

University of Durban-Westville

**An Assessment of Water Services in a Peri-
Urban Area of Umtata
(Case Study)**

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**An Assessment of Water Services in a Peri-Urban Area of Umtata
(Case Study)**

by

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DECLARATION


*This dissertation is dedicated to my loving Father and Mother
(**Tamsanqa and Nobuntu Ntuli**)*

Their support and motivation has meant so much to me

PREFACE

The survey work described in this dissertation was carried out in Umtata peri-urban area in the Eastern Cape, South Africa under the supervision of Professor Fred A. O. Otieno.

This study represents original work by the author and has not been submitted in any form to another university. Where use was made of the work of others, it has been duly acknowledged in the text.



MzwaBantu Ntuli
SEPTEMBER 2001



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EXECUTIVE SUMMARY

Background motivation

South Africa, like most developing countries is experiencing rapid population growth especially in peri-urban areas of the former "Bantustan" states. This is resulting in an increased water service demand. Consequently water shortages are often experienced. In apartheid era, these states were deprived of many basic human necessities such as adequate water services, education, employment, income and electricity. In spite of the Water Services Act 108 of 1997, which states that everyone has a right to basic water supply and sanitation [hereafter referred to as "water services"], these communities are still living with often-inadequate water services and other basic human necessities. The typical example and the study area with these communities is peri urban area of Umtata former capital town of Transkei.

Presently with the coalition Government of National Unity in place there is still a mounting effort to provide more and more communities with adequate water services that are user friendly and within reasonable access as well as affordable to all. However, limited resources, such as funds, water and engineering skills in the water sector make it difficult to achieve this goal.

These areas like study area, Umtata peri-urban, consist of a mixture of economically active semi-skilled labour force for that particular city and poor of the poorest and has attracted relatively little comment, systematic research and official response concerning delivery of water services. It is therefore essential that well organized research in water and environmental engineering that is effective be conducted in order to solve the water service needs of these relative poor communities.

Hence, the ultimate aim of this study was essentially to assess, meaning to study to have understanding of the current practices, problems and issues related to current water services and to outline the need for integrating people's water socio-economic activities to engineering planning and designs of water service facilities for such communities. This was accomplished by revealing and recording the facts about people's needs, perceptions, practices, attitudes and expectations concerning water services.

The findings of the study could have significant input in ensuring delivery of sustainable water services that low-income people can afford. This implies that it is essential to also focus on the requirements of the domestic water user not only on use of arbitrarily fixed engineering design rules based on the Western Standards but standards must be relative to the particular socio-economic environment where they are to be applied

and may vary from place to place and from time to time, they must even vary from community to community. They cannot have general applicability and should not be thoughtlessly transferred from one environment to another where they may be totally socially and economically inappropriate.

Reliable water services can be developed and sustained by fully involving the affected community. This needs to be integrated with an education and awareness program that provides people with information about benefits and shortcomings associated with improved water services. The findings of the investigation indicate the following results:

Brief summary of results and conclusions

The partnership between stakeholders in the water service industry is an integral to the effective implementation of educational processes that promotes awareness of benefits and shortcomings from improved water services. The findings of this study indicate that the existing water services are inadequate and dilapidated and need to be repaired and/or upgraded depending on the presence various resources. However, benefits associated with improved services is still not a priority for these communities as they are still focusing on better job opportunities and other basic necessities. This implies that poor water services in these areas morally impact the households far less than is envisaged but this

does not mean benefits awareness and hygiene education should not be promoted.

Broken and unreliable water service infrastructure limits and costs these communities in terms of transporting water and curing of water-related diseases. To mitigate this water services that are affordable to all are recommended and people should be advised and informed of the reasons behind to pay for their water services.

The study finally found that the relationship between stakeholders is often more important than technical aspects of the water service delivery in determining its success. This implies that water service policies as well as engineering designs for peri-urban areas of former “Bantustan” states should be drafted on bases of demand and what people can afford to pay and maintain. This study therefore concludes that water service delivery can be successful from all stakeholders involved only by properly addressing the practical and social problems associated with improving or putting new water service infrastructure.

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LIST OF ABBREVIATIONS

CBOs	Community Based Organizations
DWAF	Department of Water Affairs and Forestry
EIA	Environmental Impact Assessment
KDC	Kei District council
M	Meters
PSC	Project Steering Committee
RDP	Reconstruction and Development Program
SADC	Southern African Development Cooperation
TBVC	Transkei, Bophutatswana, Venda and Ciskei
VIP's	Ventilated Improved Pit Latrines

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CHAPTER 1

1.1 BACKGROUND TO THE STUDY

The problems associated with water service delivery in peri-urban areas of former TBVC states can be related to many factors. The rapid population growth and poor water service delivery in these areas are among the challenging problems that faces South Africa today. This population growth is based on the migration of rural poor in search of better opportunities rather than economic growth (DWAF, 1997c). The majority of this population that lives in these areas is overcrowded with people of low income with little or no knowledge of environmental awareness hence this area is having deteriorating environmental conditions.

The provision of adequate water services has fallen behind population growth and community expansion as well as RDP developments. The provision of adequate water services in any community helps alleviate the poverty under which those communities live, facilitate other development activities e.g. save energy and time spent when fetching water but the foremost benefit anticipated is improved health status (Dangerfield, 1983).

It therefore goes without argument that the understanding of the problems and issues related to water services is an essential step for successful planning and implementation processes of water services. The lack of this information has meant that studies and research to get information on problems and issues concerning water services be promoted. The studies will therefore provide a contribution towards the development and selection of best alternatives and the development of effective water service policies and strategies at provincial and district level for areas that were deprived of these necessities.

1.1.1 Aims and objectives

The focus of this study is on assessment of water services in peri-urban areas of former TBVC states. A broad description of factors that influence water service will be provided, however, this is not the central theme of this study. The aim of this study is rather essentially to assess, meaning to study to have understanding of the current practices, problems and issues related to current water services and to outline the need for integrating people's water socio-economic activities to engineering planning and designs of water service facilities for such communities. This was accomplished by revealing and recording the facts about people's needs, perceptions, practices, attitudes and expectations concerning water services.

To outline some of the challenges facing this integration and finally, to provide recommendations on how these challenges can be addressed and while recognizing the broad spectrum of the study topic, the survey questionnaire was compiled, and contained multiple specific objectives which include:

1. Identification of existing water services, their influence on usage pattern in terms of transportation, storage, treatment, how much, specific use and sullage water and the need for new or upgraded services.
2. Investigation of people's awareness and conditions to achieve various benefits as well as the need and ways to promote awareness on benefits and spin-offs associated with improved water services.
3. Investigation of impacts of water services on users as well as the need to reduce the negative impacts like inconvenience, stagnant wastewater and water-related diseases as a result of unreliable water services in order to make these settlements more acceptable as places to live and work.
4. Examination of the factors that limit water service infrastructure utilization and how these factors can be minimized and eliminated.
5. Investigation of the affordability to pay for improved water services and how equity should be used in terms of tariff considerations.

1.1.2 Description of TBVC states

TBVC states were the products of the past "Bantustan" policies introduced by the apartheid regime particularly to fragment Black population in order to deny them of many basic human rights such water services, education, training and to create tension as well as conflicts amongst the Black population.

To re-address past imbalances in service provision the present government is faced with a task of providing water services at an affordable cost using the most practicable technology. Special attention is given to those communities who were historically denied the access and economic benefits of water services and whom piped water is still a dream (DWAF, 1997c).

The provision of these services by any State depends on the resources of the country and economic policies that are followed by the government. A country whose policies are not geared towards sustainable growth and development often fails to afford these services at low costs.

Increase in water demand in peri-urban areas of former TBVC states can be attributed to the following circumstances:

- (i) Increase of informal settlements due to lack of affordable housing in central locations close to centres of employment.
- (ii) General increase in level of education.
- (iii) Making of formal households available for tenants in order to provide income for the owner.
- (iv) Making of rooms available to support relatives working in the city just as a social imperative (Palmer Development Group, 1994).

As a result of the above-mentioned factors, these communities live with often water shortages and other basic human necessities.

1.1.2 Description of the peri-urban areas of former TBVC states

Peri-urban areas of former TBVC States also referred to as "Traditional Villages" are made of traditional villages and can be defined as an area with no form of local government but within particular kilometres radius of the city. Kilometres radius depends on the demarcations of that particular city. These areas accommodate communities and labour force especially of low-income and informal settlements. Due to current political and socio-economic changes these areas are undergoing rapid population growth and the water services that were planned for are therefore overused. Rapid population growth can be linked to migration of people from less developed remote villages with the notion that communities in peri-urban

areas enjoy far better levels of access to various human basic needs. Secondly this area is closer to the places of employment therefore labourers can therefore generally be able to save time and transport costs.

Since the population densities are higher than planned for, considerable problems are created particularly in water services provision. Such problems are associated with deliberating maintenance and operation in this area.

1.1.4 Defining adequate and inadequate water services

Palmer Development Group in 1994 defined adequate water services as an easy access to services and facilities like tap close or in the house, or where a tap has been designed and constructed to be effective, to prevent contamination, and is regularly used by all members of the household or community. As part of water services, the term adequate sanitation on the other hand means the provision and ongoing operation and maintenance of a safe and easily accessibly means of disposing of human excreta and wastewater, providing an effective barrier against excreta-related diseases, which is used by all members of a household, and does not have an unacceptable impact on the environment (SA White Paper on the National Sanitation Policy, 1995).

On the contrary, inadequate water services comprise of unprotected river streams, not well managed community taps, and unimproved pit latrine, bucket system, bush or none and have a negative impact upon users, operators and the environment.

1.2 GENERAL INTRODUCTION AND LITERATURE REVIEW

Water service is part of basic human needs. This is to say, provision of adequate quantities of safe water using suitable facilities for domestic use and the provision of proper sanitary facilities for handling and disposal of human body wastes are basic necessities for maintenance of good health and economic growth (Genthe and Seager, 1996). Satisfying them meets basic requirements for survival.

This therefore implies that, it is in water supply and sanitation, more than in any other sector that issues of equity must be addressed. Thus, public funds should be allocated to serve people with inadequate and ineffective water supply and sanitation facilities rather than a few with wasteful models based on inappropriate foreign standards (Institute of Water Engineers and Scientists, 1993). However, communities with little political power and other competing priorities, this is usually not the case. In developing countries fund allocation to water sector is largely independent of demand for better water services (Singh *et. al.*, 1993). This is why the provision of water services in these areas did not keep pace with the socio-economic and political development of the country.

As population grows, the demand on a finite resource like water grows as well, and water is set to become the crucial resource limiting South Africa's growth and prosperity. International benchmarks put South Africa into the category of periodic or regular water stress at present. Research has indicated that fresh water sources will be depleted by year 2020 if water resources are not well managed (RDP Water Demands, 1997). Most hard hit communities are those in rural and peri-urban areas of former TBVC states.

Water service delivery is hampered by lack of proper operation, maintenance and awareness. Hence there is urgent need to encourage more efficient use of water and to develop new facilities and sources of water by encouraging regional sharing of water and engineering skills among member states of SADC (Delgado, 1997). As long as the processes by which water is extracted and shared are environmentally sound and sustainable, this region can make great strides in improving the livelihoods of its people through shared water.

Despite international efforts to promote the development and implementation of water and sanitation plans under the 1980-1990 International Drinking Water Supply and Sanitation decade, these areas, SADC still do not have access to adequate water services. (Cowen and

Cowen, 1999). Furthermore if water services are present there are problems such as odour, cleanliness, inadequate water source points, poor maintenance, excessive walking distances, long queues at taps resulting from population growth and vandalism. This implies that the way these communities utilize water service facilities is far from ideal i.e. they are not getting the social, economic or environmental benefits of water services that they could or should be getting, indeed that they need to get (DWAF, 1997b).

The main effect of population growth on the other hand is the intensity at which service facilities are utilized if present. Such unplanned population growth results in considerable negative consequences. These include (1) overcrowding at facilities that can create social conflicts and reduce quality of life. (2) The breakages and overloading that has not been planned for can result in public health hazards and environmental degradation through, for example run-off, stagnant water in drains and (3) improper sanitation like lack of privacy when defecating and associated health hazards.

Given such challenge that is to put adequate and suitable water services, the government and agencies investing in water services are faced with increased pressure, for example, on the need for improved sanitation to dispose wastewater and body wastes in a manner to avoid contamination

of available water resources at minimum costs. Contamination of water resources like rivers results in water-related diseases. In some cases rivers are used as a source of domestic water hence the need for improved water services in order to also protect water resources.

Lack of access to adequate and safe water services is a significant cause of ill health in South Africa (Palmer Development Group, 1995). In 1994, DWAF reported that more than 12 million people in South Africa did not have access to adequate water services and thousands of children die annually of avoidable diseases related to poor water services. The lack of basic water services is more acute on women and children of rural and peri-urban areas of former TBVC states. They are the principal collectors of water and have to walk long distances to transport water, a heavy burden that consumes their energy and impacts directly on their health. In urban areas, municipalities are addressing inadequacies in water service provision whereas in areas with no municipalities, water service policies, strategies and problems are included in the Reconstruction and Development Program (RDP).

RDP is not about construction of houses, roads, clinics and water service infrastructure as many people think. It is first and foremost about the empowerment of the previously disadvantaged communities by providing them with knowledge to make their own decisions and to take ownership

of development projects (Jansen and Austin, 1997). Hence RDP has identified lack of adequate water services as an important priority for government intervention (DWAF, 1997a). However former TBVC peri-urban areas have been left behind.

The RDP short term goal is to provide every person with a healthy environment. This will be achieved by establishing amongst other things, firstly, a national water service program which will provide all households with clean, safe water supply of 20 to 39 litres per person per day within 200m radius of the household and facilities to build safe toilets (RDP, 1994).

It must be noted that the purpose of providing water service infrastructure should be based upon affordability and particular effort and, therefore must be directed at minimizing the cost of capital works in the engineering infrastructure. Economy in design and adequacy, but not over-adequacy in the capacity of services, should be therefore the bases of approach (Wolhuter and Associates, 1982). This entails the selection of levels of service and standards of design, which are appropriate and also entails undertaking a realistic assessment of the overall infrastructure reliability. Other matters of importance which should be given adequate consideration are:

- Selection of energy source, whether this should be electricity or diesel.
- The type of pumping unit preferred
- Details concerning the equipment, pipe and layouts in accordance with good modern practices.
- The availability and level of skills of maintenance staff, the effect of failure of the infrastructure and
- The possibility of alternative sources of supply.

In 1994 the Steering Committee on water and sanitation services was formed. This Committee objective was to ensure that every household is provided with a functional, non-polluting sanitation infrastructure, which gives a full protection from waterborne and faecal-oral diseases. One of the controversial decision it took was to provide households with cash subsidy: first R700 under Mvula Trust Program and R600 under National Sanitation program. Communities attitudes to cash subsidy however created problems as people focused on money and found other uses for money rather than improving their toilets (Mqadi, 1999). This issue was addressed by subsidizing people with building material like toilet seat, bag of cement and pipe for ventilation. The off spin of this proposal was lack of money to hire a qualified builder.

Underlying this subsidy policies above are two related assumptions: (1) That sanitation, while vital to household health, is not a high priority in

disadvantaged communities whose scarce financial resources are utilized for primary basic needs such as food, shelter, clothing and schooling. (2) That it will be more efficient to lower the costs of improved toilets through subsidy than to raise the priority people assign to sanitation (Breslin *et. al.*, 1997).

This shows that current initiatives are uneven and a variety of approaches and technologies that have been proposed or in use sometimes conflict with financial, human resource and institutional arrangements (Evan, 1994 in Netshiswinze, 1999). Hence it is thus necessary to study means by which benefits associated with improved water services can be delivered taking cognisance of the resource constraints affecting peri-urban areas.

The none consultative tendencies when water service projects are planned has often been reported and has a lingering effect on project infrastructure and maintenance. Poffberger, 1980 in Altaf *et. al.*, 1993 for example, noted that in Indonesia a failure to incorporate local knowledge of soil types, drainage problems, land stabilities and failure to take local social relationships into account has caused problems in water service systems. Lack of local involvement results in an attitude of "their (government's) project, their responsibility". Such attitude is terrible destructive for maintenance of water service infrastructure and is often left as a local responsibility (Howe and Dixon, 1993 in Nqadi and Holde,

1999). There is however the suspicion that promotion of community participation and management may be the way of “passing the buck” in the face of huge demand (WSSCC, 1999).

Presently water services in developing urban areas tend to be designed as inexpensive communal systems and as a result they tend to have less impact on intended beneficiaries (Singh *et. al.*, 1993). However due to financial and human resource constraints it is unlikely that the high-grade facilities will be provided in the immediate future and what is likely is to upgrade and maintain the ones in existence (Brookshire and Whittington, 1993). This implies that water service provision needs to be seen as a process of improvement, rather than “a once off” provision of certain types of water services.

Costs for improvement and/or provision of water services are often assumed to be covered by the combination of subsidies from the central government or from international donors, but in some cases these may need to be locally financed as well (SANTAG, 1999). Once the water service system is in place, benefiting recipient is required to contribute substantially toward the payment of operating and maintenance costs. Equity may be used as a counter argument because of inability to pay, social and cultural issues may preclude many people from receiving the services.

In developing countries water service cost recovery is approximated to be 30% of the total costs (World Bank, 1994). Recovery is jeopardized by promises of free water services from politicians (WSSCC, 1999) and communities set the tariffs at levels far below cost recovery. This results in International Agencies and NGO's having no incentives to deliver services to people who are always poor or always wanting to get everything for absolutely free and not proactive.

1.2.1 Water service infrastructure and impact on water usage pattern

According to Water Service Act (Act 108) of 1997 water services means water supply and sanitation services. It is emphasized that water services must be provided under certain conditions that must be available to everyone and provide sufficient information to enable a consumer and potential consumer to be aware of important aspects relating to water services provided or that will be provided to him or her. Water usage pattern on the other side is primarily influenced by socio-cultural activities.

Social and Cultural Consideration

Helping people to help themselves requires a knowledge of, and sensitivity to, the social and cultural context of a water service improvement program (White Paper on Water and Sanitation, 1994). It is

therefore necessary to understand how society functions, i.e. communities and single households within, and what factors promote change (Kalbermatten *et.al.*, 1982). Considerations should be given to the institutions of political and social nature that are operating at the local level and to the forms of leadership and authority that are generally accepted by the majority of people.

Group and community identity, gender roles, the relative importance attached to different forms of authority and the ways in which it is exercised are influenced by culture, i.e. all that is passed down human society including language laws, customs, beliefs and moral standards. Culture shapes human behavior in many different ways including the status attached to different roles and what is deemed to be acceptable personnel and social behavior. In many cultures, for example, the elderly command traditional authority and influence within the family and community. Culture also influences how people interpret and evaluate the environment in which they live.

With regard to sanitation behaviour, defecation is often a private matter which people are unwilling to discuss openly, while the burying of faeces is widely practiced to ward off evil spirits, whether water, stones, leaves or paper are used will affect the design of sanitation services (Zoysa *et. al.*, 1984). There is a logical series of technical questions that need to be

asked in order for acceptable technical solutions to be found. It may be confusing, therefore, when water use and sanitation behaviour is found to vary widely between communities within the same physical environment. Predetermined rules cannot be applied.

Although communities may lack knowledge of modern medical explanations of diseases, they often have concepts of what is pure and polluting. Of the water resources available to particular households for domestic purposes, running water may be most acceptable for drinking because it is exposed to the sunlight. It is considered to be alive and therefore pure, while water in shallow wells, which does not have these attributes is deemed suitable only for washing and building (Franceys *et. al.*, 1992).

Concepts of clean and dirty, pure and polluting, are well developed in the world religions, and have a ritual and spiritual significance. When people are told that new water services will make their environment cleaner, it is their own interpretation of this concept that will be used. Clean may have quite different meanings to project promoters and recipients. Thus it is essential to look at traditional categories of cleanliness and dirtiness, purity and pollution before embarking on campaign to motivate people to accept a project in improved water services or to change their behaviour to comply with new standards of cleanliness (Simpson-Hebert, 1984).

Evidence of the value attached by communities to cleanliness and, by implication, and environmental sanitation is found in studies of diarrhea. People's perception of its cause may be divided in three categories, physical, social and spiritual. In many cases, physical causes are identified and, although the germ theory is not explicitly stated, the faecal-oral transmission routes of diarrhea appear to be understood. Households may associate diarrhea with polluted environment including uncovered food, dirty water and flies (Kalbermatten *et. al.*, 1982).

As on-site water services involves improving the physical environment, it may be readily accepted as one means by which to reduce the incidence of diseases. Equally, social and spiritual causes are perceived to be important, and include, for example, female social indiscretions and witchcraft. But these three apparently unrelated causes of diarrhea should not be interpreted as mutually exclusive or divergent approaches to disease (De Zoysa *et. al.*, 1984). They are often interrelated in practice, within a holistic interpretation of the environment. Efforts should be made to determine how community's beliefs, knowledge, and control over environment could be harnessed in a positive way. Careful judgement is required to distinguish between those beliefs and ritual behaviour that are conducive to good tap and sanitation practice and those that need to be changed.

All societies undergo adjustments in their social structure and culture over time. How change is brought about and what is that changes are important issues that need to be addressed. The profound impact of forces for change on diverse societies finds expression in patterns of apparently increasing uniformity between cultures (Bourne, 1984). In demographic terms, these include rapid growth of population, and internal migration of people from rural to urban areas coupled with urban expansion.

Access to education may increase awareness of the health of improved water services, while income and willingness to pay will influence the ability of a household to acquire particular facilities. Community based organizations and influential leaders can assist in marketing the concept by emphasizing factors valued locally. These may include the status attached to possessing a facility. Or its functional value in terms of comfort. Equally, factors such as rapid increase in population that limits privacy may heighten the perceived need for innovation in sanitation services.

People resist change for many reasons. They may be resistant towards "experts" who know little of local customs and perceived need of innovation in sanitation services than local people. Leadership may not be

united within a community. For example, those with traditional authority who fear loss of power and status may oppose innovation strongly supported by political and educational elites. New technologies may be aesthetically unacceptable or conflict with establishment patterns and personal and social behaviour (Kalbermateen *et. al.*, 1982). Furthermore, households vary widely in the resources of money, labour and time available to them and have their own priorities. This implies that public participation and communities comments should be considered in engineering designs.

For those with limited resources, the cost in the short term of an apparently low-cost system may be too great when set against their need for food, shelter and clothing. In addition, in terms of capital investment, improved latrines may be very costly for households if they take long time to clean, are difficult to use or involve radical changes in social habits (Pacey, 1980). There may be seasonal variations in the availability of money and labour. Thus the timing of the promotional aspects of the project in relation to, for example, agricultural seasons may be important in determining the local response.

The democratic composition, economic characteristics and attitudes to water services of individual change over time. Experience shows that once people start to improve their houses their interest for improved water

services is likely to be aroused. Thus some households may be encouraged to install in-yard taps and VIP's as one aspect of the modernization process. Projects should be flexible enough to allow households to invest in on-site water services not only when they feel motivated but also when they have the resources to do so. Indeed it may be most appropriate to introduce a range of on-site technologies within a particular community from which households can make choice according to their own changing needs and priorities.

To identify a demand for improved water services is more positive than to initiate a supply technology that is deemed to be good for communities. The former depends upon cooperation between providers and beneficiaries which comes through dialogue and the exchange of information. Individual users are the ultimate decision-makers in the acceptance or rejection of new technology.

It is them who determine the success of a project, since the value of the investment depends not only upon community support but, more particularly, on the consent of households and individual users. They need to be convinced that the benefits of improved water services, and the new technology with which it is associated outweigh the cost.

Water supply services

Provision of water services includes resource development, treatment, storage and delivery of bulk supplies. Water storage is used to cater for peak demand and also as the safe major safeguard against malfunction in the water supply infrastructure. Storage should only be provided where there is no storage present and where such storage is considered necessary (Wolhuter and Associates, 1982). There is a wide range of proper water supply service facilities that are in use. These include hand pump, boreholes, community taps, yard tap and fully reticulated water supply system with multiple taps provided in the kitchen, bathroom and garden. The efficiency of the water supply infrastructure influence the actual volume of water used by the domestic water user. Domestic water is required for drinking, cooking, dish, clothes and body and hut construction and ecological protection.

The other sources of domestic water may include river streams, dams, wells boreholes, harvested rainwater using gutter system. In many instances these sources, for example, river streams may be unprotected and therefore prone to pollution. Gutter system collects rainwater from dwelling unit with a corrugated iron roof into a storage tank or a plastic drum. The costs of putting such system and purchasing storage

containers are from householder's income. This may result in small containers being purchased and consequently harvested rainwater will be insufficient to meet whole water needs of the household for long period.

In areas where there is a limited number of water source facilities for example, communal taps, inconveniences and competition lead to some households resolving to other means of water source. On the other hand, improving efficiency of water source, for example, by providing more water source points or yard taps this results in considerable increase in water usage as well as water wastage of the water that is already scarce (Van Schalkwyk, 1996).

Households use different sources of water for different purposes, for example, harvested rainwater would be used for drinking and cooking, whilst river water would be predominately used for clothes washing. In cases where community depends on rivers for water, rivers can be perennial or seasonal rivers. In seasonal rivers water abstraction would be restricted to rainy season which occurs during summer. In winter the amount of water is low and the abstraction of water requires a considerable effort to scoop water using basins to fill larger container. This process is time consuming and pollutes water as well as limits the domestic water use by households. This may result in serious health effects, as this water is prone to pollution from source and use. It is also

associated with energy costs as one has to travel steep slope from fetching water. Following are ways to prevent water contamination.

Protecting water quality from source and in the delivery system

In order to prevent water contamination hence water-related diseases, water must be safe either when it is drawn or/and extracted from the source to the delivery system being bucket or water pipe. The source must be protected and the off-take point must be properly protected from human, agricultural and industrial contamination or the water must be adequately treated before it enters the piped system (Boot, 1994). To be sure of safe water supply, the system must be looked after and well maintained. Regular inspection of water service facilities will be necessary to monitor and to attend to leaks and breakdowns as soon as possible.

Leaks and breakdowns not only cause loss of safe water but also as a consequence create pressure problems that allow seepage of unsafe water into piped safe water. Operation and maintenance of water facilities in peri-urban areas of former TBVC states should be a village plus service provider responsibility. In this case a service provider must assist the village in selecting a water committee and local caretaker/s. In addition it must be discussed that everybody should contribute towards the

protection of water source points, for example, prevention of damage, careful use of tap and the cleaning of the surroundings.

Protecting water quality between collection and use

A permanent and suitable supply of safe water alone does not guarantee good quality water for the user. Water may become unsafe at any point between collection and use. There are several points to think about in order to prevent contamination of water between collection and usage.

These include:

1. Cleaning of hands before collecting and carrying water
2. Washing the container before filling it with water
3. Cleaning and covering the container on trip back to house
4. Covering water container properly in house
5. Using of clean cups and mugs while taking water from the bucket
6. Putting of container away from children access

Wastage and leakages

Losses arising from wastage and leakage occur in any public water supply infrastructure, however they should be stringently controlled. For example by periodically educating communities about the shortfalls of water

wastage and regular inspection. The losses are caused by various factors, including leakage through fittings, pipe joints, faulty plumbing and wastage through failure to close taps, misuse of water and undue consumption like washing a container with large volume of water. In community taps as compared to individually metered taps it is difficult to assess the actual leakage within the infrastructure. Wastage at community taps by leaving taps open, use of hose pipe to fill big containers can be controlled by rural authorities. Wastage studies to seek ways of reducing water wastages are encouraged. The inevitable results of this practice, as is true in most developing countries, is open drains that are full of stagnant water (Ramasubbban and Singh, 1989).

Sanitation services

Of the engineering infrastructure and utility services that are required by low income community, the provision of cost-effective sanitation services, is one of the most difficult problems to solve satisfactorily. Sanitation services are those required to dispose off bodily wastes and wastewater in a hygienically and environmentally friendly way. Environmentally they should create, wherever possible, positive environmental impacts, preventing or at least minimizing pollution of natural resources. These include sanitation facilities like flush toilets, improved latrine systems. Safe and adequate sanitation is at least as important as safe water supply. Water supply projects should be integrated with new facilities for excreta

disposal. Behind this, lies an assumption that the provision of sanitation facilities will lead to the direct improvement in public health (Chalinder and Kedikilwe, 1997). However this assumption is not widely accepted as other factors like poverty, poor nutrition and health services play a vital role.

Provision of sanitation services, therefore faces the new challenge of changing perceptions about itself. In many societies sanitation is a very sensitive topic. People do not like to talk about it. Also the low priority people sometimes give to new sanitation facilities compared to other needs may be a handicap in the adoption of sanitation improvements.

Provision of adequate quantities of water should be accompanied by adequate means of disposing wastewater and body wastes. However, this has not been the case as emphasis has been placed on water supply with little or none on sanitation. Low emphasis on wastewater and sanitation can be cited to lack of political will to sacrifice financial resources for the use in sanitation projects. The situation is made worse by the fact that the people in greatest need have lesser political power (Water Research Commission, 1995). Other aspects affecting sanitation services delivery may include:

- Ineffective promotion and low public awareness concerning sanitation and wastewater management.
- Little effective demand for water services especially sanitation.
- Widespread ignorance of cultural beliefs and taboos of communities being served.
- Disregard of the value of sanitation services and scarcity of water

In developing countries peri-urban areas do not have facilities or sites available to dispose water from clothes, basin washing and bodily wastes. As a result liquid waste may amplify disease transmission especially at times of floods. This wastewater may be absorbed by natural systems such as water body and soil thus contaminating surface and ground water. The absorptive capacity is determined by the characteristics of that particular receiving body and by the volume and characteristics of waste product. This implies that the control of waste products from sources can minimize the negative effects on the receiving environment. This should be a priority because when wastes are discharged into the environment in an uncontrollable manner, then the damage to the receiving body is much harder to control or limit than prevention.

Each community must choose the most feasible and convenient option to provide necessary safe sanitation. Selecting the most appropriate option requires a thorough analysis of all factors including cost, cultural

acceptability, simplicity of design and construction, operation and maintenance and local availability of skills and material (Allan, 1997). As part of the process, positive traditional practices need to be understood and advantageously be included in the scientific knowledge. Furthermore it is very important to raise the interest of the people by discussing the present situation together with health risks involved and by stimulating the people to think of what difference the use of new system may make for the health benefits in a community.

Places for safe sanitation

A safe place to defecate is a properly designed place where the impacts of faeces cannot cause infection and pollution to the environment. For developing communities, a clean ventilated pit latrine is such a place. Where there are no latrines, people resort to defecation in the open space and bushes. These may be indiscriminate or in special places for defecation generally accepted by the community, such as defecation fields, rubbish and manure heaps, or under trees (Fanceys *et. al.*, 1992). Open defecation encourages flies, which spread faecal-related diseases. Hence, in view of health hazards and the degradation of the environment, open defecation should not be allowed in villages. Boot, 1984 listed condition that need to be fulfilled for safe places for defecation.

Defecation is mostly likely safe when the following conditions are all fulfilled:

- Where faeces are not exposed to other people or domestic animals
- Where faeces are not exposed to flies
- Where faeces are not moved or used as manure on the field before they have become harmless
- Where faeces cannot be washed into water supply sources
- Where faeces cannot drain through the soil into water supply source
- Where urine does not get into water in areas where urinary schistosomiasis is a health problem

Household sanitation systems

Various sanitation systems in this sub-heading will be introduced with a brief indication of their sustainability for particular situations, the constraints on their use and their advantages and disadvantages. There are many different versions of the various systems, but the main types include:

(a) Simple pit latrines

A latrine is a safe place to pass faeces and urine, but only when the latrine is properly constructed, well maintain and cleaned regularly. Otherwise the latrine will increase the risk of diseases transmission instead of reducing it. This consists of a concrete slab over a pit, which may be 200 mm thick. The slab should be firmly supported on all sides and raised above the surrounding ground so that surface water cannot enter the pit. A squat hole and tight-fitting cover that will prevent flies from getting in and out the pit.

Advantages of simple pit latrines	Disadvantages of simple pit latrines
Low cost Can be built by householder Needs no water for operation Easily understood	Considerable fly nuisance and mosquito nuisance. Odours Not necessarily safe

Pit latrines are suitable in low density areas and can not be used for sullage disposal. Simple pit latrines can be improved to VIP's and to pour-flush toilets, which in addition can be served with small-bore sewers.

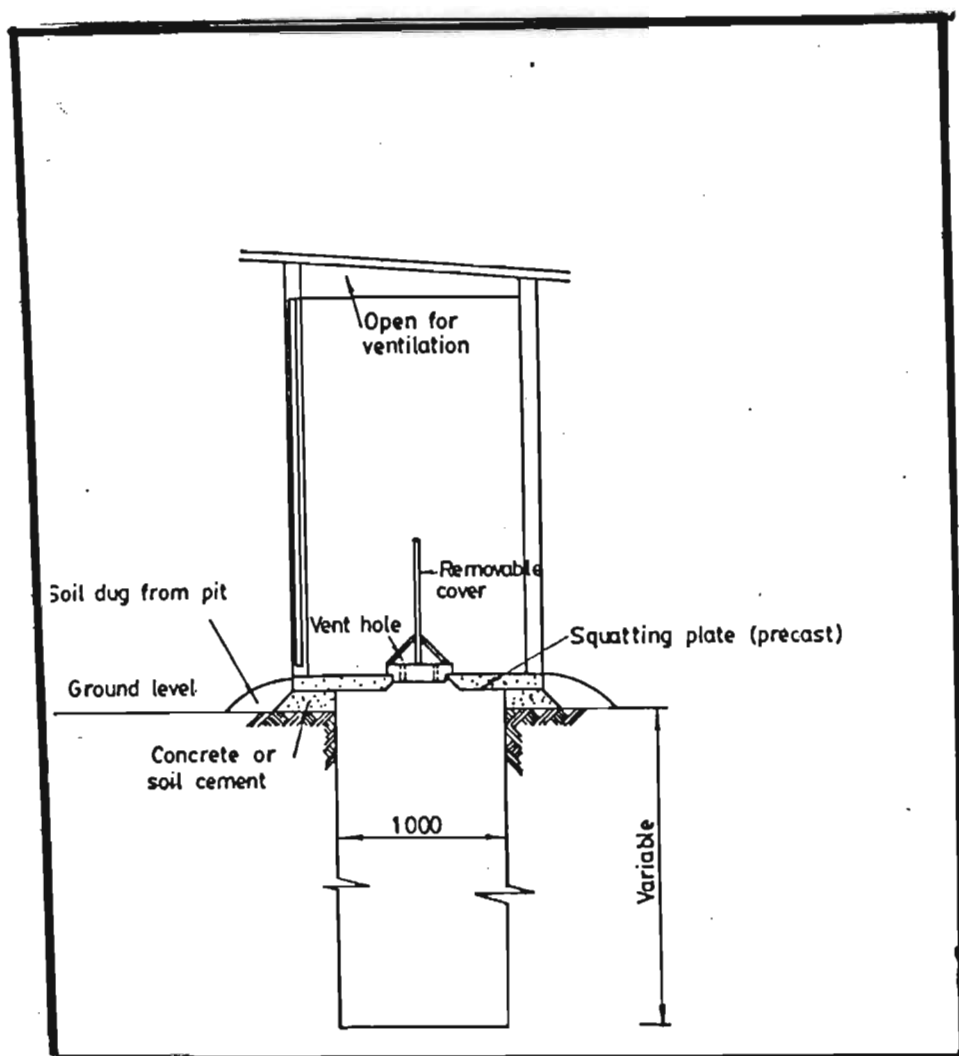


Figure 1: Conventional unimproved pit latrine

(b) Ventilated improved pit latrines (VIP's)

Fly and odour nuisance may be reduced if the pit is ventilated by pipe extending above the latrine roof, with fly-proof netting across the top. Such latrines are known as ventilated improved pits (VIP's) latrines.

Advantages of VIP's	Disadvantages of VIP's
Low cost Can be built by householder Needs no water for operation Easily understood Control of flies Absence of smell in latrines	Does not control mosquitoes Extra cost of providing vent pipe Need to keep interior dark

Improved technical design of these pit latrines makes their use possible in densely populated areas. Their potential health benefits over no sanitation' situation is high.

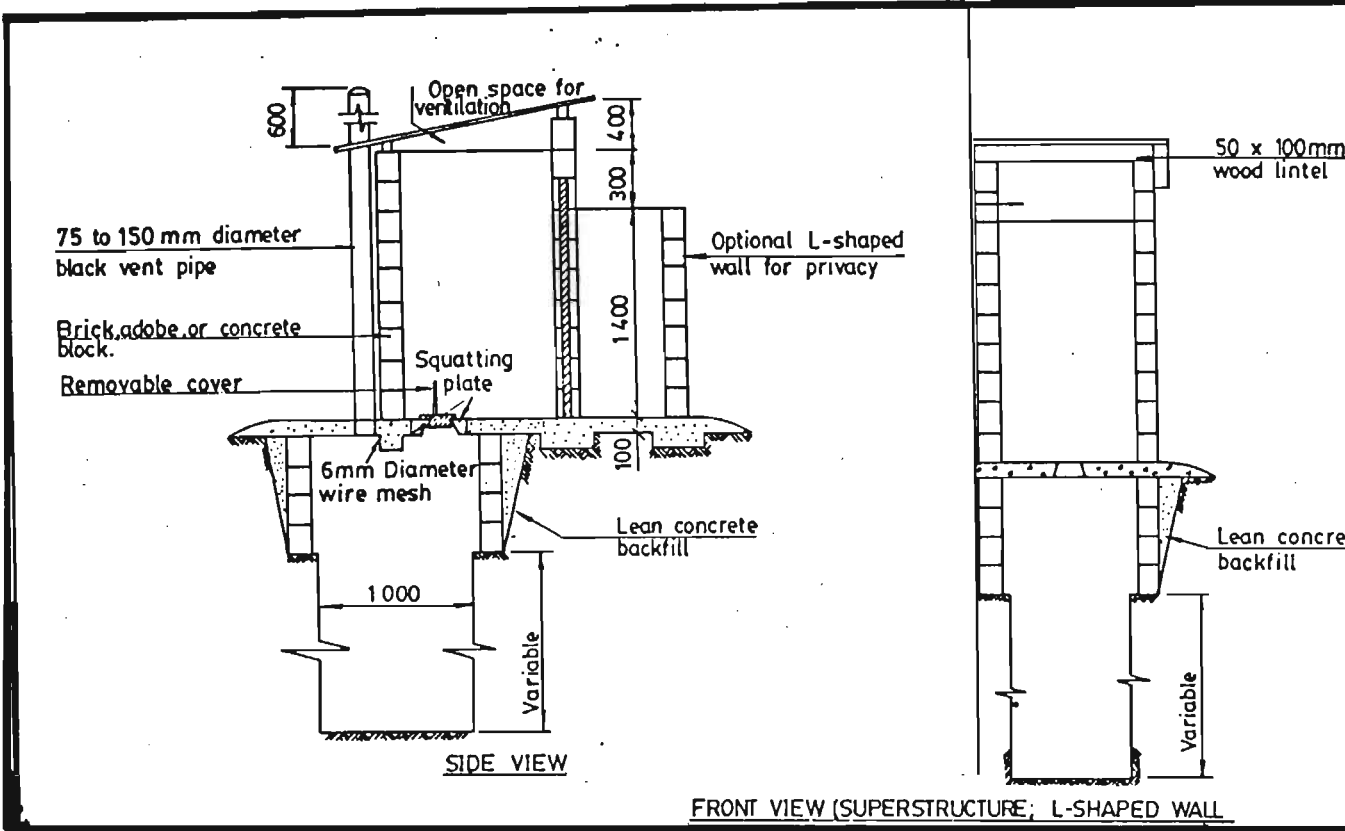


Figure 2: Ventilated Improved Pit latrine.

(c) Composting latrine

In this latrine, which is designed to operate under anaerobic conditions excreta fall into a watertight tank to which ash or vegetable matter is added to attain carbon-nitrogen ratio for composting to occur. The mixture decomposes to form a good soil conditioner in about four months. Pathogens are killed and dry alkaline compost is produced.

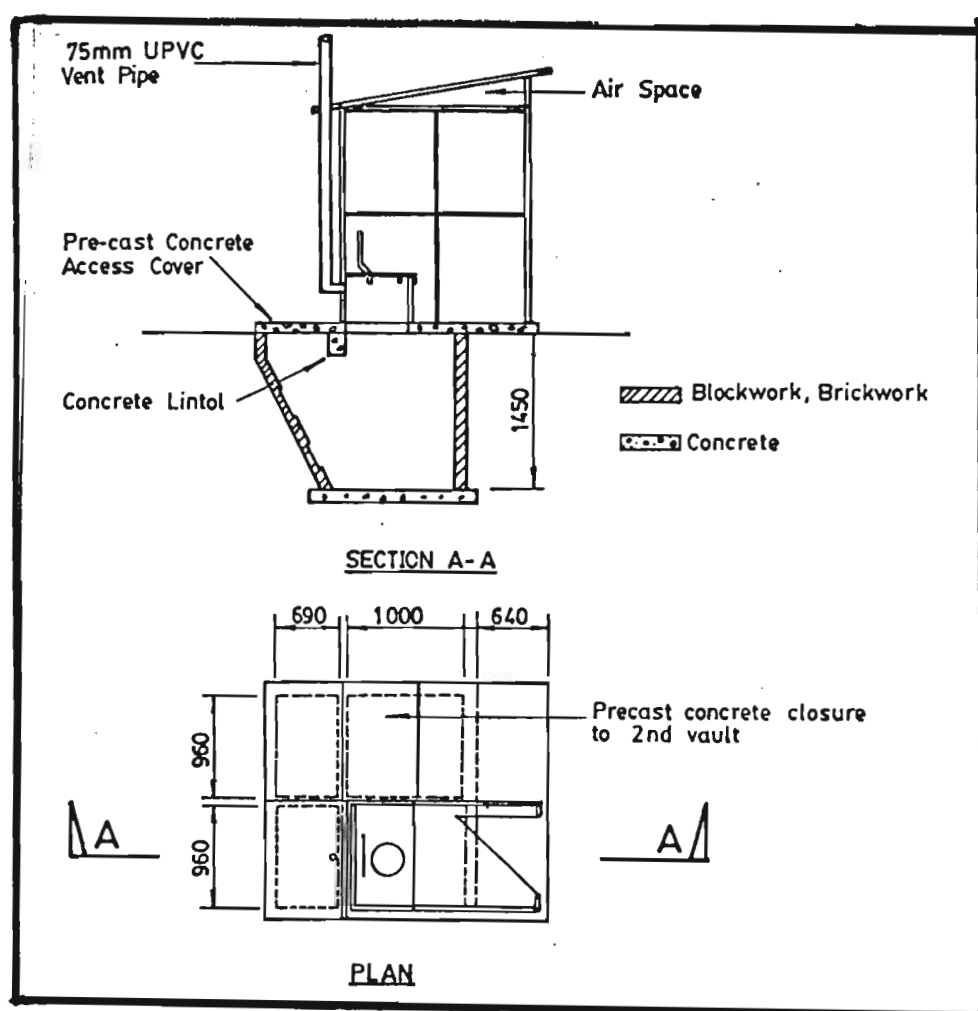


Figure 3: Composting latrine

Advantages of composting latrine	Disadvantages of composting latrine
A valuable humus is produced	Careful operation is essential Urine has to be collected separately in the batch system Ash has to be added regularly

(d) Septic tank

A septic tank is an underground watertight settling chamber into which raw sewage is delivered through a pipe plumbing fixture inside a house. The sewage is partially treated in the tank by separation of solids to form sludge and scum. Effluent from the tank infiltrates into the ground through drains.

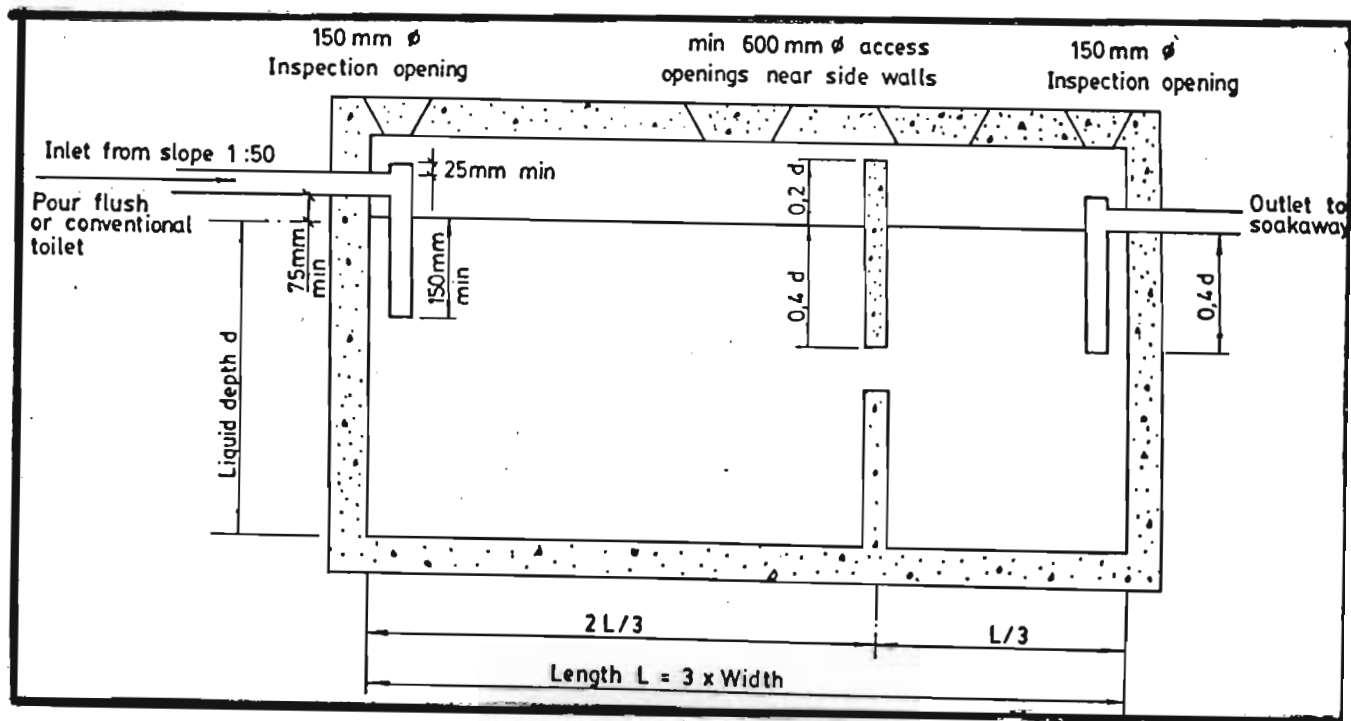


Figure 4: Sectional view of a conventional septic tank

Advantages of septic tank	Disadvantages of septic tank
Gives the users the convenience of a water closet	High cost Reliable and ample piped water required. Suitable for low density housing Regular desludging required, and sludge needs careful handling Permeable soil required

Community sanitation systems

(a) Bucket latrine

This latrine has a bucket for the retention of a faeces and sometime urine, which is periodically removed for treatment or disposal by a nightsoil labourer.

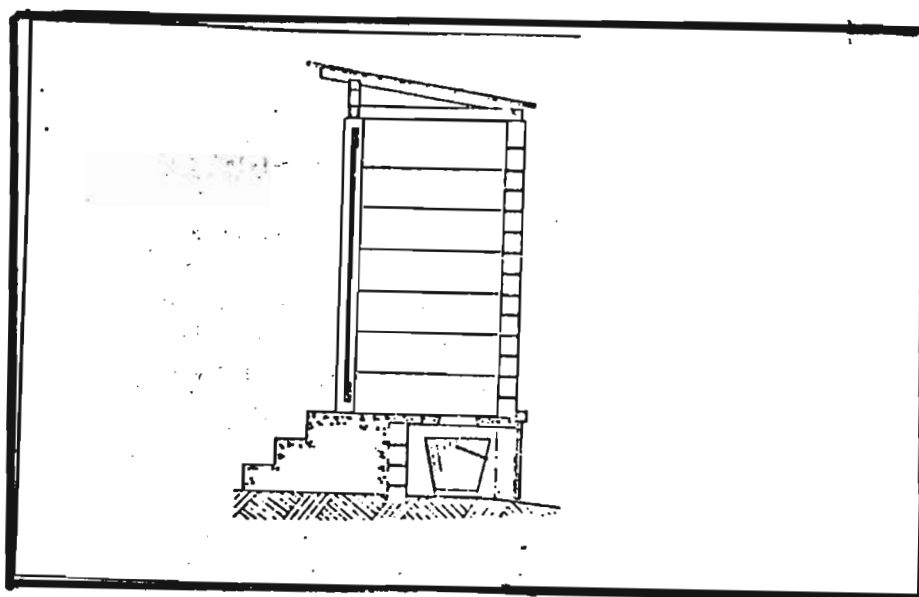


Figure 5: Traditional bucket latrine

Advantages of bucket latrine	Disadvantages of bucket latrine
Low initial cost	Malodorous Creates fly nuisance Collection is physically undesirable

Bucket system has a limited role and is not upgradable.

(b) Vaults and cesspits

Vaults are built under or close to latrine to store excreta until they are removed by hand using buckets or by vacuum tanker. Similarly, household sewage may be stored in lager tanks called cesspits, which are usually emptied by vacuum tanker on a regular basis.

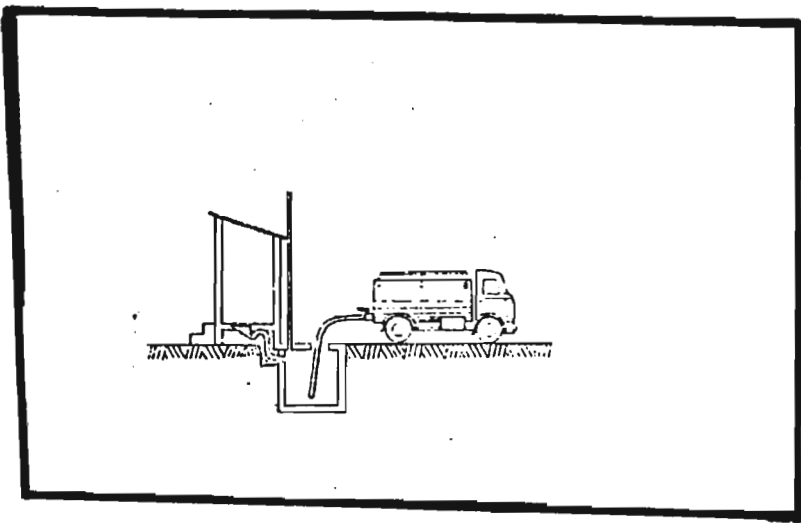


Figure 6: Emptying of vaults or cesspits

Advantages of vaults and cesspits	Disadvantages of vaults and cesspits
Satisfactory for users where there is a reliable and safe service	High construction and collection costs Irregular collection can lead to tanks overflowing Efficient infrastructure required

(c) Sewerage

Discharge from U-shaped toilet pipe and other liquid wastes flow along a system of sewers to treatment works.

Advantages of sewerage	Disadvantages of sewerage
No nuisance near household User has no concern with what happens after flush Treated effluent can be used for irrigation	High construction costs Reliable piped water supply required If discharge is to a water-course, adequate treatment is required to avoid pollution High maintenance costs Installation difficulties in already built areas

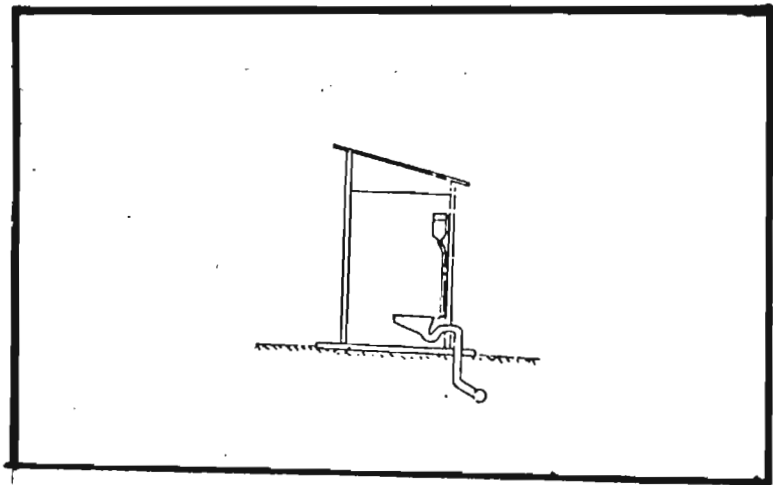


Figure 7: Conventional flush toilet

1.3.2 Awareness of benefits associated with improved water services

Water services are said to be essential for life but to a larger extent they satisfy basic fundamental needs of human beings. It has however been shown that provision of suitable water services alone, does not benefit the community (Fass S. M, 1993). Knowledge and understanding of benefits of improved water services is said to be the essential issue in delivery of water services.

This implies that the beneficiaries of water services should be made aware of all possible benefits and shortcomings of reliable water services. It is therefore essential that the provision of reliable water services be integrated with an education process and training programs with regard to both positive and negative benefits of water services. Understanding of benefits of reliable water supply and at the same time promotion of, for example, the need to pay can be mutually reinforcing, each generating awareness on each other (Palmer Development Group, 1995).

The sustainability of capacity and quality of service primarily depends on awareness and on the intensity of use. Should water service facility be overloaded and not well maintained, the capacity of the water service system deteriorates thus leading to uncontrolled wastewater and water

discharges into receiving water resources and environment through overflows and leakages.

Promoting public awareness on benefits of improved water services

Promoting public awareness is surely one of the most important components in promotion of both positive and negative impacts on improved water services. Helping people develop their own understanding of the connection between new water services, everyday behaviour and health behaviour may indeed be the best key to the community adopting the project as its own and gaining full benefit from it (Boot, 1984). Creating public awareness on benefits of improved water services may lead to increased enthusiasm for and commitment to protect water service systems and thus help wider aspects of community participation. Financial management and operation and in particular maintenance can benefit from increasing community awareness and support.

Public awareness education on both positive and negative aspects of improved water services will more likely be successful when they are related to everyday life. This is why home visits, small group open discussions and informal talks offer such good opportunities. This contact makes it easier to discuss what one gets from improved water services.

For the same reason the emphasis can be put on demonstrations. For instance, it is often much better to demonstrate than to tell what are the benefits or shortcomings of, for example, cleaning toilet facility or leaving the tap leaking and not controlling wastewater. Similarly, when discussing about dangers of children swimming in dam, it helps when a child affected by schistosomiasis is used to demonstrate the dangers of contaminated water. This local observation could lead to the discussion of the health risks and how difficult it is to prevent children from swimming in dams. This implies that successful public awareness education can be achieved by using common objects that are familiar locally. In addition to live demonstrations, a variety of other aids can be used. These include audio-visual aids like posters, flipcharts, slides, films, stories, models, drama, local radio station and so on.

Audio-visual materials can do a lot to facilitate promotion of public awareness. These materials can help the community to give information on what kind of behavior may help to get a benefit from improved water service facility or avoid negative impact. For example, audio-visual materials can show the community how to use water standpipe properly. But effective learning will only be by doing. Furthermore audio-visual materials should be improved by graphic presentation and open discussion at the end.

Benefits of improved water services

The desire for improved living conditions is a natural tendency observed in communities at all developmental levels, these include the most underdeveloped communities (Van Schalkwyk, 1996). One of the most important social benefits from provision of adequate water supply and sanitation is the reduction of human suffering in terms of energy, time, danger, health aspects and costs spent when collecting and transporting water. Okun, 1987, gave the following beneficiary example, "when women are freed from water bearing activities, they have more time for income producing work, childcare, household tasks as well as training and hygiene educational programs". The same applies to children's obligation to fetch water at the expense of school time.

Hygiene education is surely one of the most important of these components. New water supply and sanitation facilities alone will not however have full impact on the benefits such as health unless people use them properly and this requires lasting education in health and economic benefits. But the linkages extend even further. Getting hygiene education right may lead to increased enthusiasm for and commitment to a project to and thus help wider aspects of community participation.

Other possible benefits include reduction in cases of water-related diseases, improvement in standards of living, enhancement of human dignity and facilitation of economic development. Given such benefits listed in table 1, it therefore goes without argument that improved water supply and sanitation facilities should receive top priority in developing communities. However, in developing countries this has not been the case due to competing social and political priorities.

Table 1. The relationship between water service improvements and potential benefits (Okun, 1987)

Benefit	Accessibility	Quantity	Quality	Reliability
Time-saving	Saving on water collection journey for each household.			Saving during season when unreliable sources fail
Health improvement	Water piped into the household may increase quantities used and reduce exposure to water-borne diseases.	Potential improvements in hygiene if additional water is used	Eliminates an avenue of faecal oral transmission.	May avoid seasonal use of more polluted sources of water.
Labour	Labour released by time saving and indirectly by health improvements	Indirect through health improvement	Indirect through health improvement	Seasonal timesaving.
Agriculture advance	Possible indirect Benefits from Labour release	Surplus or waste available for gardening		Seasonally significant in some cases
Economic diversity	A prerequisite but usually a major one.	A prerequisite but not usually a major one		Permits permanent settlement.

It has been however pointed out that these benefits are unattainable for majority of the population in developing countries and so some combination of improvement in quality, availability and reliability must be decided upon on planning phase. There are necessary prerequisite conditions for achievement of various benefits and table 2 lists the basic complimentary inputs necessary to achieve some benefits.

Table 2. Prerequisite conditions for achievement of various benefits
(Feachem, 1975)

Benefit	Prerequisite conditions
Immediate aim	Active community participation support. Competent design, adequate facilities for operation and maintenance and appropriate technology utilized.
Stage I benefits	New supply used in preference to old, new supply closer to dwellings than old, water use pattern changed to take advantage of improved quantity, quality, availability, reliability, hygiene changed to utilize improved supply, other environmental health measures taken and supply must not create new health hazards (e.g. mosquito breeding sites).
Stage II benefits	Government personnel concerned must provide good advice and extension services with agriculture, animal husbandry, cooperative, marketing, education, credit, etc.
Stage III benefits	Water service developments must be just a single component of an integrated development program that has the active support of the local community.

With the assurance that improved water supply and sanitation improve the quality of life i.e. health aspects, facilitate other economic development activities, save time spent carrying water over long distance, it is therefore imperative to have thorough understanding of the current impacts facing water supply and sanitation services in peri-urban areas. Factors impacting water supply and sanitation services are thoroughly assessed in this study.

1.2.3 Impacts of water service on users

Convenience, ease and accessibility of water service facility seem to be the key factors that impact on the water user (Boot, 1984). This means that community taps are more likely to be used when they are easily operated and give continuous flow of water. Handwashing might be adopted more easily when water is always close at hand. Bathing and clothes washing at special site will more likely to be accepted when these places are easily accessible, with plenty of water without long waiting times.

It is often more important that the community should discuss with their Headman or community leader (established administration) the type of water service facility preferred. A forum seeking to answer the following questions need to be set to find out:

- How new facilities can be identified and developed?
- Where are suitable sites for community taps that are easily accessible to everyone in community?
- How many taps are needed to prevent long waiting times?
- How can water be arranged to be close hand for handwashing after defecation?
- How and where can the households construct suitable toilet facilities?
- How can we get outside people to assist us on our problem and so on?

These imply that projects on water services should be community demand driven not only Government driven (DWAF, 1998).

In order to facilitate answers for the above-mentioned questions, the community needs to form as already stated a forum usually called a Project Steering Committee (PSC) which is acceptable to the community. The PSC should be a representative of all stakeholders and include specialists, authorities, NGO's not community only. It is very important for women to be involved in the decision making, as they are usually the ones who suffer most from lack of water services (DWAF, 1997).

The government in collaboration with affected community should work out and compare the costs of designs of the water service infrastructure as well as the operation and maintenance cost arrangements and how much everyone would have to pay every month. In order to fully sustain the services, the consumers in general should pay the full operating and maintenance costs of the services consumed. Exceptions to this should be made for truly indigent households waiting for welfare support to be sorted out (DWAF, 1995). However, the volume of "free water" provided to them should be limited and should be made to pay arrears at very low rates once welfare support sorted out. The reason for this is to avoid conflicts that might arise like all households reporting that they are waiting for welfare support to be sorted out.

Tariffs should be sufficient to ensure that the services are sustainable while on the other hand affordable to all. It is better to have few sustainable taps than having a lot of taps that are not working or leaking and creating environmental hazards. In most cases, cost recovery from water users is far below what is required to finance operation and maintenance hence deterioration of services in the future is usually foreseen. Other factors enhancing deterioration include lack of political will to fully subsidize community services, inefficient tariff collection

procedures, poor maintenance, corruption and unauthorized connections (Delgado, 1997).

The community must be involved in identifying those to be trained and employed on the project, as well as in determining at what rates they should be paid. Training must be specific and functional so that the people could be able to use the skills acquired in other fields. Some sort of education and public relations campaign is necessary to inform people of their rights and responsibilities and the reasons for having to pay. This prevents troublemakers from misinforming people.

Access to the water from the various source points impacts the sophistication and the level of distribution coverage, i.e. as the number of taps in the reticulation system increases so access improves (North and Griffin, 1993). Van Schalkwyk and DWAF 1996, recommended that community taps should be spaced in such a way that the domestic water users need to walk not more than 200m to 250m to the tap. Exceptions should be made in cases where barrier is confronted. Walking distance would be therefore quite often less than of 250m. Community taps may serve as little as only five to six household plots. Common service problems at these water service facilities include leaking taps as well as sealed taps awaiting repairs for months.

At times of service problems, it is suggested to get it repaired locally if feasible as soon as possible. While water is needed for drinking and domestic purposes, it could be discussed with nearby community whether water could be fetched from their community tap. This water however is not safe as the water from community tap and the risk of disease transmission may be serious.

To prevent infection with water related diseases from unsafe water, Boot, 1984 suggested that the community using traditional sources of water should at least treat it with disinfectants such as spoon full of domestic jik and boil all drinking water for ten minutes before use. Boiling of water while acceptable may be a problem to poor households who do not have money to buy fuel (paraffin) or power to harvest firewood as most affected are always elderly people. In that case it is suggested that water should be at least boiled for children consumption. Known local ways to treat the water should be discussed and published.

Community water supplies on the other hand should be at all times be of a quality acceptable to the consumer and also acceptable from a public health point of view. Care must be taken not to set unnecessary high standards of quality, which can lead to increased size and cost of treatment or to the use of special techniques like conventional water

purification plant (Wolhuter *et.al.*, 1982). Chemical testing of water should be undertaken to determine the aggressive or corrosive properties of water and to establish if these factors have any impact on the section of pipework of the water infrastructure. This helps in the choosing of correct type of pipes to be used in order to avoid early deterioration.

Impact on water users in addition depends on the number of people served per water service facility. If the number of households outnumber the number planned for, it makes it difficult for the households to draw sufficient quantities of water in peak hours (morning and afternoon), thus resulting in habit of obtaining water during day hours of which day hours give a good time for repairs and maintenance. In order to avoid this water service provision should not be seen as once off provision, the number of community taps should increase the increase in community population provided if they will be paid for.

Diseases resulting from improper water services

Improper water services primarily results in water related diseases. Water related diseases are those diseases that in some way are related to water in the environment or to impurities within water (Venter *et. al.*, 1996). They are called water-related diseases because their transmission and prevention depends on water.

The World Health Organization, 1994 (WHO) estimated that approximately 80% of all sickness and diseases in the developing world can be attributed to inadequate water services. It is reported that every hour more than 600 people die because their water services are contaminated, inadequate or non-existent and the health of those who are medicated is often permanently damaged. Many of these disease are manifested in the form of specific water-related maladies such as diarrhea, worm, skin, eye and insect borne infections. These diseases have in past years killed more than 6 million children in developing countries and contribute to the deaths of up to 18 million every year (Delgado, 1997).

Safe water services like proper community taps and VIP's can help to prevent these diseases. However, prevention of water-related diseases is not a matter of new facilities, It is also the matter of good hygiene practice. This is good hygiene behaviour that helps to prevent water related diseases. For example, washing hands after defecation, cleaning latrines, closing water storage utensils and toilets, wastewater control etc is the good hygiene behaviour needed in these societies.

Water related diseases have been identified, namely water-borne, water-washed, water-based and water-related insect vector. Table 3 on the next

page shows the four mechanisms of water related disease transmission, example and preventive strategy.

Table 3: Identified mechanisms of water related disease transmission.

Transmission mechanism	Example	Preventive strategy
Water-borne	Cholera, bacillary dysentery	Improve water quality and prevent casual use of other unimproved sources.
Water-washed	Trachoma, scabies, louse-borne fever	Improve water quality. Improve water accessibility and improve hygiene.
Water-based	Schistosomiasis, guinea worm	Decrease need for water contact, control snail population and improve quality.
Water-related insect vector	Sleeping sickness, malaria	Improve surface water management, destroy breeding sites of insects.

Routes of disease transmission

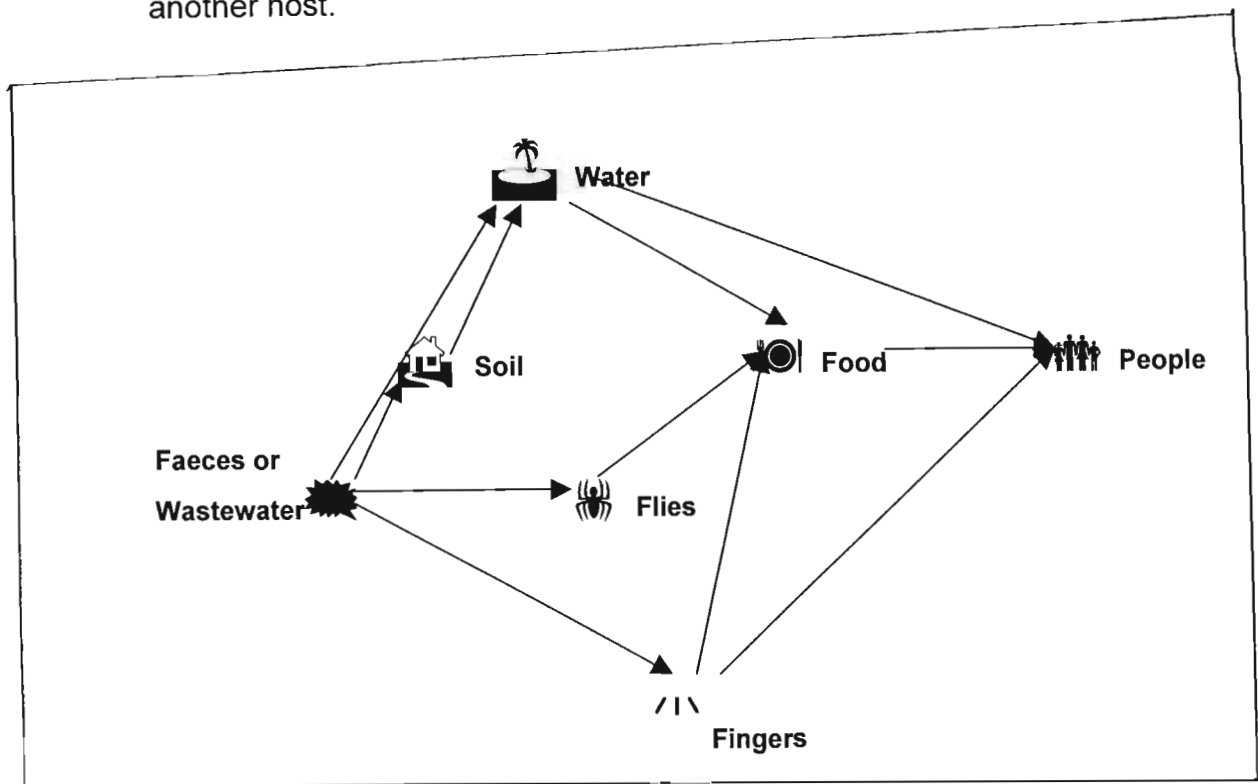
The poor control of wastewater and unsanitary disposal of infected human feaces leads to the contamination of surface and ground water resources. Stagnant wastewater often provides good sites and the opportunity for certain species of flies and mosquitoes to lay their eggs, breed and feed on the exposed material and to carry infections. In addition this

wastewater creates intolerable nuisance and odour (Franceys *et. al.*, 1992). This implies that more emphasis should be put in wastewater resulting from community taps during planning phase. This however does not promote wastage of water. Presently there is no communal tap with wastewater provision and wastewater will always be produced as long as there are communal tap systems.

There are many routes in which germs hence diseases from unsafe sanitation practices and uncontrolled wastewater can reach human beings. In developing countries, it mostly happens through faecal contamination of fingers, flies contaminating food and cooking utensils and runoffs into river sources. Transmission of faecal-related diseases normally follows one of the following routes in Figure 8 on the next page.

This is when the germs are transmitted from one source (1)hands or flies to (2) water, (3) food and finally to the (4) human being. Food may be contaminated when it is handed with contaminated fingers and flies. Water on the other side may be contaminated when drainage runoff collects faeces in the river system. Water may look very clean, although is contaminated with variety of germs after raining.

Figure 8: Transmission of faecal-related diseases from one host to another host.



Pollution of water resource impact also on microbiological water quality and deterioration of water quality as already mentioned results in water-related infectious diseases. Microbiological water quality is of importance to both human beings and livestock. From a human perspective, transmittable dangerous microorganisms may persist in the flesh of stock intended for slaughter and consumption during cultural and customary feasts. Thus causing illness after consumption.

1.2.4 Factors that limit infrastructure utilization

World Bank, 1994 indicate that most of the health benefits of safe water are attainable at levels of 30-40 litres per capita per day. This permits a desirable level of personal hygiene and provides protection against the range of prevalent water-related diseases. Whether more or less water than this desirable minimum is needed depends upon a series of limits such as:

- (a) The general availability of water in the region.
- (b) Climate of the area.
- (c) The form of infrastructure
- (d) The distance, which water must be carried from standpipe to house and the method of storage within the house
- (e) The cost of water and the payment method.

Assuming adequate quantity of water is available, water tariffs and droughts have a restrictive influence on the volume of water used by households. Charging for water delivered is to generate revenue so as to ensure sustainability of water service facilities as well as to discourage unnecessary wastage of water and irresponsible use and promote awareness of the scarcity of water. Several tariff systems are available

for consideration and these include a fixed monthly fee or flat rate fee whereby households are required to pay a fixed monthly fee irregardless of the volume of water used. Dissatisfaction however sometimes prevails because residents living near the water point, have better access and therefore use more water than residents further away do. This problem is however unlikely to be solved in the near future unless each an every household plot is provided with in-yard metred tap.

Access to available water services is a considerable factor that limits water utilization. It is usually found that the personal water utilization can be reduced where carriage distances are substantial and steep. More effort is required where water collectors need to travel areas having steep gradients particularly when the containers are full and need to be transported in the uphill direction. Long walking distance from household plot to access water as it occurs in most villages, further limits water use in terms of time taken and energy expended in conveying water.

Avoidance of excessive walking distance usually includes clothes washing being done at source rather than at home. Extensive use of wheelbarrows that are aimed at reducing the burden of fetching water is one example (Van Schalkwyk, 1996). In poor sources of water, deteriorating water quality e.g. high salinity, suspended decaying material that causes odour

in river water seriously inhibit water use. Suspended decaying material can result in various water-related diseases like cholera.

1.2.5 Affordability to pay for improved water services

The water from the spring, river and rainwater is free just as using the bushes and open veld for defecation. When engineering skills and machinery are used to lay pipes to bring safe water closer to the community, that water is no longer free. Building toilets and drainage system also costs money.

People need to pay for the building material of their toilets and need to pay for keeping them in good working order. The community needs to pay for the pipes, chemicals to keep the water clean, fuel for the pump, operation and maintenance and staff. This implies that the beneficiaries of water services should be made aware of where the water comes from, how it is treated, how it is put next to them, where the wastewater should go, why these services should be available and paid for and how to take responsibility for and ownership over the infrastructure provided (Jansen and Austin, 1997).

Increasingly it has been recognized that supplying free water does not necessarily ensure greater equity. "Free" water often ends up being more

costly to the poor than the rich in terms of time, money and energy spent while fetching water (Delgado, 1997). Most of people living in former

TBVC states are generally predominately low-income class, hence do not use much water as compared to people living in urban areas. They mostly use water for drinking, dish and clothes washing, cooking and personal hygiene. This implies that their tariff should be appropriately low. Low tariffs however do not imply people will automatically pay, in some instances people pay if they feel that they are getting value for what they are paying for.

These communities maybe either willing to pay but do not have the ability to do so or do have ability to pay but because of poor quality of services people may not want to pay. Significant frustration is created when demand for water services is demonstrated but no money is available.

Other aspect that affects the willingness and ability to pay includes level of education. Education is considered to be the indicator of the potential to generate income hence ability to pay. With increased level education, the standard of living and the willingness and ability to pay for efficient water services also increases. Ability to pay and willingness is having many complications that go beyond the scope of this study.

The broad overview of the existing water services and factors affecting water service delivery and the integrated development planning process as well as the benefits associated with improved water services is described in this literature review. Thereafter the challenges facing factors that limit water utilization and affordability are investigated and conclusions will be drawn logically based on the findings. Following is the method study that will assist in making broad recommendations concerning challenges and sustainability in water service provision.

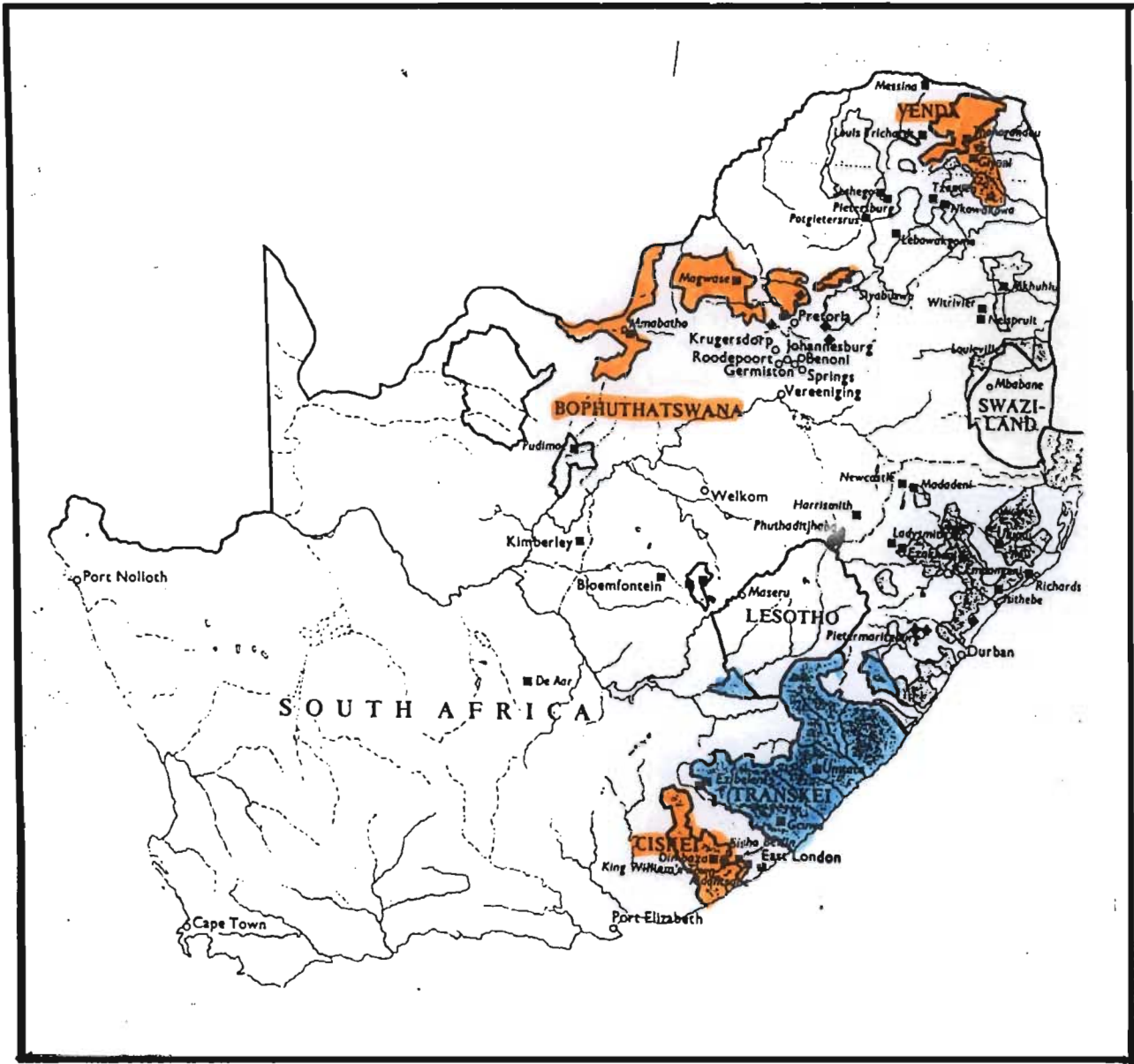


Figure 9: Locality map: Highlighted (blue) is the locality of the study area and orange are other TBVC states.

CHAPTER 2

2.0 METHODOLOGY AND DATA COLLECTION

2.1 The current situation: An overview

The present water services in peri-urban areas of former TBVC states are simply inadequate and unhealthy as well as of varying standards. There appears to be an imbalance between the levels of service offered for different services. For example, as compared to construction of roads, water service projects have been failures (Kei District Council, 1999). For a variety of reasons, many water service schemes did not live up to expectations. Evidence of such failure is exhibited on the damaged, unused and poorly maintained water infrastructure that are scattered throughout the peri-urban area of the former capital of Transkei, Umtata.

The major reasons for such failures are that water service infrastructure tends to be designed as inexpensive communal system with few water source points and as a result are normally overused. Such systems are often poorly maintained and have much less impact on use pattern of the intended beneficiaries than is expected. People who use water from such systems often continue to use traditional sources such as rivers and

harvested rainwater. These and other sources like taps in areas of employment are used to supplement the low volumes available and inconvenience from the public source. Some of the failures are attributed to:

- (i) Insufficient funds and human resources and competing priorities that resulted in some projects being abandoned before completion
- (ii) Government planner's use of arbitrarily fixed designs and uneven topography
- (iii) Lack of technical expertise to operate and maintain water services facilities once in place
- (iv) Non consultation with the affected community during planning in installation

These failures affected the extent to which TBVC states realistically addressed their water services delivery. Transkei "Bantustan" government policy regarding water services was that infrastructure belonged to the state, and was responsible for its operation and maintenance. It was illegal for local communities to tamper with or/and fix the water facility. Water services delivery was based on the assumption that households living in "traditional" villages cannot afford to pay full costs of fully piped water system. Thus, water service programs were justified as poverty-

alleviation programs, not as infrastructure necessary to support socio-economic development (Cain and Illing, 1997).

2.1 Study site selection

The survey was planned to gather information regarding practices, problems and issues like number of and queuing at water source points as well as usage pattern influence water utilization. This however provided the underlying problems and issues concerning facts about people's needs, perceptions, practices, attitudes and expectations towards water service delivery. The following criteria was used in the selection of the study site:

- Status of current water services i.e. only areas with inadequate water services were chosen
- Accessibility of water source points i.e. only those areas with fairly easy access to water source points were considered
- Willingness to show and discuss water storage and usage patterns in households
- Willingness of community and school officials to participate
- Existence of different kinds of water supply and sanitation infrastructure that can be examined and photographed

2.2 Description of the study site

The study area consists of the peri-urban area of Umtata, South Africa, an underdeveloped urban area. This peri-urban area encompasses "traditional" villages and the informal settlements located within 5km radius of the former capital of Transkei. These include Corana, Sibangweni, Pyne, Zimbane (traditional villages) and Mandela Park (informal settlement). Data collection, surveys and interviews were concentrated in these areas. There was also communication with the Kei District Council an agent responsible for provision of water services in this area.

Typical of all peri-urban areas of former TBVC states, population consists mainly of Black population group, characterized with high unemployment rate, shortage of water services and poverty. Whereas on the other side the peri-urban areas of former White controlled urban areas consists of industries and suburbs that have adequate water and other services. Many residents and tenants of the study area commute to Umtata for employment opportunities. This community comprises a wide range of socio-economic groups and a common cultural heritage.

Settlements in the study area consist of households that have been orderly set out. This as well applies to most informal settlements. Some of the plots are used to provide accommodation to family members, civil servants and other workers. This therefore results in there being more people living in the village than it was anticipated and therefore designs for water service infrastructure in place for lower number of people need to be upgraded or changed.

These "Traditional" villages were originally planned to accommodate Black civil servants and labourers working in Umtata City centre. Due to political and economic events, the plans were altered, services such as water supply (community taps) but no sanitation facilities were made available and continue to be available to provide the most basic service to communities, but due to rapid population growth the old plans prove to be inadequate. Some of the areas were and are still provided with poor communal taps and unimproved pit systems for sanitation or nothing at all. Despite the developments, informal settlements remain with no formal water supply or sanitation provisions and they make use of either neighbouring facilities or the surrounding bushes and open veld to get rid of their body wastes.

2.3 Data collection methods

The study was conducted with the use of survey questionnaires, interviews, field visits and photographic taking. Interviews and questionnaires were used to collect data on household characteristics, water storage patterns, perception of current sources, perceptions on the need for improved water services over the existing services and the willingness to pay. Survey questionnaires were randomly distributed to schoolchildren of 8 different schools that fall within study area. Only 70 survey questionnaires were left for distribution per school of the village included in the study.

Schoolchildren were allowed to go with questionnaires to their respective homes and their parents answered the questions. The reason for this was that one group of community like those working were at work or looking for jobs during day hours and their comments were needed. This group therefore filled the questionnaires relaxed after working hours. Because of number of questions, parents were given one to two week's time to answer the questions. Approximately 20 to 30 interviews were conducted in each and every village. No Headman or Councilors were included in the study as they approached the study politically. Selection of households to be interviewed was based on the outside appearance and field visits as well as photographs of different water service infrastructure were taken.

Information regarding practices, problems and issues as well as the need for water services from informal settlements was also collected. Data to fulfill the objectives of the study was collected over a four to six week's period. The author of this study conducted interviews on all household visited including the informal settlements. Interviewers and data was also collected from local people and children in the community water service points. The comments from Mr Kwetyana of Kie District Council were taken into consideration in this study.

CHAPTER 3

3.0 Results, data analysis and discussion

The responses from questionnaires and interviews were collected, evaluated and presented graphically. Where possible photographs of current conditions and practices were taken. It was found that most people living in this area are from remote rural village in search of job opportunities and closeness to areas of employment. Water services are inadequate and most depend on communal taps and unimproved pit latrines. It seems as there are no provisions for wastewater. Water is fetched mostly by women and children using plastic drums on wheelbarrow and kept on open buckets for easy use. Most people have poor understanding of benefits associated with improve water services even though poor services impact on their daily activities. Long walking distances, queues and unreliability of water services limit water utilization. Communities are willing to pay for in-yard taps however their income disadvantages them for this comfort.

Conclusions and recommendations were drawn logistically linking the objectives to the study with facts raised by Mr Kwetyana of Kei District Council, the district council responsible for the development of Umtata peri-urban area that include their current financial and human resource

constraints by that time, the government constraints as well as affected area socio-economic impacts.

3.1 Population dynamics

The aim of this investigation was to ascertain the reason for increased population density in these areas. The sample of randomly selected study group as shown in Figure 10 indicate that on average 80% of the people living in the study area are from remote rural areas and 20% from urban areas. The households of this area have been orderly set out. This can make it easy for in-yard tap installation.

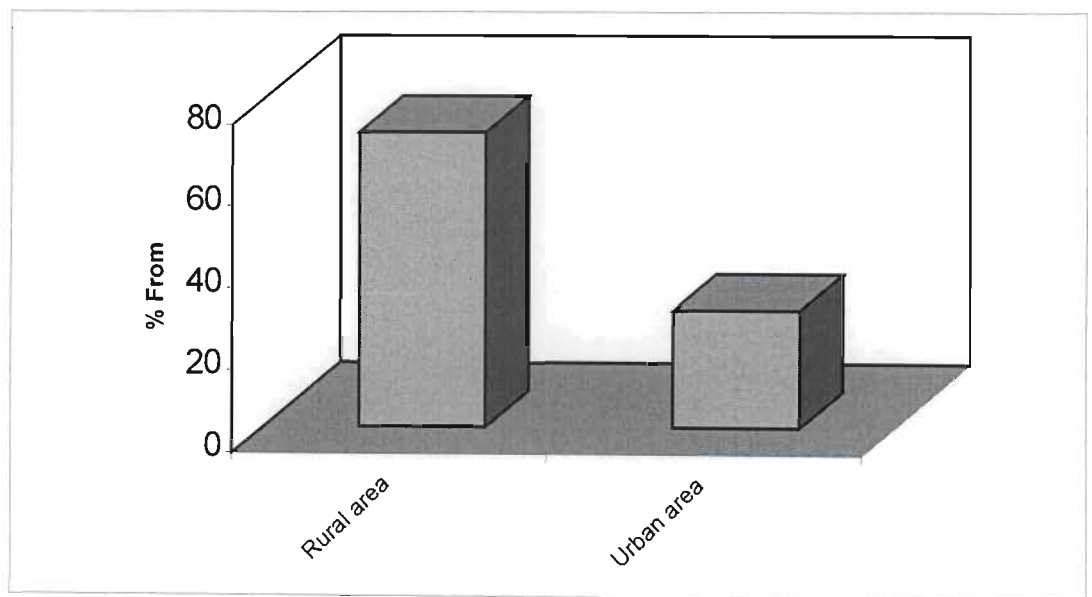


Figure 10: Home background of people staying in peri-urban areas.

The reasons that made the households to migrate onto this area vary widely. These include perception that this area has improved services,

forced relocation, close proximity to higher educational centers and job opportunity centers, relatively cheap accommodation for migrant workers. The other major reasons are saving in transport cost, as this area is very close to the areas of employment and city centre.

The migration of people into these areas is resulting in increased water service demand. A small percentage of population moved from urban area to this area for the reason that they could afford to get land at low cost and there are cheaper or no service rates paid in this area. This however has a long-term impact on sustainability of water services provided.

3.2 Existing water service infrastructure and usage pattern

The goal of this objective is to explore the present water service infrastructure and their usage pattern thereof. The level of water services varies in different villages and range from non-serviced to middle serviced. Although sanitation is an integral part of water services, it has however been found that past government and engineers mainly focused on water supply services. No well-planned sanitation services and up to certain extant water supply services are found in this area.

3.2.1 Existing water supply infrastructure

All villages have at least more than one source of water but their primary source of water is communal taps. It seems as if increase in population density was not considered on the planning phase as some highly populated villages have the same number (10 including working and not working) of taps as low populated villages. It is then found that former Transkei government installed the community taps without consultation of the community or studying population dynamics of affected community (Kwetyana, personal communication).

Of the 480 households none is having in-yard tap or in-house piped water system. This affects a total of the households included in the survey. Most of the people depend on communal taps, river streams, city taps, dams as well as harvested rainwater for domestic use. The households use water drawn from various sources for different specific purposes.

Figure 11 shows percentage difference of sources of domestic water with 70% majority of households depended on community taps but sometimes on other sources. Approximately 30% of the people living in peri-urban areas of former TBVC states do not have access to adequate water services as households still use traditional sources (river streams, harvested rainwater and other sources).

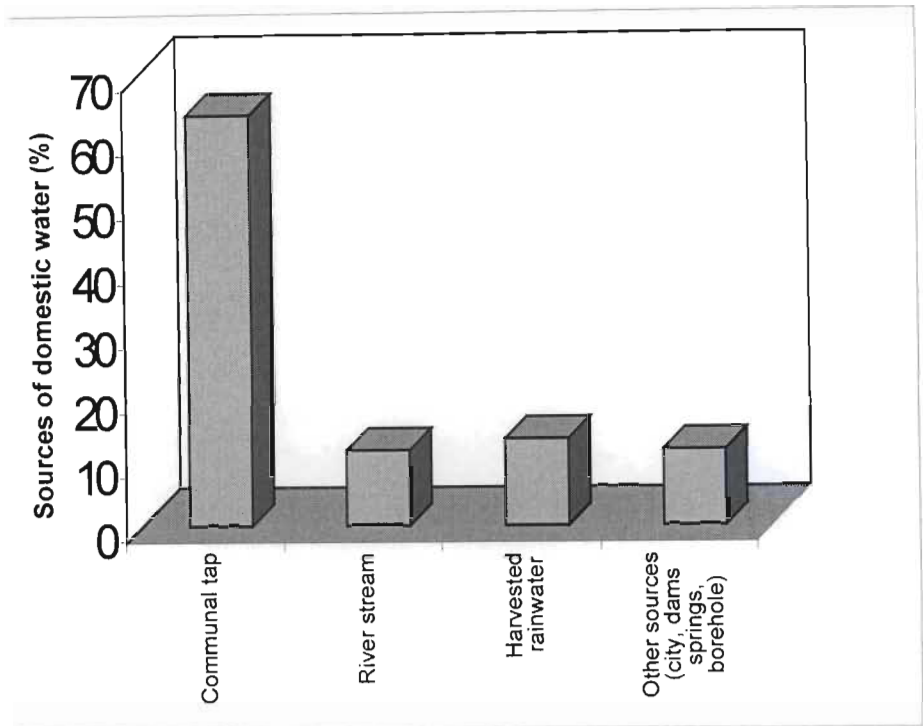


Figure 11: The water sources in the study area

Figure 12 is an example of community tap, it is located next to household plots and the wastewater runs through the plots. The dam of wastewater around this communal tap usually attracts domestic animals at water source points, hence one find these domestic animals sharing use of water services with the community.



Figure 12: Example of communal tap: poorly designed and sited and a muddy pool which could be a breeding ground for parasites and mosquitoes (*disease transmitters*).



Figure 13: Dam: contaminated water used for specific purposes with domestic animals sharing the use.

The dam water is recognized to be of poor quality, hence, this water is used for traditional mud-hut house construction and its repairs while livestock use the same for drinking. In the absence of adults children use the dam for swimming and other recreational activities and this practice terrible impact on general health of children.



Figure 14: River stream used as a source of domestic water and traditional laundry

Figure 13 and 14 show other sources of water as evidence that there are inadequate water services. Of the five peri-urban settlements studied, in Payne the community taps were noticed and reported to be no longer working for years and Mandela Park is the worst one with not even a single communal tap in place or operation. This can be attributed to the fact that it is an informal settlement and is relatively new. In other areas communities reported that most taps maintained a flow of water for only few hours a day, often randomly.

The communities in the study area do not have water committees and do not know who is looking after the communal taps. Breakages are reported to the Headmen or they notice themselves. The households think it is the Headmen responsibility and they are the only ones who know where to report and it is not their duty to keep the taps operational.

The sustainable communal tap discussed with these communities is a tap with high stand that would make it difficult for young children to reach a tap and with height that fit only buckets and 25 litre plastic drums between tap water opening and the stand as illustrated in Figure 15.

In addition to these design criteria a wastewater pan is advised to be part of the unit. This water spilling from tap stand will collect to this pan and water from this pan can be used for other uses of water other than those that need quality water. The wastewater that poses a threat to health and water resources can therefore be managed in this way.

The spacing of community standpipes should be based on realistic assessment of the following general criteria:

- Maximum one way walking distance should not exceed 200m.

- Maximum of 20 households should be served by one standpipe
- Peak flow in the reticulation supporting community taps should be on order of three times average annual flow.

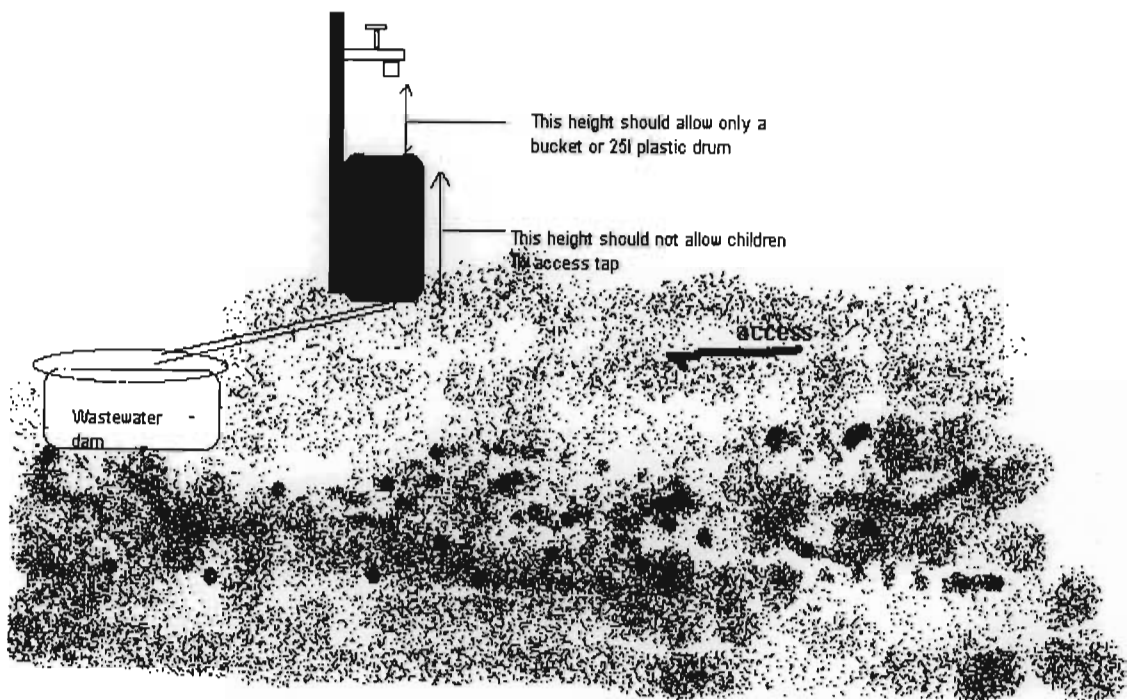


Figure 15: Envisaged communal tap.

3.2.2 Sanitation services

While there is crisis of expectations, in that communities expect waterborne sewerage that they use in areas of employment, there is

also a general unawareness of the fact that there are acceptable sanitation options like VIP's, at reduced levels of capital cost, between simple pit latrine and full waterborne sewerage. There is generally lack of water in these areas, it therefore seems unreasonable that sanitation options not using water should not be considered.

There is neither a sewerage system nor households with septic tanks in the study area. Households rely heavily on unimproved pit latrines and bush to discard of their body wastes. The study indicated that with the exception of the very poor, practically every household owns pit latrine of some kind (simple unimproved pit latrine), of which are build at the owners initiatives and costs as shown in Figure 16. Generally odour is noticed hence the toilets are sited some distance from the house. A distance of 5m is suggested. Some of the pit latrines are constructed by mud or scrap material or old corrugated iron and can be easily blown by strong winds or rains. It should be however noted that these forms of latrines are upgradeable with time as the socio-economic position of the household and his ability to pay improves.

It is observed that these pit latrines are not periodically cleaned and are poorly maintained and consequently have bad smell, flies and insect problem. Only a user who perceives the toilet seat to be dirty cleans it but not the whole toilet facility. They do not have seat cover to prevent the flies from getting in and out of the pit. The toilet doors do not tightly close and wind and dogs easily open and as a result bad

smell comes out and no one cares about closing the doors. It is hence suggested that communities should be made aware and encouraged to maintain their pit doors if they do not have enough money to construct a new structure (Ventilated Improved Pit Latrine).

Households remarked that their toilets are only unsafe for the children and do not feel comfortable when using them. Hence children are permitted to defecate in bush or any area that is hidden or even within household site. The excreta near and around household plots and the houses are consumed by pigs and dogs that are wondering around. Culturally men and boys are allowed to pass urine at the walls of kraal and women behind the house. There are no educational programs going on concerning benefits associated with safe and healthy sanitation.

There is not even a single household that has a VIP which was built as part of 1994 National Sanitation Program (toilet seat and cement or R600 government subsidy from the National Sanitation Program) already discussed in the text and communities never heard about this program. This is therefore the duty of the local government in collaboration with the Councilors to work with communities to get this R600 or material subsidy in order to facilitate the improvement the sanitation services that are already existing in this area.



Figure 17: Sanitation facility: Unimproved pit latrine. *"No wonder people prefer to use bush"*

Although VIP's may appear to be costly, but constructing one is generally far cheaper than curing disease and environmental damage from unimproved pit latrines. The local government should encourage households to make small incremental improvements such as fitting vent pipes with fly screens. This way the community will be empowered to bring about changes that will greatly improve their health and quality of life.

In sites where there is a communal tap, wastewater is a problem. This is because there are even no wastewater drains designed to collect wastewater from communal taps to safe area where it can reused so to avoid environmental health problems associated with wastewater. As seen from Figure 18 wastewater from communal tap is just neglected and find its way to any place that it can settle. Much of the pollution arises from these careless design and planning practices.

This wastewater may find waterways and flows into ground and/or urban water resources. The peri-urban community is the most affected by the deterioration of the physical and natural environment. Such impacts are enhanced by the already large, and still growing, concentration of populations in these areas.



Figure 18: Inadequate drainage: wastewater from communal tap.

Wastewater from bodily washing (sullage) is disposed off in the yard or the garden just behind the house (see Figure 19) in the garden. Water used for dish washing sometimes is stored and fed to chickens, pigs and other domestic animals. Failure to dispose this wastewater in correct area e.g. soak pit at the corner of the garden, results in accumulation of this sullage water with the resultant odour, diseases and negative environmental impacts.

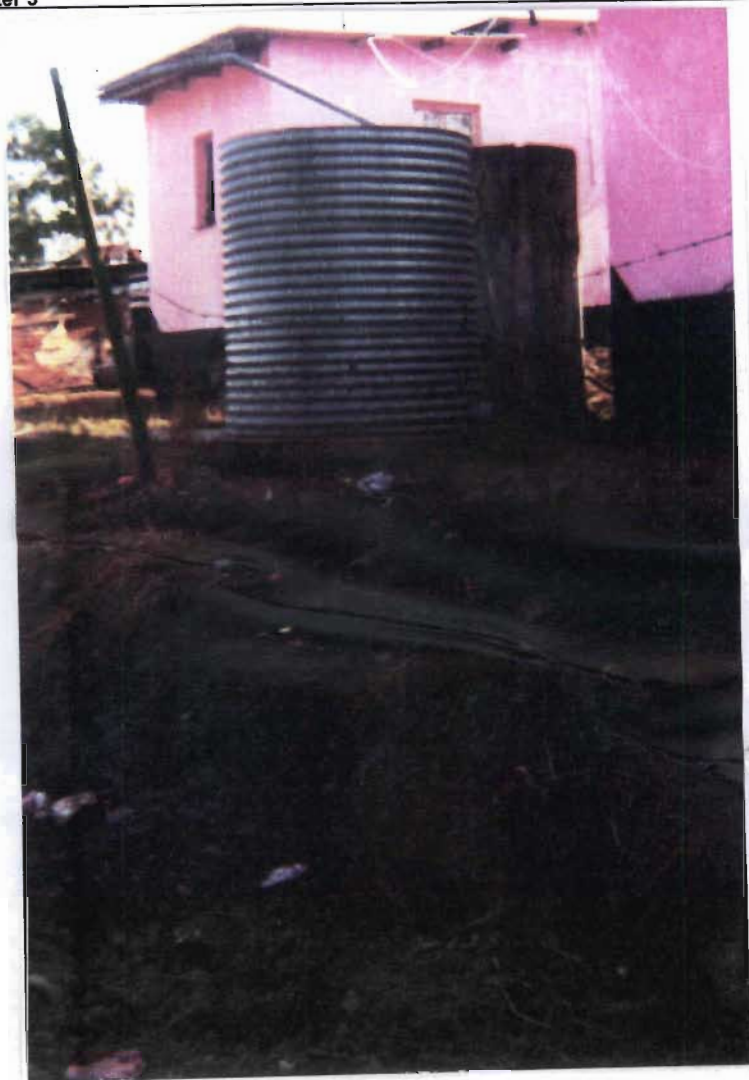


Figure 19: Wastewater drainage problems at back of the household plots.

Evidence of this as shown in Figure 19 is the pools of dirty water that accumulates around the households as there are no drains or sewers for disposal of wastewater. Some household plots are contaminated with baby's excreta as well as domestic waste which can also become a breeding site for and attract vermins like mosquitoes and flies that act as vectors of water-related insect diseases. This problem is worse in households with high number of tenants.

3.2.3 Patterns of water usage

The effort spent in obtaining water makes the pattern of water usage not wasteful as compared to modern standards. The most common form of container that is used to collect water is 25-litre plastic container. It is mostly transported to the household by a wheelbarrow over or less than one-kilometre distances.



Figure 20: Queues of containers waiting to be filled with water from communal tap.

Figure 20 shows long queues of the collection containers used by households. It is also evident that households have to wait long times before one gets water. To avoid this households fetch water with

multiple containers at once thus making one trip per day to the water source point. This usually inconveniences other households who are in hurry and social conflicts result.

Buckets are used mostly by households without possession of wheelbarrows or those near the water source and are transported by putting them on top of their heads. Figure 21 shows percentages of different transport means. Basically wheelbarrows are the preferred means of transport but due to unaffordability to buy wheelbarrows people resort to head transportation.

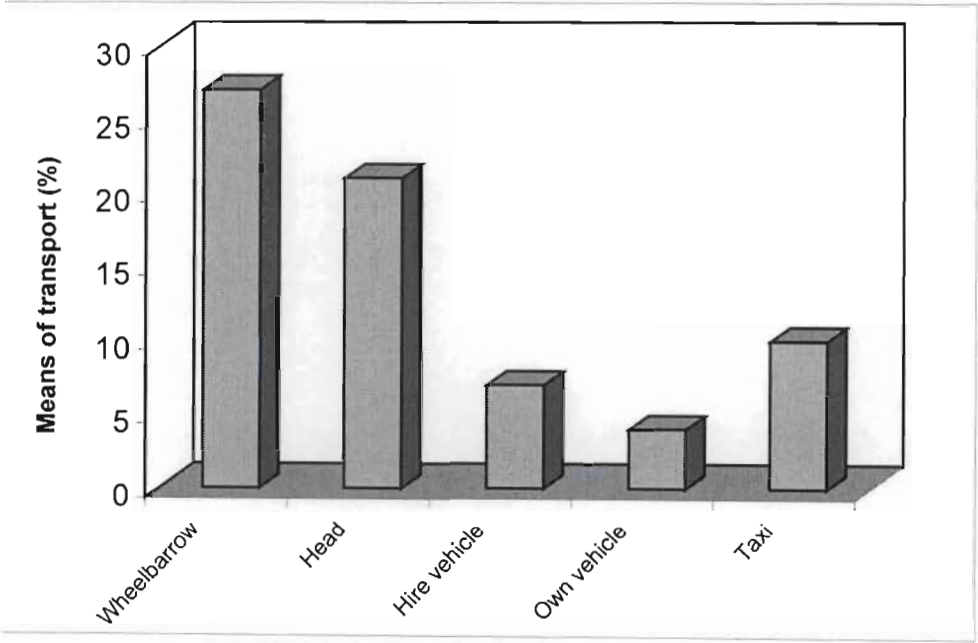


Figure 21: The percentage use of different water transportation means.

Housewives and children of school going age are responsible for water fetching. They fetch water during the afternoons and when schools are closed, housewives are released from fetching water especially during the day. In the Xhosa and in most African cultures, it is the task of women to collect water and its them who report back and neck injuries, as they have to lift heavy containers from the ground to home.

Some dwellers collect water into many large containers by motor vehicle or ox-wagon especially if are preparing for certain function e.g. funeral and feasts. Other households have to wait for hours to get water from that particular tap or walk long distances to another communal tap. This practice results in social conflicts that could have been avoided. To avoid this the government in partnership with the communities need to put more funds for the addition and expansion of the already existing water service infrastructure.

Once in house most households keep their water containers inside closed. However once poured in open container for easy use, it is noticed that the container is kept unclosed and therefore this water is prone to contamination by flies and germs. Figure 23 shows that households usually leave the dishtowels, enamels containers unprotected. This makes it easy for flies to transmit disease-causing germs from the source to the host.



Figure 23: Water storage pattern in household with open bucket full of drinking/cooking water.

If properly protected between source to the household, the above statement implies that contamination of water occurs mostly at the household unit rather than at the source and most of the respondents reported that they do not treat water before use irrespective of the source. This also applies to households with water storage tanks on their plots.

Except for the poorest of the poor household, as shown in Figure 24 every household has been provided with gutter system and storage tank. Harvested rainwater is kept in tanks and big containers purchased

at owner's initiatives and this water is considered to be a precious material by these communities who experience inadequate water services.

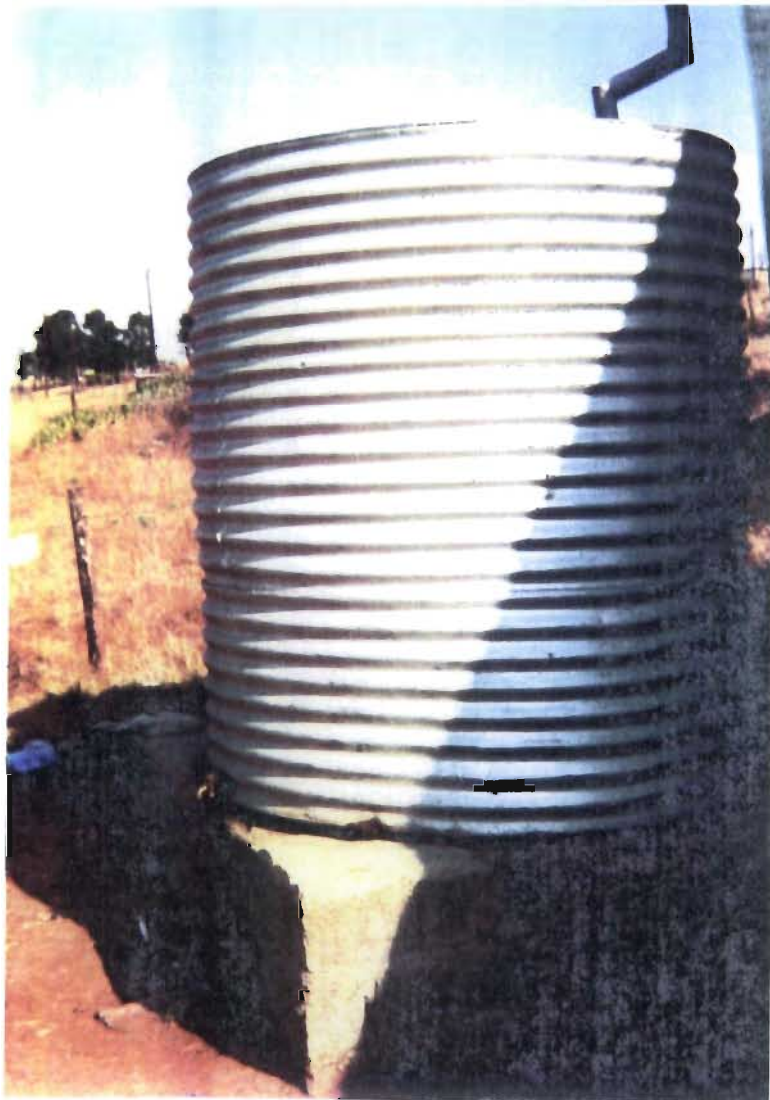


Figure 24: Water storage tank and a gutter system leading into the tank.

The water from the tank is used exclusively for drinking and cooking. The tank is usually locked in order to prevent children from playing with this water. However, water storage tanks offer a good breeding site for bacteria and algae if there is no rain. It is suggested that communities should be educated to treat water storage tanks periodically with at least Jik or HTH.

3.3 People's awareness of benefits associated with improved water services

It is not enough to simply put new services. Care must be taken to ensure that problems experienced in the past do not deteriorate the new or upgraded services. Workshops and well-credited programs must be implemented to cover benefits and financial implications as well as environmental benefits associated with effective water services.

Majority of the respondents have relatively poor understanding of benefits associated with improved water services. They are unable to make a link between poor water services and the presence of diseases such as diarrhea, hookworm, etc. It became clear that users have placed a high focus on other social issues than water services. However, there is a reasonable number of respondents who indicated that there is a need for improvement and this reflects the need for improvement.

Only when water services issue is introduced, 80% of the respondents desire for a change-over from traditional services communal taps to in-yard taps and any improved sanitation system and are willing to pay for such improved services. Perceived comfort and convenience that is offered by yard connections in urban areas and areas of employment are thought to have inspired this desire. One of the respondents said, "people must donate money to improve water supply because water is one of the most important thing that one cannot live without". Because of the unreliability, crowding and quarrels at community taps, most of the respondents want yard taps instead of more community taps being installed. In many cases, the opportunities for socializing while drawing water or washing clothes is not considered a benefit and in many instances have a negative value.

However community water infrastructure designed without allowance of private house connections would not be adequate to support private house connections. If upgrading is considered, the infrastructure would require considerable replacement of materials. In water supply infrastructure design, consideration should be given to the fact that increased demands may be made in the future as an increase use of water service infrastructure occurs and simple means of reinforcing the reticulation should be borne in mind at the time of initial design.

The collected data shows that 90% of people in these communities are not aware of any health benefits associated with improved water service especially with regard to sanitation services. They do not believe untreated water and unsanitary conditions can result in diseases and hence death. Some say their grandparents were using untreated water for domestic use and bush for defecation and they did not get sick and die. Some say they were born in these conditions and they are used to them.

Washing of hands after defecation and before eating is a dream that does not have any benefit. The only benefit that most of the respondents are aware of is time saving specifically in terms of queuing at the water source. Other than bad odour, they are not aware of any other benefits from improved sanitation services. The interviewed most poor households are even not aware that flies spread germs and bad odour attracts flies that spread germs. The awareness of benefits associated with improved water services is very important and need to be improved or increased using various programs available. These include: promotion of awareness at churches, schools, clinics and in households. Trained health care workers should do this. Awareness not only helps to promote desire for reliable services but also serves to motivate people to get involved.

3.3 Impacts of water services on users

Adequate water services improve the quality of life and reduce people's suffering and make the settlement more acceptable as place to live and work. The majority of the population recognise that their water service infrastructure is unreliable, for reasons unrelated to sanitation. Households perceive that their sanitation services are good enough for their daily use. In areas with operating taps, the number of plots hence households served per community tap on average was 15 and 60 respectively.

Other than long queues, 90% of the respondents reported that there were inconveniences at water source points such as interruptions for about two to three hours/weeks and have to resort to other sources of water like rivers and the taps in city centre and areas of employment. In this way water system may have a negative impact on the consumer in terms of health risk and energy spent when using alternative source like river or in terms of money spent on buying wheelbarrow and transporting water using public transport from city. Other impacts reported include: the need to wake up very early to collect water which may result in one being late for work or school. The time spent walking and queuing at water points.

When there is no water in a tap, containers are left in queue and therefore there is a risk that someone's container can get lost while in the queue, this results in social conflicts. There are no formal restrictions that prevent households from collecting any amount of water from the tap. The taps are not on centre position in relation to the whole settlement. They are positioned on the upper side of most settlements and as a result water lost from tap tends to move towards the nearby households thus creating environmental health problems. There are no trenches that have been made to redirect wastewater or rainwater to safe places. This implies that the level of drainage service is poor.

From field visits, the water loss by rough looking is expected to in the range of 10%. The water loss includes water used to rinse containers and spillage while filling the container especially by children. There are also signs of leakage at community taps. Some of the elite respondents are of the opinion that in most cases, loss of water does not result from malicious intent but rather from ignorance of the reasons for non-payment and poor knowledge of benefits of having communal taps

Kie District Council at the time of the study reported serious problems with maintenance of water service facilities due to lack of funds and vandalism especially by children as well as during community conflicts.

This implies that there is need to re-look at the design of taps that will not be easily accessed by children. However, this alone will not help, there should also be a close co-operation between community and service provider.

3.4 Factors that inhibit water utilization

The survey found, as was expected that there are many households using a single tap. For example, it was found that on average there were more than 15 household plots dependent on a single communal tap.



Figure 25: Evidence of children waiting for the availability of water from a communal tap.

The higher the number of households per tap, the more likely that there will be arguments over access to tap and interruptions especially during peak hours and respondents reported that they are avoiding such times and this limits water use. Figure 25 illustrates that in most communal taps there are always children and adults who are waiting for water to be available.

Overcrowding in communal taps reduces the level of service availability to the households. Walking distances between working communal taps varied from 200m to 500m. As walking distance increases the households are obliged to buy wheelbarrows hence the number of families who own wheelbarrows also increases. Those who do not have means to buy wheelbarrow in order to transport large amount of water are therefore restricted to use water as water they want.

Excessive walking distance and queuing is common at these water source points, some households prefer other sources of water such as taps at city and rivers. However in rivers, visible contaminants such as dead animals is often included in the explanations of the factors that limit river water use. Others choose to reduce water-collecting effort by washing clothes at the source e.g. in rivers and dams as is shown in Figure 26.

The wastewater from clothes washing is again discarded next to or directly into the river stream. This wastewater definitely drains back into the river. This indicates that the people in this area are not educated to be environmentally aware, as this wastewater will affect aquatic biolife and subsequent downstream users

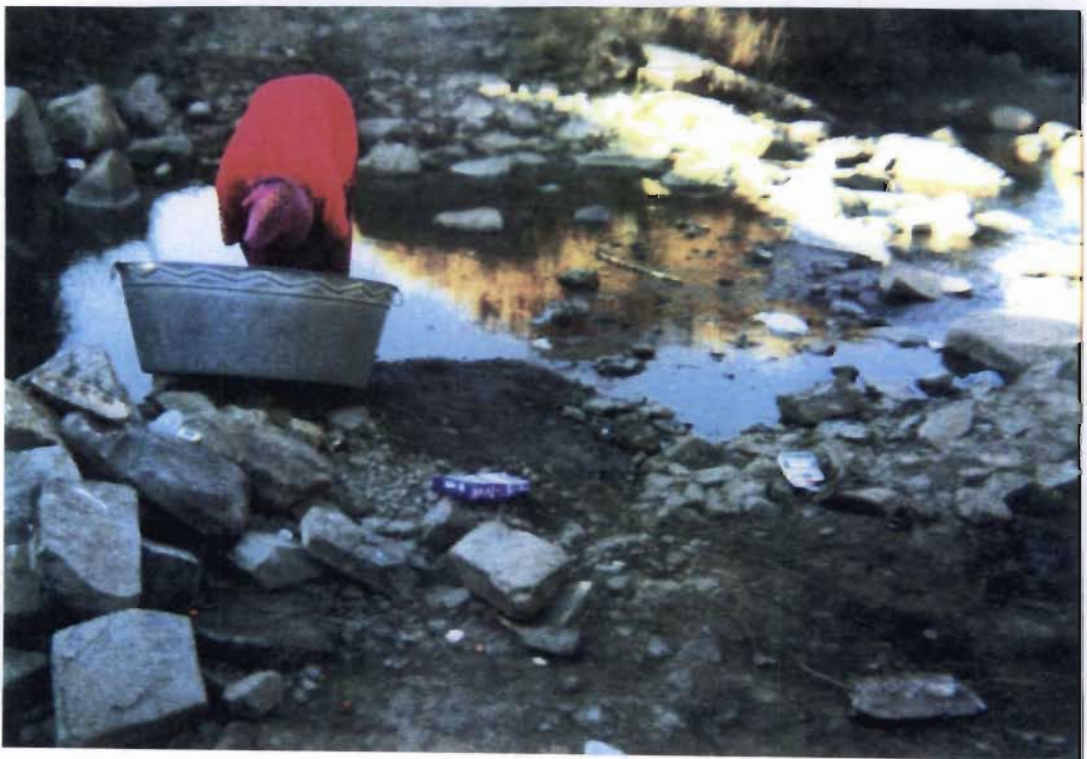


Figure 26: Household washing clothes at the river.

3.5 Affordability to pay for improved water services

Inherited dispensation from "Bantustan" governments, as found in the study area that is, not paying for water services raises some confusions when households are informed that they will have to pay for water services should they be improved. However, some households are aware to some little extent that adequate water services are an absolute necessity for life. The literate to some extent are aware of the debilitating effects of inadequate water services.

The study found that 70% of which is the majority are generally willing to pay for improved water services. 10% are those who do not understand why they have to pay for water whereas they were promised free water by Politicians and were all along not paying. It is found that 20% of people were unwilling to pay small amounts for improved community taps, but are willing to pay larger amounts for yard taps.

The desire for changeover from community tap water distribution infrastructure to individual yard connection seems to be the trend. Those who are willing to pay small amounts also put condition that they will pay if the tariffs are to be determined in consultation with them and be affordable for all. Presently, water from communal taps is not

charged and the community is aware that should they want their water services to be improved, they should pay for it.

The culture of non-payment should be addressed and be a part of education and awareness programs like Masakhane Campaigns. The understanding of the need to pay, how the service fees are to be collected and used should be included. On service fee determination all stakeholders should be represented and every aspects of the water service from engineering design to commissioning should be explained to the community.

Ten rand per month may seem little and enough but to those with low or no income it can be out of reach. These poor of the poorest will be faced with a dilemma of choosing between spending money on food or water. Some of the respondents said service fee would deprive their children food and they choose to still search for water, no matter how long the daily track. Exceptions can be made for those who are dependent on social grants, but everyone will need an exception and hence the service collapses. It is in these social grants that most households have to ration for service fee, transport, food and other social issues. This is an interesting challenge for all stakeholders, the government, and engineers, for what is the point of promising “access” to water services if it remains unaffordable to some.

CHAPTER 4

4.0 Discussion, Conclusions and Recommendations

4.1 Discussion

The expectations of the former disadvantaged communities regarding their access to basic water services have grown tremendously since the 1994 democratic elections in South Africa. However, the government policies regarding the acquisition of these services now requires community participation and ownership as a prerequisite for delivery of services. In order to meet these requirements extensive work with CBO's and institutions is needed in terms of skills training, capacity building, technical support, planning and facilitation of project implementation, where communities are expected to plan, manage, implement and maintain their own water services.

It has been found that the households from peri-urban areas of TBVC states are coping with relatively inadequate water services. These communities either use unreliable communal taps or traditional sources such as rivers and dams. The desire for improved water services is however the natural tendency observed in the study area. This argument

is supported by data collected listing water services as first priority and roads the second, electricity, roads, clinics and schools following and sanitation services the last. Even though water services were community's first priority, electrification of households was given the first priority by the government. This makes it is clear that the government of that time never consulted the community concerning their priorities.

In some of the villages such as Sibangweni that already have existing water services such as communal taps, dwellers are dissatisfied with the performance and reliability of the existing water services and are considering and hoping for more reliable water service infrastructure.

Communities of the study area need yard taps as well as to the lower extent improved sanitation services. 70% of people are generally willing to pay, however their realistic education level and better job opportunities hence financial income in most cases suggest that these people are poor and cannot afford to pay large amounts like one thousand rands at one time and monthly tariffs according their consumption. It is therefore suggested that the selection of appropriate water service facilities should be in accordance with 25l/day volume of water that needs to be delivered to the domestic water user (Van Schalkwyk, 1996). This implies that reliable water services such as in-yard taps as mentioned above will take long to be in place in these peri-urban areas.

Even though the government is aware of the benefits associated with improved water services, but emphasis is being placed only on water supply with little or none to sanitation services. Palmer Group, 1994 reported that this position provides an important opportunity to promote public awareness and improved sanitation services and environmental education especially during water meetings.

In order to promote public health awareness on improved sanitation and water services the RDP office and Department of Health state that (1) There should be an increase in the training of community health care workers. (2) There should be a program of retraining and re-orientating all health workers at a primary health care approach. This program promotes a shift from mere inspection to education and demonstration. However, there is a general feeling that a more proactive role in health education and promotion is likely to take a number of years to develop. Educating community to practice basic water treatment activities, such as boiling, addition of disinfectant and washing hands after defecation are more practical actions.

The program should also raise awareness about hazards associated with use of untreated water and improper sanitation. They should also focus on the need to reduce unnecessary waste of water in taps and in households

and proper disposal of wastewater as well as household solid waste. Increased water usage associated with increased level of education, income as well as increase in population density is thought to increase wastewater drainage problems in underdeveloped villages (Altaf *et. al.*, 1993). This implies that wastewater drainage system should be taken into consideration in planning and design engineering phase of village water system.

Even though people are made aware of negative effects of wastewater and poor sanitation, majority of the people in these “traditional” villages are resistant to change and have poor environmental values. The evidence of this is open drains that line both sides of the pathways that carry stagnant water that is often overflowing and creating public health and safety problems. This can be attributed to the past government planning engineers past policies that did not pay adequate attention on drainage issues next or around the communal tap.

Presently water from community taps is free as communities do not pay for operation, households therefore have no incentives to conserve water and tend to be careless or else, households find many other uses of water when it is available essentially free. One result is creation of low pressure in water reservoirs and hence unavailability of water. In order to ration this, it is suggested that the taps should be provided with a form of flow

restrictor valve. Because of high usage of water the systems the system become unreliable and as a result only few water taps run water and people must still find other alternative private arrangements to supplement water needed and thus too many resources are expended hauling water inefficiently. If this can happen with the new services the households will not be willing to pay much for such services.

In addition to education and awareness, in order to avoid waste of water and vandalism it can be suggested that the government should implement a legal system on community level on how offenders that waste water or brake water facilities should be punished and face heavy fines or imprisonment. In this way people will learn by example e.g. on what happens when one breaks the water facility.

If households can afford the higher costs associated with yard taps and metered connections as well as VIP's. The higher prices will enable the government to collect higher revenue to pay for the increased running costs and provide to chemicals to treat VIP's. However, if the government settings fail to hold specific individuals responsible for performance of systems, systematic failure is almost assured with minimal chance of corrective action (Howe and Dixon, 1993). Thus it may be very difficult to fix the blame for inefficiency. The results of the survey generally suggest that this would be a popular policy change in the near future. This means

that policies and engineering designs should be made to cater for this popular desire of in-yard taps.

It must be accepted that VIP's creates a point source of pollution especially in areas with sand or gravel soils, as pathogens travel fast and long distances on these soils. In such areas, shallow wells and uncased boreholes should not be used for water supply purpose.

Modern households with higher income were found to provide themselves on their cost with gutter system and water storage tank or big container. The problem with gutter system is that, the gutter leading into the tank is usually not diverted to discard the initial runoff, which is usually polluted with dust and other debris. This normally lowers the quality of water harvested from the roofs. Hence it is suggested that when it starts raining, gutter leading to water storage tank should be diverted to prevent that initial polluted runoff from entering the water tank. Rainfall pattern of the area however is a restrictive influence that hinder on this household initiatives, for what is the use of buying tank that is or will be always empty. When is full after good rains, it is suggested that it should be locked from use by children.

70% of which is the majority of respondents favoured paying for improved services. Of course, the decision on whether to install in-yard taps and

VIP's must take a full consideration of the cost of purchasing plumbing material, hiring experts, building and maintaining of these facilities. Once water service system is in place, distortions in operation and maintenance usually arise. There are many factors that lead to lack of incentives for good operation and maintenance. For example, water service projects are generally administered from the national and provincial level with little direct contact with project areas (Howe and Dixon, 1993). Good maintenance and operation with the assistance from the government is thought reduce water service delivery problems, promote socio-economic development and quality of environmental resources.

4.2 Conclusions

Based on the findings of the data and the interviews conducted, it can be concluded that effective hygiene education, political will of the government and the availability of technology to bring improvements to the poor at a cost that they and the government can afford is the solution. In order to achieve this it is suggested that, there should be fresh different approach to the planning, design and management of domestic water supply and sanitation services especially for peri-urban area of former TBVC states. This includes the necessity to consult the affected community in order to identify area cultural water requirements and to determine what level of service is adequate, acceptable and affordable in order to ensure

sustainability of water services. Furthermore the need to maintain and operate the system and also awareness education programs concerning benefits associated with improved water services also need to be considered.

Objectives of the study were and summarized as follows:

- Identification of existing water services, their impact water usage pattern and the need for new or upgraded services.
 - Investigation of people's awareness and ways to promote awareness on benefits associated with improved water services.
 - Investigation of impacts of water services on users.
 - Examination of the factors that limit water service infrastructure utilization.
 - Investigation of the affordability to pay for improved water services.
1. Identification of existing water services and pattern of usage were conducted. Water service facilities are inadequate and deteriorated. It appears that provision of yard taps is favoured and toilets given the least priority. Water is mostly collected and transported using 25-litre container on wheelbarrow. Water is prone to contamination when stored in open water bucket at household. Sanitation facilities are primitive and are constructed for the reasons of convenience and privacy. Newly designed communal taps that will not be easily accessed by the minors is recommended.

2. People's awareness of benefits associated with improved water services was examined. Only energy and time saving benefits are give high profile. These results imply that interventions should be made aiming at health promotion e.g. promoting better kitchen and toilet hygiene. Appropriate consultations before holding workshops should be made as people seldom read or listen to notices while on the other hand audio-visuals are expensive to hire. People are generally willing to serve in water committees and to be trained as plumbers in order to maintain water infrastructure.
3. The impacts of water services on users were studied. It is found that water service systems are unreliable. This result in tremendous waste of time and money by water users as well water-related diseases which are amplified by stagnant wastewater found in drains or back and neck injuries or pains reported by women who have to collect water and lift heavy containers from the ground to home. It is suggested that reliability can be achieved by promoting benefits associated with improved water services.
4. The factors that limit water service infrastructure utilization were investigated. On average in all villages more than 15 plots share a tap. It is found that most social conflicts arise in communal taps, poor

guarantee to get water and long queues often encountered limits water use. Poor safety, bad smell, untidiness and worn toilet or/and toilet seat do not affect the use of toilet. These cause households to prefer using bush to defecate.

5. Affordability to pay for improved water services was investigated. Financial considerations are ultimately the decisive and controlling factor in many decisions and actions. Most households have to some extent have the source of income e.g. government social grant. However the reality is that most the poorest of poor cannot afford paying high amounts other than unwilling to pay and this is where equity should be applied.

4.3 RECOMMENDATIONS

1. Levels of service required from service infrastructure should be geared to the affordability of the community and as far as is practical, water like electricity should be metered and paid for. Upgrading of service infrastructure in the future projects must be considered when planning the initial development phase.
2. Public participation should be integrated in planning as necessary input for both efficiency and equity for any government proposed development especially water service projects. It should be recognized

that this process could lead to a very real tension both at grass root level and at a government level. People want water services and they want them now, but the process of community participation (EIA) eventually slow down the rate of delivery. But it is in the best interest of South Africans to rather do the job correctly and thus ensure sustainability than to meet short-term objectives with the subsequent possibility of failure and high replacement costs.

3. In planning phase for water services, upgrading of the infrastructure and the people from informal settlements should be considered as they are part of South Africans and in-close proximity to the effected communities i.e. peri-urban communities. Should the people from these settlements not taken into account, there is high probability of conflicts with people who are paying for water and then these people will consequently stop paying for water services.
4. The present government planners need to obtain a better understanding of living patterns and dynamics of peri-urban areas of former TBVC states. This implies that studies on population and living dynamics of peri-urban areas of former TBVC states should be conducted. These studies will help in the designing and planning of sustainable water service facilities. Once in place monitoring by services provider is greatly. Monitoring helps to assess the real value

and sustainability of the services provided. Installing new taps or VIP's is an easy part, the real test come in monitoring whether people pay into Community Fund so to maintain new taps and toilets. Failure to do this results in problems that should have been avoided

5. Because of culture of non-payment, the tariffs should be made affordable in order to gradually familiarize people with paying. In meetings the community should be encouraged and informed of the need to pay and it should itself have say in a tariff determination and whether payment should be per adult or per household per month. Should they not be informed, they will not pay. Payments should be made by door-to-door collection and receipts should be issued in order to make sure that records and amounts balance. Proper Communications should be in the local language spoken by that community.

Presently, South African government is striving to provide water services to all and giving free 600 litres to the poor of the poorest but this process should also balance economic restraints against the cost of putting new or upgrading water service systems in peri-urban areas of former TBVC states and remote traditional villages.

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SURVEY QUESTIONNAIRE

**QUESTIONNAIRE FOR AN ASSESSMENT OF WATER SERVICES IN A
PERI-URBAN AREA OF UMTATA (CASE STUDY)**

1. PERSONAL DETAILS

Date of birth

Gender

Date of interview

House address

2. POPULATION DYNAMICS

1. How long have you been living in this area?
2. What made you to stay here?.....
3. Where did you live before coming into this area? ☐ Rural ☐ Urban
4. Do you have any tenants in your household? ☐ Yes ☐ No
5. If yes,
why?.....
.....

3. OBJECTIVES OF THE STUDY

1. What is the source of your domestic water
If other is it protected from pollution
(a) In-house tap (b) Tank
(c) Communal tap (d) Neighbor's tap
e) Other.....
2. If other, is it protected from pollution? ☐ Yes ☐ No
3. If communal tap, who installed it?

(a) Transkei government (b) New South African government

4. If communal tap, how many are they in whole village?.....
5. If communal tap, how many water fetching trips do you do per day?.....
6. If communal tap, were you contacted before they were installed? ☐ Yes ☐ No
7. If yes, do you have water committee looking after communal tap services?.....
8. If communal tap, who is looking after its operation and maintenance?.....
9. How many households share water source?.....
10. Distance from the water source?.....
11. For how long do you wait to get water from water source?.....
13. How do you get water home?.....
14. What type of container do you use to store water?.....
16. Do you treat or boil water before use? ☐ Yes ☐ No
17. Is the container/s kept inside/outside open or closed?.....
18. Are there times when the water supply is interrupted? ☐ Yes ☐ No
19. If yes, for how long?.....
20. What other water sources do you use at times of interruptions?.....
21. What impacts does interruptions have on you?.....

-
-
22. Is there a facility for complaints and queries? ☐ Yes ☐ No
23. Do you pay for your water? ☐ Yes ☐ No
24. If no
why?.....
-
25. Do you want your water supply to be improved? ☐ Yes ☐ No
26. What type should it be? ☐ More communal ☐ in-yard tap?
27. If water source is improved, will you be able to pay? ☐ Yes ☐ No
28. If no why?.....
29. If yes, what will be the source of
income?.....
30. How are people who can't pay will be catered
for?.....
31. How will be the people motivated to
pay?.....
32. What actions should be taken in case of non-
payment?.....
33. Who will decide tariff?
- (A) Water services provider (B) Community
- (c) A+B
34. How much are you willing to pay?.....
35. If improved, who is going to maintain and operate the water service
system?.....

36. If improved, what benefits will you get from improved water

services?.....
.....
.....

37. Are you aware of any negative impacts resulting from use of contaminated water?

1..... 2.....
3..... 4.....

38. Are you aware of water-related diseases?

☐ Yes

☐ No

39. If yes, which are they?

1..... 2..... 3.....
.....

40. Are there any health education programmes going on in your community?

☐ Yes

☐ No

41. What type of toilet does the household have?

(a) In-house flush toilet

(b) Bucket system

(c) Pit latrine

(d) None

e) Other (specify).....

42. Who initiated you to build a toilet facility?.....

43. How many people share toilet facility?.....

44. Where do children defecate?.....

45. How is your toilet condition?

☐ Poor

☐ Unsafe

☐ unhealthy

46. Do you wash your hands after defecation?

☐ Yes

☐ No

47. If yes, why?.....

48. If no, why?.....

49. Do you periodically clean you toilet? ☐ Yes ☐ No

50. If household does not have toilet, where do members normally
defecate?.....
.....

51. Are there times when you have to wait while someone is using
toilet?.....

52. Do you have sewerage system? ☐ Yes ☐ No

53. If yes, is it efficient? ☐ Yes ☐ No

54. Do you want it to be improved ☐ Yes ☐ No

55. If yes, will you pay for sewerage system? ☐ Yes ☐ No

56. If no, why?

57. Where and when do you do your clothes
washing?.....

58. Where does the grey water from washing etc. often disposed of?

- a) Sewerage b) Separate drain
c) Nearby waterway d) Dumped in street
e) Dumped in yard f) Other

59. Are you aware of benefits from improved water services? ☐ Yes ☐ No

60. Which
ones?.....
.....
.....

61. Which of the following development is your priority (least them in order of preference)?

Electricity, roads, water supply, sanitation, clinics, schools and others (specify)?

1..... 2..... 3.....

4..... 5..... 6.....

RESPONDENT’S COMMENTS AND SUGGESTIONS

.....

.....

.....

.....

.....

.....

.....

.....

.....

I thank you for your support. NDIYABULELA