
 - **E-Coli**
 - **132 CFU/100 ml**

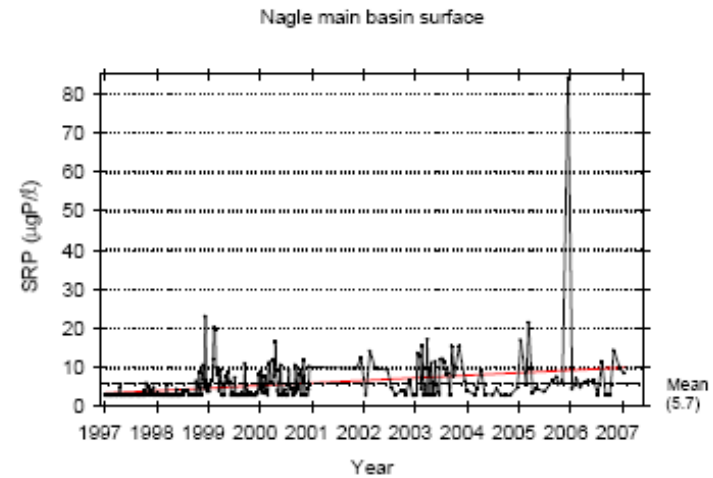
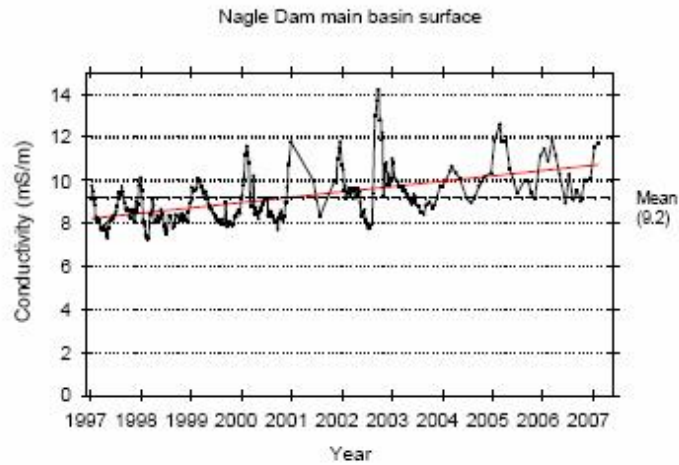
Water Quality Overview

- **Upper Mgeni Catchment**
 - **Good water quality – EC <15 mS/m**
 - **Midmar, Albert Falls and Nagle Dams – Average SRP < 0.01 mg/L – mesotrophic**
 - **Some upward trends**

Water Quality Overview



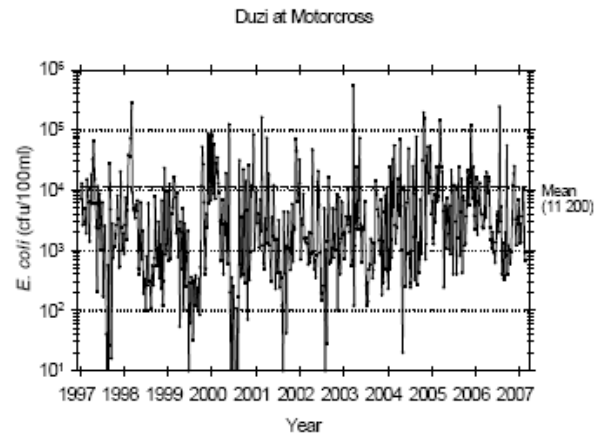
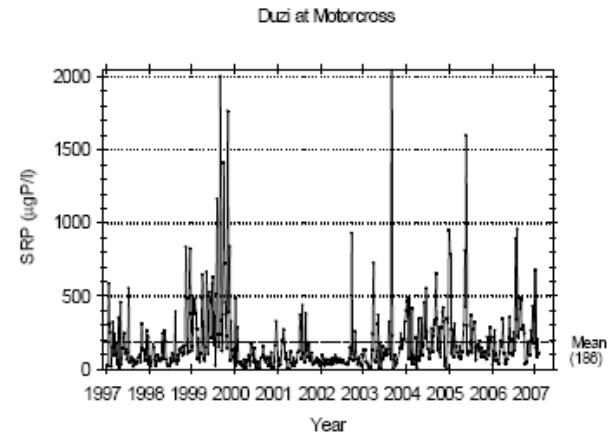
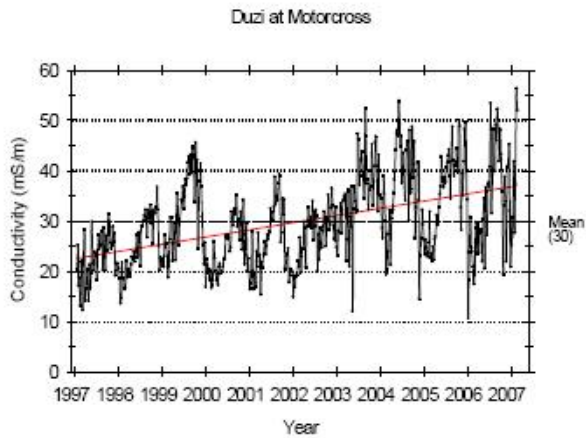
Water Quality Overview



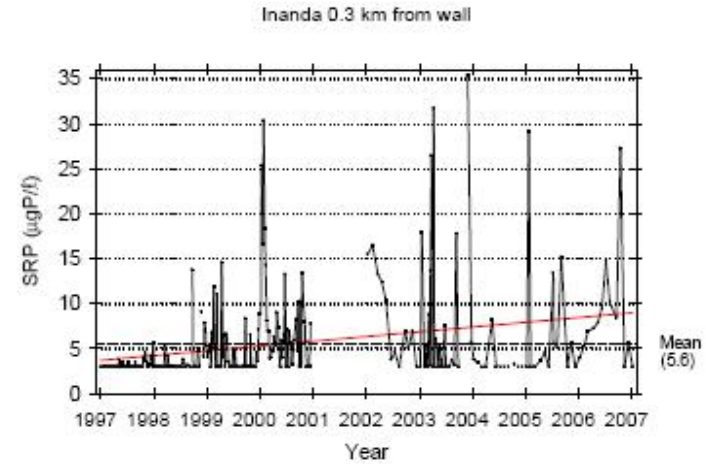
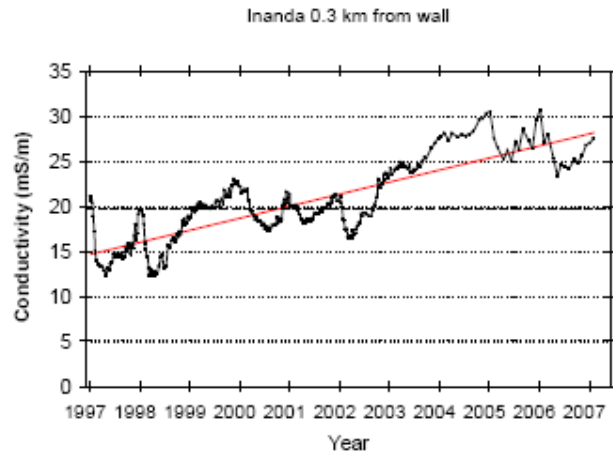
Water Quality Overview



Water Quality Overview

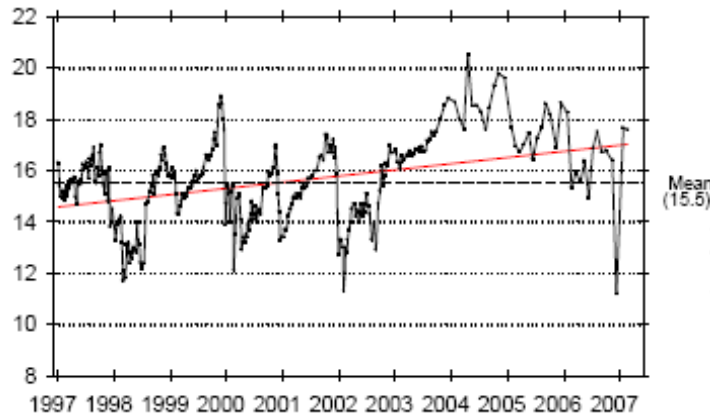


Water Quality Overview

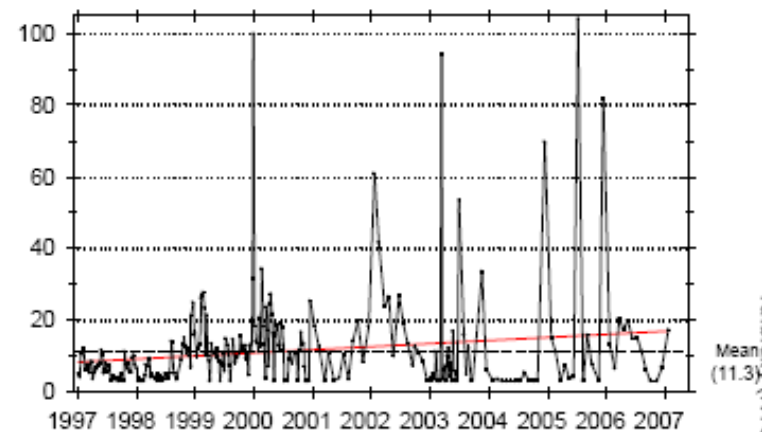


Water Quality Overview

Hazelmere main basin surface



Hazelmere main surface basin



Re-use WWTP effluent

Competition for use of effluent

- **Indirect/direct re-use for urban supply**
- **Re-use agriculture**
- **Meet EWR estuary**

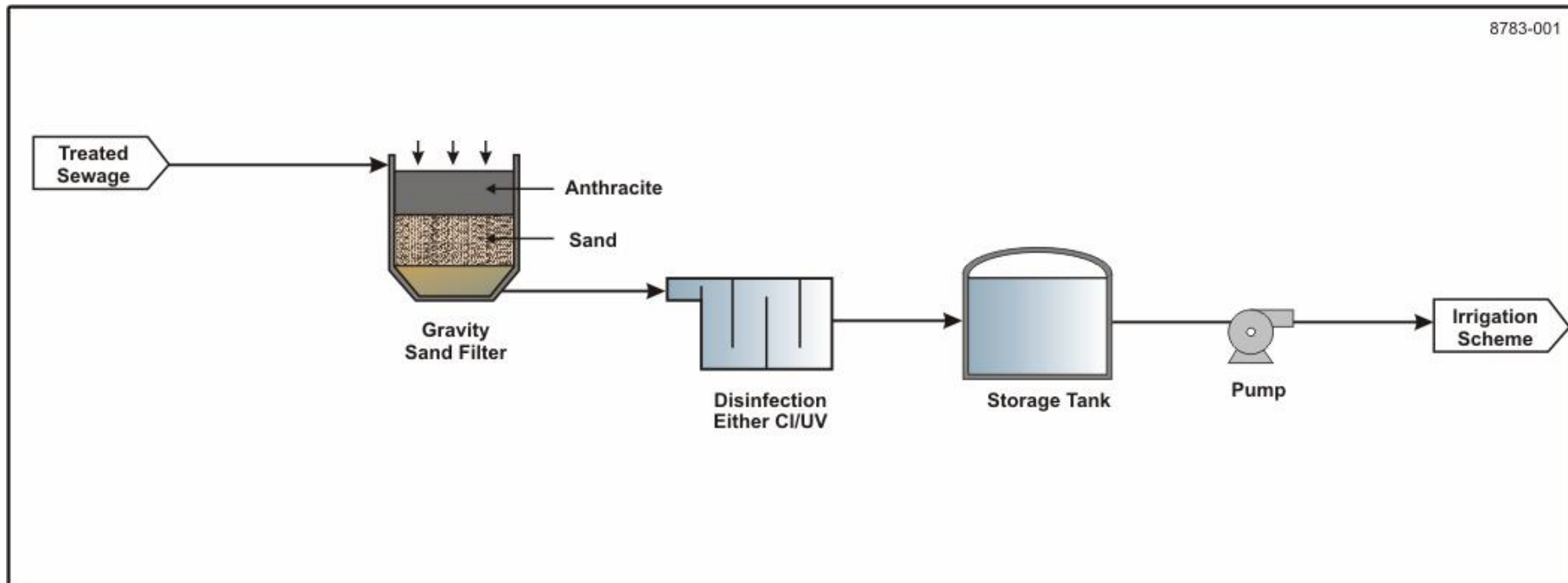
Re-use WWTP effluent

- **Considered three re-use cases**
 - **Re-use for irrigation**
 - **Removal of phosphorus to discharge into a dam for re-use**
 - **Treatment to potable standard for direct re-use**

Re-use WWTP effluent

- **Treatment technology for irrigation**
 - **Treated STP still contains pathogens**
 - **Protect farm workers against infection by water borne diseases**
 - **Foods that can be eaten raw (not processed)**
 - **Adopted a conservative approach**
 - **Filtration and disinfection**
 - **Need to remove SS so can disinfect**
 - **Golder has been contracted to look at Dube trade port agriculture**

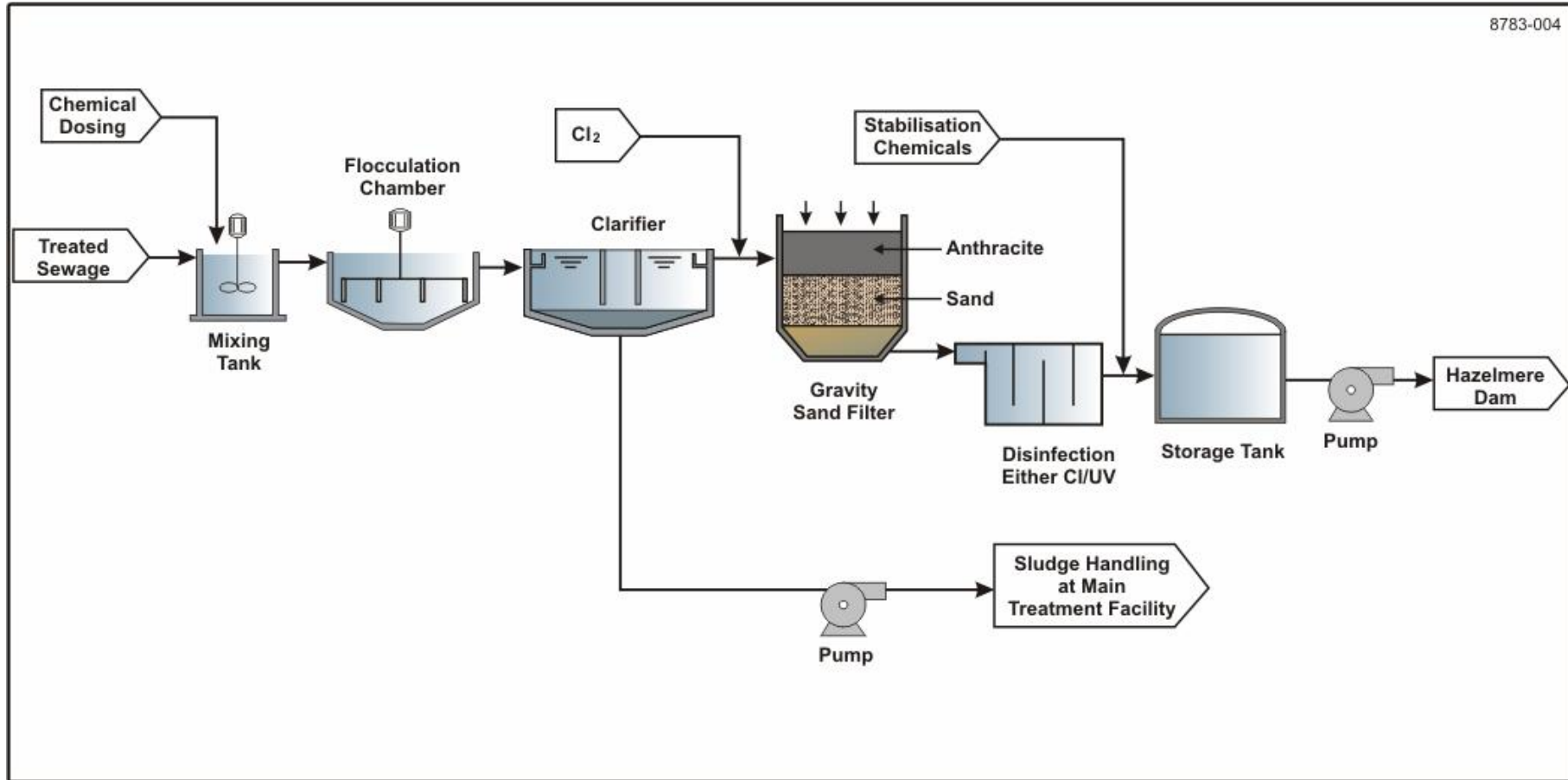
Re-use - Irrigation



Re-use WWTP effluent

- **Treatment technology for discharge to dam**
 - **Remove P so that we do not change trophic status of dam**
 - **Originally costed to remove Phosphorus (P) to 0.1 mg/L**
 - **Initial assessment of impact on dams showed that trophic state changes from mesotrophic to eutrophic average P increases to above 0.025 mg/L**
 - **Need to increase P removal to 0.035 mg/L**
 - **Add extra chemicals and filtration step to improve to 0.035 mg/L**

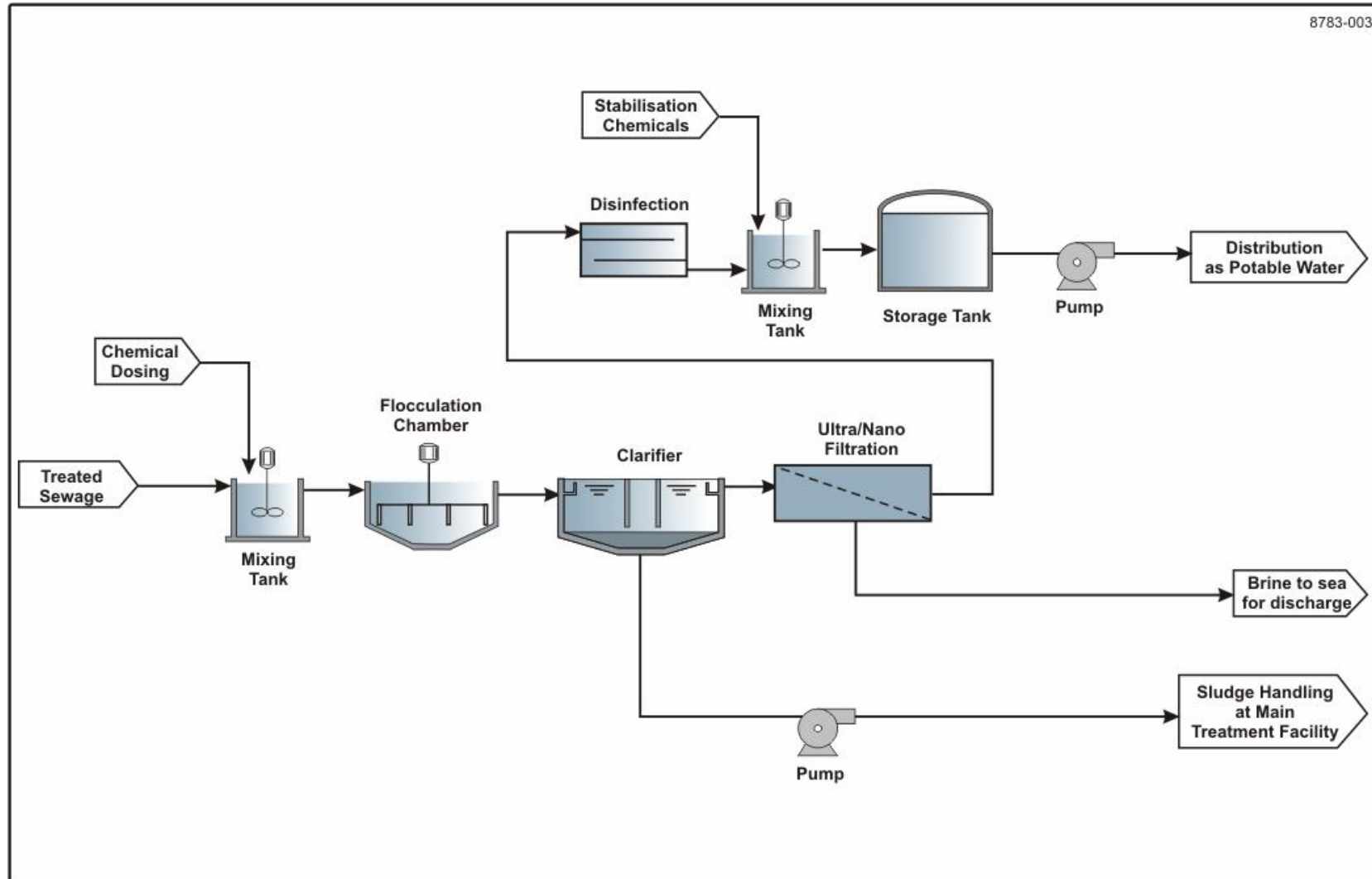
Re-use WWTP effluent



Re-use WWTP effluent

- **Treatment technology to potable standard for direct re-use**
 - **Industrial component should preferably be less than 10% of influent**
 - **Need to exclude organics/SS for disinfection (Trihalomethanes)**
 - **Exclude pathogens using multiple barriers**
 - **Produces brine which has to be disposed. Looking at disposal through the sea outfalls – Do not have costs at this stage therefore not included in URV**

Re-use WWTP effluent



Re-use WWTP effluent

- **WWTP Analysed**

Plant	Capacity
Verulam	6.5 ML/d (2.4 million m³/a)
Tongaat Total	8 ML/d (2.9 million m³/a)
Phoenix	14 ML/d (5.1 million m³/a)
Kwa Mashu	63 ML/d (23.0 million m³/a)
Northern	54 ML/d (19.7 million m³/a)

Re-use WWTP effluent

- **Assumptions on cost calculations**
 - **WWTP are performing according to specifications**
 - **Costs are pre-feasibility level at +/- 20%**
 - **Costs in 2008 Rands**
 - **Costs do not include the supply infrastructure to deliver to users**

Re-use WWTP effluent - Costs

	WWTP				
	Verulam	Tongaat	Phoenix	Kwa Mashu	Northern
Irrigation					
Capex (mill R)	13.0	15.1	22.3	64.0	57.3
O&M (R/m ³)	0.3	0.3	0.3	0.3	0.3
Removal P					
Capex (mill R)	5.9	6.8	10.1	29.0	26.1
O&M (R/m ³)	0.13	0.13	0.13	0.13	0.13
Potable standard					
Capex (mill R)	31.7	37.1	56.4	174.2	69.0
O&M (R/m ³)	3.0	3.0	3.0	3.0	3.0

Desalination Sea Water

- **Indicative costs for screening desalination as an option (+- 40%)**
- **Membrane technology used**
- **40% recovery**
- **Disposal of brine to sea**
- **Treat to produce 50 million m³/a**
- **Power usage - 6 kwhr/m³ of product water**
- **Power usage – 34 MW**
- **Costs indicative – we are following up with some other suppliers claiming cheaper costs to understand basis of costs**
- **Link to Umgeni Water Study once info becomes available**

Desalination Sea Water

Capital Cost (million Rand)	1 850
O&M Cost (R/m³)	6.86

Conclusions

- **Initial assessment shows that level of P removal will change trophic state of dams. Need further removal which will double capital costs and increase opex costs.**
- **The impact of discharging treated effluent on the water quality of the dams trophic status needs to be assessed using more detailed analysis.**
- **Desalination costs appear to be prohibitively expensive – will refine when Umgeni Water info becomes available**