

ROODEPLAAT WATER TREATMENT WORKS PHASE 1: PROCESS UPGRADE

SUMMARY OF WORKS	
Type of Works	Water Treatment Works
Location of Works	City of Tshwane
Size of Works (Mℓ/D)	60 ML/D
Date of Award	25 June 2010
Date Completed	3 October 2013
Completion Value (Including VAT)	R 73 695 697.84
Client	City of Tshwane
Conditions of Contract	FIDIC YELLOW BOOK

The deteriorating quality of the raw water source (Roodeplaat Dam) supplying the Roodeplaat Water Treatment Works required advanced treatment processes to be added to the existing process stream to remove taste- and odour-causing compounds which affected the aesthetic quality of the final water. These aesthetics have a significant effect on the perceived quality of the water by the consumers, and thus it is in the Employer (City of Tshwane)'s interest to present an aesthetically pleasing product to the public.

The new advanced treatment processes were added to the existing conventional process train as follows:

- Potassium permanganate dosing facility added at raw water pumping station for increased contact time (compared with dosing facility at inlet works).
- Pre ozone dosing added directly upstream of inlet works for oxidation (replaces pre-chlorination).
- Pre-RGSF ozone dosing added downstream of sedimentation and upstream of Rapid Gravity Sand Filters) for additional oxidation and pre-filter conditioning



Pre-RGSF ozone side-stream injection pump station



Ozone generator building

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- Main ozone dosing added downstream of Rapid Gravity Sand Filters for oxidation of taste- and odour-causing organic compounds.
- 20 off Granular Activated Carbon (GAC) filters added downstream of main ozone contact tank for removal of oxidized organic compounds.

A new low lift pump station comprising three axial flow submersible pumps (two duty, one standby) was installed upstream of the main ozone contact tank to provide the additional head required to get the entire plant flow through the two new additional structures (ozone contact tank and GAC filters).

Three Ozonia ozone generators (two duty, one standby – capable of supplying 26 kgO₃/hr each) produce the 37kg/hr of ozone gas required for the three dosing points from Liquid O₂ (LOX) vaporised on demand. Liquid cooling of the ozone generators is provided by four end suction centrifugal pumps (two duty, two standby), while oil-free dry additive air (-70°C dew point minimum dryness) is provided by two scroll compressors (one duty, one standby) with two desiccant dryers (one duty, one standby). A host of instrumentation and control valves ensure that the automatic control system can react autonomously to most operational scenarios without human intervention being required.



Cooling water pump station and additive air equipment



Ozone generator vessel and Power Supply Unit

The pre and pre-RGSF ozone is dosed via side-stream injection pump stations. This principle refers to a portion of the main plant flow being diverted, pumped through an eductor (which draws in a controlled quantity of ozone gas), and that ozone-rich side stream then being reintroduced into the main plant flow for rapid mixing.

The main ozone is introduced into the main plant flow downstream of the low lift pump station water in a dedicated contact tank. The contact tank comprises two hemispheres which can either run in one duty, one standby or two duty, zero standby configurations, for maintenance purposes. The ozone gas introduction directly into the water is accomplished via ceramic diffusers installed in six arrays (three per hemisphere) at the bottom of plug-flow chambers to provide maximum contact. Each dosing chamber is provided with a strengthened glass viewing port to view the fine bubble distribution.



Main ozone contact tank gallery

The GAC filters remove oxidised organic taste- and odour-causing compounds through 1.7m deep beds of GAC atop lateral filter drainage systems using constant-level control



GAC filter building upper gallery



Ozone feed gas preparation