Marquard reservoir designed unique capability of extension

SETSOTO MUNICIPALITY in the Eastern Free State identified a need to increase the potable water storage capacity of Marquard and Moemaneng, and Kwezi V3 Engineers were appointed in August 2004 as the design and project management consultants on the project. The project was completed on 1 July 2005.

PURPOSE

While the water demand in Marquard and Moemaneng amounted to 1,36 Mℓ/day, the storage capacity had been only 2,38 Mℓ (enough for 24 hours). With the 3 Mℓ reservoir the storage capacity was raised to 5,38 Mℓ (48 hours).

CHALLENGES

The project presented various challenges. First, Marquard has a generally flat topography which limits the options for the location of reservoirs. Second, the available funding ruled out the possibility of an elevated reservoir(s) with the required capacity (3 Mℓ). The limited funding also had to be used to maximise the reservoir capacity, and third, the funding available required that most of the project funding – R2,9 million of a total of R4 678 577 – had to be spent before 31 March 2005.

DESIGN FEATURES

The project comprised the construction of a 3 Mℓ concrete reservoir and a 2,08 km pipeline from the reservoir to Moemaneng.

The reservoir could be constructed only in its present location because it is the only place near Marquard and Moemaneng with sufficient elevation. Other locations would require long supply pipelines to and from the reservoir.

CONSTRUCTION

The reservoir has a diameter of 29 m and a height of 5,895 m and was designed and built using floating-roof technology. With this technology the floor, wall and pillars are built, after which the roof – which has a total mass of 357 tons – is constructed on the floor around the pillars.

The concrete roof is built to float on the water and is raised above the pillar caps by the water pumped into the reservoir. The roof is then rotated into position and the water level in the reservoir is lowered to rest the roof on the pillars and wall supports.

The steel reinforcing was designed to accommodate a 6 Mℓ reservoir, and 75% of the cost of the additional steel reinforcing was covered by the exclusion of shuttering in the roof construction.

What makes this project unique is that the capacity of the reservoir can be doubled in the future by raising the roof, pumping in water and

Left: The completed reservoir. Note the cover slabs on the sleeve pipes and corbel sleeves. When the reservoir is extended to 6 Mℓ, the slabs will be removed, the roof floated, turned and lowered, the walls and columns extended, and the roof repositioned

Below: The bent bonding reinforcement at the top of the existing wall (Phase 1) is ready to be cast in concrete

MARQUARD: 3 Mℓ RESERVOIR AND GRAVITY FEED PIPELINE TO MOEMANENG

Category Technical Excellence 2006

Submitted by Free State Branch

KEY PLAYERS

Client Setsoto Municipality
Consulting engineers Kwezi V3 Engineers (Bloemfontein)
Contractor Pro-Care Civils (Welkom)
Project financiers MIG

with

Right: Workers are securing the centre-bearing cross into position. The roof was floated to the top and rotated to rest on the 21 columns and 25 carbels after the water had been drained

rotating it so that the openings in the roof correspond with the pillars. The roof is lowered around the pillars by lowering the water level.

The wall and pillars may then be extended and the roof raised to its new position by raising the water level in the reservoir and following the same procedure than before. This implies that the client will not need to demolish the existing roof and construct a new one, which will bring about a great saving.

IN CLOSING

What elevates this project to the class of excellence is the planning involved in making provision for the future expansion of the capacity of the reservoir, as well as the resulting saving.

Source:
http://www.saice.org.za/downloads/monthly_publications/2007/CivilEngFeb07web/#/0