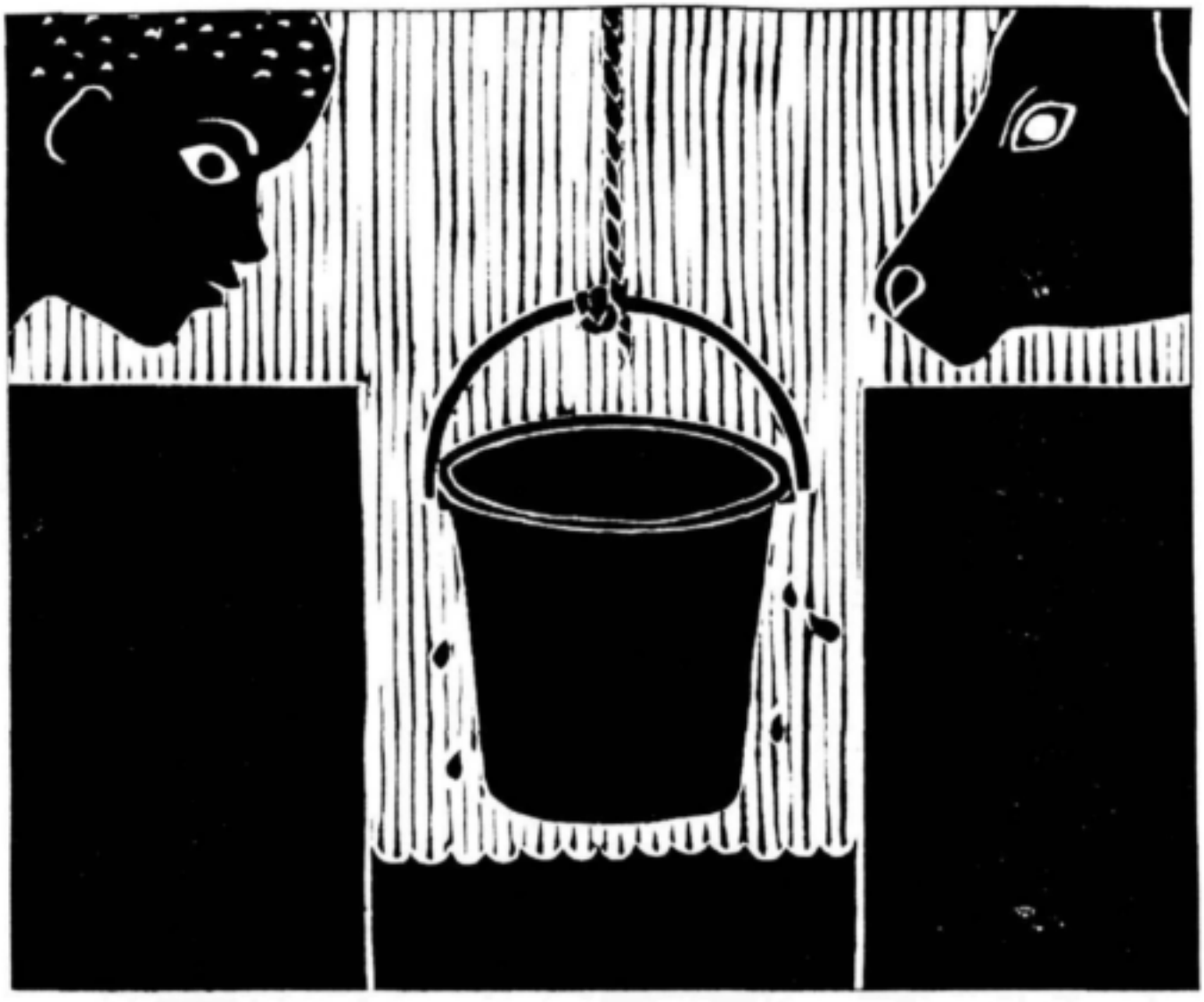
WATER RESEARCH COMMISSION



Winterveld:

Case study of informal water supply arrangements.

SUPPORTING DOCUMENT TO REPORT KV 73/95

Working paper prepared as part of a project titled:

Evaluation of Water Supply to Developing Urban Communities

May 1994

PDG PALMER DEVELOPMENT GROUP

P.O. Box 53123, Kenilworth, Cape Town, 7745
Tel: (021) 797-3660 Fax: (021) 797-3671

Preface

The Water Research Commission appointed Palmer Development Group to carry out an evaluation of water supply to developing urban communities in South Africa in May 1992.

The broad objective of this project is: to carry out a strategic evaluation of the present status of domestic water supply to developing communities in the urban areas of South Africa with a view to providing relevant and up to date information and analysis upon which rational policy and practice may be based so that the large and increasing demand for basic water supply services in developing urban communities may be met in an economically efficient and equitable manner.

The project was conceptually divided into three phases as follows:

Phase 1: Overview

a. A review of the current status with water supply to developing areas internationally.

b. Execution of a survey of water supply to the urban areas of South Africa, based on questionnaires and interviews, to determine who has access to adequate water supply, what type of systems are being used, and to obtain as much operating and cost information as possible.

Phase 2: Evaluation

a. Evaluation of water supply systems from the point of view of: level of access and acceptance by communities; technical options; cost; financial viability; management efficiency; and environmental impact. The method of evaluation was largely based on a case study approach.

Phase 3: Proposals

a. Putting forward proposals for improving water supply in these developing urban areas over the next decade.

b. Preparation of guidelines for the planning and implementation of water supply systems.

A comprehensive set of reports has been prepared for each phase of the project, as listed on the following page.

This report is one of the set of case studies which has been carried out to get a more in-depth understanding of the factors affecting water supply in South Africa, with an orientation as described below.

Orientation of case studies

The intention has been to select case studies to cover a wide variety of water supply situations, from those in metropolitan areas to those in "dense settlements" which are remote but still considered to be functionally urban. In each case specific factors of importance were identified. The findings from each case study have been drawn together in the summary report (Report No 20) where they are used to develop overall proposals for improving water supply services in South Africa.

It is important to note that the case studies are not intended to be used as a basis for planning water supplies in the particular areas studied.

List of documents

PHASE 1

1 **Main Report:** Evaluation of Water Supply to Developing Urban Communities in South Africa

Regional profiles: Domestic Water Supply : Regions A - J

2 Region A: Western Cape
3 Region B: Northern Cape
4 Region C: Orange Free State, including QwaQwa and part of Bophuthatswana
5 Region D: Eastern Cape, Ciskei and portion of Transvaal
6 Region E: Natal / Kwazulu
7 Region F: Eastern Transvaal
8 Region G: Transvaal, Gazankulu, Lebowa and Venda
9 Region H: PWV and the Adjacent Areas of KwaNdebele and Bophuthatswana
10 Region J: Western Transvaal including Bophuthatswana

Bulk Water Supply to Metropolitan Areas

11 Bloemfontein
12 Cape Town
13 Port Elizabeth

PHASE 2

14 **Ikapa:** Case study of a water supply system in a metroploitan area.
15 **Mamelodi:** Case study of a water supply system in a metropolitan area.
16 **Botshabelo:** Case study of water supply and sanitation arrangements.
17 **Inanda:** Case study of water supply arrangements to a peri-urban area.
18 **Winterveld:** Case study of informal water supply arrangements.
19 **Lebowa:** Case study of water supply in dense settlements.

PHASE 3

20 **Main report: Evaluation of water supply to developing urban communities: summary**

21 Costing of water supply arrangements.
22 Water and sanitation handbook for communities.
23 Guidelines for the provision of water supplies to developing urban communities (Still to be prepared).

Acknowledgements

The research in this report emanated from a project funded by the Water Research Commission and entitled:

"Technical, socio-economic and environmental evaluation of water supply to developing urban areas in South Africa".

The Steering Committee for this project included the following people:

HC Chapman	Water Research Commission (Chairman)
BM Jackson	Development Bank of Southern Africa
C Croeser	PLANACT
C Sweigers	Department of Water Affairs
B Myrdal	Development Action Group
M van Ryneveld	University of the Witwatersrand
JP Rodrigues	Municipality of Durban
S van der Merwe	Rand Water Board
A Fourie	Cape Provincial Administration

The financing of the project by the Water Research Commission and the contribution of the members of the Steering Committee is gratefully acknowledged.

The information upon which this document is based was obtained from a range of persons and organisations whose assistance is sincerely appreciated (see list of interviews at the back of the document).

Project team

This document has been written by Ernst Zöllner of Palmer Development Group, together with Eric Ngomane. Ian Palmer, Richard Palmer and Rolfe Eberhard assisted with data collection, editing and the drawing of conclusions. Frances Cullinan (edits), Trevor Hughes (graphs), Lynette Booyens (maps and figures) and Meta Zöllner (cover page) provided technical assistance.

Summary

Winterveld is an informal urban settlement and smallholding area in the Odi1 region of Bophuthatswana, north-west of Pretoria. Over the last four decades the owners of smallholdings in the southern portion of the Winterveld settled thousands of tenants on their land in an unmanaged and uncontrolled process of subdivision. In the absence of formal engineering services, an informal system of water supply developed. Tenants typically obtain water from boreholes and wells controlled by the landowners or shopkeepers. Water from this source is not only expensive and often inconvenient to obtain, but water quality tests have shown that most boreholes and wells are contaminated with faecal coliforms; traces of salmonella have also been found.

The southern part of Winterveld, a now proclaimed urban area known as Klippan, was reticulated with DBSA funds in 1989, providing 280 of the 1658 smallholdings in Winterveld with the possibility to connect to the formal supply system. Only 35 such connections have been made to date, a remarkable situation given the poor groundwater quality and the capital costs of the installed system. Reasons for the low connection rate include policy regarding connection applications, the high connection costs, vested interests by landowners in the sale of water from their own sources, fears about a lack of control over cost recovery on their plots by landowners, a lack of information within the community and poor communication between the community, designers and managers.

This case study of water supply in the Winterveld highlights the ineffectiveness of technical solutions to water supply problems which do not take cognisance of local social and economic conditions, including tenure arrangements. Inflexible national policies and guidelines often hamper progress in water supply at the local level. More innovative approaches are required to accommodate local requirements. Substantial sums have been spent on water supply in Winterveld over the last five years, but virtually no progress has been made in providing affordable and clean water to the community.

TABLE OF CONTENTS

List of Tables

List of Figures

1. INTRODUCTION

1.1 Case study objectives

The transformation of Winterveld from an agricultural smallholding area to one incorporating a dense, informal settlement in its southern part, has presented authorities and consultants with particularly complex development issues. Until the late 1970's virtually no infrastructure development or growth management took place in the area. Such gross neglect was to have been addressed in the creation of a Winterveld Development Fund, but little progress has been made during the last 15 years towards applying the funds to the most urgent development challenges in the area: water and sanitation provision.

Despite funding being available for capital projects, very few households in Winterveld have access to water which is safe to drink. The population relies on unimproved pit latrines as the only sanitation system. The lack of progress towards addressing these basic needs provides important lessons for design engineers and those involved in planning and operating water systems. The purpose of this report is to elucidate these lessons.

1.2 Methodology

The study has drawn from a range of published material on Winterveld, interviews with persons working in the area, and from the experience of Palmer Development Group as development consultants in the area.

1.3 Structure of the document

Section 2 of the document briefly presents the most important characteristics of the Winterveld area within the larger context of the PWV region. The important link between tenure arrangements and the level of infrastructure and services is explained.

The various water supply arrangements within the area are described through a series of tables, maps and diagrams in Section 3. In line with the objectives of the case study, the levels of access to water of the Winterveld population and the quality of water consumed are examined in greater detail.

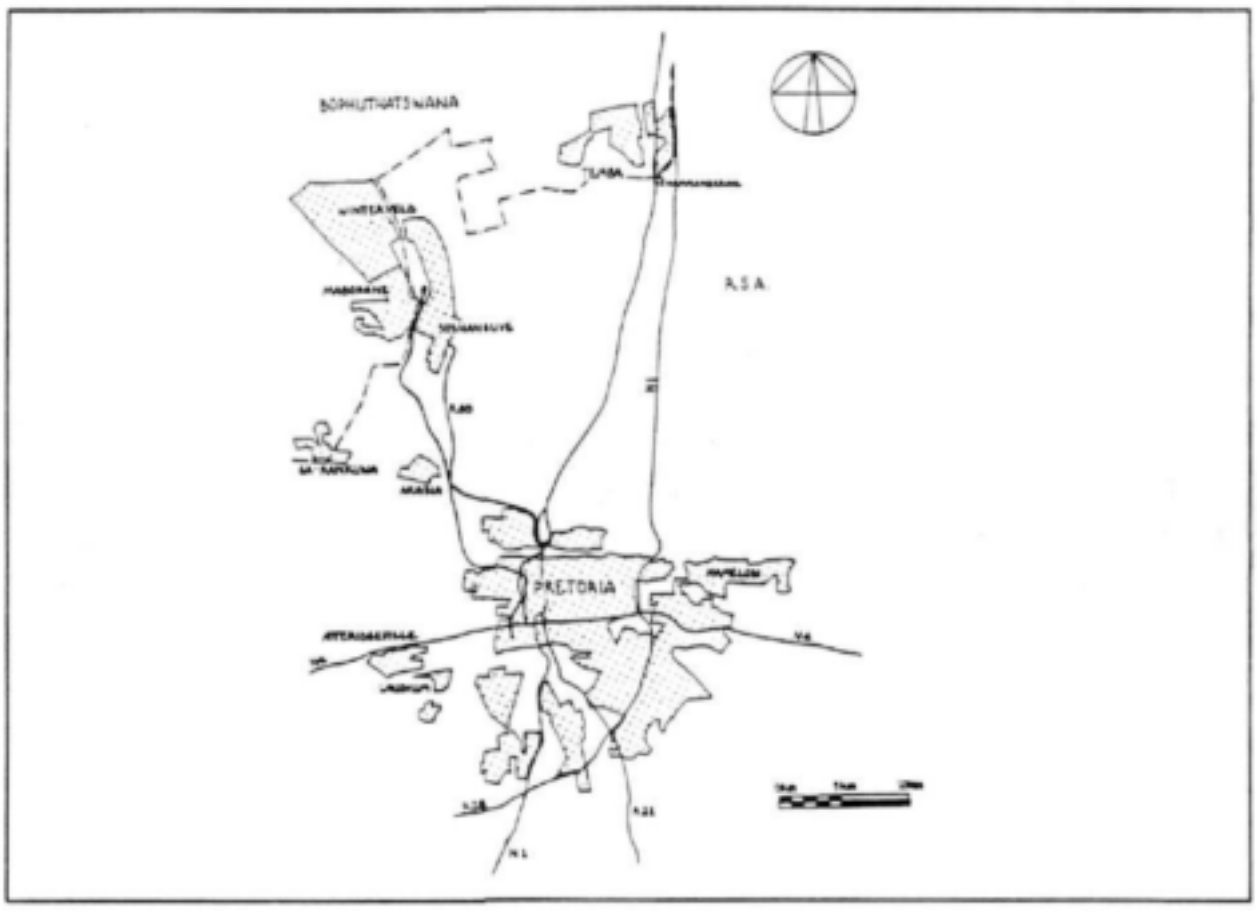
The document concludes with Section 4 which draws out lessons from this case study for future water supply in developing urban areas. These lessons are not conclusive statements, but rather pointers for future policy and project designs.

2. BACKGROUND TO THE WINTERVELD

2.1 Regional context

Winterveld is an informal urban settlement and smallholding area of approximately 9 500 hectares situated at the interface between the corridor of urban development along the southern border of Bophuthatswana's Odi 1 region and the tribal areas to the north (see Figure I). The economic centre to which the Winterveld relates is Pretoria, 30 km to the south-east. This makes it functionally part of the PWV complex, but, in political terms, the Winterveld is governed and administered from Mmabatho (340 km to the west).

Figure I : Regional context: the North-western Transvaal



Immediately to the south-east of the Winterveld are Mabopane in Bophuthatswana and Soshanguve in South Africa. The southern portion of the Winterveld and these two areas function as a single urban area clustered around the Mabopane railway station and bus depot. The main route to Pretoria is the Mabopane highway. The Lucas Mangope highway connects these areas to Ga-Rankuwa. Bushveld Road is the major north-south link through the Winterveld, connecting its northern parts to the Mabopane-Soshanguve node (see Figure II).

Figure II : Sub-regional context: Mabopane-Shoshanguve-Winterveld

Beirut and Lebanon are formally developed residential areas south of Winterveld. These two pockets were developed by Bophuthatswana Housing Corporation for the Bophuthatswana Department of Local Government and Housing (DLGH) to provide formal houses and plots to people from the Winterveld in the late 1980's. However, due to the expensive nature of the development, very few of the present population of these areas in fact came from the Winterveld[1].

2.2 Settlement structure

Winterveld is unique in terms of its history, land ownership, tenancy and style of housing. It is one of very few areas in South Africa where land was purchased by black South Africans before 1948, surveyed and legally registered in their names. This form of individual tenure has survived 'the Apartheid era' and the transformation from an agricultural smallholding to an informal urban settlement, and remains in place today. The following are important settlement characteristics of the Winterveld:

[1] Although officially considered part of Winterveld, for the purposes of this study both areas are considered separate to Winterveld.

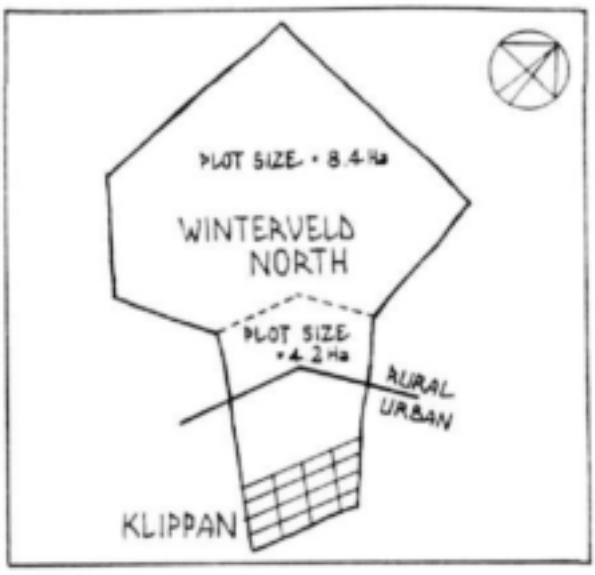
a) Urban south - rural north

Winterveld is divided into a rural, northern half and southern, 'proclaimed' urban half called Klippan (Figure III). The 1993 population is estimated to be approximately 180 000.

AREA	POPULATION (1990)	POPULATION EST. (1993)
Klippan	113 367	150 000
North	26 809	30 000
TOTAL	150 176	180 000

Source: PDG & Mosotoane (1993)

Figure III : Urban and rural transition



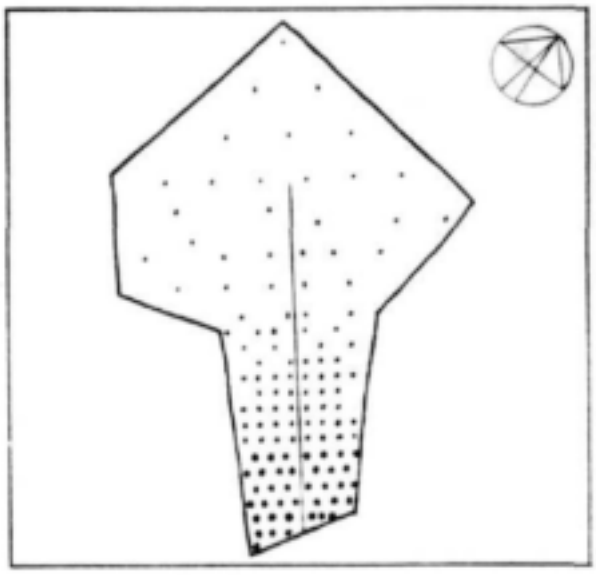
b) Higher densities in the south

Population densities are much higher in the southern portion of Winterveld and along Bushveld Road to the north, since people attempt to live as close as possible to bus and taxi routes and the train station (Figure IV).

AREA	PERSONS PER PLOT (1990)	PERSONS PER HECTARE (1990)
Klippan	218	52
North	24	4
OVERALL	91	16

Source: Setplan (1991c)

Figure IV : Population distribution



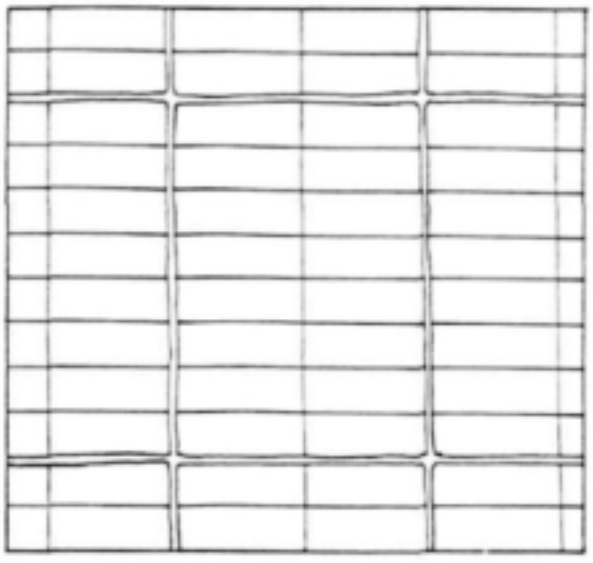
c) Regular grid of blocks

Plots are typically 4.2 hectares (5 morgen) in the southern part and 8.4 hectares (10 morgen) in the north (Figure IV). The blocks of 4.2 and 8.4 hectare plots are laid out in a grid-pattern and the individual plots within the blocks are clearly identifiable (see Figure V).

AREA	FORMAL PLOTS
Klippan	520
North	1 138
TOTAL	1 658

Source: PDG & Mosotoane (1993)

Figure V : Block layout



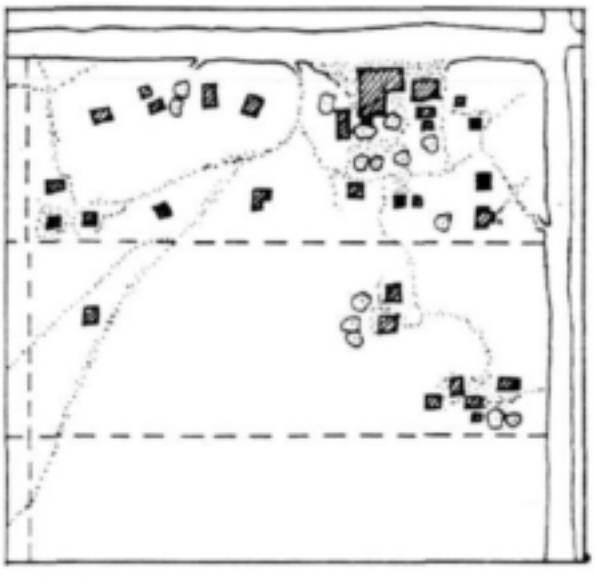
d) Informal housing layout

The layout of housing within each plot is informal in character (Figure VI). Large scale irregular subdivision of the agricultural smallholdings into rented portions resulted in haphazard homestead sizes and road patterns.

AREA	NO of DWELLINGS (1990)	NO OF DWELLINGS PER PLOT
Klippan	20 244	38
North	6 573	6
OVERALL	26 817	16

Source: Setplan (1991c)

Figure VI : Typical plot layout



2.3 The community

The community of the Winterveld is in many ways typical of informal settlements on the periphery of a major 'core' metropolitan area. It has a legacy of rapid, unmanaged growth, there are complex tenure arrangements, and its is dependent on the core area for income and additional services.

a) Rapid, unmanaged urbanisation

Since the early 1960's thousands of people have spontaneously moved to the Winterveld or were literally 'dumped' there by the state without any planning or control. Whereas some communities were 'pushed' out of "white" South Africa, others migrated from the rural areas towards the city.

The two major 'push' factors were:

- forced removals of about 30 000 people from areas around Pretoria (mainly the Lady Selbourne and Highlands settlements) and their subsequent 'dumping' in the Winterveld; and

- rationalisation and increasing mechanisation forcing workers and their families off farms in the Brits-Pretoria North region.

On the other hand, people were 'pulled' to the Winterveld because of:

- its relative proximity to centres of employment, particularly the Rosslyn industrial area;

- low rents compared to townships in Pretoria where an acute housing shortage made even backyard living expensive; and

- pre-1986 influx control legislation and the accompanying acute housing shortage in Pretoria townships which made the southern parts of Bophuthatswana's Odi 1 region one of the closest legal locations for black families to the PWV region.

Over the last two years population growth has slowed and stabilised. An increasing number of homesteads are abandoned with only shells of the wattle and daub houses remaining.

A number of factors have brought about this population stabilisation:

- the demise of influx control and corresponding growth of informal settlements in the PWV allowing households to move closer to Pretoria and other areas of employment;

- the large site and service development in Soshanguve which allowed many households in Winterveld to obtain their own land outside Bophuthatswana; and

- the above out-migration has been balanced to a degree by an influx of immigrants from countries such as Mozambique and Malawi, as well as high natural population growth. These people have taken over some of the homesteads of households which have left the area.

b) Landless tenants

Urbanisation in the Winterveld occurred through informal and illegal subdivision of the agricultural plots for large-scale tenancy and 'shack farming'. Today the approximately 1 600 plot owners (0.1% of the population) still own and control all the land in the Winterveld, thereby locking the population into a complex system of tenancy.

c) Dependency on other areas for income and services

Apart from a relatively well-developed retail infrastructure the area has very little formal economic activity. Virtually all formal employment and higher order commercial activity occurs in the 'core' metropolitan areas with nearly 90% of the formally-employed commuting out of the area daily (Setplan, 1991b).

Despite having higher levels of employment than other parts of Bophuthatswana, unemployment is high (40-45%) and wages generally low, with nearly 50% of all households having incomes of less than R500 per month in June 1989 (Setplan, 1991b).

2.4 Weak engineering and social infrastructure

It would seem that, the Bophuthatswana government originally did not want to have the Winterveld incorporated within its boundaries. However, resistance to incorporation was overcome by the creation of a 'Winterveld (capital) Development Fund' worth R212 million

in 1977. R140 million of this fund has been spent to date, but the social and engineering infrastructure remains underdeveloped and inadequate, given population size and densities[2].

The current situation with respect to engineering services is summarised in Table 1.

Table 1 : Engineering services in the Winterveld

AREA	HOUSING	ROADS	WATER	ELECTRICITY	SANITATION	SOLID WASTE
Klippan	• Tenants live in a mix of block and tin houses • Plot owners live in permanent brick structures	Gravel secondary roads, tarred main road	Boreholes, wells and some reticulated water	High voltage reticulation to shops and schools on 22kV line	Unimproved pit latrines and some septic tanks	Private contractor for institutions and shops only
Rural north		Gravel internal roads	Boreholes, wells and streams			

Source: Setplan (1991c), personal communications

Social infrastructure is also underdeveloped - there is only one post office, few telephones, one clinic and insufficient schools and community centres for this size of settlement. The result is a generally low standard of living caused by a lack of adequate access to basic services and facilities[3].

2.5 Institutional structures

Public administration and local government in the Winterveld is weak due to complex institutional arrangements, a lack of legitimacy of such institutions within the community, and a lack of community representation.

a) Complex institutional arrangements

The Winterveld is administered by the Winterveld Development Authority in the northern part and the Department of Local Government and Housing (DLGH) in the Klippan area. The DLGH is based in Mmabatho, and although there is a district office in the Winterveld, it performs only very basic administrative functions. Furthermore, the administrative

[2] The history and management of the Trust is described in Palmer Development (1993d).

[3] For detailed discussion regarding social and engineering infrastructure, see Setplan (1991c) and Setplan (1991d).

separation from Mabopane and Soshanguve (in 'South Africa') in the south is inappropriate since these settlements function as one economic and social unit[4].

b) Lack of legitimacy within the community

The Winterveld has a multi-cultural community. An estimated one third of the population is Tswana-speaking and the remainder have a wide variety of cultural origins. Largely due to lack of identity with Bophuthatswana politics, incorporation into Bophuthatswana was resisted by the local community. The introduction of Tswana-only education and other nation-building measures have caused political tension and clashes between the local community and the Mmabatho government.

c) Lack of community representation

The community does not have any formalised representation in decision-making by the various state departments involved in the area and, historically, the community has felt ignored regarding use of the Development Fund. This has created animosity towards state-sponsored development efforts. For example, when high-mast lighting was installed in the area in 1990, it was destroyed through actions of youths in the area.

[4] For a detailed discussion of institutional arrangements in Bophuthatswana regarding water supply, see Palmer Development Group (1993d).

3. WATER SUPPLY ARRANGEMENTS

3.1 Overview

Water supply arrangements in the Winterveld are largely informal and unregulated, reflecting the unplanned manner in which the settlement grew. Only a small percentage of households receive reticulated water. Table 2 compares existing formal infrastructure with what was in place six years ago[5].

Table 2 : Water supply infrastructure

TYPE OF INFRASTRUCTURE	1987	1993
Water mains	none	30 km
Plots adjacent to reticulated water	none	280
Plots with yard taps or house connections	none	35

Source: Department of Water Affairs and own calculations

The Winterveld population's access to water supply is summarised in Table 3, whereas access to formal water and sanitation supply is compared to that of surrounding settlements in Table 4. Both these tables are based on estimates and provide an indication of order of magnitude rather than exact figures.

Table 3 : Access to water infrastructure

LEVEL OF SERVICE	POPULATION	%
On site		
House or yard connection	200	0.001
Borehole or well in yard	5 600	3.1
Off site		
Communal and vending tap	7 800	4.3
Boreholes, wells, rivers, streams and other sources	166 000	92.25
TOTAL	180 000	100

Source: own estimates

[5] Throughout the discussion, 'Winterveld' refers to the whole of the settlement (Klippan and the rural north).

Table 4 : Comparison of access to formal water and sanitation between settlements

SETTLEMENT	POPULATION	ADEQUATE ACCESS TO FORMAL WATER SUPPLY (%)	ACCESS TO FORMAL SANITATION (%)
Winterveld-Klippan	180 000	4	0.01
Beirut	3 500	100	100
Mabopane	60 000	90	100
Shoshanguve	180 000	100	70

Source: Setplan (1991a) and own estimates

3.2 Informal water supply: ground and surface water

Informal sources of supply provide nearly 96% of the Winterveld population with their daily domestic water requirements. These include boreholes, wells, the Toloane River and smaller streams which are used for washing purposes.

a) Groundwater potential

Although the groundwater potential in most of the PWV region is not good[6], a high water table has ensured a sufficient and reliable supply of water for primary and stock consumption in Winterveld (Setplan, 1991c). Wells and boreholes are between 3 and 14 meters deep, and only some of the shallower wells run dry during winter months and mid-day hours in summer. Nearly every plot has a borehole or well, which is typically located in the yard of the plot owner. Wells are emptied with buckets and boreholes with various types of hand, diesel or petrol pumps.

b) Water charges

Water from streams and wells and boreholes on state or common land is free, but is not widely accessible. Water sources located on private land are not provided free, and the owners of plots control access to boreholes, wells and taps on their land. Given the lack of alternatives, tenant households buy water per container from their landlords, neighbouring plot owners, or nearby shops. The owners of plots in the Winterveld, therefore, control not only access to land (and housing), but also the supply of water.

[6] The sustainable 12 hour pumping yield in the area is generally less than 1 litre per second (Setplan, 1991).

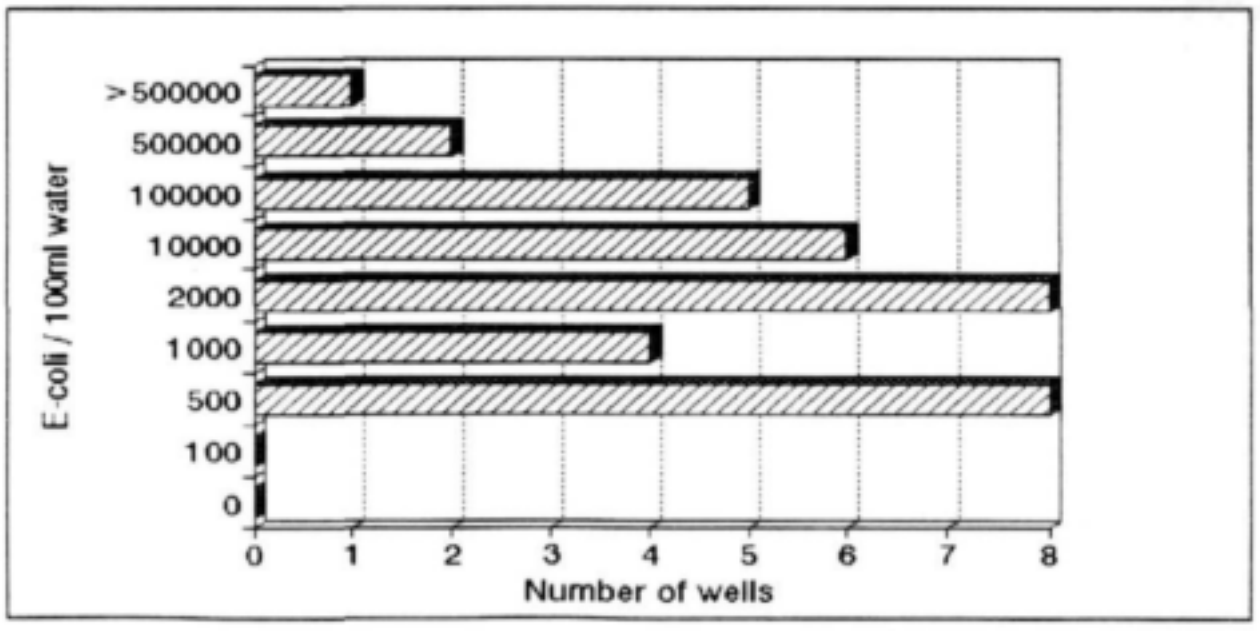
The price charged for water varies greatly throughout the area and is determined largely by competition between vendors. Water is generally sold at between 20-25c for 25 litres (R8-10 per kl), but some vendors charge as much as 30c (PDG & Mosotoane, 1991b). These very high charges reflect the effective monopoly which plot owners have over water supply in their vicinity.

A plot owner who supplies 40 households with water for domestic use could earn R40 per day from the sale of water (assuming that each household buys 100 litres at 25c for 25 litres). Being a water vendor (in addition to being a landlord) could augment monthly income in this case by R1000, a very substantial sum in the Winterveld. Income from water sales is generally substantially higher than income from rents collected, which makes the sale of water an important source of income from tenants.

c) Water quality

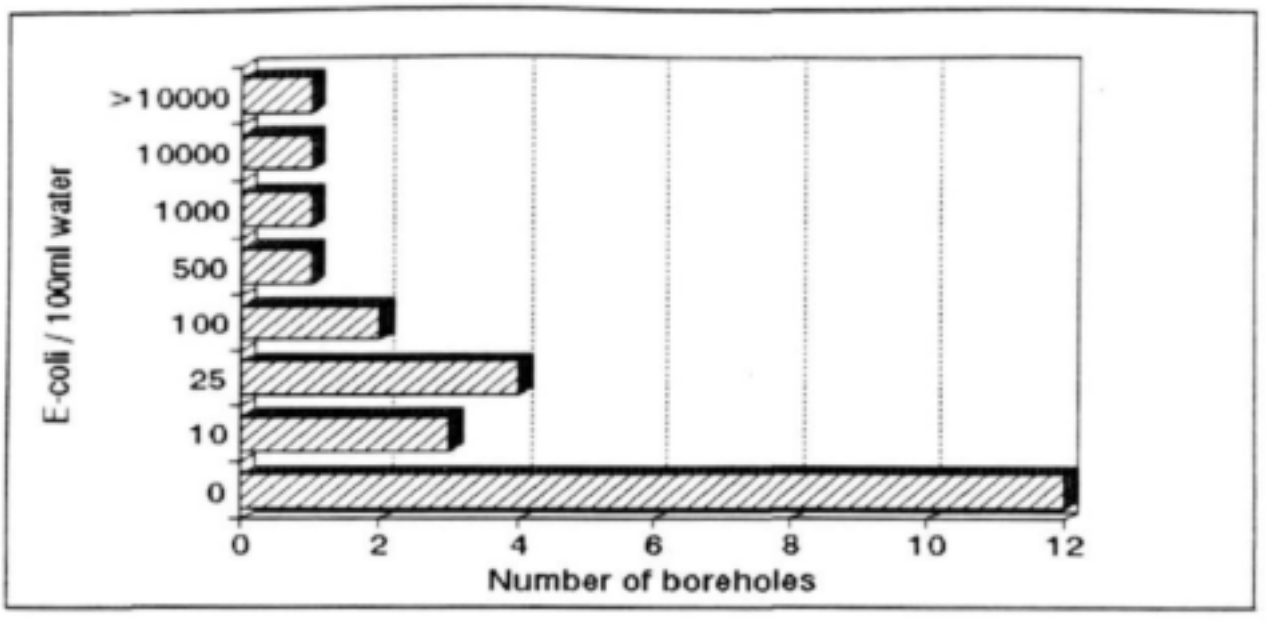
The quality of the water sold or obtained from the wells and boreholes is generally poor. An outbreak of typhoid in the area in 1991 resulted in an official investigation of groundwater quality for the first time. The Bophuthatswana Department of Water Affairs's Pollution Control Inspectorate tested the water from 34 wells and 25 boreholes for faecal coliform bacteria in February 1991, the results of which are shown in Figure VII and Figure VIII.

Figure VII: E-Coli bacteria counts in Klippan wells



Source: D. Gough, BDWAF, 18 March 1991, personal communication

Figure VIII: E-Coli bacteria counts from boreholes in Klippan



Source: D. Gough, BDWAF, 18 March 1991, Personal communication

Important findings from the test results were:

- None of the 34 wells tested and only 12 of the 25 boreholes tested were free from faecal coliform bacteria[7]. According to the WHO guidelines (1971), *no* samples from water sources used untreated for human consumption should contain E.coli counts in 100 ml water. Water from these sources should be disinfected and boiled before use to protect users from illness. This does not happen in most households[8] in the Winterveld.

- The range of E. Coli counts in the 34 wells tested was between 204 and 2,3 million per 100 ml of water, with a median of 1 600. Eight wells (or 24% of the sample) had over 10 000 bacteria per 100 ml, a level considered immediately dangerous for human health.

- The range of counts for the 25 boreholes was between 0 and 11 000, with a median of 1. Two boreholes had over 10 000 bacteria per 100 ml. Both are located close to pit latrines.

[7] E. coli is undoubtedly of faecal origin but not necessarily of human faecal origin. E. coli do not cause diseases but rather indicate presence of faecal contamination which may carry pathogens.

[8] Personal communication, Mr M.D. Motaung, Odi Health Inspector.

The Department forwarded 12 of the samples to the CSIR to be analysed for Salmonella (which causes typhoid fever) and other coliforms. The results of the further tests showed that:

- samples from one private borehole and from the Toloane River (used for washing and drinking) contained positive counts of Salmonella.

- the high faecal coliform counts were confirmed, ranging up to 700 000 per 100 ml.

Although a subsequent health care campaign in the area stressed the importance of boiling water before drinking or cooking, most households do not disinfect water before usage and plot owners and tenants are generally unaware of the bad quality of their water[9]. The health risk of using water from boreholes and wells consequently remains high[10].

The low quality of the groundwater is caused by:

- use of pit latrines in high density areas, in close proximity to wells and boreholes;
- the high water table and soil conditions which cause seepage and overflow from pit latrines into boreholes and wells and;
- leaving wells uncovered at night where animals graze.

Surface water has also been found to be highly contaminated with salmonella and faecal coliform bacteria caused by overflowing pit latrines, the high water table, and lack of a refuse removal service (see Table 1 in section 2.4).

When groundwater is used in a fairly densly settled area, with people using pit latrines, there is a potential for nitrates in the water to be a problem. However, a matter of concern is that no tests giving nitrate concentrations have been carried out.

[9] According to Dr Henning Tshibongu, Community Health.

[10] According to Mr Motaung, Odi health inspector, no cases of typhoid fever have been reported in the area over the last year. This is ascribed to factors such as the drought rather than an improvement in the quality of groundwater.

d) Consumption patterns

A 1993 survey of water consumption patterns in 445 households (PDG & Mosotoane,1993) found average household water consumption to be 120 litres per day, or about 22 litre per person[11].

Table 5 illustrates where and how interviewed households obtain their water.

Table 5 : Household water usage

SOURCE OF WATER	No. of h/holds	% of total	Ave. dist (m)	Ave. time(mins)	Colls. per day	Quantity per day (l)	Price per 25l
TAP IN HOUSE/ON SITE	26	5.8	0	0	0	0	0c
OWN BOREHOLE ON SITE	47	10.6	102	6	2	109	4c
COMMUNAL BOREHOLE	65	14.6	1 453	39	2	234	18c
COMMUNAL TAP	27	6.1	1 263	38	2	421	28c
RIVER/STREAM	2	0.4	900	60	3	125	12c
WATER VENDOR	262	58.9	810	25	2	79	24c
CANAL/DAM	5	1.1	1 220	30	2	84	26c
WELL	4	0.9	150	12	2	40	10c

The survey furthermore highlights the following:

Buying water

60% of households interviewed obtain their water from vendors, whose supply of water can be either piped or from boreholes/wells. An average of 79 litres per household per day are bought from such vendors.

Expenditure on water

On average households spend between R22 and R75 per month on water bought from vendors, plot owners or obtained from other informal sources. This amount represents about 2-5% of average monthly household incomes.

[11] Data from a joint survey in November 1992 by Louis Mosotoane and Palmer Development.

Collecting water

Children and women are generally responsible for collecting water, mostly in wheelbarrows. The average frequency of collections is twice per day (56% of households).

Distance to water

54% of households have to walk further than 500 meters to fetch water, a situation which is considered as inadequate access to water in Bophuthatswana (Palmer Development, 1993d). 32% of households have to walk further than 1 km.

Time it takes to collect water

It takes 41% of households less than 30 minutes per day to collect water, but for 11% this task can take more than one hour per day.

3.3 Formal water supply

a) Bulk water

In 1989 the southern portion of Klippan was reticulated by the Bophuthatswana Department of Water Affairs (BDWA) with funds from the Winterveld Development Trust[12]. This was the first water scheme aimed at supplying reticulated water to the Winterveld.

Bulk water is currently supplied by the Rand Water Board at 90c/kl via the Mabopane reservoir, which has a capacity of 55 Ml. This reservoir serves the fully reticulated areas of Beirut and Lebanon in addition to the southern portion of Klippan.

Until June 1993, only legal land owners had the right to apply for water connections. No tenant could apply for a water connection. The Department of Water Affairs has since consented to supply groups of tenants with water connections, provided they pay the connection fee, undertake to pay monthly accounts and obtain permission from the legal land owner to apply for a formal water connection.

b) Water tariff

Klippan was declared a sub-economic area of water supply. The water tariff since 1 April 1993 is:

[12] See reference to Trust in section 2.3.

- Consumption up to 15 kl/month - R0.70/kl
- Consumption between 15-50 kl/month - R1.30/kl
- Consumption in excess of 50 kl/month - R 2.70/kl

Current policy is to subsidise basic consumption below 15/kl per month, recover operating costs for consumption between 15-50 kl per month, and to penalise consumers which use more than 50 kl per month per domestic connection. Should plot owners wish to use more than 50 kl per month, they should apply and pay for further connections. This tariff penalty relates to policy that water supply should be subsidised to a limit of 1 kl per domestic connection per day (which is applied as 50 kl per month). The design of the Klippan reticulation system could accommodate consumption levels in excess of 50 kl per plot.

A family of six would be able to use 80 litres per person per day at the subsidised basic tariff. In Klippan, however, average plot populations of 230 persons imply that with only one metered connection, only a small fraction of the monthly water consumption will be at the basic rate. *If all people living on one plot obtain yard taps from the one metered connection,* the effective water tariff for Klippan will be in the order of R2.60/kl[13].

c) Existing reticulation

The existing reticulation network of 200mm pipes (bordering 280 plots) in Klippan is shown in Figure IX. It currently costs R 1 800 to connect, which includes the cost of the pipe from the plot boundary to the yard or house tap.

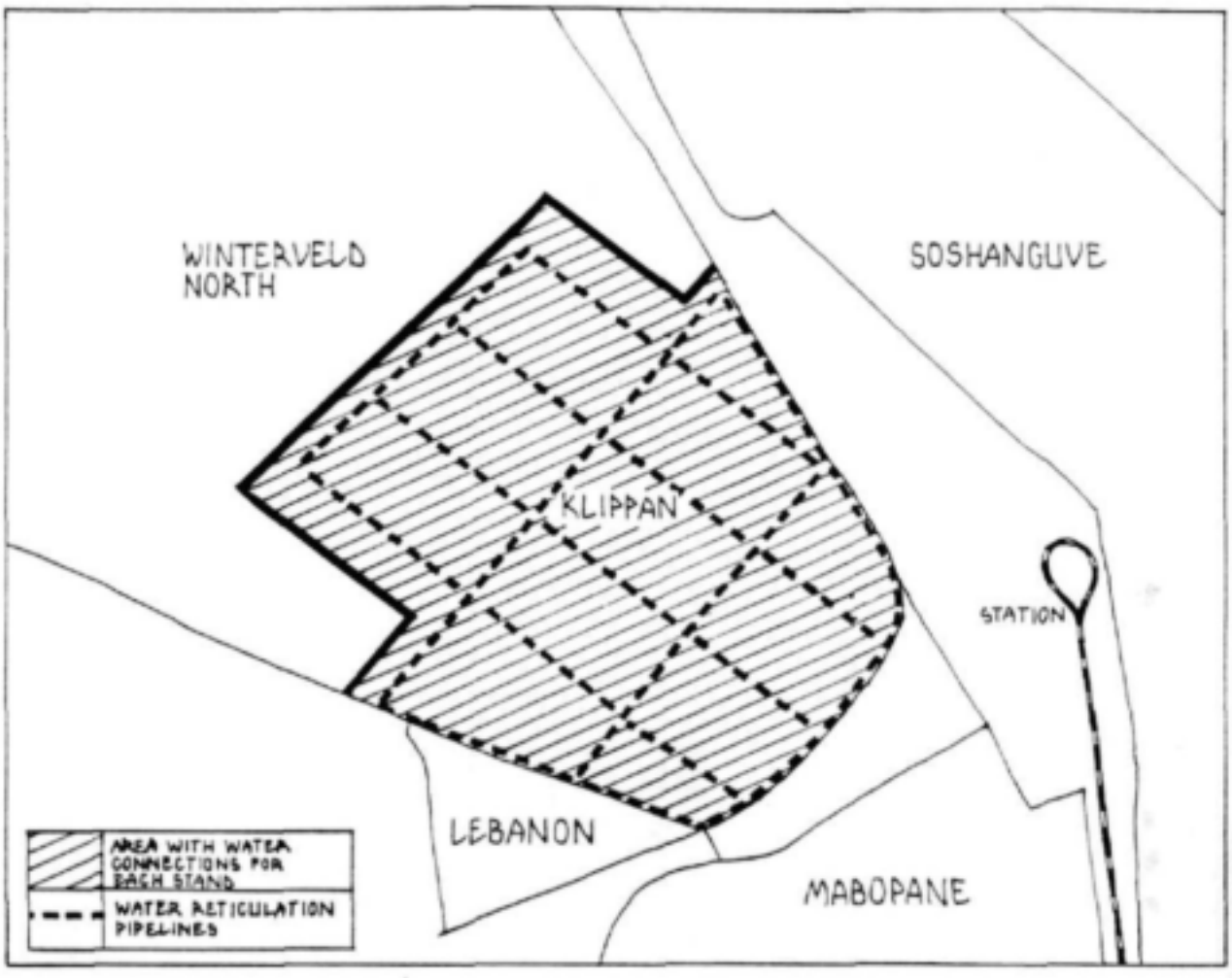
Only 34 connections to the network have been made during the past four years. Of these, two are shops, which means that only 11.4% of plots which are reticulated are connected. It follows that only a small percentage of the approximately 13 000 households who live in reticulated plots do in fact use water from the system.

This situation is remarkable given:

- the generally poor quality, high cost and inconvenience of informal water supply (see section 3.2); and
- the continuing lack of cost recovery by BDWA of the bulk purchasing rights bought from Rand Water Board in 1989.

[13] Assuming a daily water consumption of 30 litres per person.

Figure IX : Existing reticulation in the Winterveld



d) Reasons for low connection rate

In order to understand why so few connections have been made, the situation on individual plots has to be examined. Assuming a plot owner - who has hitherto supplied 40 households with 100 litres per day at 25c for 25 litres - applies for a connection to the water network, he or she has two choices: to continue selling water or to make water available at cost to tenants. The issues relating to these choices are contrasted below:

Probable effects of continued water vending, i.e. selling water from tap(s) in containers:

- *If price and quantity sold remain the same, profits on water sales to the plot owner drop from R 10.00/kl to R 8.94/kl as water is bought at an effective tariff of R2.06 per kl. Income from water sales drops from R 1 240 to R 984 per month.*

- *Tenants obtain clean and safe drinking water at the same price as from informal water sources (R31 per month).*
- *Tenants require less time for collecting water as taps fill up containers faster than handpumps or buckets from wells do.*

Probable effects of supplying water communally, i.e. free access to standpipe to all plot tenants:

- *Monthly income from point water sales (R1 240) falls away.*
- *Water consumption per plot increases as people have freer access to water at a lower price.*
- *The plot owner has to collect from tenants a monthly levy (either fixed or related to actual consumption) to pay the account. The levy would possibly include some connection fee cost recovery and profit. Ensuring that only tenants use the plot standpipe may prove difficult.*
- *Tenants obtain clean and safe drinking water at much lower cost. If water is charged to tenants at cost, its price decreases sharply from R10/kl to between R 1.30 and R 2.70 per kl, depending on by how much overall plot consumption increases.*
- *Tenants have greater scope and convenience for collecting water as taps are accessed freely during day and night.*

From the above it is clear that a connection to reticulated water (sold or for free distribution) would benefit tenants but not necessarily the plot owner. In fact, a loss of income from vending and the responsibility of collecting monthly water levies from tenants would make connecting unattractive. Since it is the plot owner who decides on whether to connect, it is not surprising that so few of the 280 plot owners have taken up the offer.

e) Constraints to formal water supply

The failure of the 1989 scheme stems from a lack of understanding on behalf of funding authorities and engineers regarding social conditions in Winterveld. There are a number of factors which constrain the provision of formal water supply (and other engineering services) which need to be addressed before progress can be made:

Policy
The restriction that only plot owners can apply for (or approve) connections makes it difficult for tenants - the parties who have most to gain - to apply for water. The high connection fee and tariff penalty restricting consumption per connection make it unattractive for plot owners to connect.

Vested interests
Landowners profit from point sales of water and have no incentive to install standpipes which provide cleaner and cheaper water to their tenants. Large-scale tenancy and the associated power of a few landlords do not allow for conventional methods of providing services, i.e. one connection to every plot owner.

Lack of information
Tenants lack information regarding the poor quality of the groundwater and effective mechanisms through which to pressurise landlords to obtain reticulated water for the plot. Information regarding the danger of drinking polluted water, and the alternatives, needs to be distributed widely.

Cost recovery
Control of water accounts may be viewed as problematic by the plot owners as they would be the ones responsible for paying. Lack of control over who accesses taps and how much water is used could create conflict between the landlord and tenants, and with residents from neighbouring plots.

As a consequence of these factors, Klippan today has a basic reticulation network which is virtually not used. Plans to extend the network into the northern part of Klippan have been shelved until demand for reticulated water increases substantially.

3.4 Evaluation of water supply arrangements

a) Informal water supply

Informal water supply in the Winterveld has some positive features:

- **Appropriate**: the vending and communal systems evolved with the growth of tenancy and settlement and is suited to the current legal and social arrangements in the area.

- **Reliable**: groundwater has proven to be a reasonably reliable source (albeit inconvenient) even throughout prolonged drought periods.

- **Income generating**: water vending is an important and reliable source of income to plot and shop owners.

Given these features, the supply situation is substantially better than that of most rural and dense informal settlements in the Transvaal. There are, however, particlar aspects which make the current water supply situation inadequate and problematic:

- **Health risk**: the close proximity of ground water sources and on-site sanitation, the soil conditions and the high population densities in the area create a serious and immediate health risk through poor surface and groundwater quality.

- **Inconvenient**: a large number of households are too far from water points for their supply situation to be considered adequate. Water can furthermore only be bought during specific daytime hours. Quantities are often limited due to the time and effort needed for collection.

- **Expensive**: water bought from private vendors in the Winterveld is very expensive, as Table 6 illustrates[14]. A lack of alternatives allows for exploitation of tenants by vendors.

b) Formal supply system

Although the existing formal water supply scheme in Klippan has the potential to provide affordable, convenient and potable water to 13 000 households, it has failed to improve the water supply situation in this part of Winterveld for the following reasons:

- **Inappropriate policy**: current policy can not accommodate the complex land tenure arrangements in the Winterveld. A connection and pricing policy which favours only one plot connection in a community where 99% of households are tenants is clearly flawed. The system was implemented within a policy framework which did not consider overall social development of the Winterveld.

[14] Information from Palmer Development Group (1993a).

Table 6 : Comparison of water unit costs

TYPE OF WATER SUPPLY		BASIC DOMESTIC COST/TARIFF
Boreholes and wells	Winterveld	R 10.00 per kl
Kiosks	Inanda - Durban	R 2.00 per kl
House/yard connections	Klippan	R 1.30 per kl
	Shoshanguve	R 0.32 per kl
	Lethlabile	R 0.35 per kl
	Pretoria	R 1.30 per kl

Source: Palmer Development (1993a); 1992/93 tariffs

- **Top-down implementation**: the supply system was designed and installed without meaningful participation by the recipient community. Tenants have never been involved in the process of gaining access to safe drinking water. Information regarding the poor quality of the groundwater has not been widely made known until very recently.

- **Inadequate management**: there has been very little commitment on the part of the state to address the water supply issue. The very slow official reaction to the lack of connections to reticulated water could be an indication of a lack of political will to alleviate the problems associated with informal water supply.

4. CONCLUSIONS

The water supply situation in the Winterveld is clearly not satisfactory, with the basic need of this community for a safe and affordable water supply not being met. Households are being charged exorbitant prices for water which is largely unfit for human use and people have to walk long distances and queue for hours to obtain this water.

This case study has identified the important factors which have led to this situation and, following from this, there are certain key lessons to be learnt which are highlighted below.

Lack of community participation

Many of the problems with water supply in Winterveld can be traced to a lack of involvement by the community in decision making. In particular this has resulted in a situation where the interests of landlords predominate over those of individual water consumers. It has also resulted in the failure of the water reticulation scheme as the planners did not understand the local social dynamics.

Poor application of technology

Technological solutions have been applied without a proper understanding of the environmental, social and financial circumstances in the area. This is evident both with older and newer water supply systems:

- In the case of the groundwater supply arrangements there has been little consideration given to proper location and protection of wells and boreholes.

- In the case of the reticulated system, the social and economic relationship between the landlords and tenants was not taken in to consideration in planning the supply system.

Inappropriate financial arrangements

The fact that so few residents can gain access to the reticulated water supply also relates to the way the tariff system is arranged, with landlords charged as individual consumers rather than tenants. There has also been a failure to look at the financial position of landlords and negotiate arrangements where they can receive some compensation for possible future loss of income from water sales to their tenants.

Recent changes in policy to allow tenants to connect as a group may improve the connection rate. Current initiatives to install kiosks on state land to sell the reticulated water at cost would make safe drinking water available to a larger segment of the population. Further innovation could see Water Committees being set up within plots to ensure cost recovery when reticulated water is brought to all the yards within a plot.

Political and institutional factors

The lack of local control over the water supply system is a further factor which has hampered improvement to the water supply system. A strong local authority does not exist and management capacity is located largely in Mmabatho. The customer/supplier relationships are therefore weak. This is exacerbated by political differences between Winterveld residents and the Bophuthatswana government.

5. REFERENCES

5.1 Documented information

DBSA **Title unknown**, report 3.7 on Winterveld, pp 314-321.

EVN Consulting Engineers (1992) **Title unknown**, Chapter 4, prepared for the Bophuthatswana Department of Water Affairs.

Palmer Development Group & Mosotoane, P. (1993) **Survey of various socio-economic data relating to water provision in the Winterveld**, preliminary draft report.

Palmer Development Group (1993a) **Domestic water supply in Region H: an overview**, draft report prepared for the Water Research Commission, Pretoria.

Palmer Development Group (1993b) **Domestic sanitation supply in Region H; an overview**, prepared for the Water Research Commission, Pretoria.

Palmer Development Group (1993d) **Financial and institutional overview of water supply arrangements in urban areas**, phase 1 draft report prepared for the Water Research Commission, Pretoria.

Schutte, J. (1991) **Bophuthatswana national land-use plan**, Institute for Planning and Development, Potchefstroom University.

Settlement Planning Services (Setplan) (1991a) **Bophuthatswana national water plan - survey of existing levels of service**, prepared for the Bophuthatswana Department of Water Affairs, Mmabatho.

Settlement Planning Services (Setplan) (1991b) **Southern Odi - Moretele development appraisal - Volume 1: Household socio-economic conditions**, prepared for the Bophuthatswana Department of Water Affairs, Mmabatho.

Settlement Planning Services (Setplan) (1991c) **Southern Odi - Moretele development appraisal - Volume 2: Technical appendices**, prepared for the Bophuthatswana Department of Water Affairs, Mmabatho.

Settlement Planning Services (Setplan) (1991d) **Southern Odi - Moretele development appraisal - Volume 3A: Regional atlas**, prepared for the Bophuthatswana Department of Water Affairs, Mmabatho.

Winterveld News Agency (WINA) (1993), press release on historical background of the Winterveld, July 1993.

5.2 Personal communications

EVN Consulting Engineers

Ian Bettesworth: Pretoria (012) 803-7444, 803-8328 (fax)
Nick Serfontein: (0140) 81-0500

Theron Prinsloo Grimsell & Pullen (TPGP)
(012) 349-1601, 349-1037 (fax)

Villiers Strauss

Bophuthatswana Department Water Affairs (0140) 843270

Johan Pansegrauw, Area Manager: Odi and Moretele
(01461) 21155

Bophuthatswana Department of Health

Dr Henning Tshibongu: Community health specialist
(0140) 8992211
Mr M.D. Motaung: Health inspector, Odi region
(01461) 222274/5/6/8, 21610 (fax)