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Design of water reticulation network configuration and public standpipes

BACKGROUND

As South Africa embarks on massive infrastructure development, especially in the water sector, there is a need for quality control of designs that are being put up for construction of water supply projects. Water is a scarce commodity in South Africa and needs to be utilised efficiently and wisely. Thus designs must aim at supplying water to a large number of planned users where a reliable source of water is located. This article highlights the invaluable resources that are available to design engineers involved in water supply projects in rural areas, and emphasises the enormous benefits that can be derived from a looped network configuration when selected in the design of a reticulation system over an entirely branched network configuration. It also highlights points that are necessary in the design of public standpipes

RESOURCES FOR DESIGNING WATER SUPPLY SYSTEMS

The following documents are useful in designing water supply systems in South Africa:

- Red Book (2003): Guidelines for Human Settlement Planning and Design
- DWAF (2004): Technical Guidelines for the Development of Water & Sanitation Infrastructure
- SANS 1200: Code of Practice for the Design of Civil Engineering Services

The Red Book is available at no cost at the website (www.csir.co.za) of the Council for Scientific and Industrial Research (CSIR) and the Department of Water Affairs guideline is also available at their website (www.dwa.gov.za), also free of charge. The SANS 1200 can be purchased from www.sabs.co.za.

The foreword to the Red Book encourages readers to use it, discuss it and debate the guidelines it contains. The purpose of the updated 2004 version of the DWA guidelines is primarily to pass on to local government the experience of national government in the development of water and sanitation services, especially in the planning and design of water and sanitation infrastructure. The SANS 1200 contains the Standard Specifications for Civil Engineering Construction which forms part of contract documents.

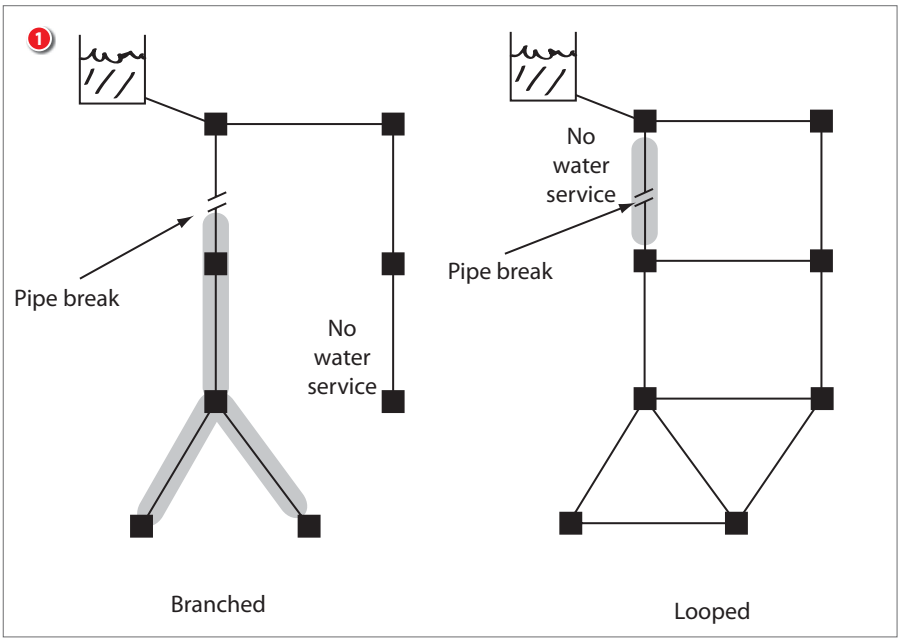
NETWORK CONFIGURATIONS

Some reticulation networks meant to supply water to a large area, such as a regional scheme, have been designed entirely with a branched network configuration. It usually consists of a long bulk pipeline which supplies water to a series of reservoirs, which in turn supplies water to various villages through a reticulation network that branches into the villages and delivers the water to users through public standpipes. There is thus only one possible path from the source to the standpipe. Such a network, though less expensive, can have the following problems:

- Low reliability
- Potential danger of contamination caused by large part of network being without water during irregular situations (Figure 1)
- Accumulation of sediments due to stagnation of the water at the system "dead" ends, occasionally resulting in taste and odour problems
- Future extensions which may cause pressure problems
- A fluctuating water demand producing rather high pressure oscillations.

A looped network can overcome the above-mentioned problems, and offers a number of advantages, including the following:

- Water in the system flows in more than one direction to get water from the source to the standpipe, and long-time stagnation does not occur as easily anymore.
- During system maintenance, the area concerned will continue to be supplied by water from other directions (in case of a pumped system, a pressure increase caused by restricted supply can promote this).



1 Branched and looped networks showing disruption of service after a pipe break

- Water demand fluctuations will not produce a significant effect on pressure fluctuations.
- Extensions to new developing areas, as well as ensuring adequate pressure and flow, can be achieved more easily.

Most water supply systems are complex combinations of loops and branches, with a trade-off between loops for reliability and branches for infrastructure cost savings. In systems such as rural reticulation networks, the low density of customers may make interconnecting the branches of the system prohibitive from both monetary and logistical standpoints. The design engineer, in such a situation, must weigh the options and choose a balanced, combined network configuration which gives best value for money.

PUBLIC STANDPIPES

The public or communal standpipes are those installations through which the public and the community/village have access to water. Some public standpipes have been constructed without a platform. In other instances there is a platform that measures just about 1 m^2 in area and the stand post is not strong enough to withstand a cow rubbing her itchy body against it. This situation is not desirable, as there is no proper drainage at such standpipes, and when they are damaged, precious water is lost.

The Red Book states that the design of the standpipe installation requires careful planning, and that special attention should be given to drainage of excess water and avoiding wastage, in order to minimise health risks. Bearing this in mind, standpipes can be designed to have watering troughs so that stray animals would not need to lick water from the taps and platforms, thereby contaminating them.

A drain and a soak pit are also required around the platform to collect and convey the excess water. A suitable slope over the top of the platform is also worth considering.

Furthermore, where household water has to be fetched and transported, mostly by women, an overhead spout can be included so that there is no need for another person to assist her in lifting the container onto her head. A ramp to cater for physically challenged individuals who have to fetch water on their own can be factored into the design.

CONCLUSION

Our friends and family living in the rural areas are dependent on, and deserve, the planned infrastructure development mentioned at the start of this article. The design of rural water reticulation systems must therefore be such that the level of service is as dignifying as anywhere else in the country. Designs should be sustainable, reliable and durable, and should make a positive difference in their lives.

REFERENCE

Original source for Figure 1:
Thomas M Walski, Donald V Chase, Dragan A Savic, Walter M Grayman, Stephen Beckwith & Edmundo Koelle 2004. *Advanced Water Distribution Modelling and Management* (First Edition). Waterbury, CT: Haestad Press.

Source:
http://www.saice.org.za/downloads/monthly_publications/2011/2011-Civil-Engineering-june/#/0