Water provision in rural KwaZulu-Natal

As an ongoing drive towards achieving the commitments set in 2000 by the Heads of State at the United Nations – to halve the number of people lacking safe water by 2015 – one of the most widely consulted policy programmes in the world, the Reconstruction and Development Programme (RDP), was implemented by the South African government.

Government’s intention was clear from the outset – to provide to the poorest of the poor in rural areas. uMzinyathi District Municipality (situated in northern KwaZulu-Natal), through two of its local municipalities, Umvoti and Msinga, identified one such an area. Ilifa Africa Engineers (known at the time as VGC Consulting Engineers) were commissioned in 2004 to conduct a preliminary survey of the area and to prepare a technical report for submission to the Department of Water Affairs and Forestry (DWAF). Application for funding through a municipal infrastructure grant (MIG) was done through a detailed business plan.

AIMS AND OBJECTIVES

The area that was identified is approximately 230 km² in size. At that stage, water was supplied primarily from streams, irrigation canals, isolated boreholes and the Mooi River, which runs through the southern section of the supply area. The sources were shared with domestic animals (cattle and goats), which presented a huge health risk.

The aim was to provide the households with a clean, safe water supply of 20–30 litres per capita per day. This was to be achieved by constructing standpipes within 200 m of people’s homes (the RDP level of service).

PROJECT DESCRIPTION

The design of the system included a number of facilities.

Water treatment plant

The supply area is situated approximately 25 km north of Greytown, which meant that there was no source of treated water to supply the communities.

An irrigation canal operated by the Muden Irrigation Board was identified as the most suitable source because a section of the canal runs near the small village of Muden. A privately owned section of property adjacent to the canal was ideally situated for the construction of a water treatment plant. The property was subsequently bought and utilised for this purpose.

The initial capacity of the plant is 3 Mℓ per day (20-hour operating cycle). The design of the plant allowed for a doubling in the capacity, should future demand necessitate it.

The raw water is gravity fed to the plant with a turbidity ranging between 35 and 400 and an average of about 40 nTU. The settled turbidity varies between 1,0 and 2,0 and the filtered turbidity between 0,03 and 0,6 with an average of about 0,4 NTU.

The compact design of the plant enables effective operation by a minimum of staff. This contributes to minimising operating expenses.

Reservoirs

Twenty five reservoirs are to be built, with 15 already completed. Their capacities range between 100 Kℓ and 450 Kℓ each. Reinforced concrete structures were chosen with a view to low maintenance costs.

Bulk lines and reticulation networks

A total of 80 km of bulk supply lines and 118 km of reticulation lines will have been constructed on completion of the total supply area.

A variety of materials were used in the construction of the pipe lines. The bulk supply lines were either uPVC or mPVC pipes with classes ranging between class 9 and class 16. Bulk lines ranged between 110 mm and 250 mm diameter pipes. The difference in elevation in certain areas necessitated the use of steel pipes. Clambon pipes as well as ductile iron pipes were used. A number of river and donga crossings required the use of flanged galvanised steel pipes. uPVC, mPVC and HDPE pipes were utilised for the reticulation networks. Clambon and galvanised steel pipes are protected with PVC rock wrap.

PROBLEMS ENCOUNTERED AND INNOVATIONS

Design challenges

Development within the supply area is scattered without any fixed patterns, which made the provision of a homogeneous supply system in accordance with conventional practices difficult. In addition, the supply system requires optimal design for the low demands in accordance with RDP standards. The volumes are small, the distances long, the elevation variations extreme (±400–450 m) and infrastructure positions remote.

Supply zones of ±90 m were established. Reservoir draw-off was further provided for at various levels to protect downstream users. This was achieved by

Figure 1 Site of the project
dividing reservoirs into distribution and transfer volumes. Intervals of 60 m would have been preferred, but this wasn’t practical because of the topography and long supply lines.

The distribution network was designed to provide for the systematic filling of the facilities from the water treatment works outwards simultaneously in all directions or in any specific direction. The average distribution flows are small and the reticulation pipes had been designed for simultaneous draw-off. Larger-diameter main distribution pipes with small-diameter draw-off were provided to ensure even distribution.

Owing to the distance and quality of access roads to the reservoirs, a telemetric monitoring system will form an integral part of the management strategy. The water treatment plant functions as the nerve centre from where the whole scheme is being operated and monitored.

Water wastage was also a concern. The widget type stand pipe is ideally suited to prevent water wastage. uThukela Water (Pty) Ltd, the water services provider, indicated that in their experience, the design is prone to blockages and timely maintenance of the standpipes in remote areas presented a problem. It was decided to construct standpipes using a 20 mm tap with a 10 ℓ/min flow restrictor. The design is tamper proof and also provides a very reliable service.

Positions of standpipes were originally positioned by means of orthographic aerial photographs. Final positions were approved by the community before construction.

Construction challenges
The extreme variations in elevations coupled with boulder strewn areas placed a tremendous strain on construction equipment and operator skills. Daily excavation progress, by means of 20 t excavators, was regularly as little as 60 m.

Dense bushveld required that wider than normal areas had to be cleared in order to facilitate the transportation of pipes to the excavated trenches. Because of the long distances involved this could not be achieved by means of hand labour, which would have been preferable in order to minimise the effect construction activities had on vegetation.

Where blasting was required on steep sections, excavation equipment had to be used to tow the compressors to the required areas.

Abnormal rainfall in the area played havoc in destroying steep sections where storm water protection measures were not yet completed.

Delivery of bulk materials to certain reservoir sites was impossible. TLBs had to be used to cart aggregate and water to these sites.

Owing to the large number of communities involved in the supply area, the sourcing of local labour also presented its fair share of challenges. The requirement of the project steering committee was that labourers were to be sourced from within the communities where actual construction activities were taking place. The social consultant and the project liaison officer played a vital role in coordinating the labour source when the construction activities crossed community boundaries.

PROJECT STATUS
The first phase of the project, which included the water treatment plant, 34 km of bulk supply lines, 25 km of reticulation lines and five reservoirs, is already in operation. The second phase is due for completion by September 2007, with the last phase due for commencement in the
2008/09 financial year. The final value of the project is estimated at R75 million.

CONCLUSION
This project is an example of government’s determination, through its various organs, to supply people with basic services in even the remotest and most difficult-to-work areas. As a consultant one does not always experience the effect such a project have on a community. One late afternoon I went with the site foreman to an area where we went past a standpipe built in the first phase. There were about ten children with water containers, each waiting their turn to fill their containers. During construction in the first phase I saw school children drinking water from an irrigation canal in the same spot I had previously seen goats and cattle drinking water. To see these children, laughing and waving to us, and filling containers with good-quality drinking water, and comparing this picture with the one of the same children drinking water from an irrigation canal a year before, brought a feeling of utter content in the knowledge that we, as a profession, are an integral part of improving the lives of all South Africans.

This specific project will eventually benefit approximately 80 000 people or 11 000 households.

Source: