

MVOTI RIVER COOLING WATER

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Glendale Sugar Millers (Pty) Ltd

Abstract

Glendale has always had a straight in and out condenser cooling system. The 1982/83 drought forced the mill to take emergency steps to recirculate water with irrigation pipes using the canal as a cooling pond.

The current drought has now forced the mill to look at a more permanent system with higher capacity. A fixed pipe system for sprays over the canal and a permanent recirculation system for turbine bearing cooling with a cooling tower was installed. No problems of a serious nature were experienced.

Introduction

The Glendale mill traditionally has had a very simple condenser cooling water system from the canal, into the condensers and then back into the canal below the pump intake. Approximately 2 km up stream from the mill is a weir across the Mvoti River (Figures 1 and 2) from where

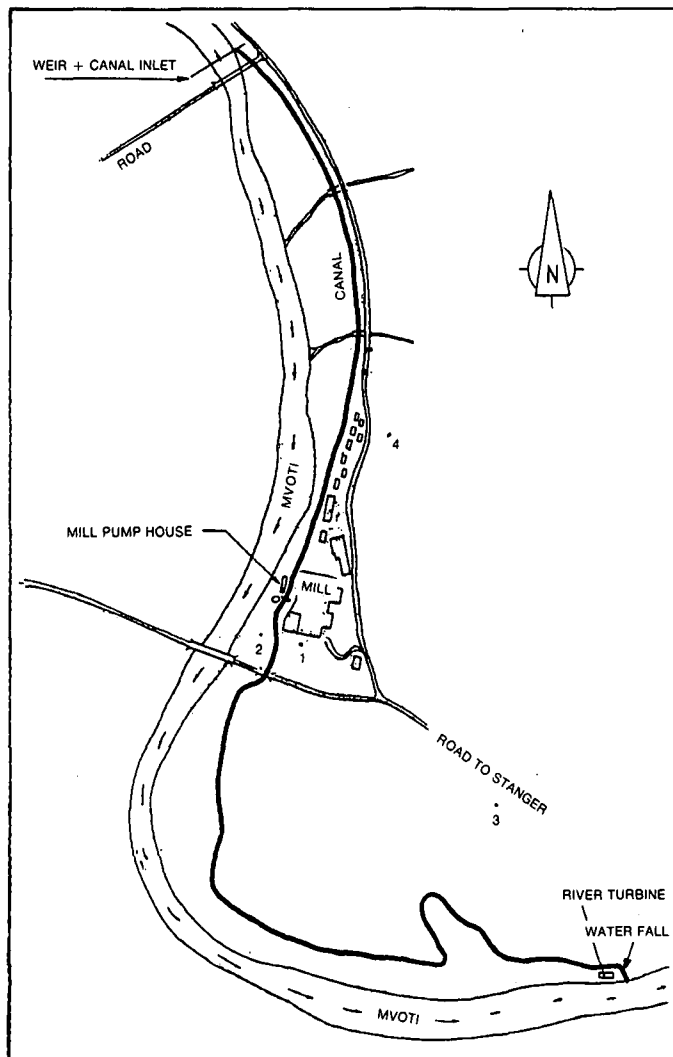


FIGURE 1 The mill irrigation canal.

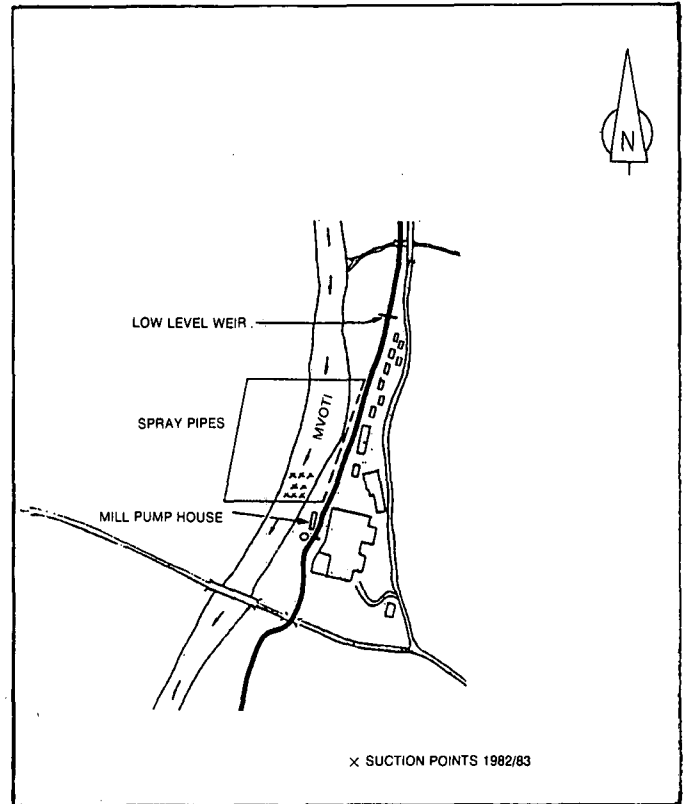


FIGURE 2 The affected canal sections.

a canal diverts water to the mill pump house. The canal carries on for another 2 km to an irrigation pump house where a water turbine of 750 kW (1936) now directly drives an irrigation pump. In the early days this was the power station for the off crop period supplying the mill and village with electricity.

The canal can carry approximately 11 000 m³/h in full flow of which the mill requires between 600 m³/h to 1 500m³/h for condenser cooling, depending on the temperature. The canal water temperature before the mill has regularly been noted at 36–37°C on hot days.

Drought action

During the drought in the 1982 and 1983 seasons the total flow in the river became less than the mill requirements. A solution had to be found.

The canal being ± 6 m wide at its top section, was bridged upstream of the mill with gum poles at 5 m pitch for about 300 m length of the canal and six irrigation pipes were laid over the top (see Figure 3). Plastic spray nozzles (Hamspray 25 mm) were fitted at 5 m intervals. These irrigation pipes were connected to two irrigation pumps which could take in the warm condenser return water and recycle approximately 250–300 m³/h.

Other than two days when the flow was still too little Glendale survived that season. On both those days the mill was stopped for several hours to increase the canal level. As

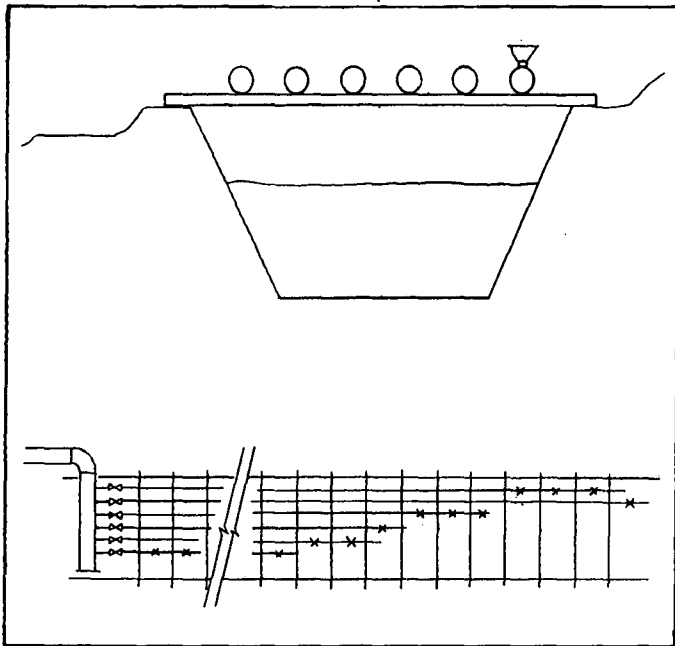


FIGURE 3 A typical canal cross section with the irrigation cooling pipes.

recirculation contaminated the water, the domestic water quality suffered as well as the oil cooler and mill bearing systems. Chlorine dosages were needed from time to time to purge the system.

Well points were sunk in the dry riverbed to obtain water for domestic use but these could only be sunk to a depth of 3 m as an extensive rock bed prevented going deeper. Subsequently cyclone Demoina in 1984 washed out all 12 well points.

When the current drought began in 1991, the first priorities were drinking water and bearing cooling water. A closed circuit system was designed using a Searle Bush 70 m³/h cooling tower, model FGS61x80-93.

The Department of Water Affairs had earlier restricted Glendale to a maximum off take from the river, stipulating that for increased needs a permanent recirculation system had to be installed. A new condenser cooling water system was therefore designed and built using a spare cane knife motor and a large 250 × 200 mm Warman pump (obtained from Sezela in 1983 with the diffuser line). A 350 mm main pipeline gradually reducing to 150 mm was laid in the canal wall and the same 25 mm Hamsprays of 1983 were fitted at 5 m intervals over a distance of 325 m. The system was designed to recirculate approximately 900 m³/h or 3,8 litres/second/spray nozzle. The domestic supply at ± 30 m³/h was taken from a point 100 m upstream of the recirculation sprays before a little weir (see Figures 4 to 6).

The extra 130 kW power supply for the pump could not be taken from the existing mill supply. The irrigation pumps at the mill pump house were supplied with Eskom power and as no irrigation was possible under the drought circumstances the pump was connected to this Eskom supply.

In order to guarantee water supply to the distillery four 100 m deep boreholes were sunk, two of which are close to the water treatment plant and distillery. An effective 8m³/h and 5m³/h respectively were obtained from these two holes while the other two boreholes proving to be less effective, one giving only ± 2 m³/h and the fourth eventually running dry.

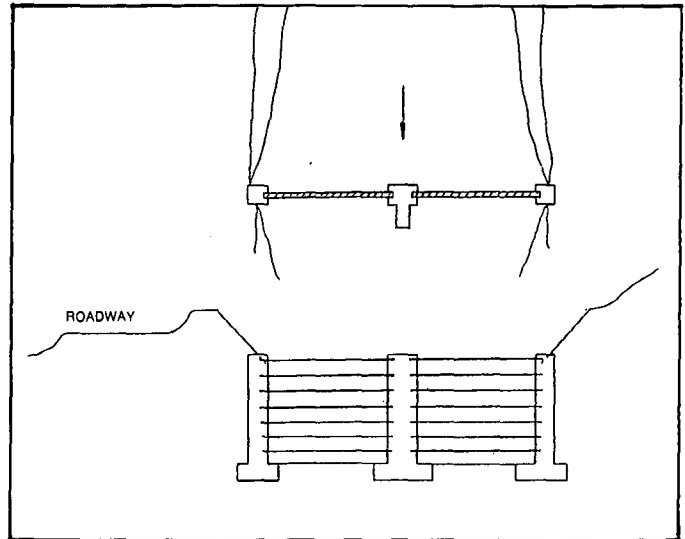


FIGURE 4 The low level weir.

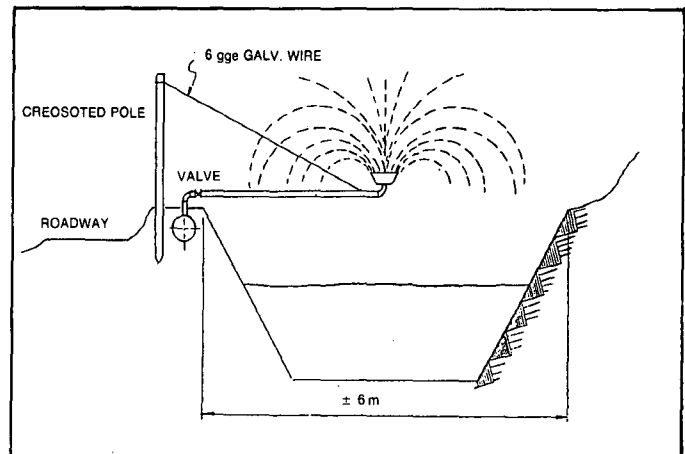


FIGURE 5 A typical section of the canal with the spray heads.

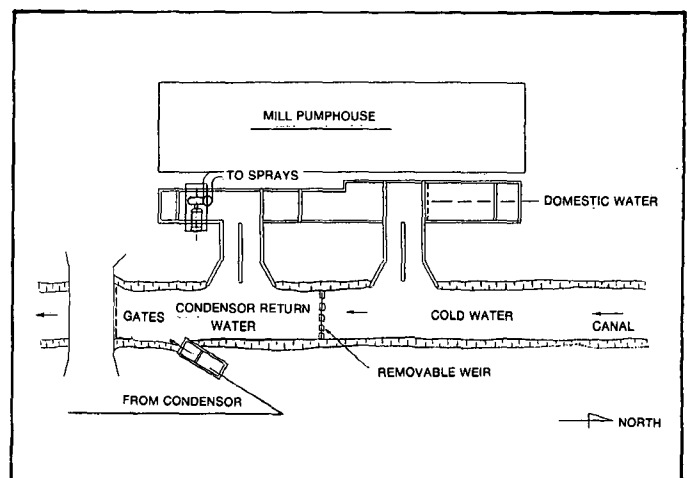


FIGURE 6 The layout of the mill pump house.

Observations

Over the last three years Glendale have managed with considerable effort to keep all services running. Garden water supply unfortunately was intermittent and only available if and when irrigation was allowed. From November 1994 until February 1995 the rainfall in the catchment area was virtually non-existent. Irrigation had been suspended for most of January and February for the first time ever. An extreme situation may develop by the start of the next season.

Glendale is contemplating developing an independent housing project with a minimum of 200 houses for which much extra domestic water will be needed. Another four boreholes at sites some distance from the mill, and will need to be approximately 200 m deep where, hopefully, sufficient supply should be available. We further expect increased needs at our distillery. Any plant or equipment installed will have

to work with minimal water needs unless the water can be recirculated. Steps are already afoot to recirculate clean waste/cooling water from the distillery.

Conclusions

An effective recirculation system has been created using simple methods. The total costs of the work in 1991, including the four boreholes amounted to R380 000 which shows that with careful planning and imagination a project can be made to succeed for a reasonable cost.

Acknowledgements

The Glendale mill staff thanked for making it all work.