

**ENVIRONMENTAL ASSESSMENT OF LANDUSE SYSTEMS  
AND WATER RESOURCES IN THE TYUMIE RIVER BASIN.**

by

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Thesis presented in partial fulfilment of the  
requirements for the degree of



University of Stellenbosch

**STUDY LEADER: Dr JH van der MERWE**

**March 1998**

### Declaration

I, the undersigned hereby declare that the work contained in this thesis is my own original work and that I have not previously in its entirety or in part submitted it at any University for a degree



Date...10 - Feb - 1998

## ABSTRACT

This study advocates the application of integrated catchment principles as a model for the solution of the water scarcity and landuse problems of the Tyumie catchment basin in the Eastern Cape. The study identifies the sources of water, the distances travelled by users of water and the perception of the community members about the water quality of the area. It also discusses the intensity of involvement of the communities in agricultural activities such as animal rearing and crop cultivation. The findings suggest that the lack of water in the area is due to inadequate planning and maintenance of water infrastructure. This has contributed to the departure of population to urban areas for alternative jobs. The intensity of agricultural practice was found to be very low. The study further reveals the paucity of water quantity that the rural areas use for their daily chores. Villagers are however much involved in the progress of water development projects and would be willing to pay a minimal amount for water provision in local areas if their efforts are required. A policy recommendation made from the study is that community related agriculture is necessary in the practice of a successful integrated catchment management policy as a form of redress to uplift the economic and social conditions of the basin.

## OPSOMMING

Die studie moedig die toepassing van geïntegreerde opvangsbeginsels aan, as 'n model om die waterskaarsheid en grondgebruikprobleme in die Tyumie opvangsgebied, in die Oos-Kaap, op te los. In die studie word waterbronne, afstande afgelê en die persepsie van die gemeenskap aangaande die waterkwaliteit in die gebied geïdentifiseer. Die intensiteit van betrokkenheid van die gemeenskap by landbou, byvoorbeeld in veeboerdery en gewasverbouing, word bespreek. Daar is bevind dat die watertekort in die gebied die gevolg van onvoldoende beplanning en instandhouding van die waterinfrastruktuur is. Gevolglik verskuif die bevolking na die stedelike gebiede vir alternatiewe werkseleenthede en die intensiteit van landbou is dus baie laag in die gebied. Die relevantheid van waterkwaantiteit vir daaglikse take in die landelike gebiede word ook in die studie aangetoon. Inwoners is op groot skaal betrokke by die bevordering van waterontwikkelingsprojekte en is bereid om te betaal vir watervoorsiening in die plaaslike gebiede. Beleidsaanbevelings uit die studie is dat gemeenskap-gebaseerde-landbou nodig is in die toepassing van suksesvolle geïntegreerde opvangs-bestuursbeleid. Sodoende word die ekonomiese en sosiale omstandighede van die opvangsgebied verbeter.



## ACKNOWLEDGEMENT

The completion of this work and the contents thereof were possible only with the financial assistance and study leave which was granted to me by the University of Fort Hare. To individuals who supported this report, I render my unqualified gratefulness, firstly for the contribution, stern guidance but friendly disposition of my supervisor, Dr JH van der Merwe. I am also indebted to Dr P de Necker for his Christian inspirational sessions especially at times when I felt emotionally and spiritually drained. I thank all the staff members of the Geography Department for accepting me not merely as a student but as one of them. My sincere gratitude also goes to my study colleagues. A special mention is made of Aida Kiangi for the encouragement she offered me through her unbending energy and willingness to discuss matters even when she was equally burdened with her studies. To my wife, Eunice and children, Aba, Adwoa and Mpumie I request for this statement:

**To God be the Glory**

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## **CHAPTER ONE BACKGROUND TO THE TYUMIE BASIN STUDY**

### **1.1 INTRODUCTION**

Environmental assessment is an objective, holistic evaluation of the quality of an environment in terms of its physical attributes and/or aesthetic value. It is used to give the natural environment credibility and comparability with socio-economic data in planning decisions (Goudie 1985). This thesis proposes the need for holistic attempts to solve problems of water shortage and the development of landuse infrastructure for rural areas. Among the numerous difficulties facing the rural people of the Tyumie basin, are water shortages, neglect of farmland<sup>s</sup> and lack of infrastructure. It is very necessary to expose the magnitude of such problems by an assessment study, before attempts are made to solve them. This chapter provides the definition of the study problem, the aims of the study and the objectives intended to be achieved. The geographical location of the Tyumie basin is also described, as well as an outline of the need for the study. The chapter then describes the methodology and, finally, a brief of the outline of the whole study. The environment and environmental management are not neutral (Hart 1992) which means that in the process of environmental planning, the use of resources must be geared to the utility of the society. In essence, there are underlying currents that tend to shape geographical landscapes. It is the task of Geography to express this manifestation in its spatial context.

### **1.2. LOCATION AND BACKGROUND TO THE STUDY AREA**

The Tyumie basin, is situated in the Eastern Cape province. It is a sub-catchment of the Keiskamma river (Fig 1.1). It is found between Latitude  $32^{\circ} 35'S - 32^{\circ} 55'S$  and Longitude  $26^{\circ} 45'E - 27^{\circ} 00'E$ . The basin as a geographical region is confined by the Amatole mountain ranges to the east, the Hogsback mountains to the north and the Menzieberg to the west. Its southern extent is the confluence of the Tyumie and the Keiskamma rivers. The mountains encircle the Tyumie river and its tributaries, extending in a series of almost unbroken peaks from the Kroonskop (1070m) in the west, through the Tyumie peak (1481m), Pefferskop (1086m), Menzieberg (1645m), and Hogsback (1937m), to the Mkobeni (1140m), above Ncera location (Fig 1.2).



Fig 1.1 The Study area - Tyumie basin

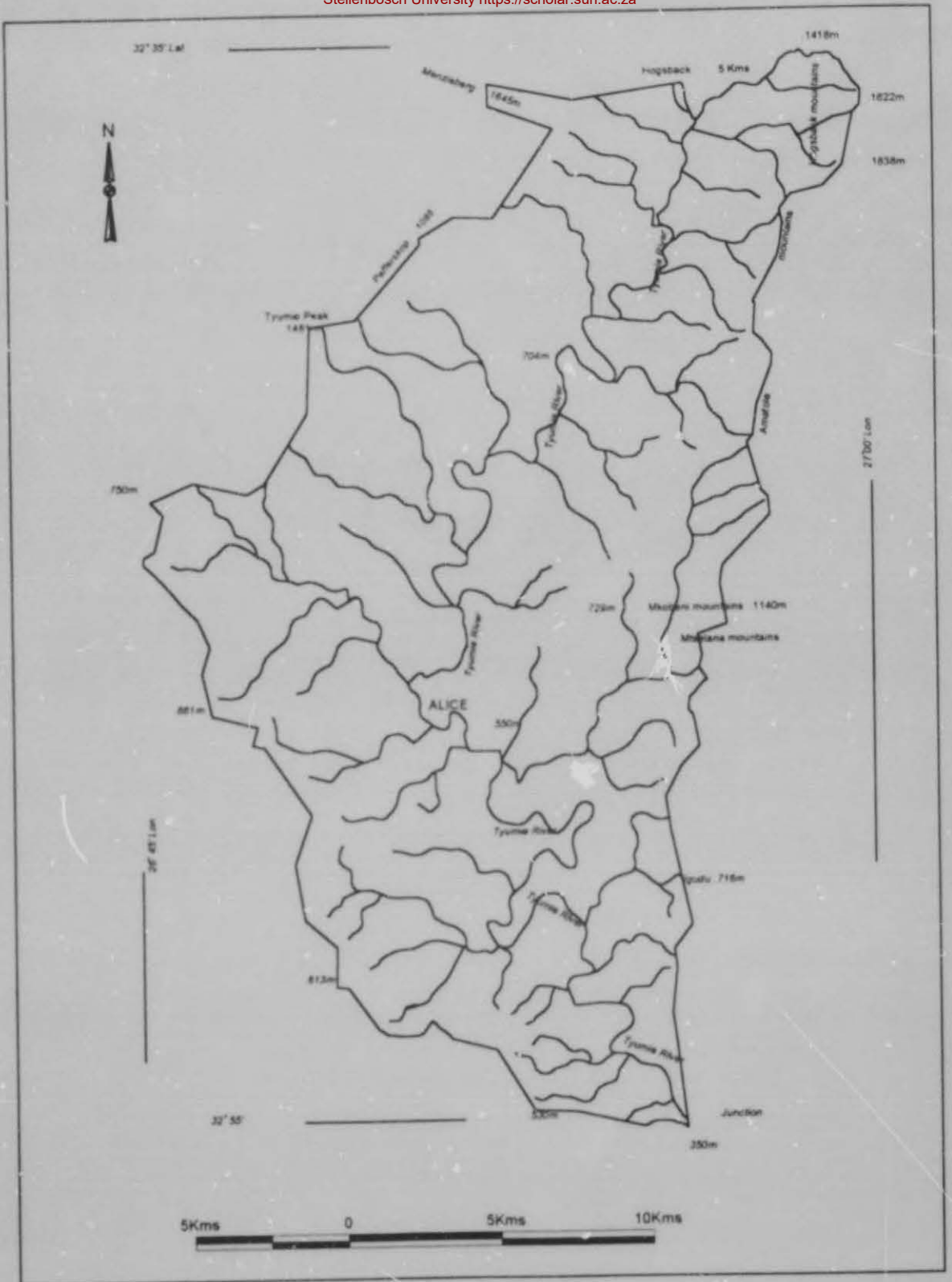


Fig 1.2 : The Physical boundary of the study area



The area is predominantly rural. However, socio-economic changes and incentives of urbanisation have made many residents reliable on the urban economy (Mini 1988). This has had a debilitating influence on rural agricultural practices. The dependence of the people in the area on the urban cash economy has resulted in the neglect of rural activities such as farming. The result is that capital infrastructure such as weirs, dams and pipelines which should have developed alongside the growth of the villages have also been neglected either by local communities because of a lack of knowledge and funds or by the national government because its emphasis is laid on the areas of mass human engagement, which is the urban areas. Cultivated lands are left untilled and animal farming is ignored. Of greatest concern is the lack of development of water resources and therefore the continuously increasing difficulties that people endure to secure water for drinking and for basic necessities such as cleaning, cooking and washing.

Until 1981, commercial farming activity was practised mainly in the western part of the area. Water infrastructure, necessary for commercial farming, was also developed in the western part. The eastern half is occupied by homesteads whose residents practice traditional farming and depend on rain for crop cultivation. With an increase in population, a problem certainly has developed in the eastern half as water resource development has lagged behind population growth. Since 1981 a similar inadequacy of water infrastructure development has arisen and increased, in the west because of water infrastructure development has arisen and increased, in the west because of resettlement of human population has increased there. This happened after the incorporation of the area into the former Ciskei and the departure of white commercial farmers from the successfully producing pastoral and arable farmlands.

One can deduce from the above that political policies and land allocation practices have influenced the present settlement patterns. In affecting the population and settlement patterns, the landuse patterns have also been influenced. The history of land allocation and policies such as betterment planning and villagisation (Cross & Haines 1988), are combined forces whose imprints are seen in the location of the settlements, the population characteristics and the landuse patterns of the area (De

Wet & Leibrandt 1994). Water, being the link between landuse activities and human survival, is desperately lacking in the Tyumie basin.

### 1.3 THE NEED FOR THE STUDY

The importance of water resources in the world is reflected in the efforts expended to highlight the effect of population growth on water resources (Kevin 1997) and in the statement that the ultimate and maximum level of population growth will be determined not by housing, clothing, or food, but by the amount of water resources available to mankind. In 1977 the United Nations declared the 1980's as the "International Water Supply and Sanitation Decade" with the aim that by the year 1990 most people would have access to an adequate supply of healthy water and acceptable sanitation facilities. Aiming at a healthy supply of water the world body was envisaging the attainment of sufficiently basic water supply to all peoples in the rural areas, who need to be satisfied by

- the amount of water
- the quality of water
- the distance to the water supply
- and the reliability of the water supply ( Emmett & Rakgoadi 1993).

South Africa's anticipatory attempts to monitor and set up water networks is a manifestation of its intent to avoid the danger of losing control over its water resources (Parsons and Tredoux 1997) and meeting the above requirements. These criteria are considered in this study with the intention of estimating the effectiveness of water supply provision in the Tyumie basin. The research was undertaken with the above requirements in mind, bringing to the fore the need to plan for the physical and human resources in a holistic manner. Environmental investigations of this nature require the knowledge of social values, administrative constraints and legal provisions (Fuggle & Rabie 1992). These permeate the discussions in this research. Geography is a discipline that views problems in a holistic manner and identifies patterns of similarities and differences. Explanations can then be provided from which solutions are possible for any existing problem. An integrated approach to river catchment basin study is a geographic tool that embraces both physical and human components in a geographical area. Such an approach can be applied in such investigations. The

study is justified by the attempt to expose the physical, human and social problems in the area which combine to reflect on the water shortages experienced and the neglect of the land for agricultural activities. The next section is an attempt to combine the facets of the above narrative to provide a focus for this study.

#### 1.4 PROBLEM STATEMENT

The amount of water consumed by humans for drinking and basic hygiene is low relative to the expense and effort inherent in its provision. Water provision in bulk for human usage is more lucrative and feasible when the motive extends beyond simply human consumption (Walmsley 1995). When the commercial interests of agriculture (Van Zyl Mckenzie & Kirsten 1996), as in the case of the former white farming areas of the Tyumie basin, or manufacturing and the industrial sector (Schutte & Pretorius 1995) are absent in the process of water delivery, then production and supply ought to be paid for by consumers, who may be the main users, if the provider wants to recover costs. In a territory like the Eastern Cape, and specifically in its rural areas, such as the Tyumie basin, such a venture is difficult to undertake. Unemployment levels are high (>30%) and income levels are very low (>R500 per month per family) and therefore not feasible to initiate. Water provision to the rural areas is therefore not lucrative on a cost/benefit basis. The attainment of sustainable development which is the strategy of the national government and of the Department of Water Affairs and Forestry (DWAF) (DWAF 1994) in such a situation is impossible. Communities in the Tyumie area alone cannot, without assistance, provide good drinking water for themselves due to the high cost of provision but the government usually expects any water project to be self sustaining. Water, however, is the basis for the agricultural practice that holds the key to economic and social uplift in the rural areas. This means that communities ought to pay for the maintenance of equipment for the provision of water. Much as the communities need reticulated water, and few have actually attempted to provide services for themselves (Dewar 1994) they can only afford to pay for the consumption of the water. The effect of such a situation is the inadequate and unequal levels of water provision whereby commercial farmers took the initiative to provide their own sources of good, clean and safe water in the area, and other communities continue to rely on raw, unreliable and unsafe sources of water such as

from unprotected springs, rivers and stock dams. It is agreed that the water development in the commercial farming areas was possible because of the government's subsidisation agricultural policy (Van Zyl *et al* 1996) but the problem to deal with now, is the inequitable water resource development which expresses itself more clearly when compared with population and settlement patterns. The effect of this dichotomy is not only on the level of human water consumption, but on agricultural activities as well, a cause which requires effective planning (Nel & Berry 1992).

In the Tyumie basin, whereas settlements are concentrated in its eastern half, water infrastructure density is higher in the western half. This is the effect of different landuses, which are commercial farms in the west and traditional settlements in the east. The dislocation of communities and resettlement of populations into the basin (Louw & Kendall 1986; Skweyiya 1991) without any consideration for adequate increase in water and its infrastructural development has contributed to the low accessibility of water to people and shortages of water that are experienced by the rural communities in the Tyumie basin, today. This problem is seen when one observes the involvement of children and women and the distances that they travel, the weight of containers carried and, the strain of pushing wheelbarrows in a bid to obtain water for consumption. Agricultural activities have also slowed down as essential water cannot be carried to farming plots. Household use of water is minimised because water has to be conserved to the barest and water use is restricted to only the most essential usage. Investigating the extent of the impacts of water inadequacy on domestic use and landuse systems is the crux of this thesis. The process is what is termed as an environmental assessment.

It may be hypothesised that the shortage of water and lack of accessibility of rural communities to a good, clean and adequate water supply is the result of the failure to apply holistic landuse planning and resource development principles (Vink 1975) in a rural area such as the Tyumie basin. This is a cause that has contributed to the decrease in agricultural related activities. With no substantial income from agriculture, the process of rural urban drift has also set in. The Tyumie area can be described as



a decaying rural area. An assessment of the status of the environment, is necessary from which goals and objectives can be set. Having defined the problem, it is necessary to highlight the aims and objectives of this study.

### 1.5 AIMS AND OBJECTIVES

Six aims were identified for the project. These are, to:

1. Assess the *sources and reliability of water* for domestic purposes and different landuses in the Tyumie Basin.
2. Identify the *uses of water* for domestic and agricultural purposes in the Tyumie Basin.
3. Establish the *level of accessibility and quality of water* as perceived by the communities.
4. Describe the *development of water infrastructure* as a result of land tenure developments.
5. Demonstrate the level of adequacy of water by the *present consumption* and waste-water *disposal behaviour* of the rural communities.
6. Provide a basis on which *future policy* planners may determine the provision of services to the rural communities in the Tyumie basin.

Having stated what is to be done, attention is now turned to how the study was undertaken. To understand the present landuse patterns and water infrastructure, a reading of relevant literature was undertaken, focusing on landuse principles (Vink 1975), agricultural policy in South Africa in the past (Van Zyl et al 1996), the role of the institutional organisations and departments in the provision of water in the developing areas of South Africa (Schutte and Pretorius 1995; Schur 1994) as well as the effect of land administration (Louw & Kendall 1986) and land reforms (Letsoalo



1987; Van Zyl et al 1996) on rural economies and populations (Skweyiya 1991). The importance of realising the above characteristics is seen in the design of the research methodology that is described in the next section.

## 1.6. THE SURVEY

A questionnaire was drawn up to gather data on the sources and uses of water and the reliability of the water sources in the study area while information was also obtained concerning the quantity of water used by the communities, waste-water disposal and the perceptions of community members on water quality. Questions were also asked to find out the level of community participation in water projects in the communities. The questionnaire is attached as *Appendix A* while the procedures and tools used in the gathering of the data are described below.

### 1.6.1 Survey methodology

This section describes the research methods used in the study. It is important to highlight the difficulties inherent in the collection of data in developing countries and areas such as the one in this study. Conyers (1982) has stated the differences and difficulties of data collection in the developing countries compared to advanced nations. These problems may be cultural or relate to the physical environment and were evident in this study. The study was conducted in August, when many pupils were at school and only the elderly, women and some family heads were found at home. To some of the villagers the survey implied that supply of piped water to the area is imminent. An element of suspicion was always noticeable at the first encounter with the local population. This was overcome by the presence of a local Xhosa-speaking interpreter who assisted throughout the data collection period with the introduction of the research mission and the explanation of any question in the questionnaire on which the respondents needed further clarification before answering. It was encouraging that most of the settlements lie on a road network and therefore a systematic itinerary was followed using the roads as a guide (Fig 1.3). However, some of the outlying farmholdings, such as Upper Tukulu in the south (number 59), Upper Mjilo (57), Skutshwana (26) and Evergreen (36), could only be reached after travelling on disused and rugged terrain.

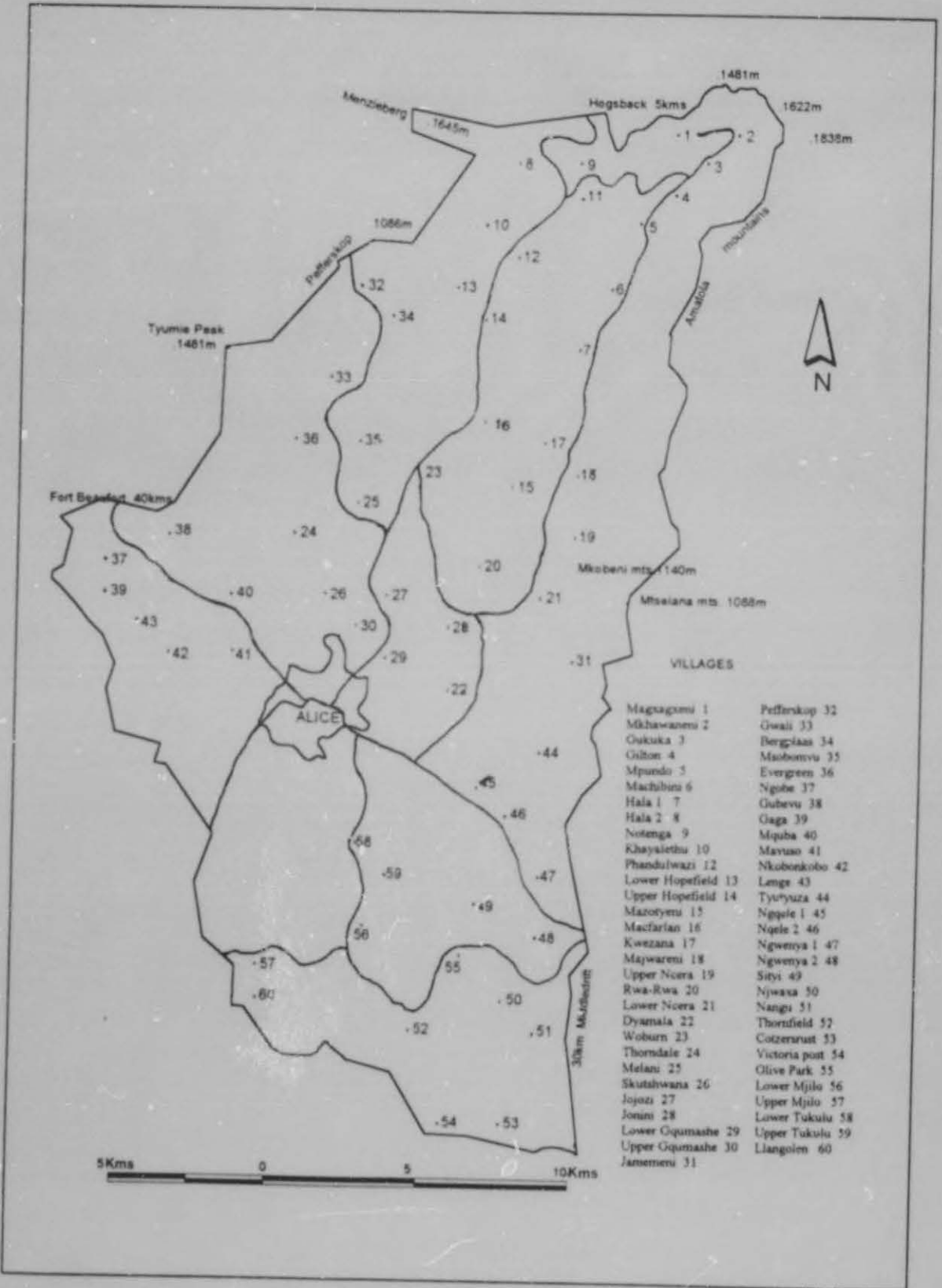


Fig 1.3 Villages and access roads in the Tyumie basin

## 1.6.2 Tools for data collection process

The following types of tools were employed in the data collection process:

- Survey method through the use of **questionnaire and interviews**.
- Observation method, which involved the use of the **human senses** and the capturing of information by means of a **camera**.
- Map analysis, with the aid of **topographic maps and aerial photographs**.

Each of the above methods is described in detail to indicate their relevance to this study

### 1.6.2.1 Questionnaire formulation and administration

Survey research is the most commonly used method for data collection in the social sciences. Its advantage is the ability to elicit information directly from the feelings and perception of the target group. Its disadvantage is the personal bias that may encroach in its design and administration. Respondents can also contribute to inaccurate results by deliberately providing the wrong answers to spite an unsuspecting researcher. Personal relationships are of the utmost importance if this method is used. Nachmias (1976) indicated that interviews form the basis of survey research. This is because a researcher will always introduce a questionnaire in an interview situation. In using the survey method, the questions were designed in order to translate the research objectives into specific questions whose answers would resolve the problem statement.

### 1.6.2.2 Questionnaire structure and content

The questionnaire consisted of 20 open and closed questions. A blend of open-ended and closed questions was used to obtain structured as well as non-structured answers from the respondents. The aim was to avoid the collection of too varied possible answers and at the same time receive directly focused answers which are relevant to the research aim.

### 1.6.2.3 Themes of questions

The questions were organised according to the following themes

Firstly, the characteristics of the village or community (Question 1).

Secondly, the family structure, that is the population in each household. For the purpose of this study each family is regarded as a household, and includes grandchildren, where applicable (Question 2).

Thirdly, aspects concerning the water sources, such as containers used and distances travelled by water users to obtain water in the locality (Questions 3-12).

Fourthly, the landuse practices and water uses for irrigation or agriculture-related issues (Question 13-16).

Fifthly, the community members' awareness and involvement in water development projects in the community (Questions 17-20)

### 1.6.3 Survey constraint: population data.

The population statistics of the entire basin were unreliable (Crosby & Fabricius 1990) because different sources provided conflicting figures. It is an agreed fact that the extended family system prevalent in black communities does not permit very accurate household figures at censuses in those developing communities. A complete data base of all villages in the study area was difficult to obtain from the Central Statistical Service(CSS). This is due to the increasing number of settlements and the movement of settlements from one location to the other in the intercensal periods. Recourse to figures collated by civil engineers such as Hill Kaplan Scott, to supplement data from the CSS were not realistic when compared with those available at CSS. An example is that the census data of 1970 in Ciskei provided figures of some villages which were higher than those of 1988. The 1991 data of some villages



showed a lower figure than the 1988 figure. Reliable, accurate and complete population figures for the entire villages in the basin could not be obtained.

### **1.6.3.1 Sample frame**

The Tyumie basin was considered as the study frame. Within the basin are 60 settlement units comprising of villages and farmholdings. These constituted the total population. The total population falls under seven tribal areas. Twenty four settlement units were randomly selected to form the sample size of the study. The methodology is explained in the next section. It was expected that the number of households could be obtained during visits to the village sites. This was in fact not possible and time did not permit the counting of all houses in the villages and farmholdings. The Central Statistical Services has also not published the latest (1996) household census figures. Consideration was given to the size of the tribal authority area, the number of villages and the type of settlement, that is whether it is a nucleated village or a combination of nucleated village and farmholdings or a farmholding in the selection of the sample. In areas where both nucleated and isolated farmholdings existed, it was necessary to include at least one of both in the sample. The selection of sample villages was done from a topographical map after carefully considering their spatial location and ensuring their representativeness of the entire basin. The order of selection was made according to the position of the settlement as follows: 1: The most centrally-placed village; 2: North; 3: South; 4: East; and 5: West.

### **1.6.3.2 The sampling methodology**

There are seven tribal authorities in the study area (Fig 1.4). All of them were selected. All the 60 settlements within the 7 tribal authorities were also selected. Three settlement units were selected from each tribal authority area by their spatial location, ensuring that each village is as far as from the other within each tribal authority area. Thus 21 settlements (3 x 7) were initially selected. Two of the tribal areas, Imingcangathelo and the Tyumie had a comparatively larger areas in size and more settlements. The Tyumie had the largest number of villages and therefore 2 more settlements were selected from the Tyumie area and 1 additional settlement was selected from the Imingcangathelo tribal area. Thus the **sample size** was made up of



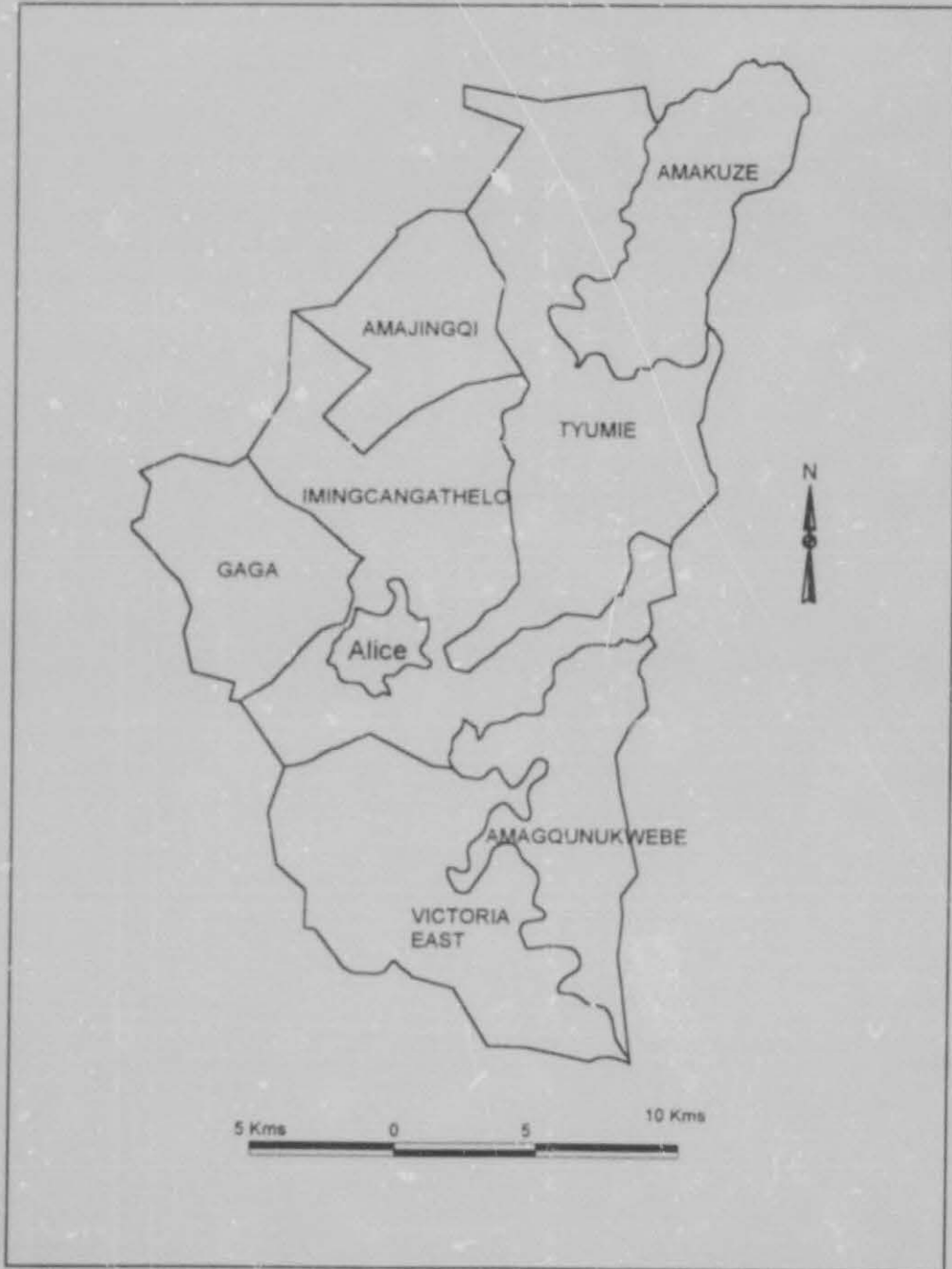


Fig 1.4 Traditional authority boundaries

**24 settlements.** For a representative result the researcher had aimed to select a minimum of 30% and a maximum of 40% of settlements to form the sample size for the study. This was achieved with the 24 selected settlements which constituted 40% of the total number of settlements in the study area. A settlement is either a village or a farmholding. In summary, three villages were selected out of seven from Amakuze tribal authority. Five villages were selected from the Tyumie tribal authority out of 15 villages. Three villages and one farm were selected from Imingcangathelo, out of nine. Three villages each were selected from Gaga and Amagqunukwebe. Two villages and one farmholding from Jingqi, and three farmholdings from the Victoria East area. In effect the number of villages relative to the size of the tribal area constituted the sample size. In each compact tribal village, questionnaires were administered to ten households at arbitrary intervals and distances from each other. On each of the farms which were selected two families were interviewed. On the selected farm in the Jingqi, however, only one family was found who was interviewed.

Table 1.1 shows the sample frame which comprises the three levels: Tribal authority, villages, and households interviewed in each traditional area. The total number of selected villages was 24, which constituted 40% of the 60 villages in the basin.

Table 1.1 Sample frame for the study in the Tyumie basin

Tribal Authority	Villages/farms	Sample	%	Households Interviewed
Amakuze	7	3	42.86	30
Tyumie	15	5	30	50
Imingcangathelo	9	4	44.4	32
Jingqi	5	3	60	21
Gaga	7	3	42.86	30
Gqunukwebe	8	3	37.4	30
Victoria east	9	3	30	6
Total	60	24	40	199

#### 1.6.4 Conducting the survey

According to Young (1976) it is better to obtain a large sample for a truly representative data collection. This is desirable if sample errors are to be avoided. This is true because a larger sample is closer to the total population. However, it is not always practical as it makes the analysis of data unwieldy. One hundred and ninety nine households were interviewed with the assistance of an interpreter. This was performed as follows:

1. A reconnaissance visit was made to the entire area and an itinerary was drawn up for the collection of data.
2. A second visit was made to each selected village where the purpose of the survey was explained to the "chairman" of the village before administering the questionnaire.

Several factors which may have an influence on response quality were guarded against in the questionnaire formulation and administration. These include:

**Cultural inhibitions** : The sentiments of the communities regarding previous relocation and the sensitivity of enquiring about the size of land and number of animals owned. The Xhosa people are sensitive to the land and animals they own and any questions on these are regarded with suspicion. Through question 13, attempts were made to elicit some data but with little success. The information obtained on this aspect came through informal interviews only after the confidence of the respondents had been gained.

**Leading questions**, in other words those that beg for obvious answers compromise the results of research, and therefore, were carefully avoided.

#### 1.6.4.1 Field observation

The information from topographic maps were counter-checked by observation and the interviews conducted in the field. The researcher used the observation method to notice the conveyance of water by children and the operation of the windmills. It was observed that children were the main carriers of containers to the water points. Some data obtained by this method were captured on photographic film, which are displayed as demonstration elsewhere in this study. Most of the cultivated fields were observed to have been fallow for a considerable length of time

#### 1.6.4.2 Map Analysis

One of the main research and data collection tools of the geographer is the map. The study area is covered by two 1:50 000 topographic maps (3226DD ALICE and 3226DB SEYMOUR). These maps were purchased from the Directorate of Surveys and Mapping in Mowbray, Cape Town. In addition to the topographic maps were **18 aerial photographs** (All photos were taken on Job number 981 and covered strips 9, 10, 11 and 12). Photo numbers are as follows: Strip 9, photo numbers 248, 250, 252 and 254; Strip 10, photo numbers 286, 288, 290, 292 and 294; Strip 11, photo numbers 298, 300, 302 and 304, and strip 12 photo numbers 339, 341, 343, 345 and 347. These photos were taken on 6 March 1996 with a scale of 1: 50 000. The aerial photographs provided the input to upgrade the information from the topographic maps. The photos helped to prevent the loss of information which may make any data from topographic maps obsolete. The photomaps were used to counter-check for accuracy and currency. Base maps of 1:50 000 were drawn from the two map sources on to a transparent film and then digitised by the use of Arc/Info to obtain the data on settlements, rivers, landuse types and boreholes/wells and dams. The tribal boundaries map was obtained from the Land Affairs Department in East London on 1:50 000 topo map sheets and this was also digitized on to the base map.

#### 1.6.4.3 Data Analysis

The type and quantity of data to be analysed have a direct influence on the choice of analytical methods to be adopted (Labovitz 1969). Though extensive, the volume of data was not unreasonable and the researcher adopted the quantitative means of



analysis to obtain quantifiably scientific result. The answers of the respondents were coded and entered into an Excel spreadsheet from which analysis was done by simple statistical measurements for means, frequencies and percentages. Graphs and tables were drawn from the categorised data. For geographical representation, the responses and conceptions were translated into maps to reveal their spatial context.

## 1.7 OUTLINE OF THE PROJECT

As already indicated, this project investigates the problems of sufficiency, quality and use of water in the Tyumie basin. It also investigates the impact of water shortage on landuse activities in the area. The following is an outline of the study. Chapter One provides a general introduction to the topic, the problem statement and aims of the study. The sample selection methodology and means of data analysis are also discussed in this chapter. Chapter two provides an understanding and developmental background of the study area, the population characteristics and the water resources available in the basin. The concept of integrated catchment water management and water provision strategies in the developing communities are also described to support the need for their application in the ambit of the study of geography as an environmental and spatial science. Data analysis is divided into two parts and dealt with in chapters three and four. Chapter three concerns the analysis of population and socio-economic factors such as the education and employment statistics of the study area. Chapter four provides an analysis of the data on water resources, water use, water conservation, community perceptions of water quality and community involvement in water projects. The government has set a 25l/c/d target of water for the rural communities (ANC 1994). This is considered too low for a community whose standard of life is steadily increasing. A hypothetical target of 40 litre per person per day usage of water was therefore set and compared with the actual water usage in the area to determine the volumes of water shortage in the area. Chapter five concludes the project with a summary of findings, conclusion and recommendations from the findings of the study.

## CHAPTER TWO UNDERSTANDING THE TYUMIE BASIN

### 2.1 INTRODUCTION

Approaches to the management of water and river basins abound in both the physical and human sciences (Micklin 1996; Rawlins 1995; Pegram et al 1997). A common generalisation is that problems of water management are best studied in a holistic manner with the smallest catchment as a unit (Pegram et al 1997; Spencer 1997). It is also agreed that community participation is essential in the provision of water for rural communities. Water resource management is designed to ensure the availability of water of adequate quality (fit for use) for basic human needs and to support economic production. The problems of supply and disposal are growing more complex in different communities (Hann 1983) and this is no different in the Tyumie basin, which is an area that has experienced the dislocations of people (both whites and blacks) consequently affecting resource development in the area. The present situation with regard to water and agricultural practices, is one of stagnation and poor resource development. The cause of economic stagnation has often been ascribed to the landuse practices such as traditional farming methods and subdivisions of land into uneconomic sizes. Masiphula *et al* (1996), however disagree with this notion and they recount the successes of black farmers in the pre-South African Union era of 1910 in crop and animal production. Letsoalo (1987) confirms this and argues that black farming had achieved a measure of success before it was disrupted by external intrusion. To manage and utilise the land in a useful manner, Mini (1995) warns of the danger of resorting to small-scale traditional farm sizes as a means of implementing reforms in the black areas as infrastructure development and market structures are not designed for such practices. At stake now is how to address the poverty of the rural areas such as the Tyumie with respect to scarcity of water for domestic and agricultural purposes.

### 2.2 SOCIO-POLITICAL SETTING OF SETTLEMENTS IN THE TYUMIE BASIN

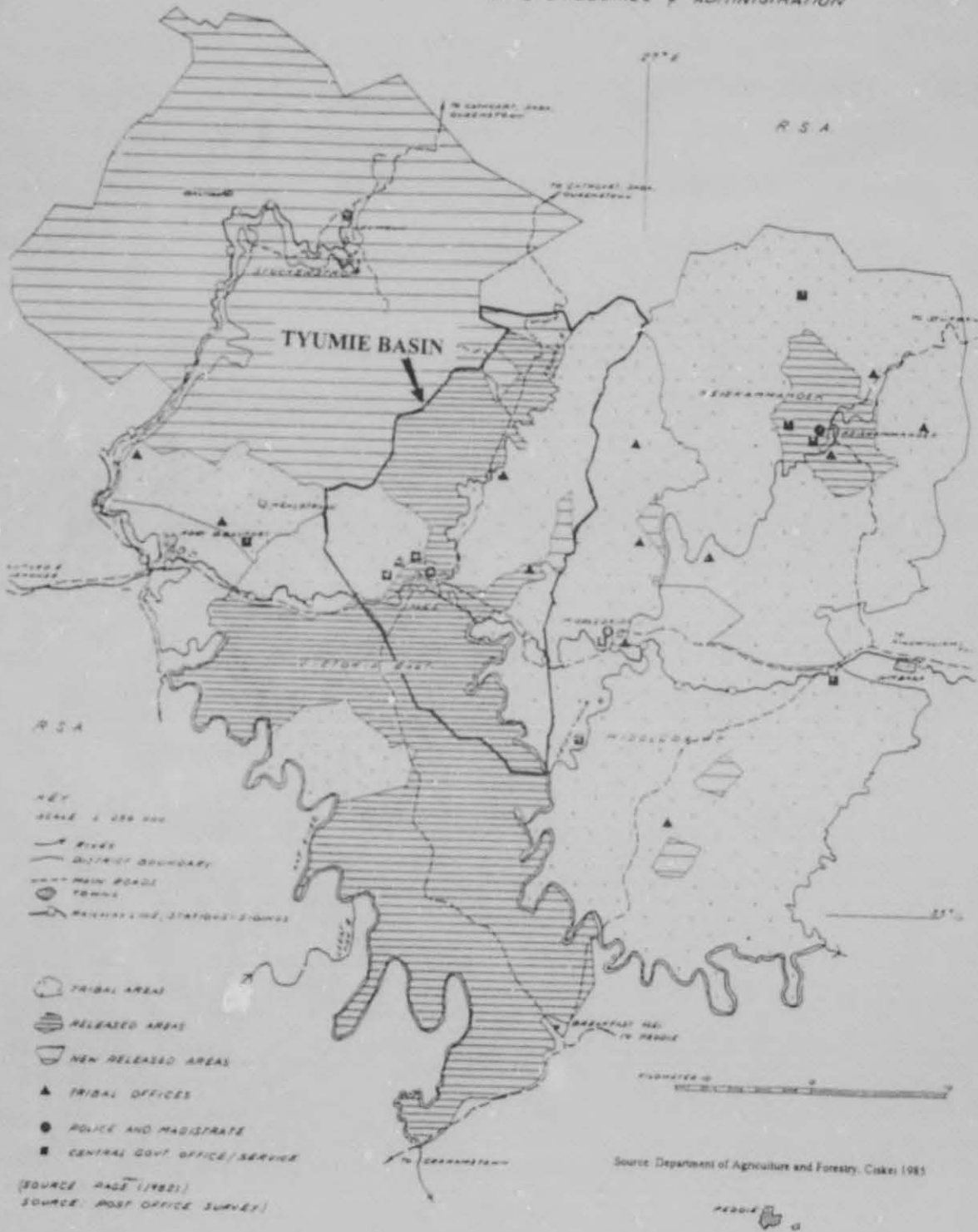
Though the origin of traditional black settlements in the Tyumie basin is traced to the fleeing of Xhosas from wars with the Zulus, many of the settlements, particularly in

the Jingqi, Gaga and western Imingcangathelo, grew after the Consolidation Act of 1960. By this Act, white-occupied farms in the area were earmarked to become part of the black reserves. These areas later became part of Ciskei after its political independence in 1981 and were transferred to the Ciskei government. The areas were originally referred to as "Scheduled" (because they were planned to be given to blacks in future) and later known as "Released" (because they were given to the blacks for compact village settlements (Fig 2.1). The purpose was to effectively manage the land for higher productivity (Letsoalo 1987), and it served as the base land on which the settlements developed. These areas were in the region referred to as Jingqi, Gaga and most of the western part of Imingcangathelo. The areas fell under tribal chiefs who were the leaders of the communities to occupy the released areas.

The released areas (now part of tribal lands) were administered by chiefs who acted as custodians of the land and allocated plots to the tribal members. Page (1982) describes the situation thus: "*the tribal lands were allocated on intrinsic tribal loyalty and commitment*", though inheritance contributed to the subdivision of allocated tribal lands after the death of the family head to whom the land was originally allocated. Therefore individual family land areas have dwindled over the years and this has enabled several researchers to refer to the land size ownership as untenable for viable agricultural productivity (Page 1982). In a sample study of Msobomvu, property sizes of families were found to vary between 30 x 40 meters, 40 x 50 meters 36 x 40 and 35 x 40 meters (Mini 1988:9).

On the landuse map shown in Fig 2.2 a distinction can be made between the predominantly cultivated eastern half and the pastoral landscape of the western half of the basin. The north-south alignment of cultivated lands indicate areas which were utilised for cultivation but is increasingly being abandoned. The western half, and especially the south western section (Victoria East) was used for pastoral agriculture by large scale pastoral white farmers. The western and central region constitute Gaga whose existence is closely linked to the urban activities of Alice and the University of Fort Hare, which is also located in Alice. The siting and growth of the rural settlements have been influenced also by roads. The conclusion from Fig 2.2

**Ciskei Western Region**  
**LAND CATEGORIES & ADMINISTRATION**



**Fig 2.1** Land administration and "released" areas in Ciskei, Western Region, 1985



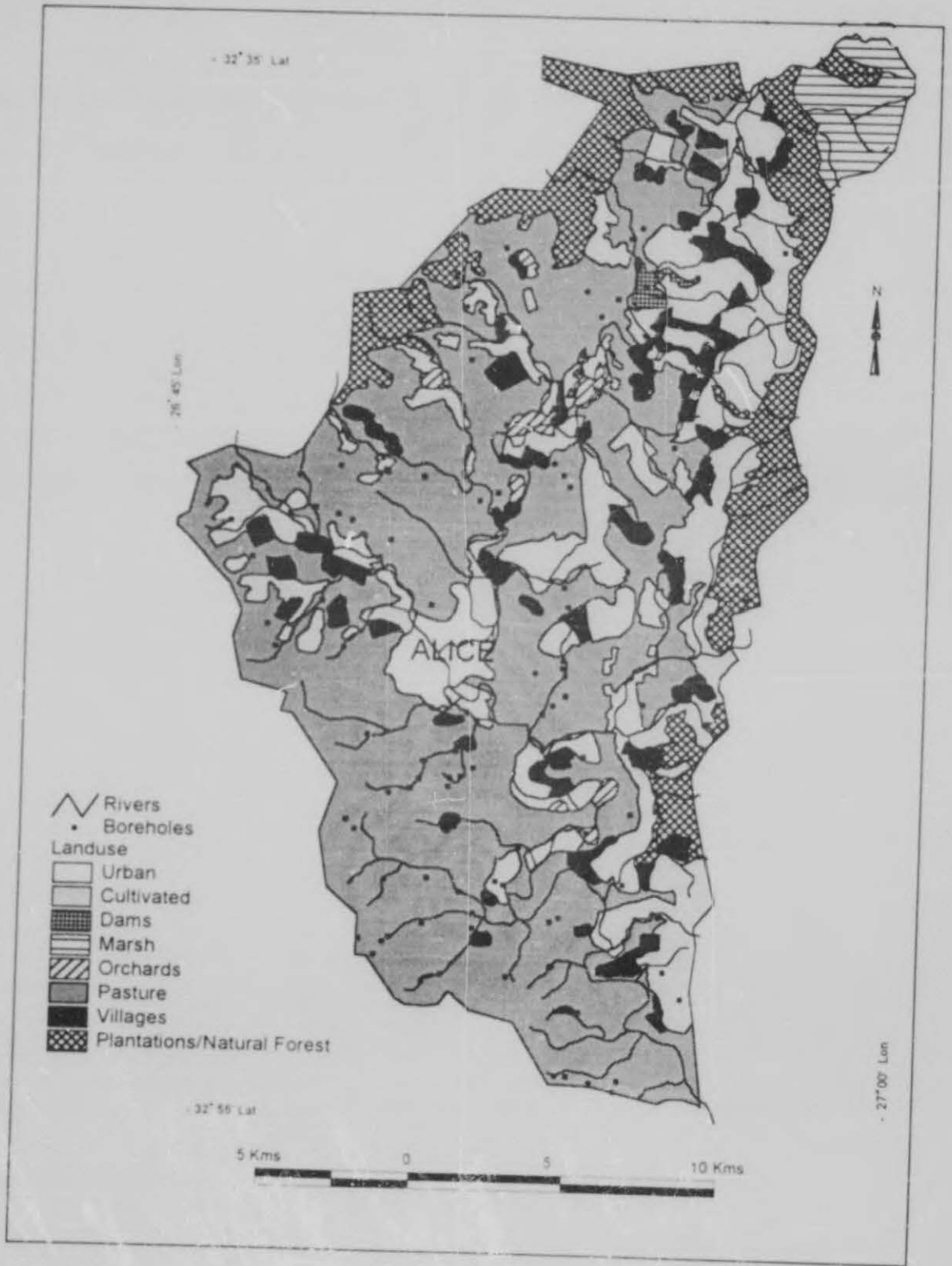


Fig 2.2 Landuses in the Tyumie basin

is that the distribution of settlements and activities is based on past settlement policies and landuse activities. Comparing the land administration map (Fig 2.1) and the landuse map (Fig 2.2) provides evidence of a direct relationship. This relationship, however, is inverse when the relationship between water resource development and settlement concentration are considered. With such background, attention is now given to the literature on population characteristics of the Tyumie basin as part of the background to understand the Tyumie basin.

### 2.2.1 Literature review of population characteristics

In reviewing the literature sources pertaining to population development indicators in the Republic of Ciskei, Crosby & Fabricius (1990) discussed the demographic analysis of the Ciskei with regard to population statistics, density, age-sex distribution and migration statistics. The conclusion was that sources pertaining to these issues were *many* but they provide *non-comparable* information. This is evident in Table 2.1.

Table 2.1: Total population figures of Ciskei in 1985

Source	Population
Ciskei Census 1985	621 463
Baseline Data Report April 1985	766 636
Ciskei Central Statistics Oct 1985	774 152
Development Bank of South Africa, 1985 Estimates	750 000

The Tyumie basin is an area composed of the southern and western part of Middledrift District and the northern and eastern part of Victoria East District. Since it is part of the two districts, reference will be made to these areas as representative of the Tyumie basin wherever figures, specific to the villages in the Tyumie area are not available.

### 2.2.2 Review of population statistics

The Census figures of 1970 and 1980 indicated a growth rate of 3,18% in the Middledrift district, and 8,8% in the Victoria East District. The Central Statistical Service indicates a figure of 2,8% from the 1994 census. The population of the Tyumie basin, excluding the major centre of Alice, is estimated at 46 508 (1991) and

with a 2,8% growth rate, the population in 1997 is expected to be 54 321. The entire area covers about 680 Km<sup>2</sup>. The average rural density therefore is 79,9 persons per km<sup>2</sup> for the Tyumie area. Problems with population censuses and the reliance on extrapolations and derived population figures are mentioned in the Development Bank of South Africa (DBSA) report on Ciskei Development Information (Department of Planning 1985). The problem is also demonstrated in the disputes over the 1996 population census, which include the former homelands in the South African population figures (Udjo 1996). Population density for 1985 is given as 96,6 persons per km<sup>2</sup> (DBSA 1987). The statistical abstract of Ciskei, (1988) No. 1 indicates the population density as 103 persons per km<sup>2</sup> (Republic of Ciskei, 1988). Unofficial population densities, reveal that population densities in Ciskei fall from between 200 persons per km<sup>2</sup> (Bisho District) to fewer than 25 persons per km<sup>2</sup> in the Victoria East District. The figure shown by the calculation for this study is still high though there are factors to explain its reduction. As social changes occur due to enhancement in educational status so population growth decreases. Positive factors that may have effected population decrease are, higher earnings attained from work in the mines or industries as they were introduced in Ciskei after independence or the employment of Ciskeians in the civil service. The rural densities of the area would be worse had it not been for migration and other positive social change factors.

### **2.3 EFFECTS OF SOCIAL CHANGE ON POPULATION**

The effect of social changes in the study area is documented by a sample study of Msobomvu, one of the study villages in the Tyumie basin (Mini 1988). As educational levels increase in a population the benefits of family planning become more appreciated. Fewer children are born to each family and household. Another factor that may have affected the population densities in the area may be the lifting of the Group Areas Act of 1950 (As amended in 1957, 1966) in 1993 and its effect on the movement of people in the rural homelands to the urban areas. All the above indicate that the population growth rate might have dropped. The population density might also be reducing as a result of the dependence on tertiary and secondary occupations and the departure of rural communities to the urban areas, particularly since the 1994 elections, though such trends might have begun with the establishment

of industries in Dimbaza, 50 kilometres from the study area after the Ciskei independence in 1981. Though migratory tendency in the Ciskei is not a new phenomenon, its effect on the rural areas is of concern. The estimates of the number of non-household members, working as migratory labourers outside Ciskei (Republic of Ciskei 1988) between 1983 and 1985 are as follows:

Table 2.2: Migrant labour in Ciskei.

1983	63830
1984	93797
1985	95835

The Transkei, Bophutshatswana, Venda, Ciskei (TBVC) statistical abstract also provides estimates of the migratory labour force (DBSA 1987) as in Table 2.3.

Table 2.3: Migrant labour in Ciskei(DBSA)

Gender	1980	1985
MALE	48 160	51 449
FEMALE	7840	8738
TOTAL	56 000	60 187

Effects of increase in population are pertinent to rural agricultural productivity because cultivated fields continue to 'shrink' and cropland is lost to the increasing population (Gardner 1996). The reverse effect is experienced when the rural people leave for the urban areas. Losing cropland either through urban development or the abandonment of the rural area in turn compounds the difficulties of obtaining good, safe and clean water as resources are readjusted to serve the urban populations (Giles & Brown 1997). This is a point at which it is necessary to consider the situation of water as it pertains to developing communities in particular.

One of the most important considerations for the location of a settlement is water. Traditionally, rural communities have drawn water from various unprotected sources such as springs, streams, rivers, lakes or dams, open shallow wells and boreholes.



Distances to water sources have increased as homesteads are built farther away from the water source and as population increases in numbers. The result is that the per capita water availability in many rural areas has now been reduced to levels far below internationally acceptable levels (Emmett & Rakgoadi 1993). The question that is often asked is how to solve the predicament of population increases, resource allocation, distribution and development in the rural areas? Several management strategies exist, a few of which are considered below.

## **2.4 RURAL RESOURCE MANAGEMENT STRATEGIES**

Rural resource strategies adopted by environmental scientists include those of physical structure development, human resource management and development and a combination of both. Though each strategy has its advantages and disadvantages, less emphasis has been placed on the human development approach until the recent raising of concern of geographers and environmentalists.

### **2.4.1 Structural approach**

Management strategies that have emerged are mainly structural, that is providing physical infrastructure. These have not favoured the rural areas much. Structural approaches involve the construction of huge dams and inter-basin transfer of water. In South Africa, notable examples are the Orange-Fish Tunnel, the Tugela and the Lesotho Highlands schemes. These have been of less benefit to the rural areas. Their construction have been useful and beneficial to urban consumers or industrial producers. The only agricultural beneficiaries are the large scale commercial plantations, such as in Natal, the lucerne and orchard farms in the Cape and the maize farms in the former Orange Free State and Transvaal.

### **2.4.2 Precautionary approach**

Pegram *et al* (1997), however, provide a framework for addressing the information needs of catchment water quality management with a view to reducing cost and remedying the alienation of the rural people from water resource development. They suggest a precautionary approach to water quality management based on a hierarchy of processes from prevention of pollution of water sources to the handling of water at

recipient points and then finally, resorting to remediation of water bodies and treatment as a last resort. The effect on the enhancement of rural domestic environment by this approach is also debatable. The success of this approach depends, however, on the implementation of a fully integrated plan which allows for the involvement of communities within the entire basin of concern.

### **2.4.3 Legislation**

It is argued that legislation could provide the rural areas with safe water if polluters are compelled to safeguard the health of water to the rural people who are not exposed to treated water. In this line a legislative instrument which allows for the reimbursement of any community that practices safe water uses and promotes any act that enhances the quality of water has successfully been introduced in the United Kingdom with good results. The only condition is that the act should contribute to the enhancement of the environment in general (Spencer 1997). This, however, does not safeguard the supply of water to rural people. In a developing country such as South Africa, the enforcement of such legislation becomes even more difficult. The call for commercial farmers to provide water to nearby villages will also not receive much support as it will be tantamount to coercion. Recourse to an integrated and holistic practice whereby all users in a catchment basin appear to have a stake seems to be the only answer to promote the attainment of an equitable distribution and safe supply of water in any water and land environment. This is provided by the proposal of an integrated catchment management approach.

### **2.4.4 Integrated catchment management**

Integrated catchment management (ICM) is the holistic and sustainable management of the socio-economic development of all resources and their utilisation within a river catchment. This is the ultimate aim of all resource management (Pegram et al 1997). Catchment water quality management is a central component of integrated catchment management because it provides an important linkage between the social, political, economic and physical environments. It also represents a major factor influencing the achievement of sustainable resource use, particularly in a region such as South Africa which has scarce water resources. The importance of ICM to geographers is immense

because of its allusion to the tenets of the subject in seeking a holistic and overall view to the development of resources in a region (Bunce & McDonald 1971). It is important that ICM should be adopted only after careful study assessment of resources in an area. Adopting this strategy shall require the knowledge of the uses to which the land is put or intend to be used for and the factors underlying the particular use. Its significance lies in the type and manner of landuse of a particular region and the socio-political harmony existing between the community and the environment of that specific area. Landuse practices are therefore important to the success of the application of ICM.

## 2.5 RURAL LANDUSE

Several factors underlie the use of the land in the rural areas and these have been well documented (Mather 1995; Vink 1975). Some of these factors are directly economic, while others are indirectly motivated through social and cultural interplay (Vink 1975), prices and markets (Walmsley 1995) as well as differences in land tenure systems (Letsoalo 1987; De Wet & Leibrandt 1994; Van Zyl et al 1996). Bunce & MacDonald (1971) mention that factors such as innovations, processes, attitudes and the nature of rural settlements also affect the utilisation of resources in rural settlements. The use of rural land has far reaching implications which may not be restricted to the rural areas. Lietman (1994: 52) has explained the environmental land conflicts which may occur between the rural and urban areas with an example in Ghana. There, residents around a coastal wetland (rural) and the city waste disposal authorities were at odds over the disposal of waste water which inundated the saltworks of the rural population, while the salt ponds accelerated coastal erosion and increased soil salinity, making the soil unsuitable for agriculture. Vogel et al (1995), describe such matters as 'green and brown issues'. Gardiner (1996) deals with some of the strategic issues arising from the concept of sustainable development within river catchments in the rural areas and proposes that the demarcation of the rural areas around catchment basins provides the true study units for analysis. It must be emphasised, however, that any approach to rural study and development should seek to promote the welfare of the rural populations or solve their problems. Such

problems are usually embedded in the social institutions associated with the land tenure system.

### 2.5.1 Definition of land tenure

Land tenure refers to the ownership, usufruct(held on behalf of), leasehold and authority over land. This is closely related to the identification and survey of land as well as to the system of registering land rights. Land tenure is the basis of landuse systems as land is bought or owned for a particular landuse type. Land tenure differs from one society to another depending on their social and legal institutions and modes of affection to the land.

### 2.5.2 Tenure systems, landuse and water resources:

The Tyumie basin is inhabited by Xhosa-speaking people who until 1994 had been ruled by a monarchical and paternal inheritance system at local/tribal level. The tribal groups in the area are the Amakuze, who occupy the north eastern part of the basin, the Tyumie tribe in the central section along the eastern banks of the Tyumie river, the Imingcangathelo, found in a central section, astride the basin, the Jingqi tribe found in the North west, and the Gaga found in the extreme west. The Amagqunukwebe tribe is found in the south east of the basin. To the west of the Amagqunukwebe is Victoria East which is not a tribal authority area but formed part of the white farmers' pastoral land which was incorporated into the former Ciskei. These areas were earlier represented in Fig 1.4 as tribal authority areas.

The former Ciskei Department of Agriculture has documented five main forms of land tenure in operation in the area (Page 1982). These were:

*Freehold tenure* over small farms, small holdings, trading stations and mission stands. This is a type of contractual land agreement by which the owner is free to utilise the land as he deems economically viable and can convert ownership by transfer to any other person for use without prejudice. The advantage of freehold system is that the user is able to develop the land and any infrastructure thereon and



secure an equivalent or higher return from its transfer. Resources on such properties are more economic:  $\frac{1}{2}$  utilised.

*Quitrent*  $\frac{1}{2}$  over buildings, garden lots, farms, smallholdings and townships. Though, very little difference exists between the freehold and quitrent, transfer of ownership is not as easy because permanent ownership always rests with the original owner of the land. As long as rent is payable, the land can be repossessed. Though this hardly ever occurs, it renders permanent infrastructure development difficult to undertake.

*Certificate of occupation* on residential stands and arable holdings are tenure arrangements equivalent to the hiring of the services of the soil and water and this seldomly permits permanent and durable infrastructural development except the capital for production for which the terms of occupation are undertaken.

*Temporary leasehold for one year* is a more restricted term of land tenure which was undertaken between landowners and tenants, usually the state and agriculturists and whose contract term renewal depended on the performance of the lessee.

Finally, *grazing rights* on grazing lands. This was the term of arrangement by which local communities were permitted to allow their stock to graze on communal lands. Only the members of a tribal or local community were allowed to permit their flock to graze on the demarcated grazing land. The responsibility of control and management of the grazing land in the past was that of the Department of Agriculture. This arrangement is significant to the black population whose grazing lands became overgrazed and resulted in eroded environments. Water resource development in such areas were restricted to the pans or dams available.

The significance of the above is that such tenureship has a direct bearing on the use and development of resources on the land, for activities such as permanent crops or perennial crops or the construction of capital structures such as dams, boreholes and windmills. The paucity of these facilities in the Tyumie basin reflects the restrictive

terms of tenureship under which land was contracted and utilised. The mixture of these tenure forms also prevented any uniform development for the area.

The link between land use, land tenure systems and water resources becomes clearer when one considers the fact that in South Africa land is as important as the water which flows on it and land ownership, purchase and occupation are fraught with various problems particularly and pertaining to efficiency of productivity and equity (Letsoalo 1987; Page 1982; Cooper et al 1996; Van Zyl et al 1996). This does not indicate that the security granted to white farmers did not have positive results. Arguing in favour of land reform, Skweyiya (1991), encourages the retention of large scale commercial white farms from which the country has, and continues to benefit so much in terms of food and industrial products as well as foreign earnings. Security of tenure was the hallmark of the policy of the South African government strategy of ensuring mass grain, vegetable and livestock production and in terms of which large tracts of land were cultivated for maize in the former Transvaal and the Orange Free State (Cooper et al 1996; Van Zyl et al 1996; Walmsley 1995). The success of agriculture however, depends to a large extent on the availability of water.

Thompson (1992) chronicles the development and control of water in South Africa and the use of water as embodied in the Water Act of 1956 (as amended, 1986). Without **water**, and without the security of land **tenure systems**, investments on the land are only temporary as the occupants' may not have any permanent stake in the property of **water and land**. On a local scale, the failure of parastatal organisations, which were considered to be the panacea to the inefficient use of resources in the rural areas of South Africa, testifies to this because the locals had a limited stake in the agricultural organisations. Examples of these schemes are the Tyefu, Keiskamma and Gwali Irrigation schemes, which all collapsed due to the shift away from the original plan of community participation. Water only serves as a resource when its intrinsic utility is realised by the community at large (Mitchell 1989) and when a sustained supply can be secured. Having a stake in the land is tantamount to the incentive of developing it and any resource on it. The history of occupation of the Tyumie basin is no different from that of the rest of South Africa. The mode of occupation, transfers,

allocation and the released lands, coupled with the land tenure arrangements associated with it, did not permit the development of infrastructure such as dams, weirs or windmills. With lack of finance and lack of control over the land, this has contributed to the varying and often low level of water development in this area in particular.

### **2.5.3 Importance of land ownership to water resource development**

In the traditional system of land tenure each tribal area is deemed to be the property of the tribe and is administered by the chief. Once land belongs to all members of the community, an individual may find it extremely difficult to invest in it. It is for this reason that officials refer to traditional land system as not productive and therefore this type of tenure was not allowed in the released areas (Department of Agriculture and Forestry, 1985). Grazing rights on the commonage were confined to members of the tribe with residential holdings in the area. Page (1982) states that on community grazing land, there were no means of preventing the diseases of animals belonging to one community member from infecting all the others, and there was little opportunity for all the community members to manage the grazing commonages together. Most of the landuse systems discussed above were highly restrictive or protectionist, the intention being mainly to restrict access to land to people as their mode of use of the land was considered unproductive. Masiphula *et al* (1996:40,43) have argued that the intention was to enforce a structural change of occupations to enable blacks to provide alternative occupation and labour to the mining and manufacturing industry.

After 1994 the legacy of the land tenure system still persists and the resultant landuse patterns and prevalent water resources are visible. Farm areas which were released are still found in Victoria East. Consolidated areas still appear as crowded villages with no visible areas used for large-scale agriculture. The released areas initially benefited from the water development of the previous farms but as population densities and growth has increased, so has the problematic conditions of the eastern section of the basin developed. The Ciskei government considered that with medium scale irrigation schemes, applicable to orchard farms, dairy and vegetable farms, the water and landuse productivity problem could be solved. These schemes achieved

initial success as the implementation was carried out with zeal. Irrigation schemes which were considered novel in the solution of water and land tenure predicaments have, however, also proved to be ineffective as ownership has invariably fallen into the hands of administrators and consultants instead of the peasant cultivators. It may be stated here that the orchard farms in the basin which are para-statal are earmarked for liquidation due to poor management and low profitability. In addition to the above, water infrastructure such as reservoirs and their maintenance have been neglected because community and national priorities do not overlap and holistic catchment basin principles are not applied.

The foregoing commentary provides the context for the problems arising from the impact of the past land tenure and landuse systems on the development of infrastructure for resources such as water in the Tyumie basin. The effect of this on landuse systems, particularly crop and pastoral agriculture, will be seen in chapter three. The water resources in the study area are now described below.

## **2.6 WATER RESOURCES IN THE TYUMIE BASIN**

Compared with the rest of South Africa, the Tyumie basin which falls in one of the highest rainfall regions (>500mm per year) is endowed with several sources of water. These are surface flow, underground sources and a relatively high amount of summer rainfall. However, 75% of the rainfall is received within 25% of the year (Late November to early February). Thus, reliability is low, making it necessary to plan for storage infrastructure for any domestic and landuse purposes. The sources of water are described below.

### **2.6.1 Surface flow**

The rural villages in the Tyumie basin are traversed by a wide and intricate network of streams (Fig 2.3). The main river, the Tyumie, has a mean annual run-off of 42 000 million cubic metres and is considered reliable. All the tributaries, however, are non-perennial and the river channels are dry in the winter months of June to September. The communities mainly rely on the Tyumie river because the tributaries invariably do not have any water flowing through them in winter.



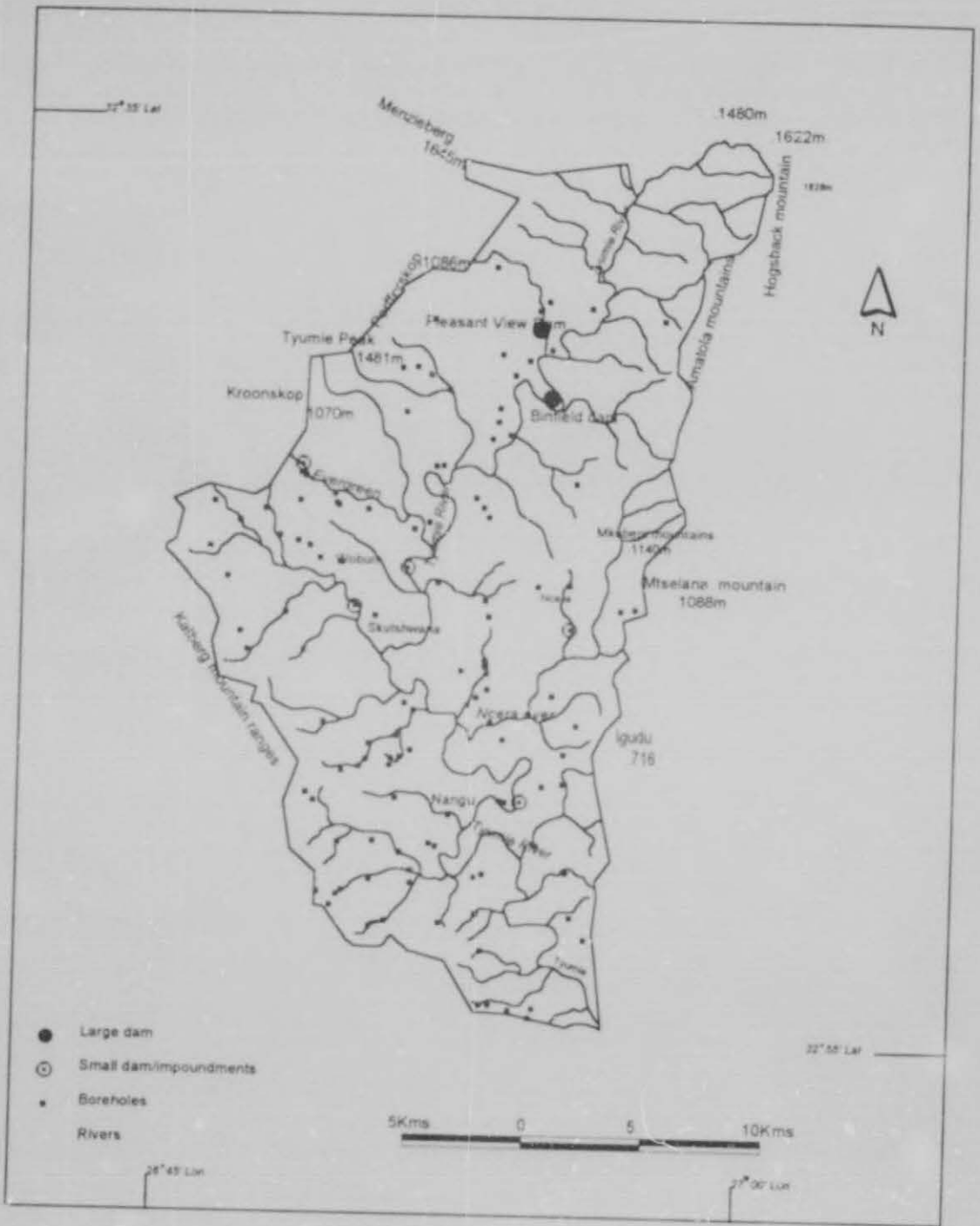


Fig 2.3 Water resources in the Tyumie basin

### 2.6.2 Groundwater

Studies by consultants, Hill Kaplan Scott in 1977 and 1985 and the yields achieved by private farmers have indicated that there is a moderate groundwater potential. Unfortunately, not all villages have boreholes and those that do have boreholes do not always have an adequate water supply. Many villages draw their water from unprotected sources such as stock dams and streams (Steffen, Robertson and Kirsten 1985).

### 2.6.3 Surface dams

The main supply dams for water distribution in the area are

- The Binfield Park dam which has a full capacity of 32 million m<sup>3</sup> (DWAF King Williams Town). This dam was officially completed in 1990 and is at present diverting water to serve the water treatment works in Alice. The Eastern Cape government has initiated a Reconstruction and Development Project intending to supply water to the Victoria East and Gaga areas. The Project, known as the 'Eastern Cape: Victoria East District: Gaga-Tyumie water supply project' is in the pipeline and consultations with the village water committees of Gaga point to the involvement of the communities in the project. Unfortunately, information being relied on by the steering committees are those extracted from 1982 when the same idea of a water scheme was proposed in a Tyumie Valley rural water supply scheme. In the 1982 scheme the storage draft analysis of the dam allocated a gross annual draft of 2.42 million cubic metres per annum to rural domestic water demands. The overall relevant dam statistics are

• Irrigation allowance	13,14 x 10 <sup>6</sup> m <sup>3</sup>
• Domestic allowance	
•       Urban	1,3 x 10 <sup>6</sup> m <sup>3</sup>
•       Rural	2,42 x 10 <sup>6</sup> m <sup>3</sup>
• Riparian	2,18 x 10 <sup>6</sup> m <sup>3</sup>
• Total	19,04 x 10 <sup>6</sup> m <sup>3</sup>

The engineers, Hayne Ross and Kleyn (1996) conclude from the above parameters, that with the gross capacity of the dam being 36,83 x 10<sup>6</sup> m<sup>3</sup>, and the design average

daily and peak summer water demands amounting to  $1,5 \times 10^6 \text{ m}^3$  and  $2,252 \times 10^6 \text{ m}^3$  respectively, it is patent that sufficient water is available for the design life (20 years) of the scheme. At present, frantic efforts are underway to supply water to the rural communities from, the Binfield dam. Other major water resources include;

- Pleasant View Dam which has a capacity of 1,95 million  $\text{m}^3$  was constructed initially to serve the urban residents of Alice and nearby farms but is now fully used by the agricultural school at Phandulwazi.
- Evergreen Dam with a capacity of 0,14 million  $\text{m}^3$  was constructed as a water supply source for a small scale irrigation scheme for the citrus farm in Evergreen.
- Smaller excavation dams or impoundments also exist for the orchard farms at Woburn, Skutshwana and Nangu.

#### **2.6.4 Rainfall**

The Tyumie basin experiences annual rainfall which varies between 500 and 1000 mm. 75% of this rain occurs between late November to February. The effectiveness of the rainfall to agriculture is however, reduced by the variability of the rainy period, the steep slopes of the area and the high evaporation rates. Estimates presented by Hill, Kaplan and Scott (1982) suggest that there is an adequate amount of water for existing uses of domestic, livestock watering and irrigation purposes. However, the implementation of projects which are meant to tap these resources are long overdue due to political and financial constraints, and water supply of adequate quantity and quality is not accessible to the rural communities. Meanwhile the rural communities have to rely mainly on rain for purposeful crop and animal farming and increasingly on river water in rainless periods.

## CHAPTER THREE: ANALYSIS OF DATA : POPULATION AND LANDUSE

### 3.1 INTRODUCTION

The following two chapters discuss the results of the analysis of data collected from the fieldwork. The results are handled under two broad headings. The analysis of population characteristics, landuse activities and its resultant patterns are discussed in chapter 3 and water characteristics that might have had any influence on the landuse patterns in the Tyumie basin is discussed in Chapter 4. Figures 3.1 to 3.7 and Tables 3.1 to 3.7 are the results of data collected from the survey. Chapter 3 begins with an insight into the changes in population structure that has developed in the black population since the 1980's. It also describes the educational characteristics of the population which has a bearing on economic activities and finally the involvement of the population in agricultural activities. It was found that agricultural activities have diminished in the Tyumie basin. There is also a lack of water infrastructure to support agriculture. The agriculture undertaken by the previous white farm owners has been abandoned and infrastructure development of water resources continues to deteriorate.

#### 3.1.1 Population profile of the Tyumie basin

The importance of recognising the population characteristics of an area in anticipation of any effective development project was highlighted in Chapter 2. The growth of population in Third World areas has outpaced that of any of the Western advanced countries and this has posed problems for the achievement of developmental targets. The data from the fieldwork indicated that the Tyumie area is in a transitional stage. This confirms research done by Van Zyl *et al* (1996), that 'in 1951, less than 5 million people lived in the homelands. This number peaked at 14 million in 1985, and in 1988, levelled at 13,1 million'. Such a transitional mode appears to be the case with the study area as the population pyramid below indicates.

The population structure, seen in Fig. 3.1 shows a preponderance of females over males in all age groups. A significant characteristic of the homeland populations is the absence of the male group from home due to the cyclical out-migration to the



urban centres in search of work. Therefore at each time in the year, there is a greater number of women than men in these areas. The effect of such a population structure is the loss of farm male labour, and dislocation of social family units.

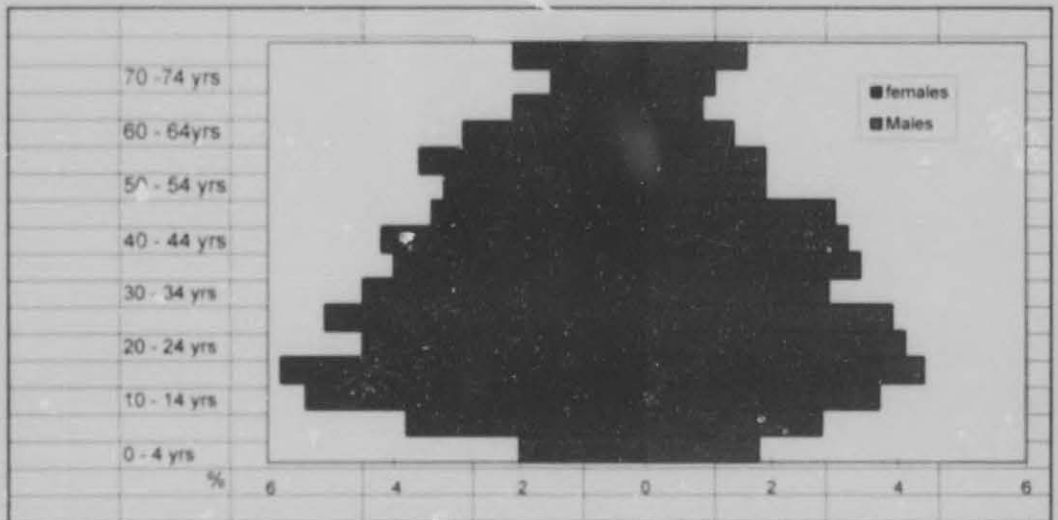


Fig. 3.1 Sample population structure in the Tyumie basin

A summary of the sample population data is presented in Table 3.1

**Table 3.1 Gender and age ratio of sample population**

	AGE GROUPS (IN YEARS)					Total No	%
	< 4	5 - 9	10 - 19	20 - 59	>60		
Males	1.8	2.8	8.1	24.3	5.0	446	42
Female	2	3.8	11.1	32.5	8.6	619	58
Total No.	41	71	265	603	145	1065	100
% of Total	3.8	6.6	19.2	56.8	13.6	100	

The sample population is made up of 42% males and 58% females. A significant 56,8% of the sample population is made up of adults who are in the economically active age group of 20-59 years. Almost a third (32,5%) of the adult and economically active population are females.

The number of people above 60 years constitute 13,6%, while 10,4% of the population are children below the age of 10. The infant group of 0-4 form 3,8% of the population. Isolating the most pertinent revelations from the data, the above description of the population pyramid has very important implications which can be

explained under the following: *the unusual structure of the pyramid in a developing world context and the low infant population number in the population structure.*

### 3.1.2 Age and Gender structure

In Third World countries population pyramid structures are often portrayed by means of a broad-base pyramid and a narrow old age group at the apex. The explanation of such a structure lies in the rapid birth-rate trend within the usually poor communities and the high mortality rate which is often associated with low health standards and poor sanitation facilities. Usually, water plays a significant part in the high infant mortality and the high death rate in such environments.

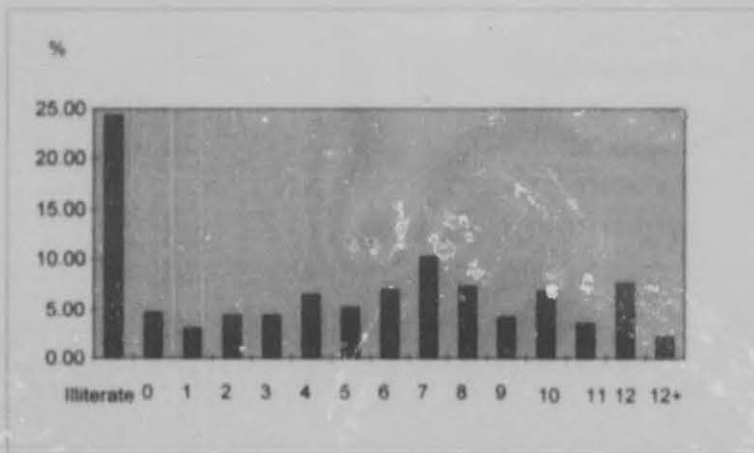
In the Tyumie basin a different population structure to the one described above is depicted, as was seen in Fig. 3.1. The most significant aspect of the structure is the very low figure in the 0-10-year bracket, which signifies a decline in the birth rate. Though one can also assume the cause to be a phenomenally high infant mortality rate, that is less likely to be the case. Though much has been written on rural-urban migration and its effect on rural population (Nattrass & May 1986; De wet & Leibraudt 1995), the population structure exhibits a significant proportion of people in the economically active age group. This group is the broad base Third World children who have reached adulthood. A plausible explanation for the low figure in the infant age bracket could then only be attributed to a transitional phase of a Third World population. The atypical structure of the population pyramid is evidence of a transitional phase of a Third World community.

Third World communities usually have more than 50% of its population engaged in agricultural or primary activities. It is pertinent, to investigate the involvement of the economically active population in agricultural activity. This is done by observing the occupational structure of the sample population in the Tyumie basin. The result will constitute the developmental profile which may support the notion of the transitional stage theory.

The development profiles of the Tyumie basin is now discussed firstly by identifying the educational profile of the population in the area.

### 3.1.3 Education Levels

The answers provided by respondents about their last level of schooling were converted from the old class standards (Sub A to Std 10) to the new grading system (Grade 1 to Grade 12). Thus Standard 10 becomes Grade 12 and Standard 1 is regarded as Grade 3. The significance of identifying the level of education is to understand the relationship between the formal education of the rural people relative to occupations, the development of landuse systems and water usage. Fig. 3.2 indicates that over 24 percent of persons have not received any formal education whilst 2.04% have achieved a higher than matric level education.



**Fig. 3.2 Educational levels of residents in the Tyumie basin**

The highest percentage of illiterates (56,1%) are found in the Gaga area (Table 3.2). This is possibly the cause of the influence of Alice, (the urban area) and the possibility of offers of jobs for even the less educated. The University of Fort Hare, government offices and staff in Alice provide employment to a large number of educated as well as others in the capacity of gardeners, sweepers, cleaners and house maids, some of whom are illiterates. Many of the educated people in the area have also left to stay in

urban areas such as Fort Beaufort, King Williamstown and East London. The distribution pattern of educational levels of the sample population in the basin is seen in Table 3.2

**Table 3.2 Educational levels of the sample population in the Tyumie Basin**

Row percentages

Tribal Area	EDUCATIONAL LEVELS (in Grades)					Total No	% of Total
	Illiterate	0 - 3	4 - 7	8 - 12	12 +		
Amakuze	25.4	17.9	26.5	28.5	11.4	140	13.1
Tyumie	5.6	16.4	40.8	36.8	0.4	249	23.4
Jingqi	10.8	22.3	28.4	33.9	4.6	130	12.2
Imingcan	41.7	17.8	17.2	21	2.3	175	16.4
Gaga	56.1	1.3	18	20.1	3.2	155	14.6
Gqunuk	13	19.2	34.4	31.1	2.3	177	16.6
Vic East	28.2	20.5	25.6	25.7	0	39	3.7
Total No	258	172	304	309	22	1065	100
% of Total	24.2	16.2	28.5	29	2.1	100	

The area with the highest percentage of people with post-matric education, that is grade 12+, is the Amakuze area (11,4%). This is followed by the Jingqi area (4,6%). It is reasonable to assume that educational standards and economic well-being are positively related. It is also true that the level of education determines the type of work people engage in, and the type of landuse that may be relevant to the community as well. The educational standards attained by the people in the Tyumie basin is reflected in the economic activities that is depicted by the profile described in the next section.



### 3.1.4 Occupations and economic profile

According to data in Table 3.3, the largest percentage of the sample population (43,4%) are children and students. The percentage of unemployed (33%) and pensioners (14% ) is very significant. The Table is an aggregation of the major groups of occupations as the variety of occupations was very large and hence persons working as hawkers, taxi drivers, shop owners were grouped under "self-employed"; similarly, farm caretakers, security officials and rangers were also categorised as police.

**Table 3.3 Occupational structure and economic profile**

Number of cases and percentage of totals

Gender	OCCUPATIONS OF TYUMIE BASIN RESIDENTS									Total
	Pension	Unemployed	Farmer	Teacher	Police	Bank	Minor	Self-employed	Students	
Male	66	147	3	7	4	19	12	9	215	482
Female	83	204	1	16	0	16	0	16	247	583
Total	149	351	4	23	4	35	12	25	462	1065
%	14.0	33.0	0.4	2.2	0.4	3.3	1.1	2.3	43.4	100

In total figures, the number of adults who are unemployed and/or pensioned is 500 or 47% of the population. Only 103 or 9,7% of the 1065 sampled population are gainfully employed. This implies a large over reliance of the population on the economically active population.

The spread of incomes in households in such instances is thin and poverty is entrenched. The main contribution of income is from the service occupations of clerical work, and the teaching profession. These have been the traditional occupations of blacks in the former homelands and it is no different in the Tyumie basin. The contribution of mining to the employment patterns in the area is 1,1% of the population. The engagement of respondents in self-employed business is very significant, noting that 2,3% of the population is self-employed. Self-employed occupations vary from fruit vending, and technical work like welding, painting and auto mechanics to taxi driving and water vending. Very relevant to this study is the number of respondents engaged in agriculture. Only 0,4% of the respondents

positively identified themselves as farmers. The informal sector appears to be the occupation that the residents are turning to. With the pattern of occupations in a rural area known as above, it is necessary to discuss the actual landuse practices in the Tyumie basin to ascertain the bearing on water resources.

### 3.2 LANDUSE PRACTICES AS OCCUPATIONAL ACTIVITY IN THE TYUMIE BASIN

The Tyumie basin is a rural area but the types of occupations shown in Table 3.3 do not suggest that agriculture is the major occupation of the residents. The following section attempts to answer the question of the types of landuse activity that are practised in the area and provide reasons for the situation.

Researchers such as Letsoalo (1987) and Masiphula *et al* (1996) have argued about the success of black agricultural entrepreneurship in the first half of the 20th Century. Their argument was that it was the intrusion of external factors like the competition of white farmers and the vagaries of trading as well as the imposition of laws on land acquisition that provided the incentive for blacks to shift from agricultural activity to mining and urban migration. Of recent concern, Mini (1988 ) cautions on the redistribution of land according to the original traditional tenure format if the aim is to achieve competitive market productivity. Evidence of local black irrigation schemes also suggests complete failure. Examples of this is shown by the performance of schemes at local areas such as the Magwa tea plantation and the Ncora irrigation schemes in Transkei. Other irrigation schemes which have failed are the Tyefu and Keikskammahoek in Ciskei. As recently as August 1997, the citrus farms in the Tyumie basin which are managed by Ciskei State officials are being liquidated due to lack of profitability.

Large scale agriculture requires heavy machinery and other large capital inputs but subsistence agriculture is more labour intensive. The proportion of labour required to produce the same amount of output in the subsistent economy can therefore be used as a measure of productivity or involvement in the rural agricultural sector. In the Tyumie basin, however, after the release of the white farm lands to the Ciskei

government for settlements, both commercial and subsistent agricultural productivity appear to have dramatically subsided.

The next sections will deal with the intensity of involvement of the population in animal and crop activity, to show the trend of the black communities in land related activities. The discussion will be divided into two; firstly, the involvement of the population in animal production and then in crop production. It is already known that only 0,4% of the population are occupational farmers. The next section discusses the ownership of stock as a subsistent landuse activity.

### 3.2.1 The practice of animal farming in the Tyumie basin

In a Third World rural setting, almost all residents engage in some form of agricultural activity. Ownership of animals, especially cattle, is a significant characteristic of the Xhosa environment (Page 1982). Most Xhosa adults prefer to own large number of stock. However, this does not appear to be the case in the area at present. Table 3.4. indicates the number of respondents and proportions of families engaged in rural animal farming. In the Tyumie basin only 30,3% of the population own cattle. This signifies a fundamental structural shift from the traditional rural economy.

**Table 3.4 Types of stock in the Tyumie basin**  
Number of respondents

Tribal authority	TYPES OF STOCK OWNED						Total	% of Total
	cattle	sheep	goats	pigs	chicken	horses		
Tyumie	19	18	17	7	2	1	64	28.1
Amakuze	11	5	12	2	1	0	31	13.6
Jingqi	6	1	8	4	2	0	21	9.2
Imingcangathelo	10	5	7	1	5	0	28	12.3
Gaga	7	6	7	5	8	0	35	15.4
Gqunukwebe	11	8	13	1	1	1	33	14.5
Victoria East	5	2	5	2	2	0	16	7.0
<b>Total</b>	<b>69</b>	<b>45</b>	<b>69</b>	<b>22</b>	<b>21</b>	<b>2</b>	<b>228</b>	<b>100.0</b>
<b>% of Total</b>	<b>30.3</b>	<b>19.7</b>	<b>30.3</b>	<b>9.6</b>	<b>9.2</b>	<b>0.9</b>	<b>100</b>	

There is, however, an appreciable proportion of families who own goats (30,3%). This is ascribed to the ease of rearing and the sturdiness of goats, which can survive droughts. Goats can also survive for longer periods without food than cattle. Environmentally, the problem with goats is that they are browsers, and their foraging

tendencies lead to a great deal of environmental degradation, especially to the shoots and buds of young vegetation. This has a negative impact on vegetative regeneration which further exacerbates soil erosion. The influence of urban economics in the area is also seen by the low use of horses. Only 0,9% of people own or use horses in the area. The rearing of pigs is practised by 9,6% of the people in the Tyumie and 9,2% of the respondents keep some poultry. The seriousness of the decline of animal production is more significant if the major animals, cattle, sheep and goats, are considered according to tribal authority areas to reveal the patterns that may emerge from such a decline.

Table 3.5 indicates the percentage of households in each tribal area who are engaged in animal rearing or farming on their properties. The table depicts that one family may be engaged in more than one stock activity therefore the totals of proportions may not add up to 100%

**Table 3.5 Proportion of households engaged in animal farming**

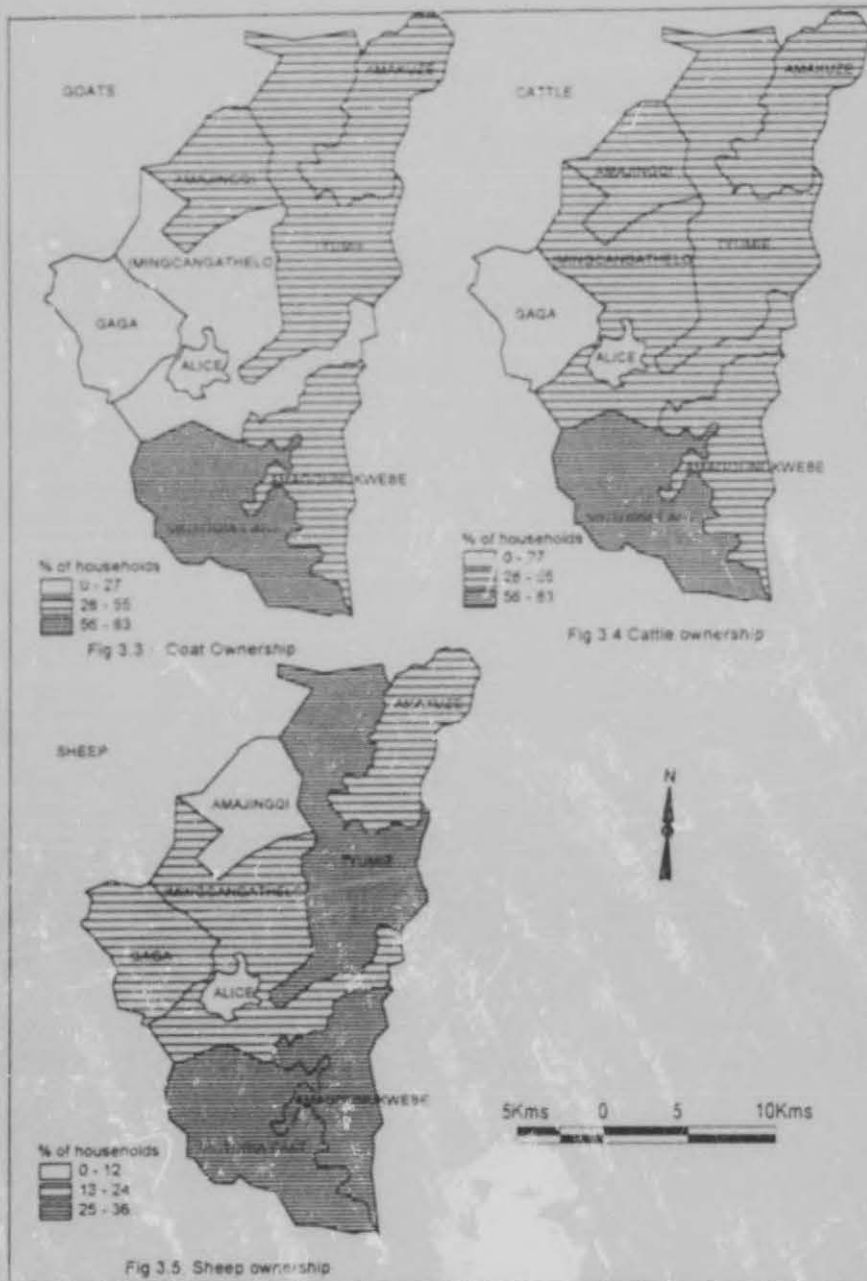
Percentage of households engaged in stock farming

Tribal area	Total No. of households	% of households engaged in stock		
		Cattle	Sheep	Goats
Tyumie	50	38	16	34
Amakuze	30	37	17	40
Jingqi	21	29	5	38
Imingcangathelo	32	31	16	22
Gaga	30	20	20	23
Gqunukwebe	30	37	27	33
Victoria East	6	83	30	83

From Table 3.5, Victoria East can be classified as a truly rural animal-producing area because 83% of the sample population are involved in both cattle and goat farming. That is the area whose commercial agriculture and water infrastructure foundations were laid by the white farming communities. In all the other areas, less than 45% of the households keep any particular stock. The above table is translated, spatially into Figs. 3.3, 3.4 and 3.5 to show the pattern of distribution per tribal area of people who own or keep sheep, goats or cattle. The highest percentage of households (83,3%) involved in goat rearing (Fig. 3.3) and cattle rearing (Fig. 3.4) is found in the Victoria East. With sheep farming (Fig. 3.5), the Victoria East, Amagqunukwebe and Tyumie



have the highest levels of households involved in this activity. Lower productivity is evident in the Amakuze and Imingangathelo areas. The lowest involvement of households in animal farming appears to be in the Gaga area. The Gqunukwebe area has a strong affinity with the Tyumie and Victoria East areas.



This is the effect of the availability of water in these areas. In Gaga, and the cause may be due to the competitive occupations available by the urban area and therefore households are more involved in other occupations.

These results suggest that the communities must be engaged in some other landuse ventures or have reduced their dependence on animal farming for a livelihood. Apart from the Victoria East area, more lucrative ventures seem to exist for the residents of the Tyumie basin beside animal farming. The engagement of the population in crop farming may probably provide the answer.

### 3.2.2 Crop production

The Tyumie basin is known for its cattle kraals and sheep farming rather than for its crop production. However, the resettlement policies of the early sixties had intended that the residents would utilise household yards for vegetable cultivation and for residential landuse as well. Table 3.6 indicates the proportion of farmers engaged in specific crops in the Tyumie basin.

**Table 3.6 : Distribution of crop farmers in the Tyumie basin**

Column percentages

AREA	TYPES OF CROPS FARMERS GROW								Total No
Tribal authority	Maize	Pumpkin	Cabbage	Lucerne	Onion	Tomato	Potato	Beans	of cases
Amakuze	23.5	25.0	10.3	16.7	10.5	22.2	19.2	14.0	46
Tyumie	29.4	25.0	44.8	33.3	52.6	22.2	25.0	37.2	82
Imingc	8.8	12.5	20.7	16.7	15.8	22.2	13.5	7.0	31
Jingqi	10.3	12.5	13.8	16.7	15.8	11.1	21.2	9.3	34
Gaga	7.4	4.2	3.4	16.7	0.0	0.0	9.6	4.7	15
Gqunuk	16.2	16.7	3.4	0.0	5.3	22.2	7.7	23.3	33
V.East	4.4	4.2	3.4	0.0	0.0	0.0	3.8	4.7	9
No of cases	68	24	29	6	19	9	52	43	250
% of Total	27.2	9.6	11.6	2.4	7.6	3.6	20.8	17.2	100

The Table suggests that the Tyumie area has the highest percentage of farmers engaged in maize (29,4%), Cabbage (44,8), Lucerne (33,3%), Onion (52,6%), Potato (25,0%) and beans (37,2%) cultivation. The number of cases indicate that 68 out of 250 or 27,2% of the farmers in the basin cultivate maize. Maize is a staple crop in the basin but less than 30% of the population is engaged in its cultivation. Maize farming

is also a seasonal activity and its practice is restricted to the summer season only, when there is sufficient rain to support production. The area with the closest proportion of maize farmers to the Tyumie area is the Amakuze. There is a correlation, therefore with the availability of water for maize production in the area. More households in the upper reaches of the Tyumie river plant maize. The further an area is from the main river, the lower the involvement of the community in maize farming. Cabbage farming, provides another clue to the effect of water on crop farming. The Tyumie (44,8%) and Imingcangathelo (20,7%) have the highest percentage of farmers engaged in cabbage cultivation. These are areas with reliable water supply.

Maize is a staple food, therefore, the figures above indicate a dependence on the urban area for food and the neglect or abandonment or under-utilisation of the land for food crop production. The trend in crop farming in general in the rural Tyumie area does not appear to differ from the decline of animal farming. To demonstrate this the percentage of farmers cultivating maize, cabbage and potato in each of the tribal areas was compared. Table 3.7 illustrates that 53,3% of the households in Amakuze cultivate maize, 33,3% cultivate potato and 10,0% cultivate cabbage. The spatial impression of this data is shown in Figs. 3.6, 3.7 and 3.8.

**Table 3.7 Proportion of households engaged in crop farming**

Percentage of households engaged in crop cultivation

Tribal Authority	No of households	% of households cultivating crop			Total No. of cases
		Maize	Cabbage	Potato	
Amakuze	30	53.3	10.0	33.3	29
Tyumie	50	40.0	26.0	26.0	46
Imingcangathelo	32	18.8	18.7	21.9	19
Jingqi	21	33.3	19.0	52.3	22
Gaga	30	16.7	3.3	16.7	11
Gqunukwebe	30	36.7	3.3	13.3	16
Victoria East	6	50.0	16.7	33.3	6
<b>Total No. of cases</b>	<b>199</b>	<b>68</b>	<b>29</b>	<b>52</b>	<b>149</b>

The general pattern that emerges is that none of the areas has more than 53,3% of its rural household population engaged in crop production. What can be concluded from



Fig 3.6 : Maize Cultivation

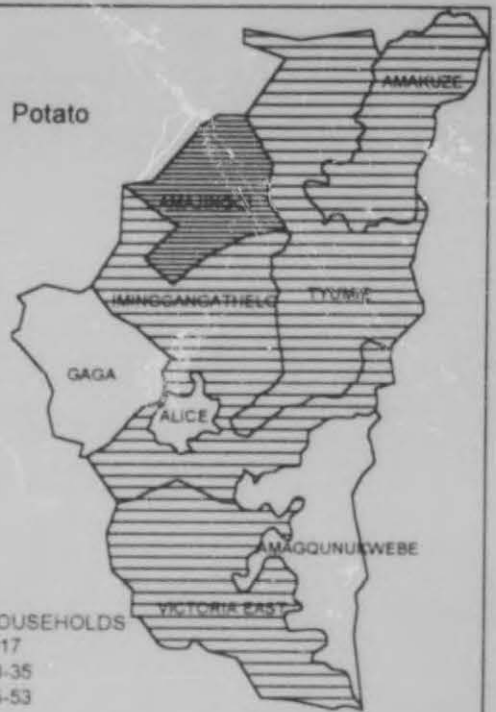


Fig 3.7 Potato cultivation



Fig 3.8 : Cabbage cultivation



the above commentary is that in all areas, crop and animal productivity have dwindled. Could this be due to the lack of infrastructure, or could this be due to lack of farming management? It may be due to farm sizes and tenureship and soil degradation could also not be ruled out. What is seen is the correlation of agricultural activity to the proximity of water sources. It is also certain that the need for a sufficient supply of water for agriculture and for human consumption is clearly discernible. It is to that aspect, water resources and people's accessibility to the resource that attention is now turned in the next chapter.

In Chapter four, the sources of water are identified and distances to water points are highlighted. The use of water and the quantities available for use are also determined from the responses of informants. Since community involvement in water projects determine the social organisation and their concern for good, clean water, that aspect is also considered. A water perception index is also formulated as an indication of the communities' interest in 'good' and clean water. Finally, the chapter will be concluded by a hypothetical target to which available water is compared, in order to ascertain the level of water shortage for the communities.

## CHAPTER FOUR ANALYSIS OF DATA : WATER RESOURCES

### 4.1 INTRODUCTION

This chapter is concerned with the water resources available to the residents of the Tyumie basin. The chapter begins with the types of water sources available, the means of collecting the water and the use to which water is put in the rural households. The information on inherent difficulties involved in the collection of the water for human and animal use are also discussed. Attention is also given to the importance of the perceptions of people as far as the quality of water is concerned. The results of data from the survey are shown first in percentage of opinions of households and then in a spatial water quality index diagram. The chapter ends with a hypothetical target of 40 litres per capita per day to which the levels of water available to residents is compared, to serve as an index of water sufficiency in the Tyumie basin. The significance of this chapter is its link with the landuse problems discussed in chapter three to conclude the study on the assessment of landuses and water resources in the Tyumie basin.

### 4.2 SOURCES OF WATER

Wherever water is scarce, a variety of sources are used in an attempt to secure sufficient quantities for survival. There were five main sources of water from which respondents obtain their water for domestic and other landuses. The sources were rivers, dams, boreholes, household taps, which were available where water is obtained from inside the yard of the house and, finally, community taps where a number of members of a community could fetch water.

Van Schalkwyk et al (1996), and Giles and Brown (1966) have indicated that the supply, use and consumption of water is related to income levels and the agency supplying it. In the Tyumie basin, levels of income are very low and the influence of supply agencies is just emerging, through the Reconstruction and Development Program(RDP). Thus the supply of water depends on the available sources in each

community's environment. Table 4.1 shows that for the residents in the entire basin, rivers constituted 49 percent of their water sources.

**Table 4.1 : Sources of domestic water in the Tyumie basin**

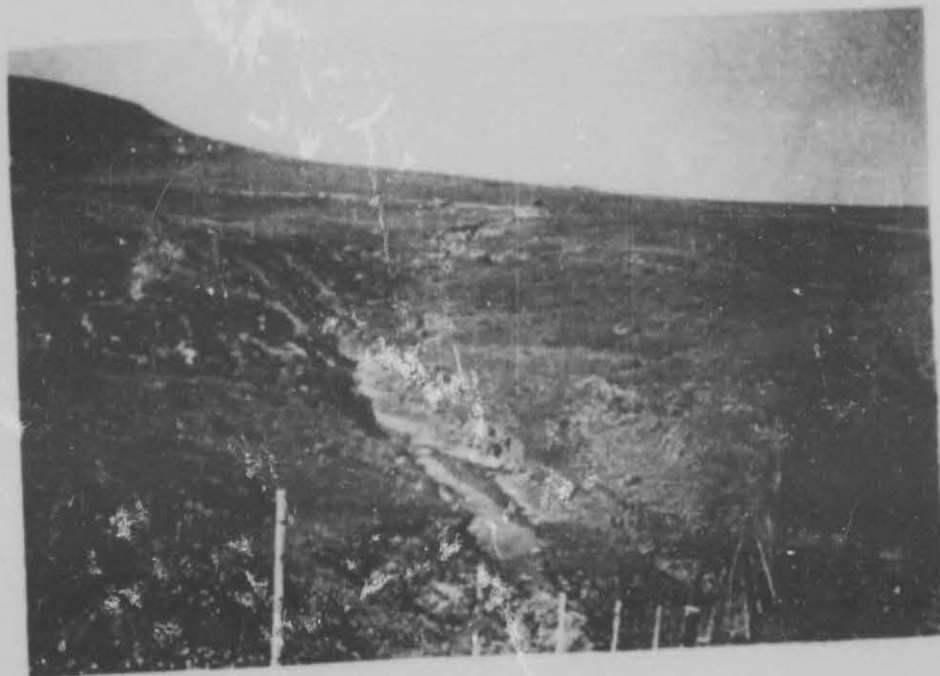
Number of respondents

Tribal authority	SOURCES OF WATER					Total Cases
	Rivers	Dams	Boreholes	House taps	Community Tap	
Amakuze	30	11	2	0	0	43
Tyumie	35	8	19	1	1	64
Imingcangathelo	14	13	13	1	1	42
Gwali	10	0	1	0	10	21
Gaga	13	0	8	0	17	38
Victoria east	3	2	1	0	0	6
Gqunukwebe	16	1	2	1	13	33
Total No of cases	121	35	46	3	42	247
%	49	14	19	1	17	10

Water from boreholes or from windmill-propelled infrastructure constitute 19% of sources and stock dams constitute 14% of water sources. Installed taps provide 17% of water sources to the community. Only 1% of water in the villages comes from taps within the periphery of the household plot or within the residential building. The above indicates that the communities in the Tyumie basin rely mainly on rivers as their source of water. It is evident that the Tyumie river which supplies the Amakuze and the Tyumie tribal areas with reliable amounts of water, makes these areas appear to be water sufficient.

The fetching of water entails travelling and conveyance. Collection points often exceed 300 metres from households and the risk of contaminating water over such distances of travel remains high. It is expected that where difficulties of reticulation exist, boreholes could serve as the alternative source if the geohydrology permits. Research by Hill, Kaplan Scott (1977), Hayne, Ross & Kleyn (1996) ranked the Tyumie basin as an area of moderate groundwater potential. It is interesting to note that 17% of the water sources is from community taps. These are usually pipeline-fed reservoirs from windmills to which taps are connected. These reservoirs often dry up

in winter and communities resort to the rivers for water. Plate 4.1 shows a common situation in winter when groundwater levels are low as a result of low rainfall. At such times communities collect water from almost dry beds.



**PLATE 4.1 :** A section of Mbashe River with an almost dry river channel. The condition in the photo is typical of the tributaries of the Tyumie River in winter. The water, above, is used by villagers in Mpundu.



### 4.3 DOMESTIC WATER USAGE IN THE TYUMIE BASIN

Data from Table 4.2 shows the total amounts of water usage in the respective tribal areas as a summation of the major types of domestic usage. Dwellers in the Tyumie and Amakuze tribal areas have the highest levels of water usage.

**TABLE 4.2 Human water consumption**

Units in litres used per day.

Tribal Authority	Sampled Population	Domestic usage of water							Total usage
		WuClo	WuWB	WuCh	WuwD	Wucook	WuAu	WuPG	
Amakuze	140	1311	356	333	258	217	32	0	2507
Tyumie	249	1521	817	725	460	375	176	400	4474
Imingc	175	1005	495	410	232	199	187	292	2820
Jingqi	130	613	250	230	145	119	63	2	1422
Gaga	155	504	445	367	231	186	218	25	1976
Gqunukw	177	1015	502	482	284	220	85	103	2691
VicEast	39	260	115	80	34	25	14	0	528
<b>Total</b>	<b>1065</b>	<b>6229</b>	<b>2980</b>	<b>2627</b>	<b>1644</b>	<b>1341</b>	<b>775</b>	<b>822</b>	

\*WuClo = water used for washing clothes; WuWB = personal washing; WuCh = Cleaning house;

WuwD = washing dishes. Wucook = cooking. WuAu = animal use; WuPG= plants and garden watering.

In both instances the ease of obtaining the water from the rivers has probably contributed to the large volumes of water which are utilised in the specific area. Both Amakuze and Tyumie residents are assured of water throughout the year due to the proximity of their settlements to the river. This supports Van Schalkwyk's (1996) finding in the Northern Transvaal that water usage is increased when the water is available and easy to get, and curtailed when there is a charge for it or is not available. In the study area as evident in Table 4.2, communities use water for the washing of clothes (WuWclo) more than for any other household activity. This is followed by the water used for bathing (WuWB), house cleaning (WuCh), dish washing (WuwD), cooking (Wucook) and on animals or pets (WuAu), in that order. The least amount of water is used on plants and gardens or for irrigation(WuPG) purposes.

When the per capita usage of water is calculated for each tribal authority area, the shortage of water in the basin becomes clearer. This is represented in the total litres per capita per day usage illustrated in Table 4.3.

**Table 4.3 Per capita water usage in Tyumie basin**

Units of water in litres

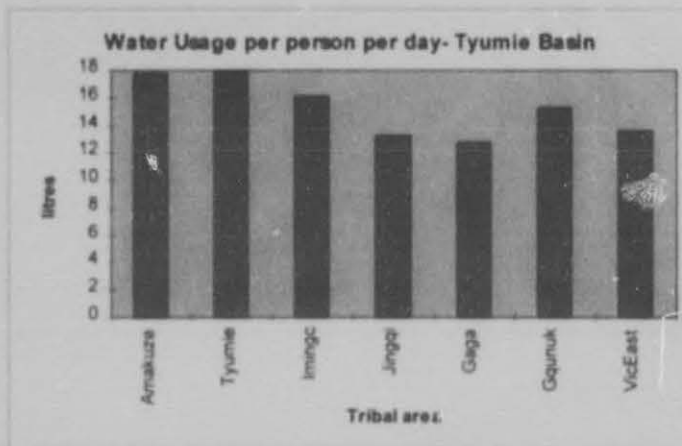
Tribal authority	Sampled Population	Domestic per capita usage of water							Total l/c/d
		WuWclo	WuWB	WuCh	WuWD	Wucook	WuAu	WuPG	
Amakuze	140	9.36	2.50	2.38	1.80	1.55	0.2	0.00	17.79
Tyumie	249	6.10	3.30	2.90	1.80	1.51	0.71	1.61	17.93
Imingcangath	175	5.70	2.80	2.34	1.34	1.14	1.07	1.67	16.06
Jingqi	130	4.72	1.90	3.43	1.12	0.92	1.13	0.01	13.23
Gaga	155	3.25	2.87	2.37	1.49	1.20	1.41	0.16	12.75
Gqunukwebe	177	5.75	2.84	2.72	1.60	1.24	0.48	0.60	15.23
Victoria east	39	6.67	2.90	2.10	0.90	0.64	0.36	0.00	13.57
Total	1065	41.55	19.11	18.24	10.05	8.2	5.36	4.05	106.56

For example, there were 140 people in the Amakuze sample population whose total water consumption for washing clothes was 1311 litres. Each person therefore uses 9.36 litres of water for washing clothes per day in the Amakuze area, whilst only 3.25 litres is used for the same purpose in Gaga. For bathing purposes the Tyumie area uses 3.3 l/c/d whilst the Amakuze uses 2.5 l/c/d. Considering the total amount of water-use by a person in each sector, residents utilise between 12.75 l/c/d as in Gaga to a maximum of 17.93 l/c/d for domestic use in the Tyumie sector. These figures fall even well short of the ANC's modest goal of 25 litres per person per day for the rural communities. The Reconstruction and Development Programme project under way presently in the Gaga-Tyumie valley has estimated that 'because rural communities significantly use less than 25 l/c/d, the design standard of 25 litres per person per day is set for water supply' (Haynes Ross & Kleyn, 1996:2).

The relatively high amount of water used for personal washing shows the priority that the communities give to health and sanitation and it also gives a clue to why water for agricultural activity is almost non-existent. This is because the total quantity available is merely enough for the very basic needs. In urban areas a person may use about 90 -

250 l/c/d (Giles & Brown 1997). Put conservatively, Emmett & Rakgoadi (1993), indicated that for health reasons 14 - 45 l/c/d is enough for the rural areas where water is critical. The Tyumie residents use the lowest amount of water within these figures.

The differences in the levels of water usage is depicted in Fig. 4.1. The Tyumie and Amakuze areas have the highest levels of water usage per person per day whilst the Jingqi and Gaga have the lowest. The significance of the above is reflected in the proximity of the tribal areas to the main river flow, the Tyumie river.



**Fig. 4.1** Per capita water usage per day in the Tyumie basin

A summary of the water usage pattern is presented spatially in Fig. 4.2. It shows that water use decreases directly with increasing distance from its source. Thus as one moves downstream from the source of the Tyumie, levels of water usage decreases. Likewise when one moves laterally away from the main stream. The River Tyumie traverses in a north - south direction and almost divides the area into two (East-West) halves. Since the river channel overlaps the boundaries of the tribal areas they tend to confuse the spatial impression and therefore is not drawn on the map. The reader is kindly referred to the position of the river on page 6 of this thesis.

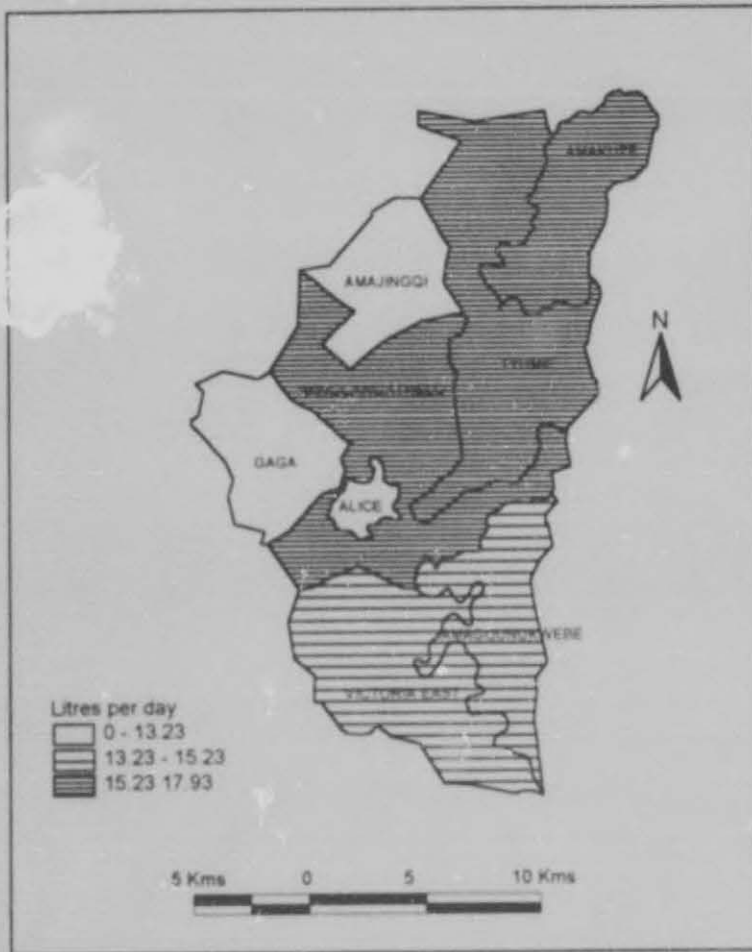


Fig. 4.2 : Spatial pattern of daily per capita water usage

#### 4.4 TRAVELLING DISTANCES AND ACCESSIBILITY OF WATER SOURCES TO RURAL RESIDENTS.

The ANC policy document on water and sanitation recommended that the maximum travelling distance to any water source in the rural area should not exceed 200 metres by 1999 (ANC 1994). When this yardstick was applied in this area, it was found that the travelling distances of the communities ranged from a minimum of 363,3 metres to a maximum of 580,3 metres on average for the entire basin. This is an average figure which masks the maximum actual figures in the specific rural villages.



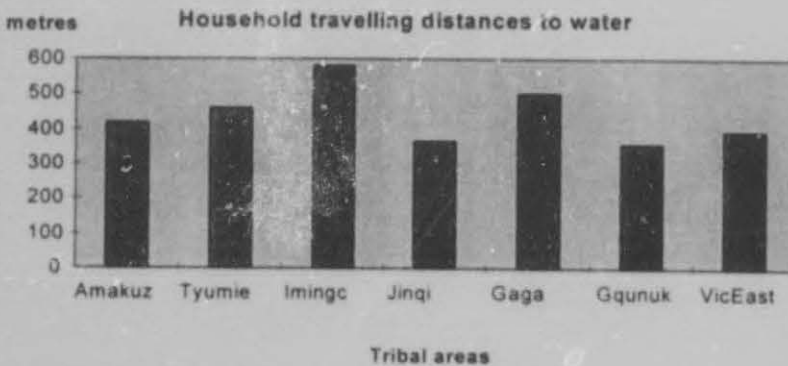
Comparing the above to the ANC standards, the community members are travelling at least 85% further than the minimum standards set by the government and at a maximum of 190% above the 200 metre standard. The total figures in Table 4.4 are the distances travelled by the sampled population for each tribal area. From the table one can deduce by imagination the amount of time and effort expended in travelling to water sources to collect water in the Tyumie basin rural area.

**Table 4.4 Accessibility of water sources to humans**

Distances in metres

Tribal authority	No of households	Distances in metres	
		Total	Average
Amakuze	30	12450	415
Tyumie	50	22895	457.9
Imingcangathelo	32	18569.6	580.3
Jinqi	21	7629.3	363.3
Gaga	30	15030	501
Gqunukwebe	30	10740	358
Victoria East	6	2350.2	391.7

The pattern of average travelling distances per household that emerges is shown on the graph (Fig. 4.3). Imingcangathelo and Gaga have the highest average travelling distances to water sources. These areas are closer to the urban areas of Alice and the collection of water by car and truck to the villages might have influenced the distances as depicted by the graph.



**Fig. 4.3 Average travelling distance per household to water sources**

However, these are also the areas which are furthest from the main perennial Tyumie river. The extent to which this affects animal watering distances is discussed in the next section. It was expected that animals may have to travel longer distances than humans but this was not the case. The reason may be due to the numerous pools of water from which the animals drink and which are closer to household locations.

#### 4.5 ANIMAL TRAVELLING DISTANCES TO WATER SOURCES

Though not always clean, nor healthy, there are a number of pools and excavated water collection points from which animals obtain water. Table 4.5 shows the average travelling distances of animals to watering points.

**Table 4.5 Average walking distances (metres) of stock to watering points**

Tribal Authority	Distances to water points*
Amakuze	340
Tyumie	224
Jingqi	233
Imingcangathelo	159
Gaga	316
Gqunukwebe	347
Victoria East	350

\* Average walking distances(metres) of stock to watering points

The travelling distances of animals to water sources were shorter than those of humans. This is because of the indiscriminate nature of animals as far as the quality of water is concerned. In all the tribal areas apart from the Victoria East community, the stock roam for pasture and water.

The travelling distance of animals is usually related to the type of farming, the availability of alternative sources of water and the accessibility for humans to the available water resources. Where water is available for human beings in adequate quantities, an arrangement is made for the animals. Where the opposite occurs, animals tend to fend for themselves. In commercially organised farming communities

water is provided specifically for the animals. Travelling distances for animals were comparable to those of humans, though both do not necessarily obtain water from the same sources. Due to the grazing patterns of the animals, estimates of 500 metres to one kilometre travelling distances were not uncommon. Walking to water sources is physiologically good for animals but excessive distances have negative effect on the condition of the animals. Animal footpaths are usually the source of soil erosion in the grazing fields. Another negative factor of long distance travel is the encouragement that it offers to stock thieves. The next section discusses how water is conveyed to the households and the effect of such walking distances to obtain it on humans.

#### **4.6 WATER CONVEYANCE**

The data from this survey identified the means of transporting water from the water collection sources to the household locations. Water providers often ensure that distances between water collection points and households or water destination points are minimised. Apart from improving accessibility, this is also a safety factor aimed at minimising water contamination (Carter et al 1996). Otherwise the objective of providing windmills, boreholes, wells or dams at great expense is defeated when water consumers are exposed to the possibility of contamination by collecting clean water and conveying it through contaminated environments. One source of contamination is the plastic containers which are originally used to collect or store materials other than water. In the rural areas, the potential of contamination is very high. Some water carriers use containers originally used for chemicals to collect water. Children constitute over 60% of those who fetch water for the family in the Tyumie basin (Plate 4.2). The safety concerns of children as far as water quality is concerned are very low as they play and fight on the way to and from water collecting points. This is one of the motives behind the need to reduce the water collection distances from source to destination by the provision of water at convenient distances to places of consumption. The effect of such an exercise will not only be beneficial to household users but for crop and animal production.



**PLATE:4.2** Children as water conveyors.

The photo shows that children are the main carriers of water. Weight and mode of water carriage poses a health threat to children and water quality at point of use



**PLATE 4.3** Children transporting water in Melani village

The necessity for water which is obtainable from distant sources has resulted in the invention of carts such as the one seen in the picture.



In the Tyumie basin, the most common water collecting containers were 20 and 25 litre plastic containers and 14 or 16 litre aluminium buckets. As much as 70,3% of the respondents convey water on their heads (Table 4.6). Only 1,5% receive water by pipeline. Whereas water vendors use donkeys, many children convey water by wheelbarrow.

**Table 4.6 : Mode of transport and conveyance of water**

Number of cases

Tribal Authority	MODE OF CONVEYANCE					Total
	Head	Donkey	W/Barrow	Pipeline	Car/Truck	
Amakuzi	25	5	0	0	0	30
Tyumie	38	11	1	0	0	50
Imingcangathelo	16	4	9	2	1	32
Jingqi	14	1	5	1	0	21
Gaga	18	0	11	0	1	30
Gqunukwebe	24	1	4	0	1	30
Victoria East	5	0	1	0	0	6
Total responses	140	22	31	3	3	199
% of Total	70.3	11.1	15.6	1.5	1.5	100

There are health implications in the carrying of heavy volumes of water on the head. It may contribute to the compression of children's spinal vertebrae, and may result in the experience of back pains to women. A full 25 litre water may weigh 25 kilograms (Giles & Brown 1997) and the number of times this is carried on the head will determine the toll that may be expected on one's health (Plate 4.4).



**PLATE 4.4** Women carrying water on heads.

The two main types of containers used for water collection are depicted in this photograph

The wheelbarrow is an effective means of conveyance because greater volumes of water can be carried by a person and steeper slopes can be traversed. This, however, does not solve the problem of the strain on the children who often push these wheelbarrows. A means to cope with this problem is the use of donkeys and carts which are owned by a limited number of people who tend to become contractors and water vendors (**Plate 4.5**). The significance of the deliberation is that water can only be obtained for domestic chores and not for any irrigation or animal farming activity. The lack of water delimits the scale of agriculture in the Tyumie basin.



**PLATE 4.5** Water collecting point at Melani.

The 50 litre and 100 litre containers are increasingly being used by wealthier families. These owners also serve as water vendors or contractors.

A container of 25 litres of water costs R 10,00 in Nkobonkobo and R 6,00 in Gwali. These charges are higher than the cost of water in the urban area in Alice, where households pay R5,00 - R20,00 a month, depending on the amount of water used. Rogerson's (1996) contention of the high cost of water supplied to rural people is confirmed in this area. It also confirms the ability and willingness of the rural dwellers to pay for water even at prices which are higher than in the urban areas despite the quality which is often well below that of the treated urban water supply. It is this aspect of water quality that the next section investigates.

## 4.7 WATER QUALITY

The natural chemistry of water can have an important influence on human or animal health. In many countries it is required to have a detailed analysis of the major, minor and trace constituents of water before the commissioning of public supplies is effected. Guidelines are given by the World Health Organisation and European Community on the quality standards for drinking water supplies. An excess of certain chemicals such as iron(Fe) or flouride(FI) or manganese(Mn) or a deficiency of iodine (I) or selenium (Se) in the natural water system can have an adverse impact on the health of people (Edmunds 1995). This is to ensure the safety as well as the acceptability of the water quality by means of taste, smell or sight to the community. Therefore, a communities' perception of the water quality in its environment is important (Kandawire 1988).

### 4.7.1 Perceptions of water quality in the Tyumie basin

Quality of water may be expected to vary between summer and winter. The perceptions of respondents as indicated in Table 4.7 show that the quality of the available sources of water is 'good' in the upper reaches of the Tyumie.

**Table 4.7 Communities' perception of summer water quality**

Row percentages of total responses

Tribal authority	QUALITY OF WATER					Total No of cases
	Good	Salty	Bad	Muddy	Smelly	
Amakuze	37.5	28.1	28.1	3.1	3.1	32
Tyumie	37.7	30.2	17.0	7.5	7.5	53
Imingcangathelo	65.6	21.9	9.4	0.0	3.1	32
Jingqi	26.7	26.7	13.3	13.3	20.0	30
Gaga	2.3	63.6	22.7	4.5	6.8	44
Gqunukwebe	17.1	60.0	20.0	2.9	0.0	35
Victoria East	0.0	100.0	0.0	0.0	0.0	1
No. of cases	68	90	42	12	15	227
%of responses	30.0	39.6	18.5	5.3	6.6	100.0

These areas are Amakuze, (37,5%), Tyumie (37,7%) and Imingcangathelo (65,6%). Nevertheless, some respondents also indicated that the water is salty in all these areas. In the Gaga (63,6%), Gqunukwebe (60%) and Victoria East (100%), the water is described as salty. Table 4.7 also indicates that for the summer season 30% of the



population considered the water in the Tyumie basin as good, 39,6 % described it as salty and 18,5% characterised the water as bad. In many cases the water in summer could therefore be characterised as 'salty'.

**Table 4.8 Communities' perception of winter water quality**

Row percentages of total responses

Tribal authority	QUALITY OF WATER					Total
	Good	Salty	Bad	Muddy	Smelly	No of cases
Amakuze	39.4	27.3	24.2	3.0	6.1	33
Tyumie	25.4	30.5	30.5	0.0	13.6	59
Iringcangathelo	48.6	20.0	14.3	0.0	17.1	35
Jingqi	25.0	29.2	20.8	12.5	12.5	24
Gaga	2.9	52.9	29.4	5.9	8.8	34
Gqunukwebe	8.6	60.0	31.4	0.0	0.0	35
Victoria east	0.0	80.0	20.0	0.0	0.0	5
No of cases	55	84	58	6	22	225
% of Total cases	24.4	37.3	25.8	2.7	9.8	100.0

A summary of the perceptions for winter conditions is depicted in Table 4.8. For winter conditions, 37,3% of the respondents in the entire basin described the water as salty and 25,8% described it as bad. The reason for the response on the winter quality may be due to the low flows and the stagnation of water pools from which the villagers collect their water. Kandawire (1988) indicated that water must not only be good for drinking purposes but must be accepted as such by the community.

Where people do not have any other source, the probability is very high that they accept as 'good' what is in fact not good, hence the description of both good and salty for the same water by different respondents. The salt content of water in the area may be attributed to the solution of minerals such as Calcium and Magnesium in the geological formation of Karoo dolerite and Sandstone formations of the Beaufort and Ecca series persistent in the basin. Results of samples taken to isolate the salt content indicated that the salty nature cannot be ascribed only to the parameters of nitrates, sodium nor iron, because the concentration of these minerals were found to be within the South African Bureau of Standards' (SABS 241) acceptable standards for human consumption. Since a more comprehensive testing of the chemical water quality over a lengthy period and seasons would be required to confirm the results, these were

considered to be inconclusive and therefore not included in this thesis. Further research is required on this to determine the cause of the salty taste of the water in the entire basin.

An attempt is now made to combine the responses of perceptions of community members in winter and summer conditions to obtain a water quality index for the year. This provides a spatial representation of perceptions of water quality of the area at a glance. It also provides a basis for the implementation of any integrated catchment management plan after identifying the areas of concern.

#### 4.7.2 Calculating the water quality index of communities' perception

A water quality index table was constructed by calculating the average of responses for the two seasons. The highest figure of description of water quality for each category of description is then identified as the main characterisation for the year. Table 4.9 is the index table which shows that for the total of summer and winter in the Amakuze area the highest average response of all the categories was, **Good (38,4)**.

**Table 4.9 Water quality index of Tyumie basin : communities' perception**

Average percentage of perceptions (summer and winter)

Tribal area	WATER QUALITY					Total cases	Index	Description
	Good	Salty	Bad	Muddy	Smelly			
Amakuze	<b>38.4</b>	27.7	26.2	3.1	4.6	65	38.4	good
Tyumie	<b>31.6</b>	30.4	23.7	3.7	10.6	112	31.6	good
Jingqi	25.8	<b>28.0</b>	17.1	12.9	16.2	54	28.4	salty
Imingcangathelo	<b>57.1</b>	21.0	11.8	0.0	10.1	67	57.1	good
Gaga	2.6	<b>58.3</b>	26.0	5.2	7.9	78	58.2	salty
Amagqunukwebe	12.9	<b>60.0</b>	25.7	1.4	0.0	70	60.0	salty
Victoria East	0.0	<b>90.0</b>	10.0	0.0	0.0	6	90.0	salty
Total cases	123	174	100	18	37	452		
% of Total cases	27.2	38.5	22.1	4	8.2	100		

This is obtained by adding the summer figure, 37,5 to the winter figure, 39,4. The total, 76,9 is the highest figure of all responses in the Amakuze area. This figure is then divided by 2 to obtain an average percentage figure of 38,4 (Table 4.9). This is the water quality index of the Amakuze area. The index is an average percentage figure for the two seasons and it describes the (degree or magnitude) general quality of water as perceived by the community.

Applying the same method to the other areas and responses, it is found as in Fig. 4.4 that areas in the northern section and closer to the source of the Tyumie river have "good" characterisation of water whilst lower sections of the river have "salty" characterisation. No area, in the Tyumie basin, by this method, characterised the water as "bad" over the other descriptions for the entire year.

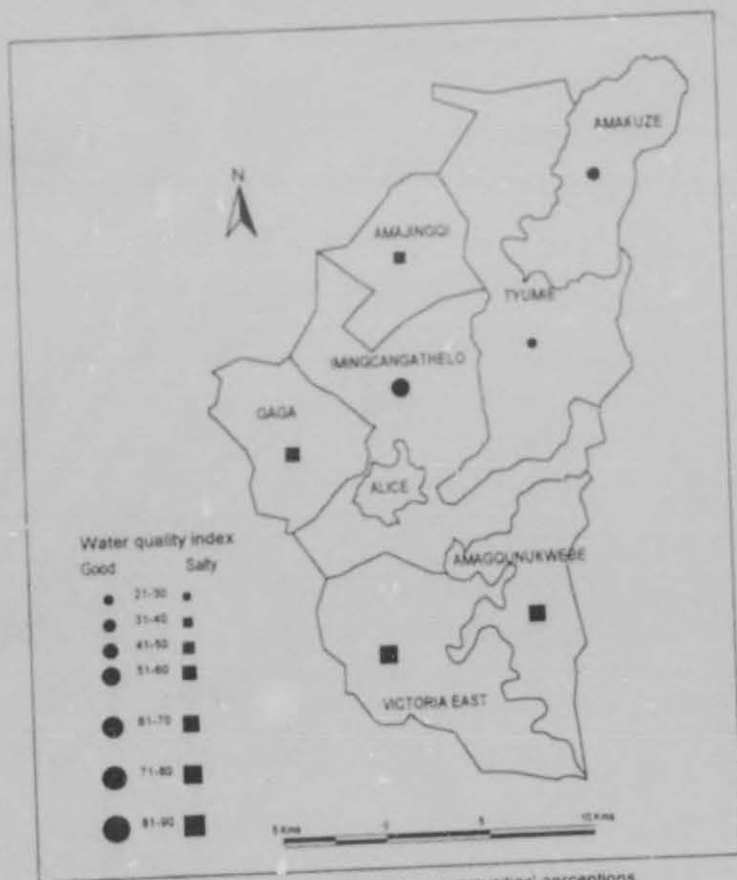


Fig. 4.4 Water quality index : communities' perceptions

Note: Symbol indicates water quality description.

From the above discussion it can be deduced that water quality is not as "suitable" as expected for drinking purposes for the entire area. According to the responses water in four out of seven tribal areas has a 'salty taste' and 'bad condition'. The three areas where respondents said water was good also have a 'salty taste'. With accessibility also being low, it is important to consider the coping mechanisms of communities to reduce travelling distances and secure enough water for the most essential purposes. Consideration is now given to the possibilities of any recycling or conservation methods which are adopted by the communities.

#### 4.8 WATER RECYCLING/CONSERVATION

In developed communities, water recycling has become a common practice. This is not the case with rural communities in the Third World which do not have the infrastructure for purification. Local communities use as little of what they obtain and save water for other uses. That appears to be the only strategy, employed to reduce the energy and cost of obtaining water. The following subsection discusses the value accorded to waste water and how it is disposed of by the people of the Tyumie basin.

In a water deficient environment, communities tend to adopt measures to cope with insufficiency. In the Tyumie basin, the communities conserve (use it sparingly) water rather than recycling it. This is done by using as little water as possible, and then immediately disposing of the used water since it is not regarded as useful for any other purpose. It is given a low utility value. Table 4.10 indicates that 48.5% of the population throw their used water onto the grass, though this may be regarded as watering of the grass in the first place to improve pasture for the grazing animals.



**Table 4.10 Domestic wastewater disposal in Tyumie basin**

Column percentages of responses

Tribal Authority	Wastewater disposal			No. of cases
	GRASS	GARDEN	DRAIN	
Amakuze	22.1	0	6.7	27
Tyumie	22.1	25	30.3	51
Imingc	11.6	25	21.3	33
Jingqi	12.6	16.7	7.9	21
Gaga	8.4	8.3	22.6	29
Gqunukw	18.9	25	11.2	31
VicEast	4.2	0	0	4
No of cases	95	12	89	196
% of cases	48.5	6.1	45.4	100

Another 45.4% regard the used water only as a waste and therefore "throw it away on to the street, or into the yard, the back of the house or anywhere". Only 6.1% of the population regard water as having any value after it has been initially used and therefore utilise the water for the watering of plants. Most of the respondents in this category are found in Tyumie, Imingcangathelo and Gqunukwebe, areas which incidentally are also close to sufficiently reliable water sources and therefore practice household gardening. An uncharacteristic exception which may represent the truth, though empirically repudiated, is the statement below, provided by one respondent:

"..... in times of shortage, the water is used for  
bathing twice or thrice before being disposed of."

The responses provided on the disposal of wastewater indicates that water recycling is not a common practice of the Tyumie communities. Where communities dispose of water so readily it may imply that water is readily available. However, people use so little of it. The answer may lie with the belief of residents that water is available but the lack of infrastructure to tap the water hampers its use for their convenience. An attempt was made to find out the consciousness of the communities on the efficient use of water and their involvement in water development projects.

#### 4.9 COMMUNITY INVOLVEMENT IN WATER PROJECTS

The current view on water issues is that communities must be involved in water development projects (Van Schalkwak 1996; Pegram et al 1997). Roberts (1995) and Gacega (1980) have explained that the involvement of communities at all levels and stages of water delivery projects to the final phase permits a continuous transfer of technology and ensure effective utilisation of infrastructure by the end users. Since the communities in the Tyumie basin have never been involved in community water projects there is little knowledge about how to maintain the infrastructure which was left behind by the departing white farmers. According to Hayne, Ross & Kleyn (1996), efforts have been made to engage the village water committees in the attempt to supply water to the Tyumie valley residents. The aim is that the affected communities should be able to understand and use the resource wisely in future. Another advantage of involving the inhabitants, is that the use of local labour tends to reduce the cost of construction (Carter 1996). The evidence in Table 4.11 proves that community members are eagerly awaiting the development of water infrastructure and reticulation and are also aware of the water shortages in the area.

**Table 4.11 Community awareness of water projects**

Column percentages

Tribal authority	Knowledge of water project	Involvement of community	Total
Amakuze	16.3	10.7	28
Tyumie	27.4	51.8	66
Imingcangathelo	15.6	3.6	23
Jingqi	12.6	1.8	18
Gaga	9.6	21.4	25
Gqunukwebe	18.5	10.7	31
Victoria East	0	0	0
Total responses	135	56	191
% of responses	70.7	29.3	100

Of the total household respondents, 70,7% indicated their awareness of plans of community water projects in their villages. The only exception was in Victoria East where ownership of farmlands appears to be in the balance after 1994 and therefore no one takes the responsibility for water development. Gaga and Jingqi areas have a less enthusiastic population in water projects. Gaga is semi-urban and residents often

collect water from Alice. In the Jingqi area urban migration appears to have reduced the rural community spirit. The Tyumie area has a strong community awareness and involvement tendency in water development issues. The community projects often entail community discussions on forthcoming arrangements for a clean, healthy water supply. Many people, however, do not attend these meetings nor are they informed of the outcome or progress of and purpose of the meetings. Almost all the respondents are prepared to pay for water if it could be supplied inside the house. At present the communities have agreed to pay a monthly charge of R5,00 for initial water development programs.

One may question the small number of persons who are involved in community projects. This is the 56 or 29.3% of the sample population. This may be explained by the fact that it is not easy to get all members at meetings and secondly development projects take such a long time to materialise that community members lose interest in water development progress underway. The chairman at Kwezana lamented that:

“.....for 19 years there have been promises to supply water to this village without any substance. After only four months of initial surveying, Eskom has supplied us with electricity”.

#### **4.10 TOWARDS A 40 l/c/d TARGET**

Chapters 3 and 4 have attempted to show how water resources and usage is linked to the landuse types in the study area. They have also attempted to show the low levels of water available to the rural communities and to indicate that the levels of water usage are due to the lack of infrastructure development for either commercial agricultural activity or for household usage. In releasing the scheduled areas for black settlements, the aim was to ensure a settlement pattern commensurate of the potential of available resources. The result, however, is a residential rural area which is lacking in any specific economic activity and a shortage of an important basic resource, which is water. This research intends to demonstrate, in addition to the previous facts, the severity of the water shortage in the basin.

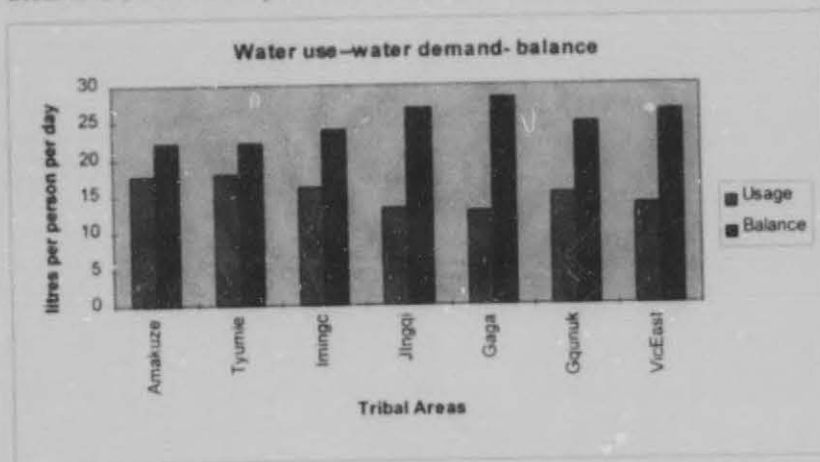
Engineers often set a target of 40 - 60 l/c/d for rural water supply (Giles & Prown 1997). The ANC has set a minimum target of 25 l/c/d. Considering that the ANC limit is too low, a limit of (40 litres) is taken as a minimum target for each resident in the entire rural Tyumie basin and compared with the amount of water being utilised at present, the difference will signify the balance that may have to be supplied to make up the shortfall on the target amount. One is justified in arguing that the 40 l/c/d is very modest, but that will expose the extent of the shortage of water for domestic use. The results of such an exercise are presented in Table 4.12

**Table 4.12 Water requirement to attain a 40 l/c/d target level for domestic use in Tyumie basin**

Units in litres

Tribal authority	Usage	Target	Required
Amakuze	17.79	40	22.21
Tyumie	17.93	40	22.27
Imingcangathelo	16.06	40	23.94
Jingqi	13.23	40	26.77
Gaga	12.75	40	28.25
Gqunukwebe	15.23	40	24.77
Victoria East	13.57	40	26.43

From Table 4.12 and Fig. 4.5 it is evident that areas with water use nearest to the target figure of 40 litres (in order of magnitude) are the Amakuze and the Tyumie tribal areas, due to their proximity to the perennial Tyumie river.



**Fig. 4.5 Extent of water shortage in the Tyumie basin based on 40 l/c/d estimate**



Areas of severe shortages are Gaga, Jingqi, and the Victoria East. Jingqi's distance from the main water system, and Gaga's peri-urban nature may explain the large shortfall in the areas. The situation in Victoria East may be attributed to the breakdown of water infrastructure in the area. It can be concluded that despite the density of the drainage network and the high rainfall pattern of the area, the Tyumie basin is deficient in the supply of water for household/domestic purposes, and therefore, for any other landuse activity. It is only when humans obtain enough water for drinking and washing and cooking that some could be spared for animals and irrigation. The problem is depicted spatially in Fig. 4.6

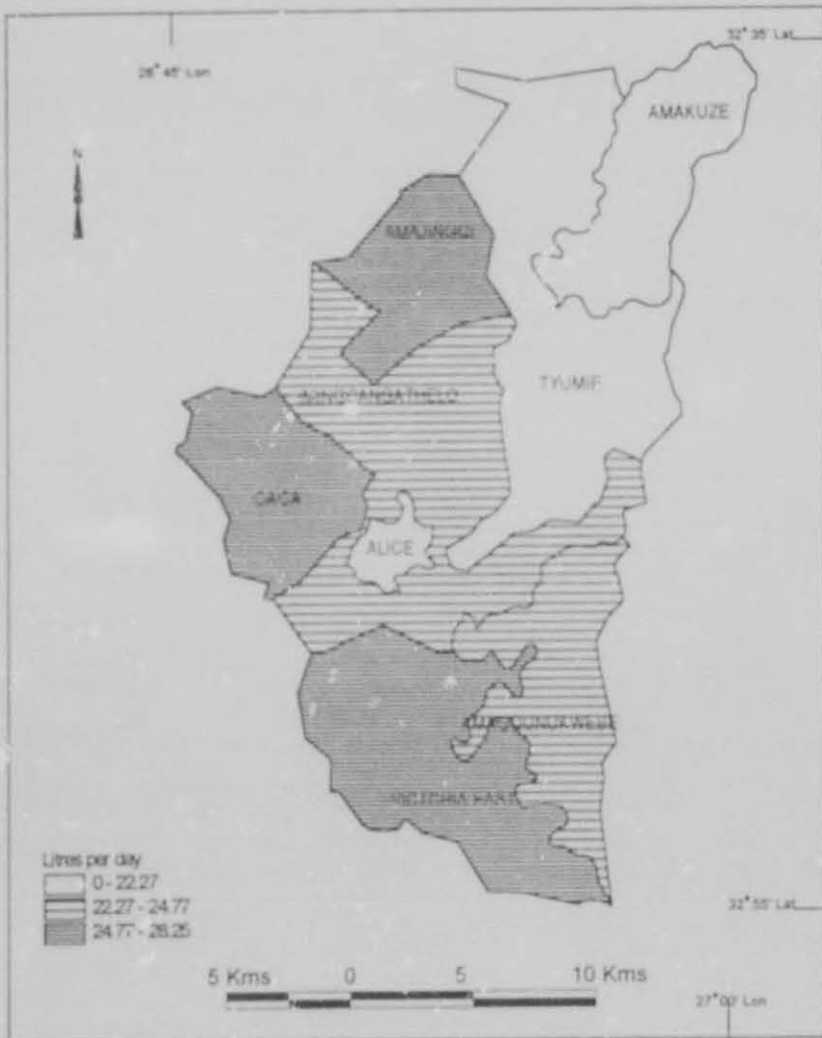


Fig 4.6. Quantity of water required to attain a 40 l/c/d .

## CHAPTER FIVE

### THE FINALE - AIMING AT A HOLISTIC PHYSICAL AND HUMAN RESOURCE ENVIRONMENT

#### 5.1 Introduction

This study began with the contention that the landuse pattern and the utilisation of water resources in the Tyumie basin are the results of inadequate planning policies related to past political, social and economic goals which have tended to affect the landuse activities of the present occupants of the area. The contention was that the policy of resettlement of the black population who was purported to be at best peasant agricultural farmers and at worst rural settlement residents in the Tyumie basin failed to consider the development of adequate water infrastructure for agricultural or domestic purposes. The study sought to use water shortages as a yardstick to measure this assertion of inadequate planning and the hardship on rural settlements. It was intended to prove that if water shortages are so deleterious to economic productivity and landuse activity, then its availability should also be important to permit a reasonable standard of life which would compensate for the unattractive economic and social way of life in the rural areas. In effect it might possibly generate enough income and activity in the rural areas to stem the unwanted cyclical migration that has rather been entrenched. By identifying the sources of water and the uses of water by the residents of the Tyumie basin area, the study has shown that the rural communities are in dire need of a better water supply system than what is available. It was also noticed that the deteriorating agricultural productivity is caused by lack of water.

#### 5.2 Summary of findings

The following salient features emerged from the study from which recommendations could be made for any future policy planners of the rural areas such as the study area. This study noted that there is a linking role between the availability of water and landuses in the rural area. This is only evident from an environmental assessment study such as this study. Without water for agricultural activity, population may be forced to seek means of survival elsewhere. Thus the lack of water has a destabilising

effect in the same way as the settlement dislocations that affected many black locations in South Africa.

There were five sources of water from which the rural communities obtain their supply. These are rivers, dams, boreholes, hometaps and community taps. The communities rely heavily (49%) on water from the rivers. Thus the first objective was achieved by knowing the exact sources of water in the basin. Much of the water used is utilised for domestic purposes with a higher proportion used for clothes washing and household cleaning. Crops and animal watering fall on a lower scale. This is because of the difficulty of obtaining the water and not because of the lack of interest in agriculture. The second objective was also thus achieved. Water is obtained from distances of between 300 metres to 500 metres (in one direction) by travelling over steep slopes. As a result water usage is limited only to essential usage and very limited quantities are used. It was established that the rural communities use between 12.75l/c/d and 17.93l/c/d. The perception of the respondents indicated a salty content but was accepted as "good" for lack of any alternative. Thus the objectives of assessing the level of accessibility and quality of water (third objective) was also achieved. Water disposal patterns indicated the absence of any water recycling behaviour of the communities. The fourth objective was also established. Community awareness of water development programs indicated a strong awareness of water projects, though only 29,3% of the Tyumie basin residents participate in the planning of the projects. More work is expected on this to understand the effectiveness of community involvement in water projects in the Tyumie basin. By demonstrating with the hypothetical figure of 40l/c/d target the shortage of water in the basin was revealed. This would not have been so evident if the 25l/c/d set by the Government was used. The above is a summary of the aims set out for the study. Other useful information that emanated from the study are also summarised below, from which a policy recommendation could be made after the assessment of the water resources and land use patterns in the Tyumie basin has been so known.

### 5.2.1 Implications of population structure on rural economy

The study has revealed that the population of the Tyumie basin has undergone major structural changes. The finding by Van Zyl *et al* (1996), that the former homeland areas have entered the transitional stage of population development appears to be confirmed. The enhancement of educational levels in the area has resulted in a shift from farm and soil related occupations to office and government employed jobs. There is, however, a large uneducated group of people in the basin, some of whose income source is found in the informal or self-employed group of occupations. The economically active people of 20 -59 years constitute 56,8% of the population but only 9,7% of the population is gainfully employed. Retirees who are over 60 years of age constitute 13,6% of the population. These are indications of an ageing population and a further confirmation of the transitional stage in which the black communities have entered. The result of these is the decay of the rural economy and the emergence of a semi urban society whose lifestyle and environmental demands are not met by the service provisions such as water in the area. This is evident in the involvement of only 30,3% of the rural communities in cattle farming and 27,2% in maize farming at subsistent level in one season of the year.

### 5.2.2 Holistic management of resources

It can also be surmised that the present problems of the area had been caused by the neglect of a holistic management strategy, not only on a regional scale, but also on a small catchment basin scale such as the Tyumie river basin. Though several strategies exist for the management of rural resources any of which to be adopted must be applied in a holistic manner. Current environmental viewpoints suggest the adoption of the principles of integrated catchment management (Pegram *et al* 1997; Carter *et al* 1996) which must involve communities (Robert 1995; Gacega 1980) from the entire basin. This ought to begin with the development of water resources through the repair and installation of windmills, boreholes and community taps. Yard and household taps could be a second phase of development. Meanwhile, the monitoring of the flow of and quality of the Tyumie river and its tributaries in both summer and winter is necessary. Present attempts by the Eastern Cape government, through the Tyumie-Gaga water supply project, appears to be adopting this strategy.



Though the survey did not delve into individual land ownership, much land was found to have been in fallow for sometime. What was of concern is safe, reliable and accessible water resources. This is the main barrier to crop and animal farming and to a considerable extent also to the survival and successful human occupation of the Tyumie basin. This is epitomised by a statement by one respondent that:

" I wish to plough like my grandfather and father did, but I do not have the means or equipment to bring in the water for irrigation".

The available spaces of land are not utilised, but water is limited even for drinking, cooking, washing and cleaning. The maximum per capita water usage in the area is 17,93 litres which falls short of even the 25l/c/d proposed by the National government.

### 5.2.3 Distances to water sources

Travelling distances of humans are over 800 meters per return trip for a volume of 16 litres of water and over terrain which are not level in slope. Water is far from being accessible to the rural communities. The effect of carrying water on the head for such distances and slopes is health inhibiting and affects the health of women and especially children, who are the main conveyors of water. The use of wheelbarrows does not solve this problem either as children are often the pushers of such means of conveyance. Communities use containers which were originally used to store materials which are dangerous for human consumption, to convey water from collecting points to the households.

### 5.2.4 Water quality

The perceptions of community members indicate a 'good' but generally 'salty' taste to the water in the basin. Spatially, the researcher found the quality of the water to be a function of distance from the source and the distance away from the Tyumie river. Apart from the Jingqi, which defied this generalisation, the Amakuze, Tyumie and Imingcangathelo areas, where water is provided by the perennial Tyumie river, has

"good" water quality. Conservation of water is only possible through limited use. There are no water recycling mechanisms. There were no evidence of industrial nor domestic water pollution and there were no wastewater drains.

### 5.2.5 Crop farming

The effect on crop farming of lack of water is shown by the absence of any large-scale crop-producing farms. Crop farming activities have dwindled in all the tribal areas. Crop farming is related to the availability of water. Hence the highest percentage of households which cultivate maize, pumpkin, cabbage, onion, potato and beans are all found in the areas of reliable water sources. These are the Tyumie, Amakuze and to a lesser extent the Imingcangathelo. Only 0,4% of the entire Tyumie population are occupational farmers. The area therefore relies on urban sources for food supplies.

### 5.2.6 Animal farming

It is a cherished custom of the Xhosa tribespeople to own cattle, sheep and goats as a sign of affluence, success and for the purpose of performing customary rites (Page 1982). As sizes of kraals become smaller due to the effect of inheritance on household plots, so the number of animals that are kept in a kraal. In addition to this is the need to provide the animals with feed and water. Thus the cherished custom is slowly disappearing as many respondents do not own any animals. This is due to socio-economic changes in the region, which has created the impression that more wealth is created in time by engaging in urban employment than in a rural agricultural activity. With water infrastructure in place and an agricultural momentum established, the impression would have been negated. Schutte and Pretorius (1997) have indicated the importance of considering other population parameters such as animals in the planning and utilisation of resources, an action which will benefit the Tyumie baai tremendously. The fact cannot be denied that lack of water contributes largely to the disincentive to rear and keep animals.

A hypothetical model, devised in this study to ascertain the levels of water shortage indicated that water shortage is prevalent in all the sectors of the Tyumie basin except the areas very close to the Tyumie river.

### 5.3 CONCLUSION

This study will therefore conclude with the assertion that landuses in the study area are linked to the past political and physical planning of the settlements in the Tyumie basin. The effect of inadequate planning is seen in the shortage of water that is being experienced there today. The relocation of people to an area without due planning for adequate water infrastructure has determined the type and level of landuse, the nature and level of water resources and usage. The comparative advantage that rural economies have over urban areas is compromised and rural-urban migration has occurred, leaving the aged and infants in the rural area.

A distinctive revelation that emanated from the study is the sign that the rural community has entered the transitional demographic stage. This clearly confirms the finding by the estimate of Udjo (1997) that the total fertility rate across all population groups in South Africa declined to 3,3 % in 1990.

Though land for agricultural purposes may be a problem, this study failed to unearth that fact from the responses to explain the low involvement of communities in agriculture. This study confirmed the contention of inadequate development of water infrastructure in the study area. Land which was expropriated by the Ciskei government for individual farms and companies needs to be returned to the community and the community should run these farms on sustainable terms so that they could reap the yields from their agricultural activities. In the past the para-statal organisations mismanaged these lands because of a lack of commitment. This is contrary to the commitment of the previously white farmers and the black peasant farmers of whom Letsoalo (1988) writes fondly.

#### 5.4 RECOMMENDATION FOR REDRESS

It is hereby recommended that government and local administration efforts should be intensified to evaluate, assess the suitability of land and the results of such studies conveyed to rural communities for appropriate utilisation. In each instance the provision of reliable, safe water, both for drinking and agriculture, should serve as the cornerstone for such ventures. In seeking solutions to the problems of each particular community, the relative effect of actions on the water resource in both quantity and quality should not be overlooked. Herein lies the advocacy for the integrated catchment management model. It calls for the integration of social values, technical skills and their application to the available physical resource for optimal utilisation.

Such a redress requires provision of credit for capital infrastructure, but water provision should be carried out by government agencies. The amount of money people pay for water from water vendors indicates an ability and willingness to pay for water and communities can assist where genuine efforts are in sight. Maintenance and operation of the infrastructure should therefore be the responsibilities of the communities. The agreement of the community to pay R5,00 per household per month for the provision of water in the Gaga-Tyumie water supply project suggests that the willingness of the people in rural areas as researched by Rogerson (1996) in Nigeria and Kenya, prevails in the Tyumie basin. This is evident in the cost of water sold to them by vendors which surpasses that of urban consumers.

If the level of world population could be determined by the available amount and quality of water, then the landuse patterns and economic upliftment of the Tyumie basin will depend on the infrastructural development of water in the area.

#### 5.5 RECOMMENDATIONS FOR FURTHER RESEARCH

The study attempted to limit its goals only to water scarcity and landuse characteristics as a means to gauge the effect of planning on rural communities. Though a limited attempt has been made to seek redress in the previous section, it is conceded not to be enough and further research would be required on the following:



- Attempts to isolate the real source of salt content of water, its effect on crops, humans and animals and possible remedial action to make the water drinkable. \*
- A study of the types of containers and their state of fitness for the conveyance of domestic water.
- A study of the actual time, energy and effort expended in securing water from sources to households.
- An analysis of the effect on health of the weight of the water containers on water carriers.
- A study of the affordability and willingness of communities to pay for water from own sources.
- A compilation of an accurate population database of the Tyumie rural area.

The above are a few of the aspects for which answers could not be obtained in this study and it is hoped that in attempting those, more information could be revealed for an eventual effective formulation of a rural environmental planning policy

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## APPENDIX      The questionnaire

The purpose of this questionnaire is to supplement data on characteristics of land use patterns, and water usage in the Tyumie Basin for studies towards an MA degree at the University of Stellenbosch.

1.

NAME OF VILLAGE/LOCATION/FARM	TRIBAL/LOCAL AUTHORITY	NO OF HOUSEHOLDS

### 2. FAMILY CHARACTERISTICS

RELATION	GENDER	AGE	EDUCATION	OCCUPATION	Additional Information
Father					
Mother					
Child 1					
Child 2					
Child3					
Child 4					
Child 5					
Other(s)					

### 3. SOURCES OF WATER

RIVER	DAM	WELL	BOREHOLE	HOUSE TAP	COMMUNAL TAP

### 4. WHAT IS THE DISTANCE BETWEEN YOUR HOUSE AND WATER SOURCE

--



## 5. WHO FETCHES THE WATER FOR THE FAMILY

BOYS	GIRLS	MOTHER	FATHER	Other(s)
------	-------	--------	--------	----------

## 6. WHAT CONTAINER(S) DO YOU USE TO FETCH WATER

TYPE OF CONTAINER	SIZE OF CONTAINER

## 7. HOW MANY TIMES PER DAY DO YOU GO TO FETCH WATER?

TIME OF THE DAY	Number of times or trips to water source
Morning	
Afternoon	
Evening	

## 8. HOW IS THE WATER/ CONTAINER TRANSPORTED TO THE HOUSE?

HUMAN	ANIMAL DRAWN	MOTOR CAR	PIPELINE	Wheel barrow	Other
-------	--------------	-----------	----------	--------------	-------

## 9. HOW MUCH WATER (in Litres) DO YOU USE PER DAY?

FOR WASHING CLOTHES	
FOR WASHING BODY	
FOR CLEANING HOUSE	
FOR WASHING DISHES	
FOR COOKING	
ANIMAL USE	
PLANTS /GARDEN	

10. WILL THE 25 LITRE CONTAINER OF WATER BE ENOUGH FOR 1 PERSON PER DAY?

COMMENT:

11 WHAT IS YOUR COMMENT OF THE QUALITY OF THE DRINKING WATER

11 WHAT IS YOUR COMMENT ON THE QUALITY OF THE DRINKING WATER

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
GOOD												
SALTY												
BAD												
MUDDY												
SMELLY												

12. HOW DO YOU DISPOSE OF YOUR HOUSEHOLD WASTE WATER?

13. LAND OWNERSHIP/TENURE/USAGE

OWNERSHIP	
OCCUPANT	
TENURE	
SIZE OF LAND/PLOT	
CROPS GROWN	
ANIMALS OWNED	
WATER SOURCE(S)	
DISTANCE TO WATER SOURCE(S)	

14. DO YOU DO IRRIGATION ON YOUR CROPS/ OR FARM?

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily												
Weekly												
Fortnightly												
Monthly												

15. DO YOU USE FERTILIZERS FOR YOUR CROPS?

TYPES OF FERTILIZERS	METHOD OF APPLICATION

16. ANIMAL FARMING:

ANIMAL TYPES	FEEDING (Communal/Private)	DRINKING WATER SOURCE	Distance of water source from farm/kraal

17. BETWEEN 1990- 1997 HAS THIS VILLAGE EVER SUFFERED FROM SHORTAGE OF WATER?

YES	HOW WAS THIS PROBLEM OVERCOME
ANIMALS	
HUMANS	
PLANTS	

18. ARE THERE ANY INITIATIVES TO IMPROVE THE WATER SITUATION (IN THIS LOCALITY)?  
ARE YOU INVOLVED IN WATER DEVELOPMENT PROJECT MEETINGS?

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19. CAN YOU SUGGEST ANY POSSIBILITIES TO IMPROVE THE WATER SUPPLY AND QUALITY  
CONDITIONS IN YOUR AREA?

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---

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20.

Additional comments:

THANK YOU FOR YOUR COOPERATION