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SUSTAINABILITY OF WATER AND SANITATION SYSTEMS

Reconstruction development plan — Hlanganani*R. Burgess and M. Slabbert, South Africa*

THE MANAGEMENT OF South Africa's water and the equitable distribution of this scarce resource are tasks delegated by the Department of Water Affairs and Forestry to various provincial water supply authorities. In the province of kwaZulu Natal, Umgeni Water plays a major role in the management and distribution of water. Umgeni Water was formed in 1974, to supply bulk water to the cities of Durban and Pietermaritzburg and other towns in kwaZulu Natal but in recent years has been working towards the concept of "Total Water Management".

In 1989 a major infrastructure study of the Umgeni Water 7000km² supply area was completed. The findings of this study focused on the fact that vast inequities in the provision of services existed within this supply area.

In order to address these inequities a further study was commissioned in 1991 that resulted in the "Rural Areas Water and Sanitation Plan" (RAWSP) being formulated. This plan made recommendations with estimates of costs for the supply of water to the communities within the aforementioned rural areas, representing a total population of 500 000 people.

In 1994 the Umgeni Water supply area was extended to include five further rural areas. As a continuation of the RAWSP and in order to assist with the aims of the Reconstruction and Development Plan, Umgeni Water Commissioned a study in each of these five areas one of which is Hlanganani.

Locality of the study

The province of kwaZulu Natal lies on the Eastern shores of South Africa and the area of Hlanganani lies within the province. It comprises six geographically separate blocks of area 1280 square kilometres.

The study area fits broadly between latitudes 29°30'S and 30°15'S and the lines of longitude 29°25'E and 30°15'E.

History of the area

The South African land act of 1913 and 1936 led to the *de jure* definition of black and white rural areas with the highest potential agricultural land being made available to white farmers. This legislation was instrumental in destroying the black farming class in KwaZulu Natal and contributed to the deterioration of both material and environmental conditions in kwaZulu Natal. Further this legislation exacerbated the distorted pattern of urban settlement in kwaZulu Natal and helped to shape the settlement pattern which is now found in the study area.

These historical influences effected the quality of life in the rural are of Hlanganani. This can be illustrated by the following statistics:

- Population densities in kwaZulu Natal are six and half times those in the old Natal Province;
- Between 40% to 60% of all households in peri-urban and dense rural areas in kwaZulu Natal receive no direct income from wages;
- Half the households in the area earn less than the household subsistence level;
- The quality of physical infrastructure/services and social facilities/programmes tend to be low in the rural areas.

Objectives of the study

The objectives of the study were as follows:

- To evaluate the best water supply options for the area;
- To evaluate the provision of water in the context of integrated development proposals for the area.

Situational analysis

A detailed situation analysis was carried out. Existing information was used but additional data, particularly population statistics, was obtained by means of field surveys and the use of aerial photography. The situational analysis, in summary comprised the following:

- A study of the demographics of the area.
- A compilation of the socio economic information comprising education levels employment, income and expenditure, standard of dwellings, access to water and related problems and the identification of basic needs and related priorities.
- An assessment of sociopolitical status in the area primarily identifying and understanding the main players, power groups and stake holders in the area.
- A summary of existing infrastructure and development plans.

Demographics

The current population (190 500) of the area was calculated by means of homestead counts using aerial photography and field surveys to assess the average homestead size. The field surveys revealed that the average homestead consisted of 8 people. It was realised during the course of the study that the growth populations were subject to significant margins of error depending on what method is used to derive them.

It was found in all the areas bar one that females are in the majority. This is a reflection of the migrancy patterns prevalent in the area and the necessity for the economically active portion of the population to seek work in the industrial sectors of the kwaZulu Natal province.

The age distribution of the population displays the skewed demographics pyramid typical of Third World communities: very large youth cohorts (< 18 years) and a small aged cohort (> 64 years) making for high dependency ratios on the economically active sector of the population. Household data collected during field surveys show that the average household size was eight and that children comprise 50 % of the household numbers in the area. Moreover, in the more rural areas between 20% and 30% of the household may consist of grandchildren of the household head. This confirms the observed phenomena of parents working in urban areas and sending their children to their grandparents in the rural areas.

Population densities varied greatly from 1500 people per km² to 50 people per km². The mean population density was calculated in 1993 as being 147 persons per km² in contrast to a density of 24 persons per km² in the white district of nearby Richmond.

Socio-economic information

To all intents and purposes the economy of the district has been dominated by subsistence agriculture and remittances from wages earned elsewhere. The dependency ratio throughout the area is approximately 50% and only 16 % of the population are self employed. Surveys show that approximately 40% of the adult population are illiterate (21 years of age with less than Std. 4 education).

Sub-regional economy is generally dominated by farming, particularly stock ranching, although dairy is also an important sector.

A study of the household economic profile shows that the mean household income per month was well under R1 000.00. 30% of the population surveyed have a household income of less than R250.00 per month with only 4.3 % having an income greater than R1 500.00 per month.

Socio political information

Political dynamics over the past five years in the district have been dominated, as in much of the kwaZulu Natal area by the battle for supremacy between the Inkatha Freedom Party and the African National Congress.

There are fourteen tribal authorities in the area. Given the dominance of traditional customs tribal authorities feature prominently in local affairs and in development matters.

There are innumerable small, local organisations or special income groups at the level of Burial Societies, Saving Clubs, Sewing and Candle-making Groups, Farmers Associations, Creche committees, School committees etc. These groups are geographically extremely localised and are insignificant as representative groups able to negotiate on behalf of communities. It is considered that

they could be important in terms of mobilising communities around a particular project.

Population growth and water demand

Population projections

The current population having been determined by household counts and field surveys, was the initial input to the population growth model. Two population growth models were used. The first one used a constant growth rate over a 25 year time span at 2.5 % per annum. A more complicated growth model using a varying growth rate over the 25 year life span of 1.1 % to 2.92 % was used as a comparison. Growth projections were compared and it was accepted that the population would grow over the 25 years from 190 000 to 350 000.

Water demand and levels of service

It is anticipated that the level of service to the rural communities will vary between a centralised community handpump or standpipe and private house connections. Final design life consumption figures (10 - 20 years) for rural areas was taken as 50l/capita/day for the mixed rural and peri urban areas and for the peri urban area a consumption of 70l/capita/day was used.

Growth in demand for higher levels of service

Cost recovery is considered a major necessity for the sustainability of the water supply systems to the area. Provision was made for the growth in demand for the higher levels of service. The growth in demand scenarios assumed a straight line relationship from 19 % of the final demand in year one to 100 % of the final demand in year 2020.

Technical alternatives considered

Development of surface water alternatives

To evaluate the possibility of utilising surface water resources per district, the quaternary catchment boundaries were used to model the hydrology of the area. Suitable abstraction points from nearby perennial rivers were identified to supply the proposed pipeline networks. Possible storage reservoir sites were located on high ground near to the identified communities.

Pipeline routes were identified running predominantly along roads and ridges. Using the quaternary catchments the flow in the rivers was modelled and tables of monthly flows according to a percentage rate of failure were obtained for each of the proposed abstraction points. The monthly flows for a 2% risk of failure were selected. The communities supplied from an abstraction point were then grouped and the population count and water demand relating to each abstraction point was calculated for the present and future scenarios. Downstream compensation was calculated for present and future scenarios and allowance for downstream irrigation requirements was built into the calculations.

Once a suitable abstraction point had been established based on the hydrology of the area and the practicality of conveying water to storage reservoirs and secondary distribution networks, the scheme was costed.

Using the growth in demand model and the water demand figures a discounted cash flow analysis was conducted on the scheme using varying discount rates and design parameters. Using this analysis the break-even cost of water was calculated. The capital cost of the works, the capital cost per capita and the break-even cost of water was then used to rank the schemes.

Development of groundwater alternatives

An evaluation of the groundwater potential was undertaken of the entire district of Hlanganani making use of aerial photography. Based on lithological principles, categories of groundwater potential were established and mapped. These groundwater potentials ranged from very low to very high (5 groundwater potential categories). Tectonic structures such as faults, dykes, shear zones, fractures were identified on the maps and circled. Potential target drilling sites were considered in conjunction with accessibility.

The areas of the high groundwater potential were then overlaid on the existing road network and the spatial distribution of the communities.

Three categories of groundwater service levels were applied to the various districts of Hlanganani. These were:

- Handpumps
- Motorised boreholes
- Well fields using motorised boreholes.

The groundwater proposals were then costed and discounted cash flow analyses were carried out. The schemes were then compared with the surface water proposals.

The way forward

The output of this study represents strategic development information for this area. This information will be disseminated as widely as possible.

The findings will be presented to various audiences concentrating specifically at local level as certain actions, issues and priorities recommended in the study will need community input. Where possible short term action will be implemented immediately while medium, long term proposals are developed. A ten year programme of implementation to serve most people in the area with services has been set as a challenging objective by Umgeni Water. Considerable outside funding support will be required to achieve this programme. Detailed feasibility studies have been commissioned for the most promising proposed schemes identified in the study. These further studies will provide more accurate costs necessary when approaching donors.

Conclusion

In order to promote the aims of the Reconstruction and Development Plan in Hlanganani with respect to water supply, there is a need to establish a partnership with all the participants. The partnership should be based on trust and close communication during the formulation of all further stages. This requirement is seen as being fundamental to the effective implementation of the plan and its success.