

VON BACH WATER TREATMENT PLANT





The Von Bach Water Treatment Plant produces potable water for the capital of Namibia, Windhoek, as well as for a number of other consumer points in the central part of the Khomas Region. The plant is situated downstream of the Von Bach Dam and 10 km south of Okahandja.

The original plant was completed in 1971 together with the Von Bach Dam. In 1978 the Swakoppoort Dam and a pipeline to Von Bach were completed to increase the supply capacity to the plant and in 1980 the extension was commissioned.

Source capacity was further supplemented in 1984 by the completion of the Omatako Dam with its pumping system to Von Bach and followed shortly thereafter by the completion of the canal between the Omatako Dam and the Karstland Boreholes in the Grootfontein area. Long term planning provides for a link from the canal to the Kavango River.

During 1996 a project to link the abandoned Berg Aukas Mine to the canal at Grootfontein was initiated to supplement the water sources.

The Von Bach Water Treatment Plant was designed to produce 3000 m³/h of potable water, although as a result of a variety of problems which had developed over the years, production was maintained at 2300 m³/h.

In the latter part of 1991, and as a result of a radical increase in demand during in 1990, the Department of Water Affairs identified the necessity for an upgrade of the plant in order to increase its production capacity.

PROJECT BACKGROUND

In January 1992, they appointed the Consulting Engineers, Burmeister & Partners, to provide the engineering services for the extension of the Von Bach Water Treatment Plant from preliminary design investigation through to construction.

The Preliminary Design Report addressed two principal issues of the proposed project. The one issue was the extent of the increase of the plant's production capacity. This required a detailed study of the possible future growth in demand as well as the supply capacity of the water resources.



The final analyses showed that the limiting factor on the extent of expansion was the supply capacity of the existing water resources. The design capacity of the upgraded plant was thus set at 6500 m³/h.

The development of additional resources and an increase in the pumping capacity of the Von Bach-Windhoek pumping system were identified as the next steps in maintaining the supply of potable water to meet the increasing demand of the capital.



The second and more complex issue was the fact that the process train of the plant would ultimately be required to treat water from five different sources:

- Natural flow into Von Bach Dam*
- Water from Swakoppoort Dam*
- Natural flow into Omatako Dam*
- Sub-surface water from the Otavi /Grootfontein Karst area*
- Water from the Kavango River*

Presently water from the first four sources can already reach the plant. Except for Swakoppoort water, which can be directly intercepted at the Treatment Plant before being mixed with Von Bach water, water from all the other sources must first flow through Von Bach impoundment where the different waters will inevitably blend.

The following aspects were taken into consideration in the process selection:

- All the dams are susceptible to high turbidity during periods of inflow. However, water is generally of medium turbidity and the total dissolved solids content is low;*
- Algae blooms occur annually in all three dams;*
- In the case of Von Bach and Swakoppoort, extended periods of anearobiosis occur;*



• *The water temperature varies from 15 to 25 degrees Celsius;*

• *The water is fairly well buffered (59 to 146 mg/l, alkalinity variation for the three dams together);*

• *The water hardness ranges from 55 to 124mg/l, for the three dams together;*

• *The raw water from Von Bach and Swakoppoort Dams are corrosive to metals and aggressive to cement based materials;*

• *Relatively high manganese content is encountered under certain conditions in the Von Bach Dam;*

• *The chloride and sulphate concentrations are low. Nitrogen and phosphorous are relatively low and the pH is generally in range of 6 to 8;*

• *Chemical concentrations are generally lowest in Von Bach Dam followed by Omatako Dam and are highest in the Swakoppoort Dam.*

Following a series of laboratory tests it was established that, from a chemical point of view, the water could be treated in a conventional treatment plant employing coagulation, flocculation, sedimentation, filtration and disinfection.

Provision was also made to eliminate bad taste and odour as well as manganese, because in the years preceding the project, these quality parameters had caused problems which could not be treated by the existing plant.

PROCESS SELECTION



The order of the unit processes was determined, inter alia, by the following:

• *Chlorination of the water will kill the algae present but may give cause to the generation of taste and odour if these are not already present.*

• *Manganese precipitates can readily be removed by sedimentation or rapid gravity sand filtration.*

• The efficiency of Powdered Activated Carbon (PAC) in removing taste and odour is reduced by coagulant dosing and the presence of free chlorine.

The construction work was awarded to a joint venture between International Construction and Murray Roberts/Gillis Mason and the project has been completed almost six years after the consultants were appointed. The plant's capacity was increased from 2400m³/h to 6500m³/h which amounts to nearly 47,5 million m³ per annum. The overall cost of the extensions to the plant as well as various additional site works amounted to some N\$85 million.



In April 1998 the Von Bach Water Treatment Plant became an asset to the newly-formed Namibia Water Corporation. This included the construction of an additional process branch, the complete upgrading and refurbishing of the existing works, extensive site works, the addition of some service buildings and the renovation of many of the existing buildings for the Regional Office of NamWater.

INTERESTING FEATURES

One of the interesting features of the plant is the de-sludging of the horizontal flow sedimentation tanks which is done from collector channels with gravity discharge. The channels are perpendicular to the centre line of the tanks and the sludge is collected by a horizontal pipe with strategically placed orifices in the bottom of the channel. The channels were constructed by pre-casting the sides in segments and placing them with a crane.

OTHER FACTS

Planning of the extensions of the works included the strategic planning of future extensions of the plant in future when the Kavango connection is completed. One of the main objectives of the design of the plant was to ensure simplicity, reliability and flexibility. Mechanical components were therefore avoided as far as possible while the combination of the old and new works provide a number of operational options which make it an easy plant to operate.

The old chemical dosing building was changed and renovated to become the head quarters of the Regional Offices of NamWater while various other buildings were added or renovated for the same purposes. The site works included a new surfaced road network and landscaping as befitting Namibia's largest and most prominent water treatment plant.



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| 1. Main Raw Water Inlet Control Manhole | 8. Northern Filtration Plant |
| 2. Chemical Dosing Building | 9. Southern Clear Water Well |
| 3. Plugflow Reactor and Primary Distribution Box | 10. Main Office Block |
| 4. Northern Flocculation and Settling Tanks | 11. Backwash Pump Station |
| 5. Circular Clariflocculators | 12. Sludge Ponds |
| 6. Southern & Central Flocculation & Settling Tanks | 13. Windhoek Pump Station |
| 7. Southern and Central Filtration Plant | 14. Main Entrance Gate |