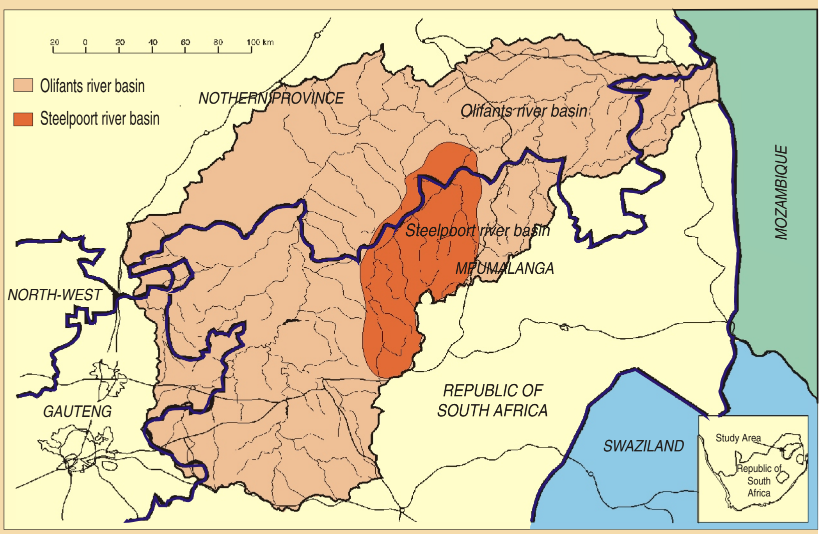
WORKING PAPER 17

Hydro-Institutional Mapping in the Steelpoort River Basin, South Africa

South Africa Working Paper No. 6



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IWMI
INTERNATIONAL WATER MANAGEMENT INSTITUTE

FUTURE HARVEST
IWMI is a Future Harvest Center supported by the CGIAR

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Coauthors: Mampiti Matete, Khabbab Abdallah, Joseph Kau and Elvis Mulibana are all postgraduate agricultural economics students of the University of Pretoria.

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Dedication

Working Papers 17 and 18 are dedicated to the memory of Dr. Jeffrey Brewer, who passed away in April 2001. Jeff provided assistance in technical editing and review of these papers, which is gratefully acknowledged in the text. This work, done in January 2001, was his last professional job for IWMI, carried out as a consultant. He had been a staff member at IWMI from December 1991 to June 1999. His former colleagues and friends were shocked and saddened by his sudden passing. Jeff was a good colleague and good friend who will be missed.

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Acronyms

ARC-ILI	Agricultural Research Council - Institute for Agricultural Engineering
CBO	Community-Based Organizations
CIRAD	French Research Institute on Agricultural Development
CIVIC	A community organization at village level, which deals with common issues at community level. SANCO is the umbrella organization for CIVICS.
CMA	Catchment Management Agency
DME	Department of Minerals and Energy
DWAF	Department of Water Affairs and Forestry
EMPR	Environmental Management Programme monitored by DME
HIM	Hydro-Institutional Mapping
IWMI	International Water Management Institute
NWA	National Water Act 36/1998
ORB	Olifants river basin
SANCO	South African National Civics Organization
TLC	Transitional Local Council (the qualification transitional was dropped after the 2000 local government elections)

Foreword

The International Water Management Institute (IWMI) commissioned this introductory study on hydro-institutional mapping (HIM) of the Olifants river basin in South Africa. HIM refers to the spatial and functional descriptions of all institutions using water in a basin. It also includes the relationship between users created by shared water use.

The products of the study are as follows:

- A publication of HIM in the Steelpoort river basin, a subbasin of the Olifants river, using a few case studies representing the different types of users (Working Paper 17).
- A description of the governmental institutions dealing with water before and after 1994. This background on previous and current institutions and policies at the different government levels is crucial to explain the situations one finds on the ground. Although this study centers on the Olifants river basin, the description is applicable to the rest of the country in broad terms (Working Paper 18).

The authors worked as a team from the outset but were responsible for particular chapters.

HIM Publication (Working Paper 17)

Chapter 1.	C. M. Stimie, coordinator (ARC-ILI)
	Dr. S. Perret (University of Pretoria/CIRAD)
Chapter 2.	E. Richters (ARC-ILI)
	C. M. Stimie
Chapter 3.	Dr. S. Perret
Chapter 4.	E. Richters
Chapter 5.	C. M. Stimie

Institutions and Policies (Working Paper 18)

All chapters. H. Thompson (Thompson & Thompson) with inputs from all the other authors.

The authors would like to express their gratitude to IWMI for making this study possible and for the direction provided throughout the study. They particularly acknowledge the substantive comments from Drs. Doug Merrey and Tushaar Shah, and the editorial assistance from Drs. Jeff Brewer and Doug Merrey.

They also trust that this study and similar studies will contribute to the efficient and fair management of the precious water resources in South Africa.

Executive Summary

This study forms part of a bigger study on water-short basins done by IWMI in several countries. It describes the hydro-institutional interactions among all types of water users in a South African river basin.

Scope

The study aims to give an overview of water users and influences on water use by institutions in the Steelpoort river basin, a subbasin of the Olifants river basin. In the light that hydro institutional mapping (HIM) is still an involving concept, one purpose of this report is to shed light on what is happening at a few selected places and thus contribute to the evolution of HIM methodology.

Methodology

The essence of the methodology used in this study is to discover and present as far as possible what is happening in reality with the use of water and the interaction of water users.

Information was gathered through discussions with on-site government officials and water users. We attempted to cover a representative range of water users while keeping the main focus on vulnerable rural communities.

Two field visits were undertaken, the first of which provided an overview. In the second visit more information was gathered at specific sites. Participatory methods were used during the second visit to obtain information from a broad range of people, including women. Extensive notes were made from each interaction and these were expanded, verified and used where possible to substantiate conclusions in the paper.

The governmental framework of the present and the past has a major influence on people's access to water, and without the explanation of these arrangements it would be very difficult to grasp why and how things developed as they did.

Water Users

Various water users were encountered in this study, including open cast mines, municipalities, industries, farmers, poor rural communities and others. Significant differences between water users became obvious through field visits and interactive interviews.

The upper catchment of the Olifants river basin has many industries, mines and coal-fired power stations. Because of the lack of water for the power station, water is imported from the Vaal river basin. This area is mainly savannah with many natural inundations (pans) and small stock watering ponds. Mines and industry in the upper catchment cause significant levels of pollution.

In the middle section of the Olifants river basin, the most striking feature is the commercial irrigation below the Loskop dam. High-value crops for export are currently grown in this area in contrast to its humble beginnings in the 1950s.

Lower down in the middle section of the basin below the Arabie dam, one finds the Arabie-Olifants small-scale irrigation scheme and other similar but smaller schemes. The Arabie scheme is about 2,000 hectares and has practically ceased to operate apart from “illegal” food gardens along the canal. Vast areas of eroded rangeland surround these schemes for the next 50 kilometers or so downstream.

The Steelpoort river subbasin is on the eastern side of the middle section of the Olifants river basin. This subbasin has a representative range of water users and a large percentage of mines at its lower end. The Steelpoort river basically shared the border between the former Lebowa and the Transvaal Province of the old Republic of South Africa. Today, the subbasin boundary is the border between Mmpumalanga and Northern Provinces. Poor communities are almost exclusively on the Northern Province side of the Steelpoort river.

Poor Rural Communities

The study dealt in broad terms with all the types of users in the basin but focused on the poor vulnerable communities. The first field visit covered most users while the second dealt only with selected rural communities.

The team was surprised by the complexity of local rural institutions and the lack of coordination in the activities of different government departments. It was also clear that the local government system is not yet effective—mainly due to the lack of funds and expertise. We found many small-scale industrial and irrigation projects using water from the river but they are not officially registered. We also found that while commercial farmers are well aware of the National Water Act of 1998 and the process of establishing a Catchment Management Agency (CMA), small-scale irrigation farmers and poor rural people are generally unaware of these.

Conclusion

This study contributes directly to the prospective Olifants river CMA, mainly by highlighting the challenges to effectively manage water in a basin with such a complex array of users.

CHAPTER 1

Introduction

1.1 Background

Hydro-institutional mapping (HIM) is not yet a well-defined methodology; thus the study team received little specific guidance for the study. A guideline document provided by the International Water Management Institute (IWMI) defined the overarching objectives for the project, which were twofold:

- To help evolve and refine the concepts, methods and practices of HIM; the work, together with studies undertaken by IWMI in other countries, is expected to be a pioneering contribution in this area.

- To develop HIM with analysis of the Olifants river basin as a practical case study, which would include:

  - an analytical description of the National Water Act (NWA 36/1998) and Water Services Act (WSA 108/1997), including descriptions of the proposed new institutional, managerial and political arrangements

  - identification and mapping of the complex of hydro-institutional relationships

  - an organizational analysis of various agencies and institutions in the public and private sectors engaged in influencing the capture, appropriation, allocation and use of surface water and groundwater in the broadest sense so as to include ecological uses as well as waste discharge

  - an analysis of the essential tasks for sustainable water management, and how they are performed by each agency/institution involved

  - policy analysis, including how "national," "provincial" and "local" government policies influence the patterns of hydro-institutional interaction

  - overall assessment about how the interaction is functioning and how it can be improved to achieve national water-sector policy goals

The team had to sort out what was feasible within the time frame and to define the scope of the project.

1.2 Scope of the Project

The following aspects were chosen as objectives for the study:

- To describe the previous and current institutional arrangements that impact on water resources management and water services
- To describe the role, mandate and goals of government organizations regarding water management and the observed practices, identifying how they operate, their constraints, relationships with users and service providers
- To describe briefly the physical circumstances that characterize the study areas (both Olifants and Steelpoort river basins)
- To stress the historical perspectives because it helps explain the current situation
- To describe typical users, through case studies and overview interviews, including their water utilization modes, their relationships with other users, with service providers, and with regulating and facilitating institutions (see definitions below)
- To locate users at basin level and to describe their modes of operation, highlighting the issues at local level (case studies)
- To describe and assess the investigation procedures and the methods that were used during the project
- To put emphasis on vulnerable areas, especially through selected cases

According to this framework, the team formulated the basic question underlying the study: ***How and why do institutions interact with each other about water, on a spatial basis?***

HIM may thus be defined as *the spatial definition of the institutional arrangements, issues and problems of water management and service provision at basin level, through the use of text, diagrams and maps.*

With regard to time- and means-related constraints, the idea of a whole basin study was discarded. The team decided in consultation with IWMI to undertake an institutional analysis at subbasin level (Steelpoort river subbasin) according to specifically selected areas and case studies. However, the Olifants river basin would be addressed in broad terms.

The Steelpoort river subbasin was chosen because it represents the whole Olifants river basin relatively well. Most water utilization is represented here: mines, industries, urban municipalities, commercial farmers, small food gardens, emerging commercial farmers, rural communities, recreational use and forestry.

The methodology that was used, its evaluation and further recommendations are developed in the paper. Refining the scope of the study, clarifying purposes and expected outputs were an ongoing process along with the study. This process is described in section 1.4.

This paper (Working Paper 17) is one of two and focuses on the details of water use and water management in the Steelpoort river subbasin and broadly in the Olifants river basin. The other (Working Paper 18) focuses on water management policies, laws, history, and organizations at national and Olifants river-basin levels.

1.3 Definition of Terms

A series of key terms will be used in the following chapters. It is necessary to create a common set of definitions to prevent misinterpretations as far as possible.

Following current legal norms, “he” will be used when referring to any organization, institution or actor.

Institution

The term “institution” is used to refer to two concepts:

- **Organizations**, which are defined as groups of people who come together to achieve a common objective. For example, government departments, firms, families, village communities, a city council, etc.

- **Sets of rules** that govern ownership and use of resources, production, exchange and consumption under which economies work, e.g., land tenure, statutory law, common law and administrative law, and informal rules such social ethics, mores, norms and values.

Actor

An actor is a person who decides and acts at local level. An actor may also be, or may belong to, an institution. But he behaves also as an individual, evolving within and influencing, a local spatial and institutional frame. Any individual influencing local decisions, interacting with other individuals and/or institutions, beyond the institution he possibly belongs to, is an actor (a chief, a farmer or any local person).

Water user

Any institution or actor that impacts on the water resources at basin level, in any way, is a water user. He may take or remove water, store water, alter the flow regime, alter runoff features, modify the water quality, discharge waste, or use water for recreational purposes.

Service providers and water service provision

Service providers are institutions that deliver services to water users. Water supply management, maintenance, funding and equipment supply, communication and information supply may be provided. For example, water boards, irrigation boards, water user associations, water service committees, water committees, local government organizations and the Department of Water Affairs and Forestry (DWAF) are service providers. A service provider may also deliver *water service provision*, as defined by the Water Service Act (WSA). He may abstract, convey, treat and distribute potable water or potentially potable water to users for any type of use.

Regulator

Regulators are statutory institutions that have the mandate to promote, regulate and enforce proper water resources management at different levels (national, provincial, local, river basin). Certain regulators issue laws, acts, procedures, rules, etc. (e.g., governmental departments, provincial departments). Some regulators aim at regulating water resources management at basin level, through strategic planning and communication (e.g., CMAs). Others aim at coordinating service providers (e.g., provincial departments, local government organizations).

Facilitator

Facilitators are mostly non-statutory institutions that aim at facilitating proper water resources management, mainly at community level. They seldom have any official mandate, but they may be instrumental in promoting and facilitating communication between local actors and the institutions defined above. Water committees, traditional local authorities, NGOs, Community-Based Organizations (CBOs), South African National Civics Organizations (SANCO) are typical facilitators.

Vulnerable area

A vulnerable area is a rural area, with a significant number of poor inhabitants who have limited access to resources, information and services, and insufficient access to good quality water.

Water board

A water board is a parastatal body that diverts water from a major water source, purifies it to potable standards and distributes the water to cities, towns and peri-urban communities.

Environmental Management Programme (EMPR)

The environmental management programme (EMPR) has been instituted by the Department of Minerals and Energy (DME) for mines to prevent damage to the environment.

1.4 Methodology

This section describes the data collection and analysis activities of the project team. Some of the twelve activities occurred concurrently. For example, discussions and planning took place over the whole project period.

1.4.1 Discussions to clarify purpose and output

Discussions between ARC-ILI and IWMI on the proposed study of the Olifants river basin started in 1998. This study forms part of an *IWMI international study of water scarce basins* funded by the Federal Republic of Germany. Three case studies were completed before 2000 as part of this basin study. The first case study was done at the Apel Rural Women's Association as an example of the development of successful community gardens and other projects with rural women (Pardeller et al. 1999). The second study was a desktop water-accounting study for the whole Olifants river basin (Small and Stimie 2000).

Further discussions on the basin study in South Africa took place in September 1999 during a planning workshop in Pietersburg. At this workshop the findings of the previous studies were presented and the need for HIM became clear in order to explain the complex interaction of the institutions dealing with water matters in the Olifants river basin. IWMI then requested ARC-ILI to prepare a proposal to conduct this study. Several informal discussions followed between September and December 1999 to formalize the project and IWMI gave the target date for the completion of the project as 31 March 2000.

1.4.2 Determination of scope and broad planning

The broad planning for this project started after IWMI indicated that it intended to commission this project. Because of the uncertainty of the exact form of the output and the scope of the project, the determination of scope and output was carried on till the end of the project.

IWMI provided background information through discussions and documents, which gave a very wide framework for the project, including the whole Olifants river basin and handover points between institutions. The concern arose that the time available and the wide scope of the project were not compatible. This difficulty applies particularly to rural communities, the main focus of the project, which are complex, difficult to access and not well organized in Western terms. To avoid a superficial and meaningless output, it was decided to focus the project on the Steelpoort river basin, a subbasin of the Olifants river basin. This subbasin has virtually all the elements of the bigger basin and was thus considered as representative and possible to handle within the time frame.

1.4.3 Selecting a project team

IWMI, through its local representative, Marna de Lange, assisted a great deal in selecting the project team. She suggested that Hubert Thompson, who was on the team that drafted the National Water Act (NWA) of 1998 and Sylvain Perret, who is an experienced agricultural economist from CIRAD and, during the time of the project, a visiting professor at the University of Pretoria, be on the project team. Chris Stimie from ARC-ILI acted as the project coordinator. The team was strengthened by a socio-technical graduate from Wageningen, Eric Richters, who played a key role and devoted 3 full-time months to the project. Thus, for this project, the engineering, economic, legal and sociological disciplines were involved. Another valuable contribution came from four postgraduate agricultural economics students: Mampiti Matete, Khabbab Abdallah, Joseph Kau and Elvis Mulibana from the University of Pretoria whom Sylvain Perret recruited for 6 weeks' work during their vacations.

1.4.4 Preparing the proposal

The project proposal came directly from discussions amongst the project team and with IWMI. The activities necessary for the project, decided on together, formed the base for the proposal. The proposal was thus accepted with some negotiation. The main project team was involved in drawing up the proposal; we found it very valuable because of the combined contributions and common goal.

1.4.5 Detailed planning

Detailed planning followed from the project team discussions. It was uncertain how the project would develop exactly but a few activities were clearly necessary. An overview field tour for the whole team was done to get firsthand experience of the area in question and to start gathering information on the ground. Eric Richters and the students undertook a follow-up tour to focus on specific sites. The rest of the activities up to report writing were also set out, but not in fine detail, because we first wanted to see what the field tour(s) would uncover. In hindsight, we feel that too little time was spent on proper planning with the consequence that unnecessary difficulties arose during project execution.

1.4.6 Gathering preliminary information

Eric Richters gathered relevant information from existing reports including collecting contact names and numbers. He also collected related information from key informants on the project before the project officially started. This information was structured and compiled into a file, which was made available to the four students when they started their work on 10 January 2000. An important source of information proved to be officials from the DWAF.

The goal of the preliminary information gathering was to ascertain what was documented about the subject and what was known by those working in related fields. This gathering may not be done exhaustively but if it is not done in reasonable depth, the project team is doomed to repeat previous mistakes.

The history of both the country and the specific project area plays an important role in explaining the current situation. For example, the fact that an area was governed by a particular homeland government or that the population was removed or that some people were there traditionally while their current neighbors were moved to the area, all affect local and other institutions. A very important source of information is the government agency responsible for water management in the country. In the case of South Africa, it is the DWAF. It has official reports, internal reports and many key informants. A detective approach may be necessary to discover relevant information, as important information is often lodged with specialists without colleagues being aware of it. A significant amount of information is usually not written down and that necessitates interviews of key informants.

1.4.7 Interviews with potential key informants

Some interviews were started during the preliminary phase, although it became apparent only later that the informants were key informants. The DWAF officials from the head office and the regional office were very helpful in relating their experiences during personal visits and telephonic interviews; they also made reports available. About 10 interviews were done with the DWAF officials; each took 90 minutes on average. Eric Richters, who carried out these interviews assisted by the students, made extensive notes of each interview. These interviews are slightly scattered because of time constraints but are still of use. Interviewing was also the basic information-gathering technique used on the field tours, but is dealt with under field visits.

People from government agencies can give invaluable information on hydro-institutional interaction. The value is often not only the content of the information but also the gaps of information. To cite an example, information on successful water management in an area is as important as information on nonexistent water management. We stressed that interviewers on this study kept an open mind when interviewing an informant. Keywords should be written down during the interview. As soon as possible, after the interview, preferably the same day, the notes were expanded into an essay format or questions and answers, according to the flow of the conversation. This record of the interview is essential for the analyses of information and as a reference for following project teams.

Another key element of the interviews was to "open the door" to an organization. An official letter to the head of a government institution or leader of a community explaining the purposes of the study should suffice. For this study such letters were prepared with good results. For other groups or institutions other approaches would be suitable, e.g., a rural community should not be approached before the tribal authority and the local government structures are consulted. This introduction process should not however develop into any form of bribery because that will obstruct the process and future interactions.

1.4.8 Field visits

In this project only two field visits of one week each were undertaken within the time available for the project. Before the first tour Eric Richters and Joseph Kau, one of the students, went on a pre-tour to the rural areas of the Steelpoort river basin to arrange for appointments for the following tour. They took with them an introduction letter from ARC-ILI, which proved useful particularly when they encountered resistance from one Transitional Local Council (TLC). The "door was opened" successfully in all cases so that subsequent visits could be arranged by phoning TLC members. The arrangements for the rest of the first tour were made by telephone from Pretoria.

The study team visited the Steelpoort basin area for the first field tour from 24 to 27 January 2000, and carried out interviews with key informants from different institutions (users, service providers, facilitators). These institutions were chosen according to their perceived representativeness and to their diversity.

The first tour was made by the full project team of eight members. It started at the upper reaches of the Steelpoort river basin where we visited the Belfast dam. The group then divided into two and a few mines and industries in the Belfast and Lydenburg areas were visited. The following day, commercial farmer groups were visited and for the rest of the period rural communities were visited. At the end of each day, field notes were expanded per group and typed. This means that work only stopped around 10 p.m. each night.

Except during the first collective interview, the team split in two groups of four, within which Joseph Kau and Elvis Mulibana translated most questions and answers when interviewing local actors (Northern Sotho/English). Two to three interviews were then carried out daily. Each interview took 90 minutes to 3 hours, according to its nature (number of participants, location, informant's availability). As a prerequisite to each interview, the interview group would present itself, the objective and scope of the study. Every evening, the team would gather, discuss and type the interview notes on laptop computers.

Synthesis and analysis were carried out in the field, with further contacts when necessary (phone calls and exchanges with informants). The compiled notes from each interview were faxed to each informant, so that he could add on or amend the text. Unfortunately, very few informants responded to this validation phase and amended the text. It is assumed that some did not answer because they agreed with the report.

The next tour was carried out by Eric Richters and the students after a week back in the office. Three rural communities were chosen for exploration in greater depth. During this second tour, participatory methods, particularly participatory mapping, were used to obtain information from the groups. Together with community members the team mapped the watercourses of the areas, water infrastructure, water use and water problems. While mapping, the team members asked follow-up questions to learn more about who does what in water management in the area. The team also tried to get an idea about the history of the areas and about how water users in the areas interact with one another and with other people and institutions involved in water management.

The mapping worked well in obtaining the involvement of everyone and especially in getting the participation of the women, who had tended to stay in the background during previous meetings. This outcome was interesting even though the study did not have gender as a specific focus. Venn diagrams were also used to indicate the importance and accessibility of institutions. The main advantage of the Venn diagrams seemed to be their prompting of lively discussion on a focused subject. The advantages of participatory methods were found to be:

- That they eradicated the "us and them" situation of a meeting.
- That they gave the community more perspective on their own situation, e.g., the participants discovered a need for a water user association at Boschkloof.
- The most important advantage was that it made the specific water situation much clearer to the team that could probe certain aspects with further questions.

1.4.9 Adjusting the scope and the output

After the first field tour it was realized that not even the Steelpoort river subbasin would be covered adequately in this project because of the complex nature of rural communities in South Africa. The team was surprised at the institutional complexity in rural communities in relation to commercial farming groups. A decision was then made that a few case studies would be done in reasonable depth to illustrate typical phenomena rather than addressing a host of areas superficially. Meetings with IWMI confirmed this course of action.

1.4.10 Analysis of information

Information from the overview field tour was placed under headings in a table format to make the information more accessible to readers. The analysis of the second field tour was mainly done in the writing and discussing process. A weak point in this project is that the information gathered was not analyzed adequately. The students had to leave at this stage to resume their studies.

1.4.11 Writing the report

Report writing was divided amongst the project team according to their experiences during the project, their skills and their available time. For example, policy and legal matters were assigned to Hubert Thompson, while the case studies were done by Eric Richters. The drafts were discussed on a regular basis to ensure that all members could contribute to all chapters and that adjustments could be made. Several project-team meetings were held to discuss drafts of chapters and these were proven valuable.

1.4.12 Finalizing the report

Finalizing the report proved to be the most difficult and time-consuming activity. It is always problematic to decide what should be included and what can be excluded. We feel that close interaction with the client at this stage is essential to finish the project successfully to an agreed end product.

CHAPTER 2

The Olifants River Basin and the Steelpoort River Subbasin

2.1 The Olifants River Basin

2.1.1 Overview

The whole Olifants river basin covers an area of 54,600 km^2, which is larger than the total area of the Netherlands and about 85 percent of Sri Lanka. Soils are mainly well-drained clay to loamy soils. The most common crop is maize; stock is 80 percent cattle.

The basin has 2,500 reservoirs, of which 90 percent have capacities smaller than 20,000 m^3. There are 30 large reservoirs whose capacities are larger than 2 million m^3 and a total storage of 1,100 million m^3. The estimated usage in the basin in 1987 was 1,060 million m^3 per year, including evaporation. The mean annual runoff is 1,235 million m^3 per year.

Irrigated farming used about 500 million m^3 of water per year in the late 1980s. This value has gradually declined over the last decade although irrigation is still the major water user in the basin. Ecological needs were estimated to be 200 million m^3 per year in the 1990s. There are about 200 mines in the basin, which use about 90 million m^3 per year. A relatively small amount of water is also exported from the basin, e.g., water is sent downstream from the Arabie dam to Pietersburg for domestic use.

If one compares the storage and usage of the basin it may seem as if the basin is not water-short. This, however, is not the case as seasonal and spatial shortages often occur. To illustrate this, the Steelpoort and Blyde rivers contribute 42 percent of the mean annual runoff of the Olifants river but only join the Olifants river at the lower end of the basin. At the top end of the basin, water has to be imported for the coal-fired power stations. This water may only be released after use according to a permit because of its pollution potential.

The main issues identified by a 1991 study of the Olifants river basin are as follows:

- availability of water in relation to demand
- quality of water
- impact of land use on the water resources
- availability of management information
- coordination of basin management practices

These issues or concerns are still valid and although the National Water Act (NWA) of 1998 has provided direction to address them, they are not yet solved.

The basin can be divided into five homogeneous regions:

- the Highveld region, above the Loskop dam
- the irrigated region, between Loskop dam and Arabie dam
- the underdeveloped or rural poor region from the Arabie dam to the confluence of the Steelpoort and the Olifants rivers
- the Steelpoort sub-catchment
- the Lowveld region, which ends at the confluence of the Steelpoort and Letaba rivers with the Olifants river

Water use in the basin according to the 1991 study is given in table 2.1. Water use by power stations is about 208 million m^3 per year and is excluded from the table above because of its being imported. Ecological use was estimated as 200 million m^3 per year.

Table 2.1. Approximate water use in 1987 in the five regions of the Olifants river basin in million m^3 per year.

Type of use	Regions in the basin					
	Highveld	Irrigation	Rural poor	Steelpoort	Lowveld	Total
Irrigation	63	220	60	82	91	516
Domestic and industrial	42	15	8	6	21	92
Stock watering	11	6	5	4	-	26
Forests	10	5	-	8	35	58
Mines	12	1	4	5	38	60
Total	138	247	77	105	185	752

Figure 2.1 is an approximate map of the Olifants river basin; figure 2.2 gives the average annual rainfall and figure 2.3 indicates the evaporation in the basin.

Figure 2.1. Olifants and Steelpoort river basins.

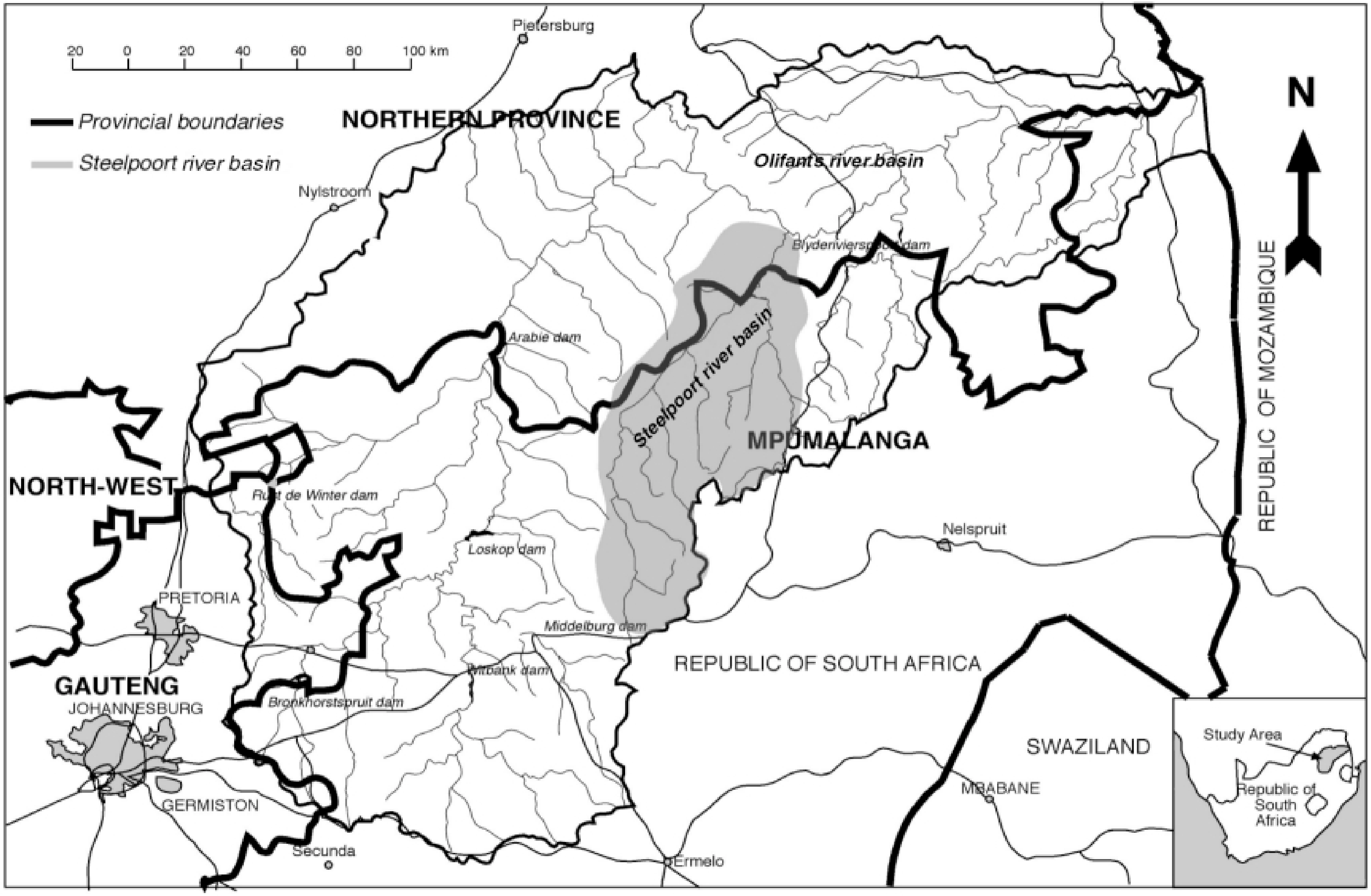


Figure 2.2. Olifants and Steelpoort river basin rainfall map.

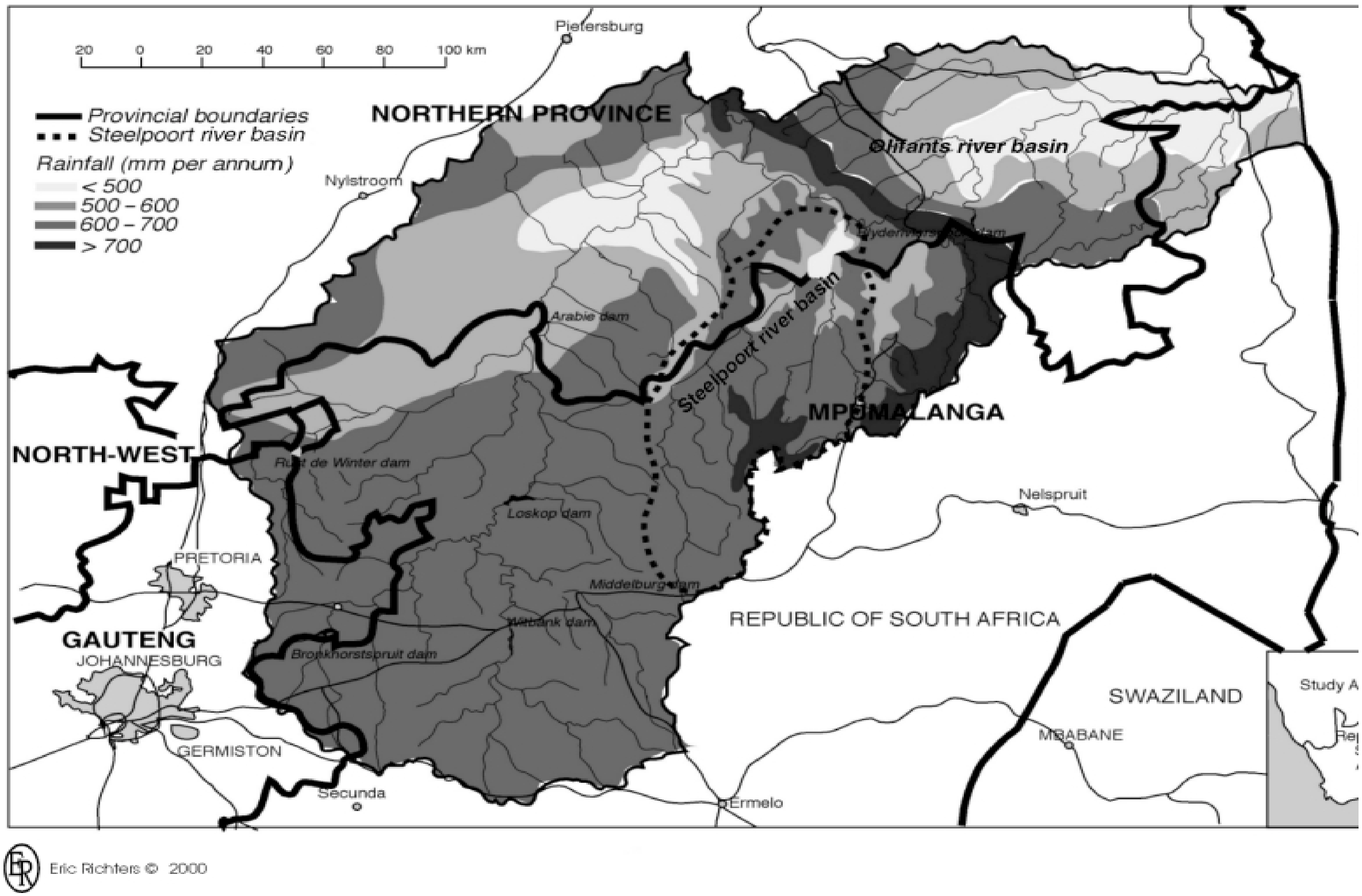
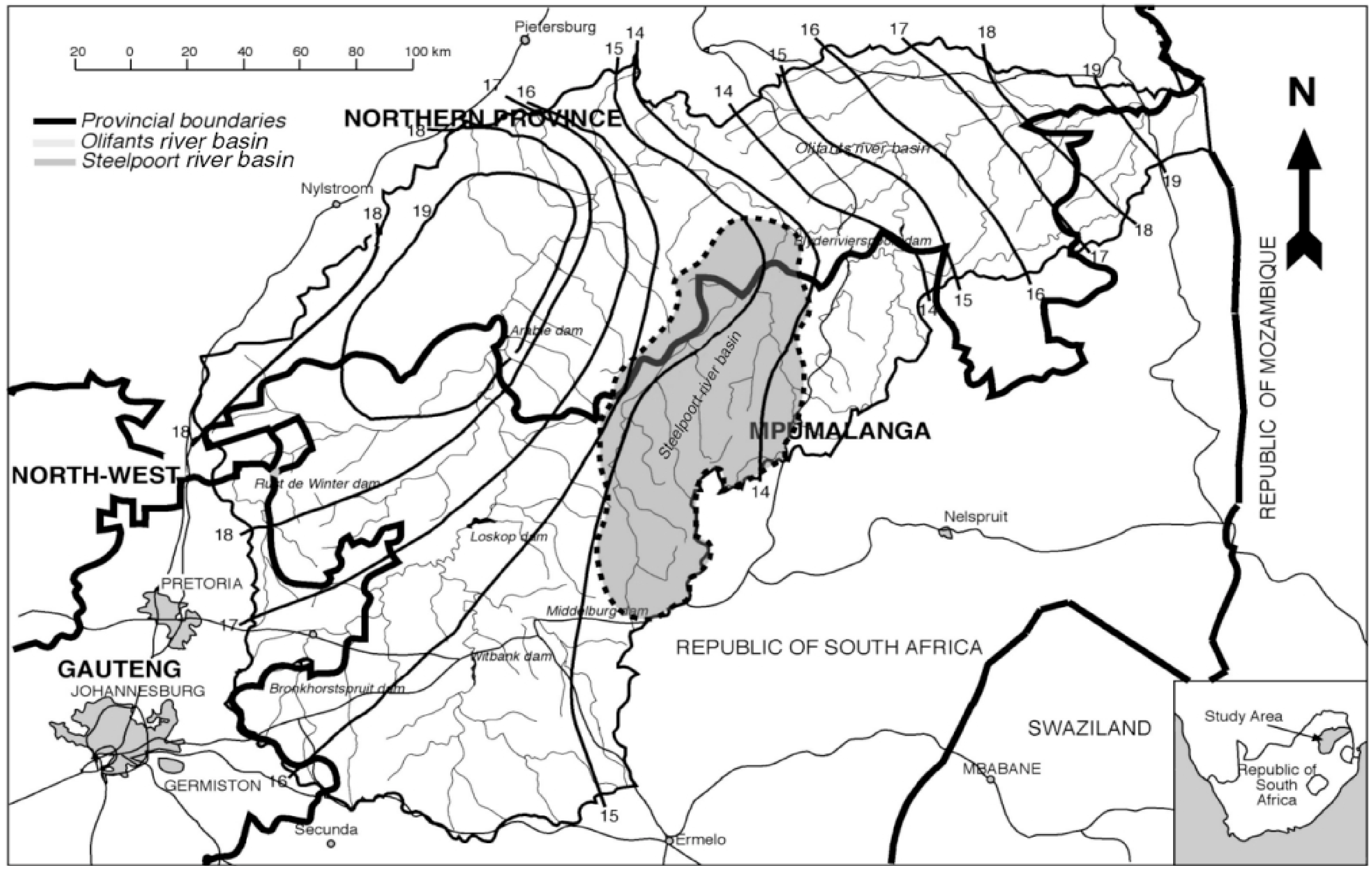


Figure 2.3. Olifants and Steelpoort river basin evaporation map.



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2.1.2 Description of regions in the basin

The Highveld region is the most developed region of the basin in terms of infrastructure. It has eight power stations for which water is imported from the Vaal river basin. Mining and industry are major sources of pollution with the Witbank reservoir being the most affected. This region is characterized by natural inundations and small farm ponds for stock watering.

The irrigated region from Loskop to Arabie dams uses about 90 percent of its water for irrigation. In recent years, commercial farmers have shown a tendency to move to high-value crops like citrus and grapes under precision irrigation systems. For example, one estate has 1,300 hectares of citrus under micro irrigation. The Loskop reservoir with a capacity of 348 million m^3 is by far the largest reservoir in the basin and supplies irrigation to farmers through a canal and releases in the river.

The underdeveloped or rural poor region below the Arabie dam is of major concern in the basin because of the multiple difficulties in the area. There is little industry or infrastructure in this region and the irrigation schemes are either underutilized or nonoperational. It is the region with the highest population and population growth rate in the basin. Stock densities are approximately three times the recommended stocking rates. This is one of the major contributions to denuded rangeland, soil erosion and a heavy sediment yield in the rivers of the basin.

The Steelpoort subbasin is dealt with in more detail below. It is noteworthy that the Steelpoort subbasin is, on the one hand, almost a scale model of the Olifants river basin in terms of topography and water use but, on the other, a unique basin with its own needs and characteristics. Competition and potential conflict between irrigation and mining are characteristics of this subbasin. There is good potential for storage to secure water supply to mines, irrigation and domestic water users. Two dam sites have been identified and the availability of funds will probably determine if and when the dams will be built.

The Lowveld section also has significant commercial irrigation but its unique feature is the Kruger National Park at the lowest end of the section. There seems to be increasing support for water to serve the ecological demand of the park. This demand is not only for quantity but also for quality in terms of physical and chemical impurities. This lower end of the catchment experiences all the effects of the water users upstream. Fortunately, the unpolluted rivers like the Blyde dilute the contaminated water of the Olifants river to keep it thus far at acceptable quality levels.

2.1.3 Institutional arrangements

Under the auspices of the DWAF, several bodies have been established to regulate water users. This applies, amongst others, to commercial irrigation, industry, mining and forest areas. A noteworthy exception is that there is no formal link with small-scale irrigators, which is mainly the result of the transformation from the previous political dispensation to the current.

The effects of the former homeland institutions are still very noticeable in the rural areas. The rural poor are in the situation that they have lost the support of the government structures of the past and the services of the current government are not yet effectual. The NWA (1998) should address these problems through water user associations (WUAs) and CMAs, but it will take several years for these arrangements to become effective.

2.2 The Steelpoort River Subbasin

The Steelpoort river basin is one of the eight subbasins of the Olifants river basin and covers an area of 7,139 km^2, which is 13 percent of the Olifants river basin. Figure 2.1 shows its position. The Steelpoort subbasin itself consists of three subbasins: the Upper Steelpoort, Central Steelpoort and Lower Steelpoort subbasins, as indicated in figure 2.4.

This section broadly describes the Steelpoort river subbasin's topography, climate, political boundaries, economy and demography. The subbasin's hydrology, water use, main water problems, and current water infrastructure developments are described in detail in chapter 3.

2.2.1 Topography

The Steelpoort basin lies mainly on an escarpment, between 1,500 and 2,400 m above mean sea level. Exceptions are the Steelpoort river valley, undulating gently between 900 and 1,200 m, as well as the westernmost area of the basin, in the vicinity of Belfast and Stoffberg, which can be classified as undulating Highveld country between 1,200 and 1,800 m above mean sea level.

The most important mountainous areas in the basin are the Sekhukhune mountains, west of the Steelpoort river and the Steenkamps and Bothas mountains, respectively, on the eastern and southwestern sides of the basin (Olifants basin study 1991).

2.2.2 Climate

Rainfall occurs predominantly in the summer months between October and March, with January generally experiencing the heaviest rain. The mean annual rainfall for the area is in the range 630–1,000 mm. Thunderstorms, with the associated low infiltration of the soil and erosion in mountainous areas, are common in the basin.

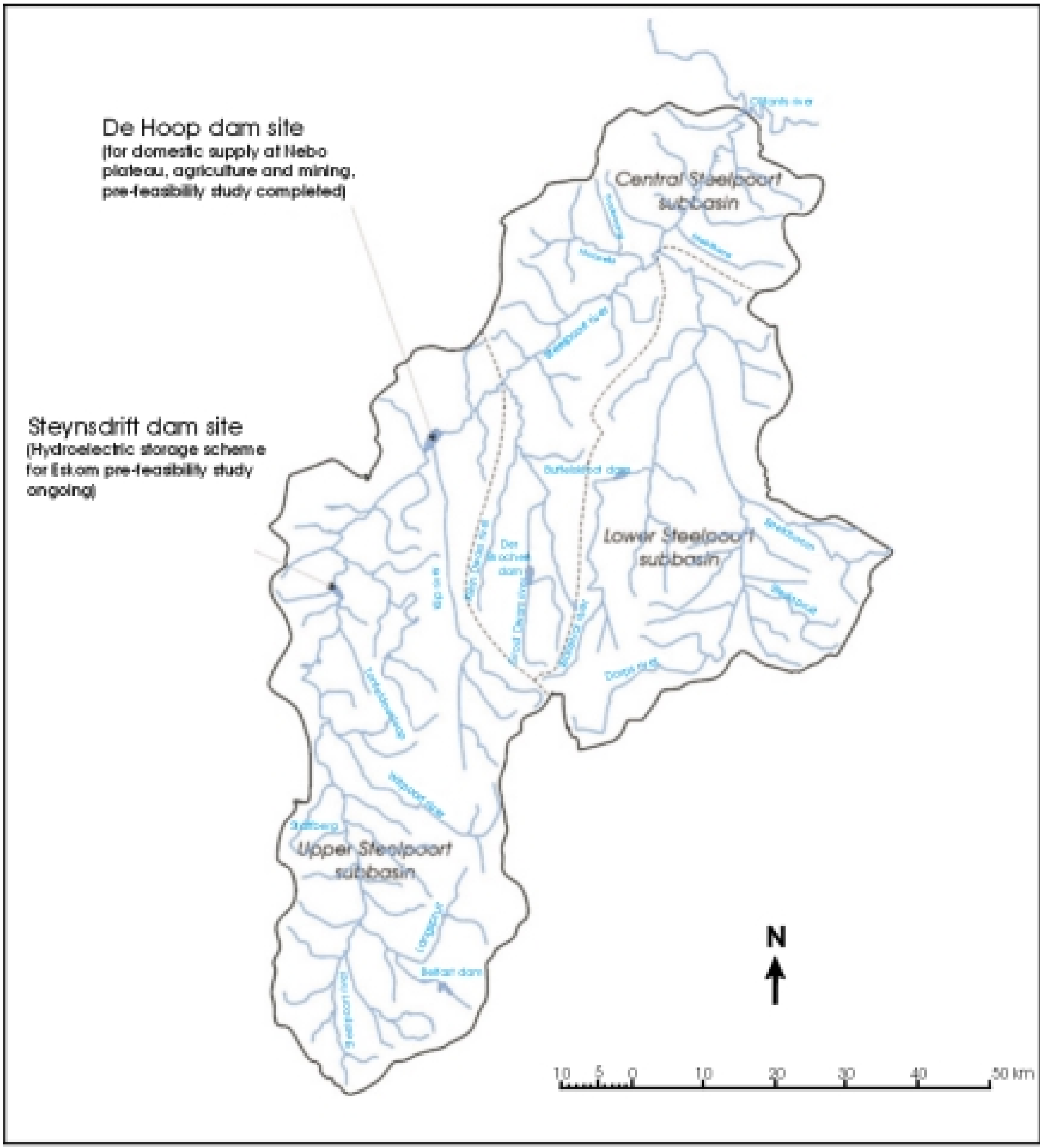
The average temperatures show moderate fluctuation. Average daytime summer temperatures vary between 19 °C and 22 °C while the winter averages are between 13 °C and 19 °C. Early morning frost occurs in low-lying areas. High evaporation occurs in the warm areas and evaporation rates are about 80 percent higher during summer than in winter (Olifants basin study 1991).

2.2.3 Main institutional boundaries

As shown in figure 2.5, the lower part of the Steelpoort river demarcates the border between the two provinces that cover the basin: Mpumalanga and Northern Provinces. Figure 2.6 shows the boundaries between the former Lebowa, South African Development Trust land, and the former Republic of South Africa. Note that the former Lebowa and South African Development Trust land fall mainly within the Northern Province and the former Republic of South Africa falls mainly within Mpumalanga Province.

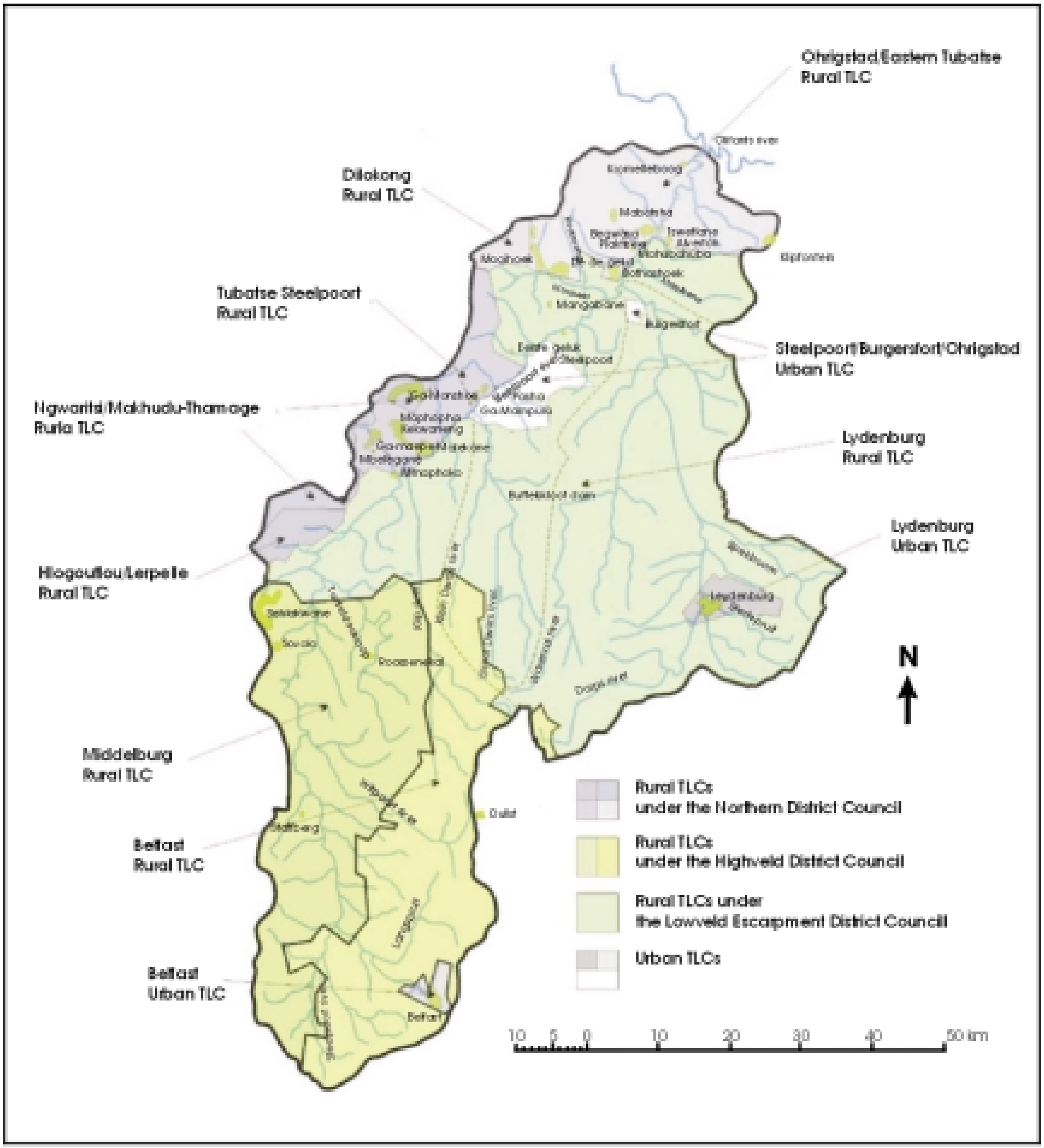
Figure 2.7 shows that the basin comprises eight rural Transitional Local Councils (TLCs) and three urban TLCs. Five rural TLCs lie in the Southern District of the Northern Province while three rural and three urban TLCs lie in the Mpumalanga Province.

Figure 2.4. Main rivers, sub-catchments, large dams and proposed large dams in the Steelpoort river basin.



Sources: 1:250,000 topographic maps: nos. 2428, 2528, 2430, 2530 and Olifants river basin study 1991.

Figure 2.5. Provincial boundaries in the District Councils and urban and rural TLCs in the Steelpoort river basin.



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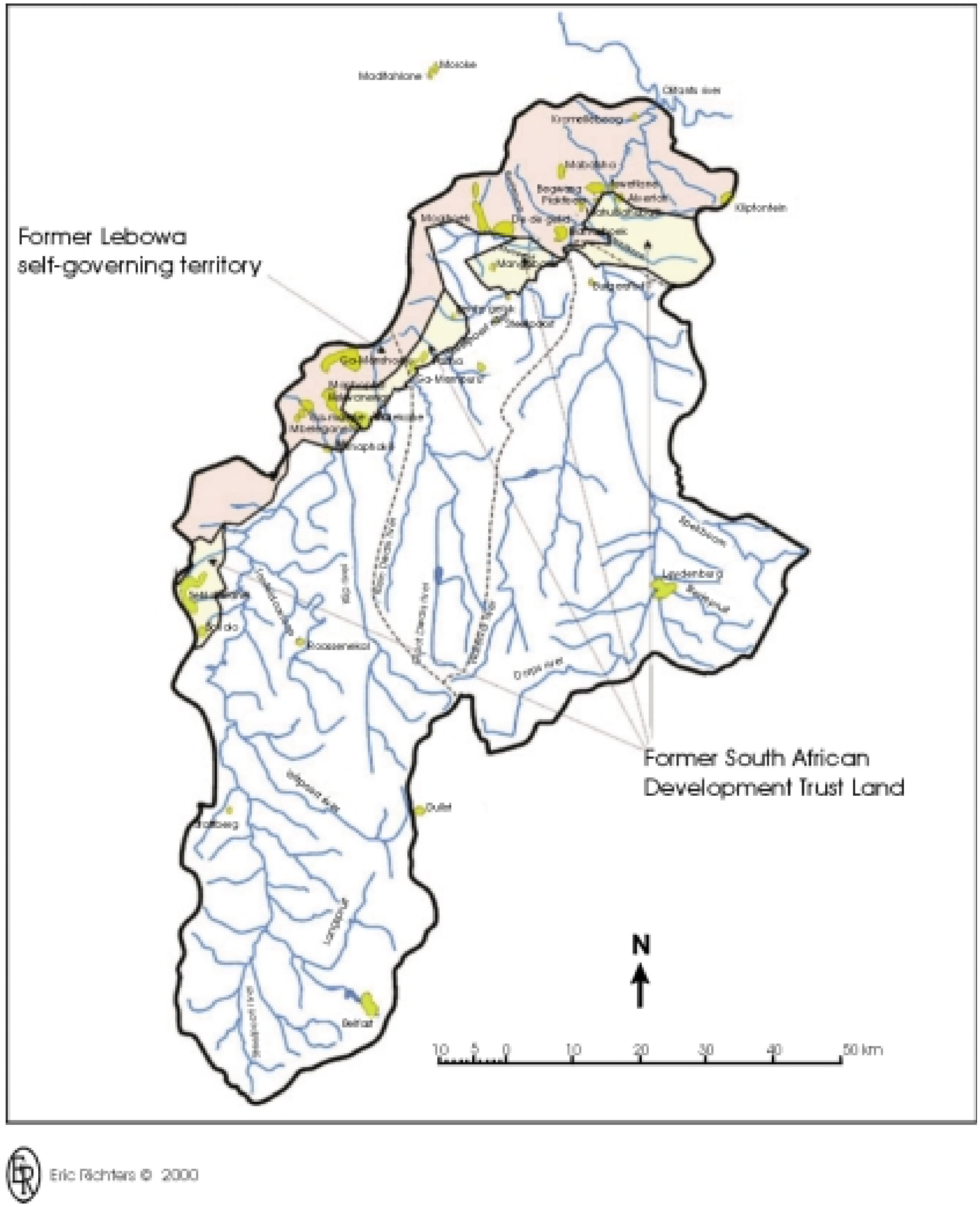
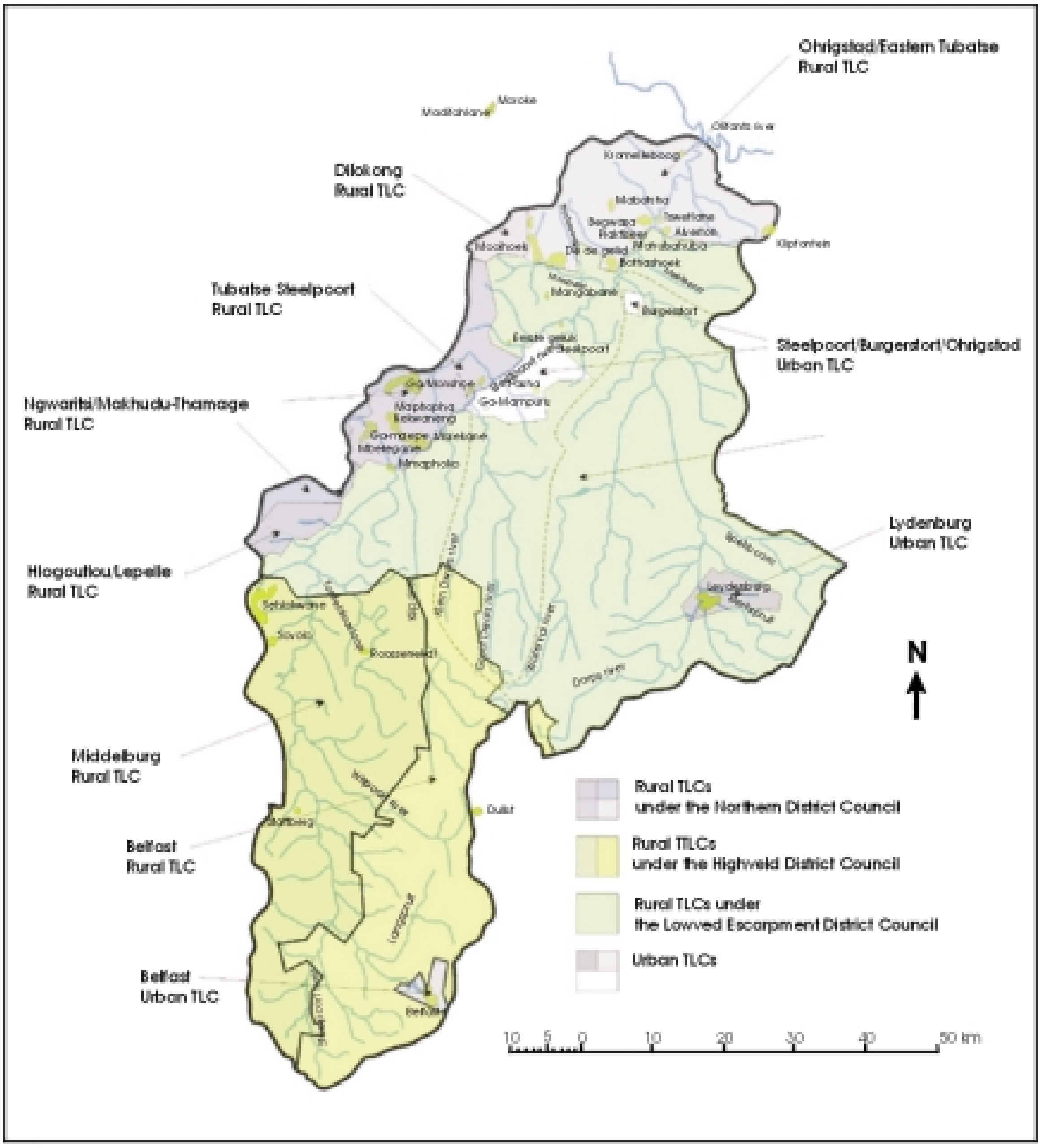
Approximate boundaries: *Source:* Undated IEC map of TLC boundaries in and around the Olifants river.

Figure 2.6. Boundaries of former self-governing territories and former development trust land in the Steelpoort river basin.



Sources: Olifants river basin study 1991.

Figure 2.7. District Councils, and urban and rural TLCs in the Steelpoort river basin.



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Approximate boundaries: *Source:* Undated IEC map of TLC boundaries in and around the Olifants river.

2.2.4 Brief economic overview

The Southern District of the Northern Province comprises 8 percent of the total area for the Northern Province, yet 25 percent of the Province's total population and 36 percent of the Province's rural population live within this district. It has virtually no economic base and is economically the most marginal region in the Northern Province. Rural incomes are mostly derived from remittances, state salaries and welfare payments. More than 60 percent of the employed people are employed in the services sector, which contributes more than 70 percent of the Gross Geographic Product (GGP) of the region. Sixty percent of the region's population is unemployed and the regional per capita GGP is R1,000 (in 2000, US$1.00 = R7.00) per year, one-third of the Provincial GGP and less than one-sixth of the national average income per capita. These figures highlight the area's economic vulnerability.

The portion of the Mpumalanga Province in the Steelpoort basin, however, has a significant economic base through the mining and agricultural sectors that stimulate the region's economy. But it has limited impact on the Northern Province portion in the basin due to the size of the economically inactive population in the region (DWAF 1999).

2.2.5 Demography

Figure 2.8 shows the main towns and settlements in the basin. The main towns are Lydenburg and Belfast, and smaller ones are Stoffberg, Roossenekal, Steelpoort and Burgersfort. The most densely populated area of the basin lies on the north bank of the Steelpoort river in the Southern District of the Northern Province. With an average population density of 117 persons/km^2 it is the Northern Province's most densely populated district, about three times the average density of the province, which is 41 persons/km^2.

The Southern District also has the highest HIV infection rate of the Northern Province: 13.4 percent versus the Province average of 8 percent. The high HIV infection rates make the area even more vulnerable. Estimates of trends show that 25 percent of the population could be HIV positive by the year 2001. The implication of these values is that unless behavior changes considerably or medication to treat AIDS is developed, the population growth rate in the Southern District could tend towards zero and possibly even decline, but more information on trends are required before improved population growth scenarios can be formulated (DWAF 1999).

2.2.6 Water resources

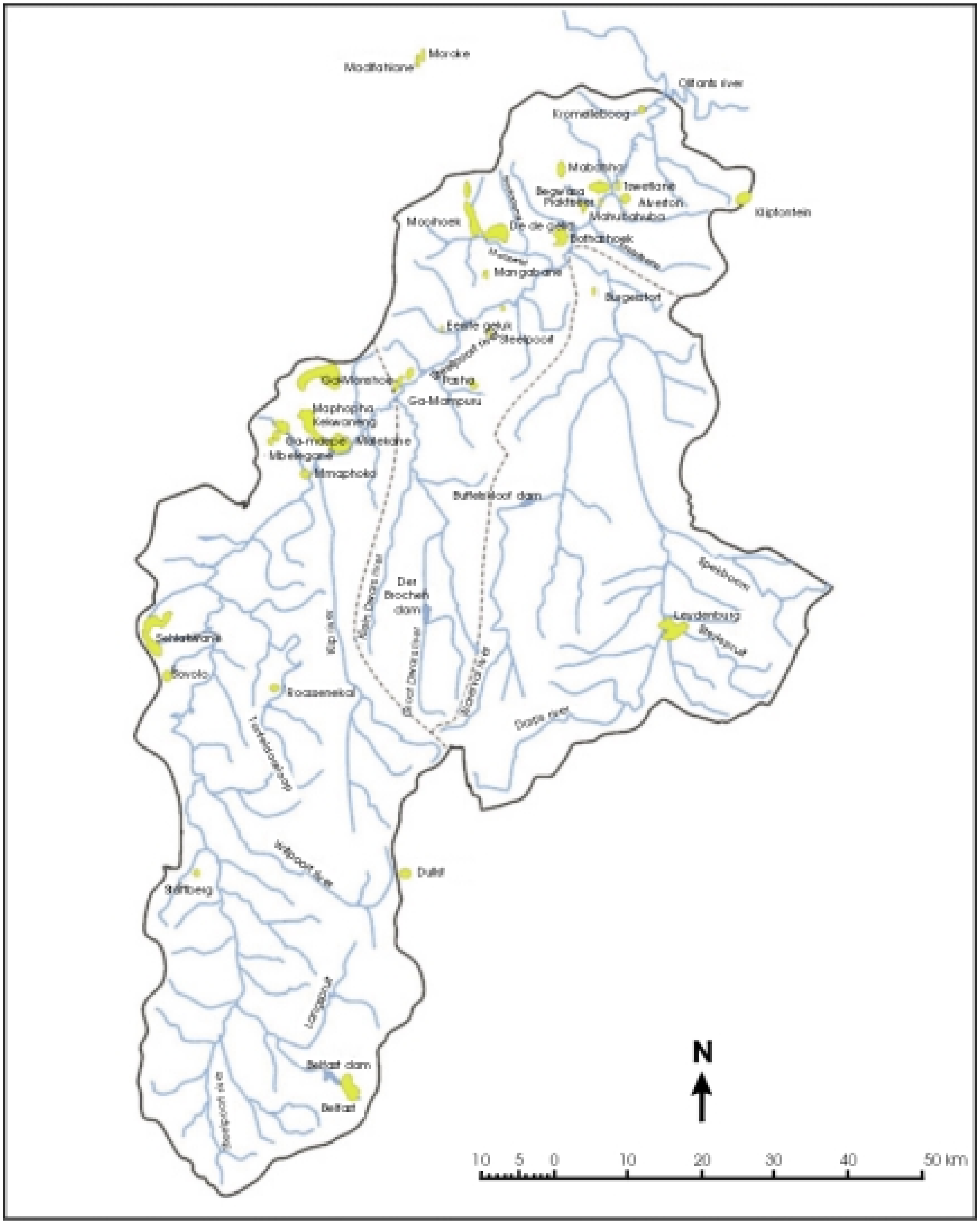
Surface water

The Steelpoort river is one of the main tributaries of the Olifants river. The Olifants river basin study of 1991 estimates the runoff in the Steelpoort subbasin at 369 m^3 per year but the DWAF study of 1999 estimates it at 397.9 million m^3 per year. Existing reservoirs store about 5 percent of the mean annual runoff (Olifants basin study 1991).

The main tributaries of the Steelpoort river are the Groot Dwars and Spekboom rivers. Other rivers in the subbasin are the Klip, Klein Dwars, Tonteldoosloop, Witpoort and Waterval (Olifants basin study 1991). Figure 2.4 shows the location of the main rivers in the basin.

There is one water transfer scheme in the Steelpoort subbasin. It transfers water for irrigation from the Steelpoort river basin to the Blyde river basin, another subbasin of the Olifants river

Figure 2.8. Main towns and villages in the Steelpoort river basin.



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Sources: 1:250,000 topographic maps: nos. 2428, 2528, 2430, 2530.

basin. A 5.5-km long canal with a capacity of 283 l/s conveys water from the Spekboom river to a farm next to the Ohrigstad river (Olifants basin study 1991).

Groundwater

The Olifants river basin study of 1991 estimates the mean annual recharge of the aquifers in the Steelpoort at 296 million m^3 per year and classifies the groundwater potential in the whole of the Steelpoort basin in the range of moderate to very high, as shown in figure 2.9. Boreholes in areas of moderate potential are expected to yield between 1.5 and 5 l/s with a failure rate of 60 percent and those in the high potential areas between 3 and 10 l/s with a failure rate of 50 percent. Boreholes in the very high potential areas are expected to yield between 5 and 20 l/s with a failure rate of less than 30 percent. It must be kept in mind that high potential or low potential is here spoken of in the South African context where groundwater is relatively scarce.

To summarize, the Olifants basin study of 1991 and the DWAF study of 1999 characterize the water resources in the Steelpoort river basin as underdeveloped. There is enough water available in the whole basin, but especially the people living in the Northern Province portion of the basin have difficulties to access it.

2.2.7 Water quality

A 1995 DWAF water quality study on the middle Steelpoort basin states that "… surface and groundwater resources [in the Steelpoort basin] are being further threatened by increasing levels of contaminants from industrial, agricultural, mining and residential sources…. Evidence of such impact was observed during a surface water quality assessment undertaken in the upper Steelpoort river catchment (Swart et al. 1995)" (DWAF 1995 [6]: v).

The same report (DWAF 1995 [6] v) concludes that in the area around the Steelpoort river in the central Steelpoort basin:

- Surface water is potable with nominal treatment (filtration and chlorination).
- Most boreholes sampled were not found to be fit to be used as a source of potable water.
- Kennedy's Vale farm (commercial),
- Pretoria farm (emerging) and
- Mac Maharaj farm (small scale+Mangabane community).

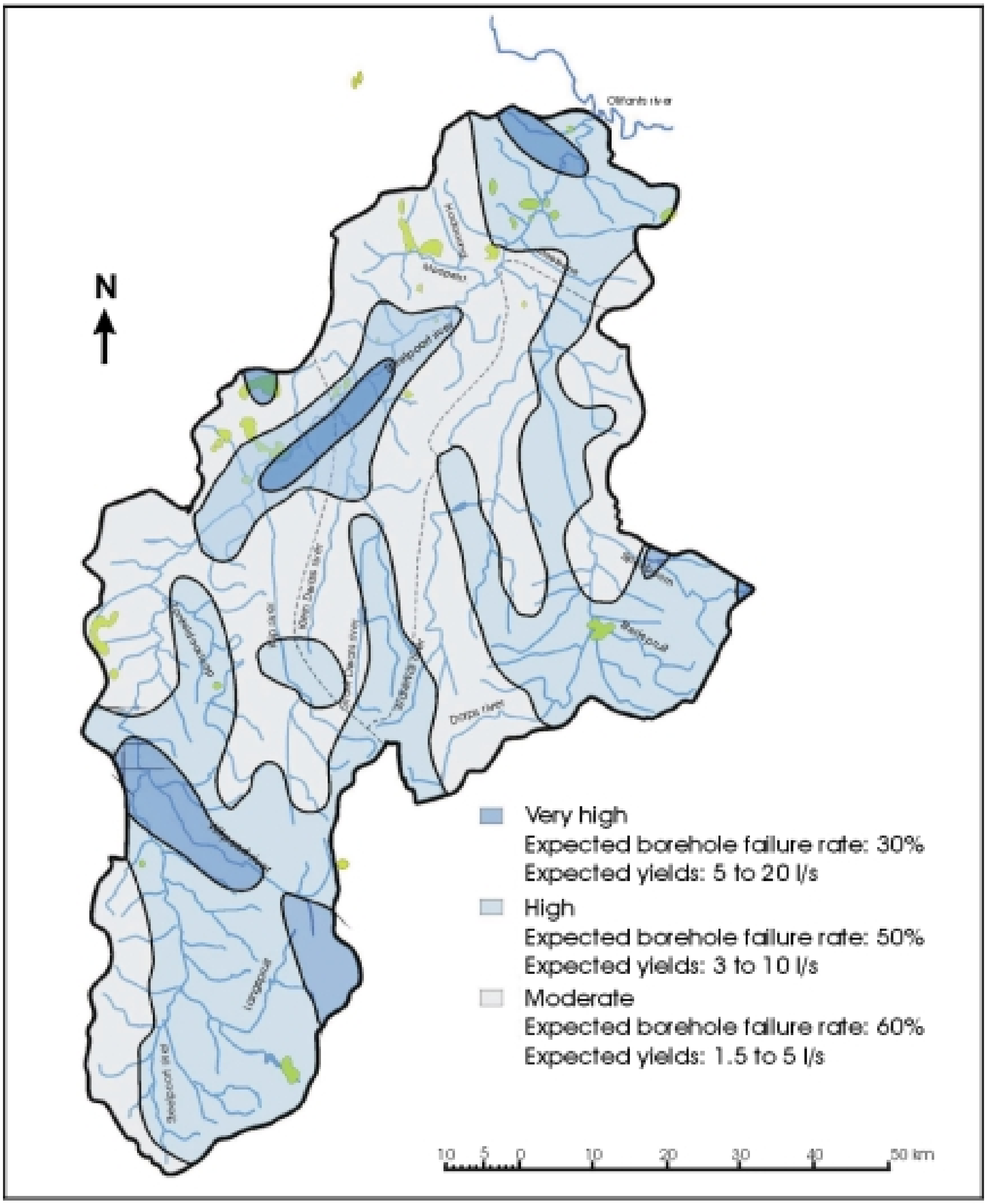
Surface water in the study area is suitable for livestock watering; groundwater is generally unsuitable.

The study is based on one sample from each of the 25 studied boreholes and surface points.

Despite the area's poor quality groundwater, the same study recognizes that "… shortage of, in particular, drinking water in the middle Steelpoort catchment…has led to the increased exploitation of groundwater resources in this area (DWAF 1995 [6]: 1)."

Water quality deteriorates in the downstream direction and is the worst in the central Steelpoort subbasin, where the majority of the basin's population lives.

Figure 2.9. Estimated groundwater potential of the Steelpoort river basin



Source: Olifants river basin study 1991.

CHAPTER 3

Water Use and Water Users in the Steelpoort River Subbasin

This chapter describes the water infrastructure in the Steelpoort river subbasin and identifies the main types of water uses. Based on interview data, the main traits of each type of user or service provider are presented through tables and short analyses. These traits reflect only facts and issues raised by the informants themselves. Thus, the information may sometimes seem incomplete or even contradictory. Full analytic reports are available with the authors. Also, one can refer to figure 4.1 (p.44) to locate the different field visits.

3.1 Water Infrastructure in the Subbasin

3.1.1 Dams and reservoirs

It is estimated that there are about 300 reservoirs in the Steelpoort river subbasin. In 1987, 261 reservoirs had capacities of less than 100,000 m^3 each and 35 reservoirs had capacities between 0.1 and 2 million m^3 each. There are three reservoirs with a capacity larger than 2 million m^3: Belfast dam (4.39 million m^3, municipal dam), Buffelskloof dam (5.3 million m^3, irrigation) and Der Brochen dam (7.29 million m^3, irrigation and mining). Figure 2.4 shows their locations.

The total storage capacity of these three reservoirs is 16.5 million m^3, with a surface area totaling approximately 740 hectares. The number of minor and small dams has probably increased since 1987. According to the projections in the Steelpoort river basin study report of 1991, the total storage capacity of minor and small reservoirs is presently about 20 million m^3 (Olifants basin study 1991).

3.1.2 Water treatment facilities

The Olifants river basin study states that the only water purification plants for domestic water in the Steelpoort river basin are at Belfast and at Lydenburg. However, the study team also came across a purification plant for domestic water at Mampuru (Boschkloof) constructed in the early 1980s. It is possible that there are more of these undocumented plants in the Steelpoort river basin. It is however very common for villages and settlements to use water straight from boreholes or rivers, without purification plants. Belfast and Lydenburg have sewage treatment plants while the other towns and settlements use pit latrines, septic tanks or stabilization ponds (Olifants river basin study 1991).

3.1.3 Possible large reservoirs

The 1999 DWAF pre-feasibility study on bulk water supply in the Middle Olifants and Steelpoort river area recommends a feasibility study on a dam at the De Hoop site in the Steelpoort subbasin. It rates it as the number one priority to meet the long-term multi-sectoral water needs of part of the Northern Province portion of the Steelpoort river basin and the adjacent densely populated area in the Middle Olifants river basin. Furthermore, the report recommends a feasibility study on possible abstraction points in the Steelpoort and Olifants rivers, of which the locations are yet unknown.

Eskom (the electricity-generating parastatal) is currently investigating the possibilities of another dam at the Steynsdrift site on the Steelpoort river. The dam would serve as a pumped hydroelectric storage scheme. Figure 2.4 shows the locations of both the De Hoop and the Steynsdrift dam sites. The Olifants river basin study of 1991 also had recommended these two dam sites.

3.2 Water Use in the Subbasin

The research team tried to answer two questions on water use: a) who uses water and where in the basin? and b) who is using how much water? Soon it became very clear that the team would not be able to answer these questions in detail within the given time frame. But the team tried to see how far it could come by summarizing available literature and through interviews.

This section divides water use in the Steelpoort basin into ten water use groups with their locations in the basin, and summarizes the available water use estimates for each of them. It also provides an estimate of the reliability and accuracy of the available data. The ten water use groups are:

- large-scale irrigation
- community irrigation and industry
- mining
- industry
- domestic use
- livestock
- aquaculture
- forestry
- recreation
- environment

3.2.1 Large-scale irrigation

The DWAF study of 1999 study lists the irrigation districts—similar to irrigation boards—and corresponding irrigated areas in the Steelpoort basin in 1997. These are shown in table 3.1.

Figure 3.1 shows the location of the irrigation boards in the Steelpoort subbasin. Recently the irrigated area in the Steelpoort basin has declined from approximately 12,000 hectares in 1988

Table 3.1. Irrigation districts/boards in the Steelpoort river basin, 1997.

Government Water Scheme	Scheduled area (ha)
Mapochsgronde	302
Watervals river	1,760
Irrigation district/boards	Irrigated area (ha)
Central Steelpoort	564
Spekboom	1,137
Lower Spekboom	2215
Laersdrift	499
Groot Dwars river	1,222
Watervals	2,273
Mapochsgronde	296
Tswelopele	1,174

to approximately 8,206 hectares in 1997. The DWAF study states that: "The general opinion from the farmers in the Steelpoort basin is that the decline in irrigation area over the past 10 years (1988-1997) is due to mining houses that have bought out and are still in the process of buying out irrigation land. According to the farmers it is to access the water rights from the rivers for possible future expansion of mining activities and accompanying water demands" (Water Affairs, 1999). During the interviews one of the mine officials stated that the mines are actually more interested in the farms for their mineral rights than for the water rights.

The DWAF study estimates the water use for the irrigation sector in the basin at 85 million m^3 per year in 1997. However, the ARDC farm, Tswelopele, has not been operational for several years and is still not operational. The scheme size registered at the Praktiseer subregional agricultural office is 924 hectares. When a volume proportional to the listed irrigated area of Tswelopele is subtracted, the estimated use for the large-scale irrigation sector comes to 74.4 million m^3 per year. That is about 19 percent of the mean annual runoff.

The Olifants basin study (1991) expected a growth of irrigated acreage to 13,818 hectares in 2000, with a total water use of 91.2 million m^3 per year. This increase has not been realized. The DWAF study of 1999 assumes that the future irrigation water demand will remain more or less on the 1997 level and bases this assumption on the general opinion of irrigation farmers.

Large-scale irrigation is generally managed through irrigation boards. The two boards interviewed are the Watervals Irrigation Board and the Central Steelpoort Irrigation Board.

The results are shown in table 3.2.

Both boards have submitted their applications to the DWAF for establishing WUAs and they are well informed of the CMA establishment process. They raised the issue of establishing a CMA at the Steelpoort subbasin level, as they feel poorly connected to the greater Olifants basin. They showed interest in better communication with other irrigation boards in the area.

Figure 3.1. Irrigation and irrigation boards in the Steelpoort river basin, according to the Olifants river basin study 1991.

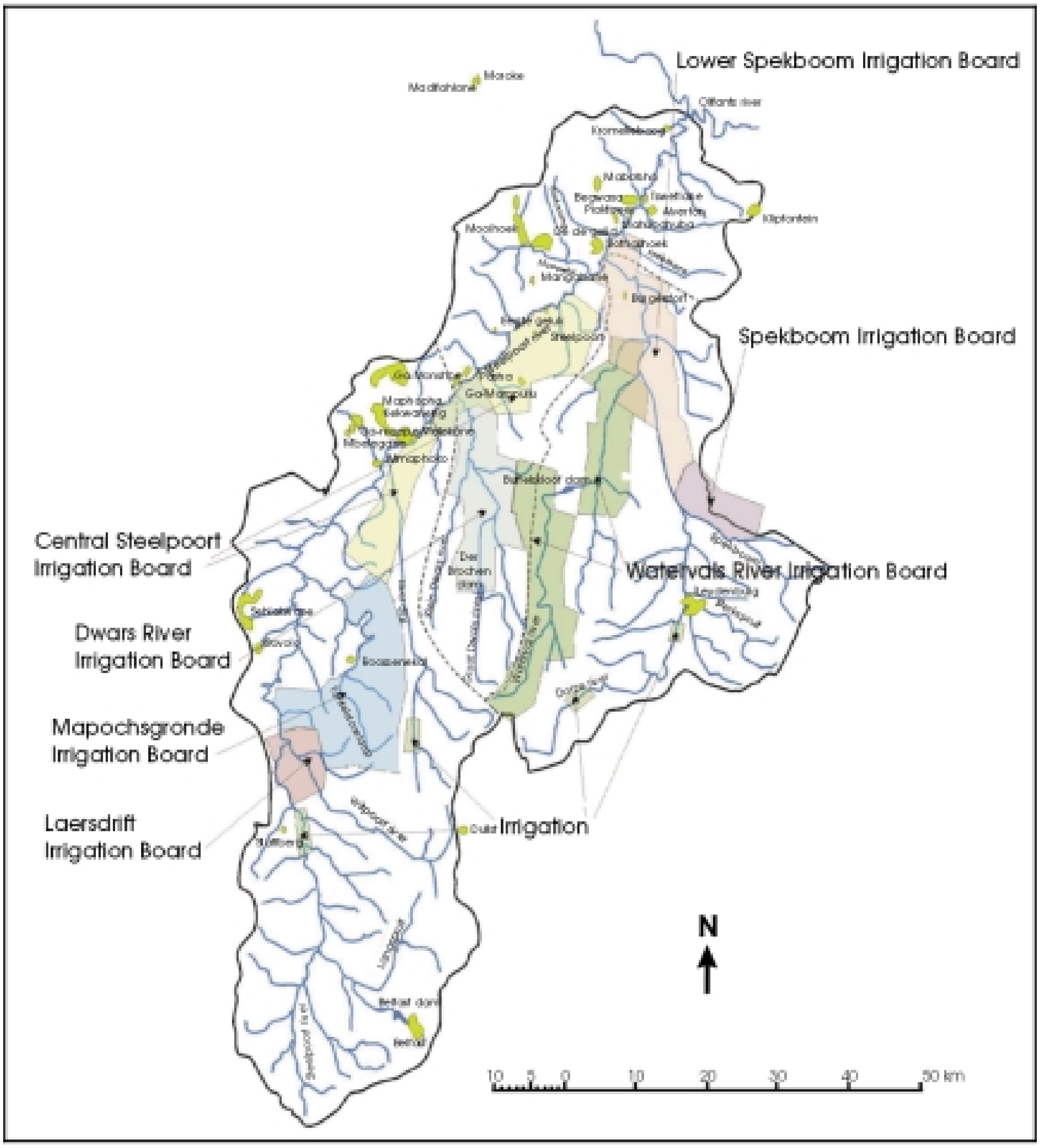


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Table 3.2. Water use by selected irrigation boards.

Water use	Water resource	Infrastructure	Institutions involved in water use	Relationship with those institutions	Relationship with other users	Issues
Central Steelpoort Irrigation Board/Tubatse Ferrochrome plant						
Chrome process: furnace cooling. No release (closed circuit). Irrigation (farmer members of the IB).	Steelpoort river. Groundwater at the attached housing complex for domestic supply.	Weir (maximum allowed pump tempo=70,000 m^3/day). Canals. pump station. Balancing/transfer dam. Main storage dam (Tubatse dam, 400,000 m^3). Sewage plant. Borehole for domestic water at the attached housing complex, and a sewage plant.	DWAF Establishment process of WUAs engaged.	Good.	Farmer members of the IB (10 members, including 9 members who are farmers and one is the Tabutse Ferrochrome plant). Good relationship and cooperation.	Very little groundwater, with low quality (high level of nitrates). Water shortage in the river at times. Steelpoort river is badly silted. CMA, Olifants river too big, too focused on the Olifants river. Water too cheap for farmers; they do not consider it as a factor for production. Everybody is waiting for a big dam in the area. Steelpoort river is underutilized. Not enough contact with other IB in the area.
Watervals River Irrigation Board						
Irrigation	Watervals river	Buffelskloof dam (5,000,000 m^3) Above the dam: earth canal Below the dam: 6 canals with parshall flumes Measurement systems: crump weirs at farm outlets. Irrigation systems: drip, micro with fertigation, sprinklers, 35 pivots (20 ha each); no flood irrigation. Most farmers have boreholes; they use them during droughts.	DWAF	Not really involved but good. But there is a lack of communication (no information on water law, consultation meetings) DWAF does not inspect the canals. A DWAF employee operates and maintains the dam. Establishment process of WUAs engaged.	They interact with Spekboom IB because of overlapping (it was said that this IB is responsible for domestic water supply in the area?)	The dam cannot supply enough water anymore, so farmers shifted gradually towards permanent crops (less cash crops than in the past). Serious leaks along the canals. Farmers pay more for dam maintenance; according to the new water laws, they are supposed to pay 100%. They would prefer a CMA for the Steelpoort river basin. Drought (1984 and 1992 especially); then farmers resorted to boreholes but it just allows them to keep the trees alive.

Three types of individual farmers were also interviewed. Their situations are different, and are described in table 3.3. The three farms were:

- Kennedy's Vale farm (commercial)
- Pretoria farm (emerging)
- Mac Maharaj farm (small scale+Mangabane community)

All these farmers use water for irrigation from a river or a dam. The first two have a borehole each for domestic water supply. They are unaware of the implications of the NWA and of the CMA establishment process (registration).

3.2.2 Community irrigation and industry

The Olifants basin study 1991 only refers to irrigation in what was, in 1991, the Republic of South Africa. Irrigation in the former self-governing territory of Lebowa was not mentioned in the report; that is, the report does not mention the 924-ha Tswelopele irrigation scheme at all, nor does it mention the other small-scale irrigation projects in the area. An inquiry at the Northern Province Department of Agriculture (NPDAE) yielded the small-scale irrigation schemes and vegetable gardens shown in figure 3.2. This information was retrieved from their database.

However, a mapping exercise with a member of the Tubatse Steelpoort TLC and an extension officer of the Praktiseer subregional agricultural office revealed that there are some more small-scale irrigation projects, vegetable gardens and brick-making projects in the areas around Praktiseer and Schoonoord subregional agricultural offices. Figure 3.3 shows the results of the exercise; the locations are approximate. The marked difference between figure 3.2 and figure 3.3 clearly shows that the central database of the NPDAE is still incomplete. There are probably also many unidentified small-scale industrial projects in the area using water, for example, the team came across a clay-pot-making project in Matimajaji that uses a fair amount of water.

The team expects that there are numerous similar unidentified small-scale projects in the basin that are largely unregistered in central databases. Especially in the Mpumalanga part of the basin, the team expects many unregistered projects ranging from small-scale agricultural projects on mine properties to land-reform projects and agriculture on squatted land. Similar mapping exercises with members of other subregional agricultural offices or TLCs in the basin could reveal these projects.

Due to lack of information, the team could not estimate the amount of water used by the community, irrigation and industrial sectors.

Interviews on water use were carried out in several rural communities as shown in table 3.4. Even though carried out during the same meetings, the interviews addressed various villages and institutions at local/community levels. Each of their representatives gave his own viewpoints. Apart form the TLC people, surrounding villages were represented by a few community members per village. The two TLC areas where interviews were carried out were Praktiseer and Eerste Geluk.

Overall, it was clear that these communities are struggling with domestic water-supply problems (severe backlogs and lacking infrastructure, lack of service delivery, perceived lack of attendance to their problems by the TLC, complexity of the local institutional fabric, rising conflicts and misunderstanding of the new dispensations in terms of water supply and services). The problems were seen as more constraining than in other interviews. The interviewed people were

Table 3.3. Water use by selected farmers.

Water use	Water resource	Infrastructure and equipment	Institutions involved in water use	Relationship with those institutions	Relationship with other users	Issues
Kennedy's vale commercial farm						
Irrigation Domestic use	Dwars River with Der Brochen dam for irrigation. Steelpoort river for irrigation (right not used). Ground water for drinking water.	Der Brochen dam (DWAF). Canal from Dwars river. Canal from Steelpoort river. Borehole for domestic water.	Groot Dwars Irrigation Board. No contacts or information on DWAF, CMA… although the farmer mentions a water right.	Because the farmer rents the land from a mine he has little contact with the IB. The farmer states that DWAF is not trustworthy (no explanations). He thinks that that there were more meetings and communication in the past (through union). Total unawareness of NWA, CMA process…	The farmer shares the canal with VanTech (vanadium mine), no problem. The farmer is involved in training other farmers on irrigation (Boschkloof) with consultants. He meets regularly with other farmers (organized by union and mining management).	In the past : severe drought, critical water quality problems due to mining; problems in affordability of infrastructures by farmers (case of the dam). The farmer is aware that such problems could rise again.
Pretoria farm. Emerging commercial farmer						
Irrigation Domestic use	River (irrigation). Groundwater (drinking).	Dam and canal (broken). Diesel pump. Sprinkler and furrow irrigation. Borehole for drinkable water.	Some contacts with an extension officer from NPDAE on crop and irrigation.	Good relationship with the extension officer. No other contacts. Total unawareness of current regulations and the institutional environment of water management.	Just an awareness of neighbors who are farming nearby.	High pumping costs due to diesel consumption. Farming problems : finance, access to fertilizers, pesticides, access to market, tractor broken. The farmer touches on the possibility of an association with other farmers.
Mac Maharaj Farm (small scale irrigation scheme) Mangabane village						
Irrigation scheme 64 ha/29 families Domestic use	Steelpoort river (irrigation and domestic water). Kwashi river (domestic).	Main canal (furrow) for irrigation. Another furrow caters for two irrigation sections only. A hand pump next to the Steelpoort river for domestic water (7 km far).	Labor unions TLC CIVICS Tribal authorities Winterveld Chrome Mine (sell and deliver water to some people in the community, allegedly alter water quality). Water committee.	Labor unions are instrumental in the sustained and good contact between community and the mines. TLC and the chief can also contact and raise funds from mines, but not directly about water (even though water quality seems to be the knot of these relationships). Farmers believe that TLC / CIVICS might play a role in solving water issues, but still touch on the lack of coordination with the chief. People are disappointed that TLC promised improvements but does not actually attend to their problems. TLC is basically their only institutional contact on water issues. WC plays a liaison role.	Mines, allegedly using much water and polluting it. Support the community with donations. Just an awareness of neighbors who are farming nearby. Total unawareness of current regulations and the institutional environment on water.	The furrow does not function any more. According to farmers, the Steelpoort river is infested with bilharzia; children get diarrhea from water. Willingness to fix the furrow and to drill their own boreholes to overcome water shortage. Farmers touch on water and air-quality problems caused by the mines. Women have to walk for 7 km to the river (hand pump) and then queue for up to 3 hours there. Lack of sanitation and drinking water in the village. The WC worker is a volunteer. The Kwashi river gets dry often, even in summer.

Figure 3.2. Smallholder irrigation and vegetable garden projects in Schoonoord and Praktiseer subregions, as indicated by the Provincial Department of Agriculture.

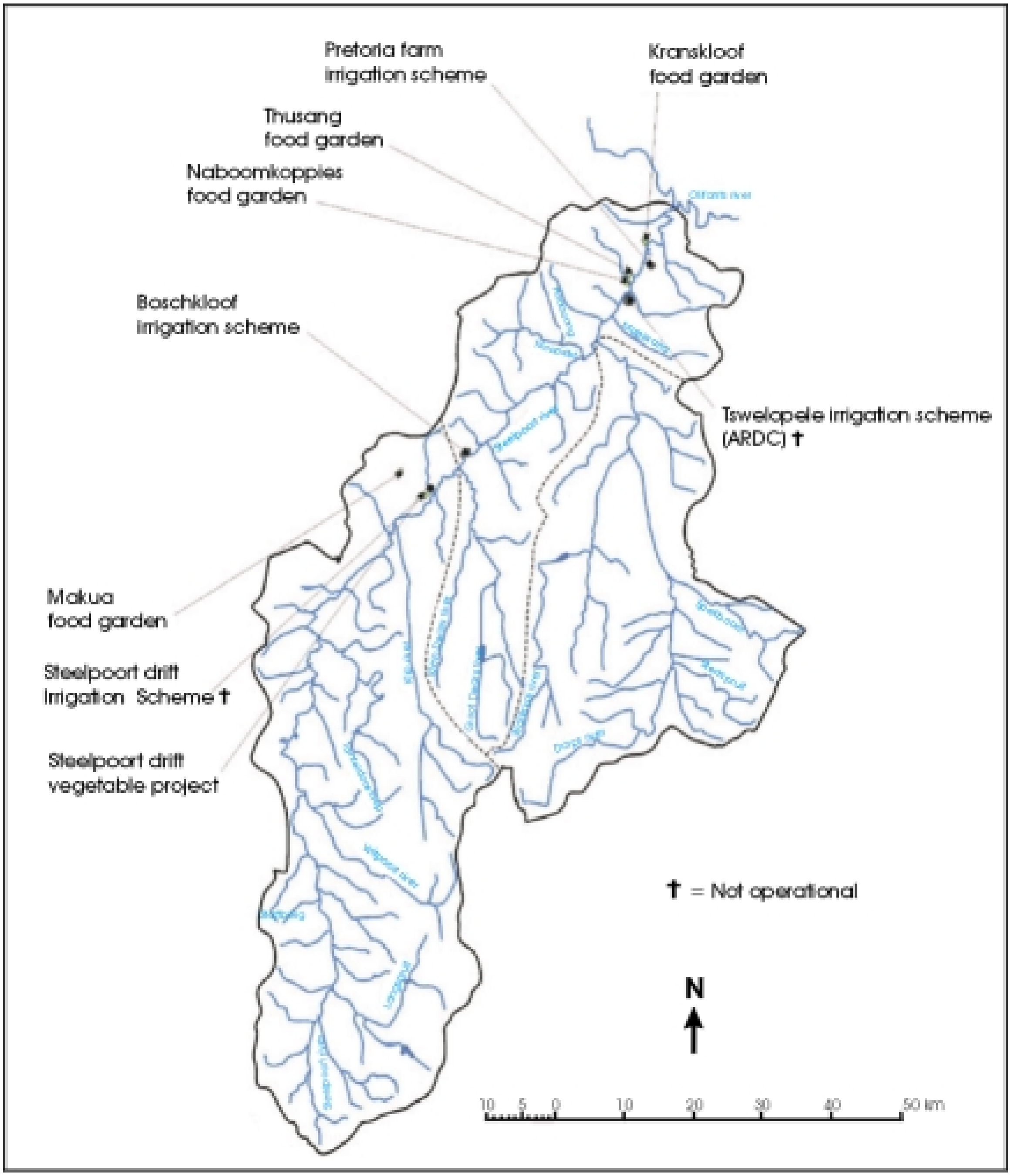

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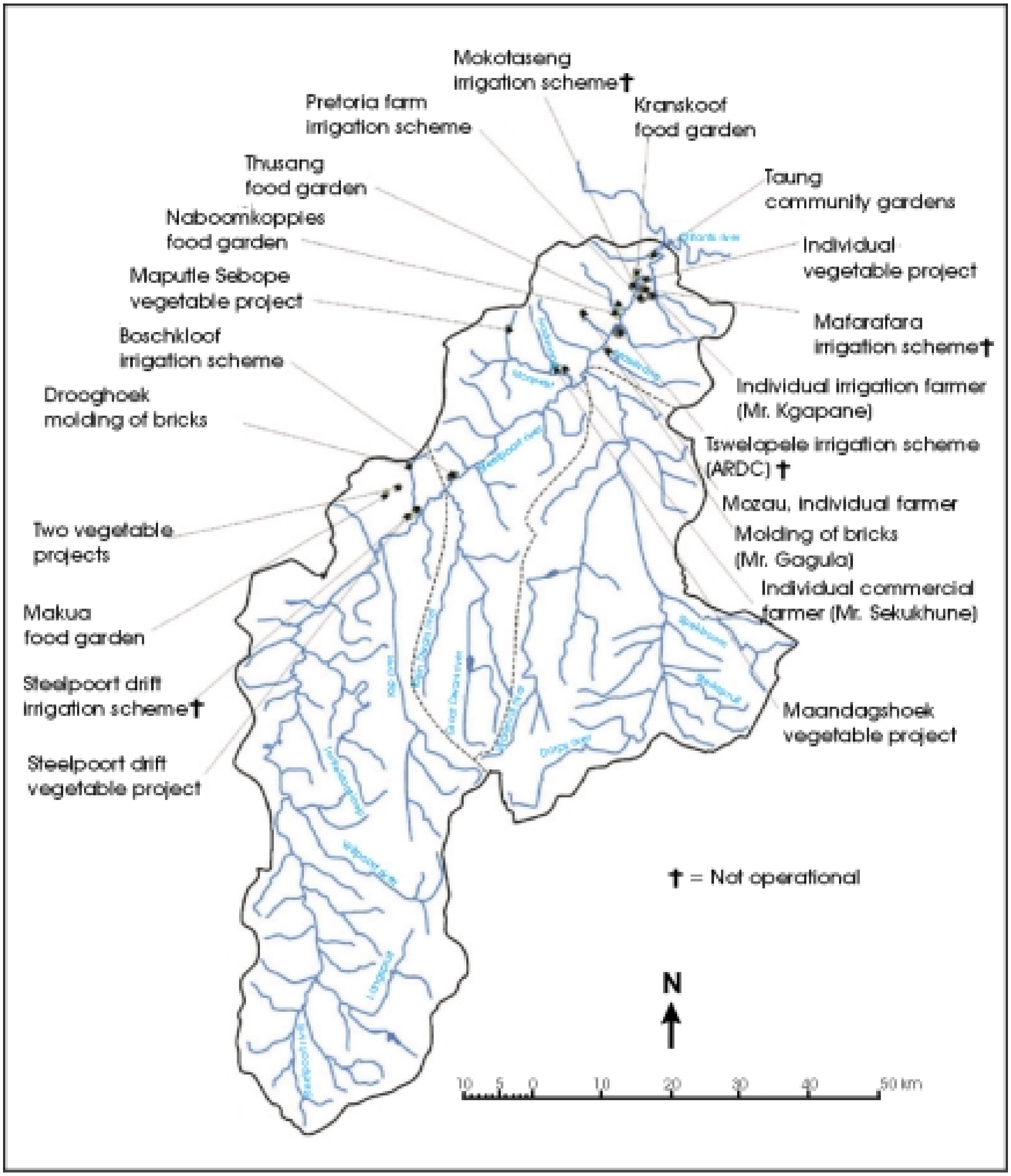
Figure 3.3. Smallholder irrigation, vegetable garden and brick-making projects in Schoonoord and Praktiseer subregions, outcome of participatory mapping with two people working in the area.



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Sources: Mrs. Ntebatse (extension worker in Praktiseer) and Mrs. Tshethka (member of Tubatse Steelpoort TLC).

Table 3.4. Water use by selected rural communities.

Water use	Water resource	Infrastructure	Institutions involved in water use	Relationship with those institutions	Relationship with other users	Issues
TRC Praktiseer and surrounding villages						
Mkotomane village (110 ha): Domestic water. Irrigation.	Ground-water River (?)	3 boreholes (1 working) Diesel pump in the borehole 1 tank Diesel pump in the river Pipes Hose pipes	Civic Association DWAF (pump maintenance, pipe replacement) TLC (liaise with CA & DWAF) Tribal Authority NPDAE (advice on irrigation)	People are not happy with the procedure for maintenance by DWAF as they have to bring them the broken pipes. They are not happy with TLC as they do not attend to their applications. The chief has good relationship with the CIVIC.	Members of the vegetable project are part of the village. No other user mentioned	The village needs more taps. There are communication problems with the TLC, which does not have a local representative and does not attend to their requests. People are not happy with the current procedure for maintenance by DWAF as they have to bring them the broken pipes for replacement or fixing (previously, this was completely organized by the government).
Botha's Hoek Domestic water	River (?)	None (wheelbarrows)	TLC DWAF	People complain that they have no water and TLC/DWAF does not attend to their requests.		People would like to be allowed to get water from two dams nearby.
Ga-Masha – Matau village	Steelpoort river	None		3 villages are unaware of CMA or NWA.		The river is polluted from upstream activities (confirmed by water analysis).

Table 3.4. Continued.

Water use	Water resource	Infrastructure	Institutions involved in water use	Relationship with those institutions	Relationship with other users	Issues
TRC Eerste Geluk and surrounding villages						
Phasha village (2000 households): Domestic use	Groundwater Mafate river (if water shortage)	3 boreholes with electric pumps; 5 reservoirs; pipes and 50 taps in section 1; others use taps next to the reservoirs.	Previous Dept. Water Affairs Lebowa (equipment and diesel supply). TLC (equipment, valves maintenance, applications). Water committee (pump management, money collection). Northern District Council (funding equipment). Eastern Chrome Mines (equipment).	No direct contact with DWAF about water. They deal directly with TLC in the event of problems (maintenance, requirements). Relationship is not good with TLC. Total unawareness about CMA or NWA.	Not mentioned	Some collect water illegally from the main pipe. Water resource is too limited to think of community projects. People complain that they have to wait too long for response from TLC or DWAF (application for new taps). Some people do not pay for electricity.
Matimajaji village (140 households). Domestic use. Irrigation use Clay-pot-making.	Oupakrans river (domestic use and irrigation) Groundwater (domestic)	A borehole with a hand pump. Buckets for irrigation.	Water committee. Tribal authority (contacts with WC, advice). DWAF. Operation Hunger (maize scheme that has stopped).	Information flows well from WC to TLC then to DWAF. WC, and tribal authority work together. They have applied for another borehole, without answer so far. DWAF came and inspected their problems but nothing happened. They still rely on TLC, although without answer.	Clay-pot-making project ongoing	No answer to their application for another borehole. When the river gets dry, they have to walk far to the mountain to collect water.
Stocking village (1,000 households).	Mogwaneng river (domestic use). Borehole (domestic use).	1 borehole. 1 engine and pump. 3 tanks. No extension pipes. Taps around the tanks. 3 hand pumps.	WC. TLC (applications, equipment). DWAF (equipment).	WC only has contact with TLC. TLC has tried to attend to their needs (pipes extension) but with poor efficiency.	Not mentioned	No extension pipes towards the village. The school has a broken hand pump; pupils have to walk 20 minutes to get water. Some people have in mind to install some pipes in the river on the side of the mountain to get more domestic water. Informants think that some children got sick drinking water from the river.

not aware of the CMA process or of the implications of the NWA. Finally, they do not interact with other users in the area. However, some are aware of certain water-pollution problems, the mines being perceived as responsible for their origin.

3.2.3 Mines and quarries

There is a high concentration of mines in the Steelpoort river basin. There are chrome, granite, magnesite, alluvial gold, coal, vanadium and platinum mines as well as mines for construction materials like brick, stone and sand. The Olifants basin study of 1991 and the DWAF study of 1999 give different numbers of mines in the basin, but the number can be taken to be around 50.

The Institute for Soil, Climate and Water of the Agricultural Research Council (ARC-ISCW)) provided the team with recent data about mining in the Mpumalanga part of the basin, abstracted from a GIS database compiled by this Institute. Among other items of information, the database provides the location of the mines, their names, their telephone numbers and whether they are open or have closed down. A large percentage of the data proved to be incorrect. The team improved the reliability of the data a bit by phoning mines and searching for correct telephone numbers. Figure 3.4 shows what the team found within the limited time available. Although it is not exhaustive and not 100 percent accurate, it does show which areas are most intensively mined.

The Olifants basin study of 1991 estimates the total mining water consumption in the basin at 4.7 million m^3 per year in 1987. Of this, 1.6 million m^3 per year came from surface sources, 2.1 million m^3 per year from boreholes, and 1.0 million m^3 per year from underground water. The study does not define the difference between boreholes and underground water, but the latter may refer to water pumped from mining pits. The DWAF study of 1999 states that total consumption in 1997 was 9.7 million m^3 per year, with 6.7 million m^3 per year supplied by surface water and 3.0 million m^3 per year from boreholes. The same study states that "the major source of water for mining at present is groundwater" (DWAF 1999: p.27). This study does not differentiate between boreholes and groundwater.

The Olifants basin study of 1991 estimates a mining water demand at 14.6 million m^3 per year in the year 2000, with 10.1 million m^3 per year from surface water, 3.1 million m^3 per year from boreholes, and 1.4 million m^3 per year from underground water. It estimates these values to remain constant till 2010.

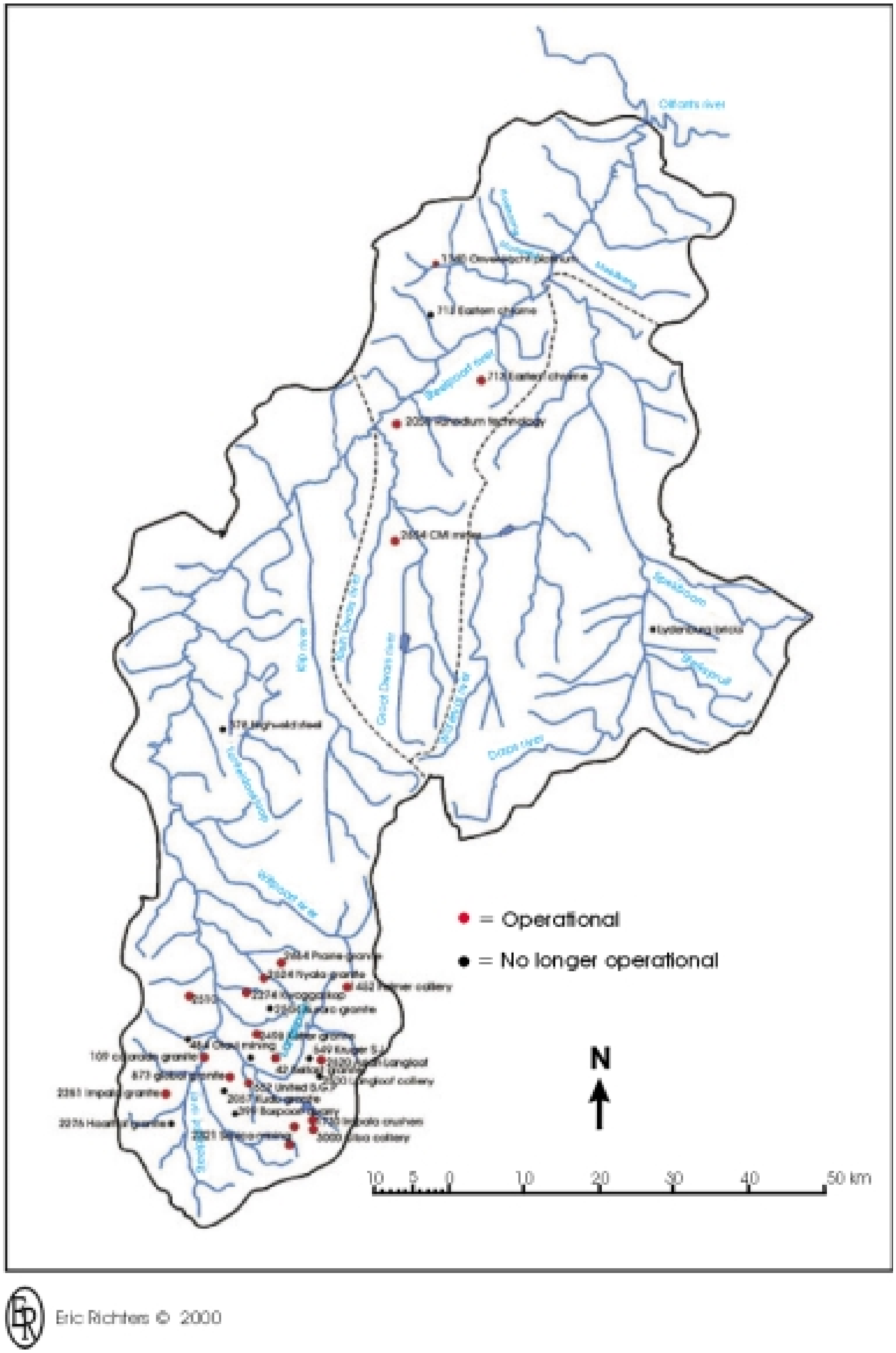
The DWAF study assumes that the water demand for mining will remain more or less the same in the near future. However, it recognizes that this assumption might be in question because "information that became available towards the finalizing of this report actually indicated that extensive mining activities might be developed in the study area during the next few years."

The two mining users that were interviewed were the Belfast Granite (quarries) and the Glisa Colliery (coal mine). Results are shown in table 3.5.

These users do not use water for their productive activities as such. But they have to handle and store a lot of water, due to their mining and quarrying activities, as water (mainly from perched aquifers) fills their pits. This water is stored in ponds at the coal mine or abandoned quarries within the premises The law does not allow them to release water without a permit, nor do they wish to release it.

They use some groundwater from boreholes to supply the plant workers with domestic water. Septic tanks are used for sewage wastewater at the granite mines. The coal mine is connected to the municipal sewage system.

Figure 3.4. Mines in the Steelpoort river basin.



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Sources: Abstract from ARC-ISCW mine database.

Their major institutional contact is the Department of Minerals and Energy (DME). They have set up an Environmental Management Program (EMPR). Water quality checks are carried out by the DME or the DWAF.

These users have little contact with other users in the area. The coal mine staff is aware and informed of the CMA process and the implications of the NWA.

3.2.4 Industry

Industry in the area is largely related to mining and agricultural activities and mainly limited to the environments of Lydenburg, Burgersfort, Steelpoort and Stoffberg. There is a large chrome smelter near Steelpoort and a large chrome processing plant near Lydenburg. The team identified these two plants as the main industrial water users in the basin. Burgersfort has a proclaimed industrial township and textile-weaving center. Service industries are concentrated round the mining communities in the vicinity of Steelpoort. Several sawmills as well as a furniture manufacturer are located at Lydenburg. There are flour mills at Lydenburg and Stoffberg. Agricultural co-operatives are stationed at Burgersfort, Steelpoort and Stoffberg and exports of agricultural and citrus products are dispatched from Steelpoort (DWAF 1999). Neither the DWAF study nor the Olifants basin study lists separate industries, their individual water usage, or their locations.

The 1999 DWAF study does not give a separate water volume for industrial use and it is unclear if the industrial water use is included in the total volume that it states for mining. The 1991 Olifants study combines water for domestic and industrial use into one estimated volume of 5.6 million m^3 per year in 1985, with 3.3 million m^3 per year from surface water and 2.3 million m^3 per year from borehole water. For the year 2000, it estimates the total industrial and domestic water demand at 7.6 million m^3 per year, with 4.5 million m^3 per year coming from surface water and 3.1 million m^3 per year from boreholes. The study estimates the total domestic and industrial water demand in 2010 at 9.2 million m^3 per year, with 5.6 million m^3 per year from surface water and 3.6 million m^3 per year from boreholes. The two industrial water users that were interviewed were the Lydenburg Mills, a maize-milling plant and the CMI Lydenburg, a chrome-processing plant.

As shown in table 3.6, even though very different, these two industrial water users show common traits. Both are supplied with water (potable quality) from the municipality for industrial and some domestic purposes. Therefore, their only sustained hydro-institutional contact is the municipality, with which they have good relationships (client-supplier type). The CMI reports monthly to the DWAF on water quality. They are not aware of the CMA establishment process, know little about the NWA, and have no contact with other users in the area. Finally, they do not have any major problem or issue with water. They do not release any wastewater from the industrial process.

3.2.5 Domestic use

Towns and settlements are the places where most of the domestic water use takes place. Figure 2.8 shows the location of towns and settlements in the basin.

As mentioned under industrial use, the Olifants basin study of 1991 combines water use for domestic and industrial purposes into one estimated volume of 5.6 million m^3 in 1985, with 3.3 million m^3 from surface water and 2.3 million m^3 from borehole water. For the year 2000, the study estimates the total industrial and domestic water demand at 7.6 million m^3 with 4.5 million m^3 from surface water and 3.1 million m^3 from boreholes. The study estimates the total domestic

Table 3.5. Water use at selected mines.

Water use	Water resource	Infrastructure	Institutions involved in water use	Relationship with those institutions	Relationship with other users	Issues
Belfast Granite Quarries						
Cleaning granite, dust suppression from roads (water pumped out from quarries). Domestic use and a few gardening irrigation (borehole).	Groundwater (borehole and water pumped out from quarries).	Borehole, pumps, storage tank, septic tank.	DME (EMPR, purity check-ups). No contact with DWAF. Unaware of CMA process.	Good. EMPR ongoing. They might need contact with the DWAF about water they store.	Give water to some people living in and next to the plant (domestic and irrigation purposes).	Rainwater and seepage water fills up the active quarries while mining. They have to pump it out towards old disused pits, thus storing a lot of water (estimated 300,000 m^3).
Glisa Colliery Coal Mine						
Extraction from subsurface water table (perched aquifer) during mining operations Water use for dust suppression. Storage in evaporation and settling dams. Domestic water from a borehole. Sewage handled by municipality. No release in stream.	Groundwater. Deep water table (borehole).	Pumps. Evaporation dams. Settling dams. Septic tanks. Borehole.	Municipality (sewage management). DWAF (quality checks). Aware if CMA and attend meetings. DME (ongoing EMPR).	Contract with municipality. Good with DWAF.	They supply water to a tulip-bulb project.	They feel that it is not useful to force them to store water, as it might be used for farming purposes. The subsurface water table (perched aquifer) should be more exploited for domestic or farming purposes, instead of building dams or pumping from the deep groundwater. The mine feels like a target for controls and enforcement whereas other users are not controlled (e.g., farmers who fertilize too much, domestic users who release wastewater on the ground). The mine might close down in the future. At the same time, it is said that they plan to expand it within 5 years ?…

Table 3.6. Water use at selected industrial plants.

Water use	Water resource	Infrastructure	Institutions involved in water use	Relationship with those institutions	Relationship with other users	Issues
CMI Lydenburg: Chrome-Processing Plant.						
Ore cooling and granulation processes. Domestic use.	Municipality domestic water supply. Purified sewage water. Some rainwater.	Kwena dam. Buffer reservoir.	Lydenburg municipality. DWAF (monthly reports). Unaware of CMA.	Good.	None.	One of the major water users in the area. They plan to expand, then they will use more water. They plan to optimize the water consumption in the process, but the overall water consumption is likely to increase. 35% unaccountable water (expected cause : pipe leakage)
Lydenburg Mills: Maize Milling.						
Moistening process of maize before milling. Washing trucks and pavements. Domestic use. Wastewater released in municipal drains.	Municipality domestic water supply.		Lydenburg Municipality. No contact with DWAF. Unaware of CMA, or NWA.	Very good.	None.	No problem foreseen.

and industrial water demand in 2010 at 9.2 million m³ per year, with 5.6 million m³ per year from surface water and 3.6 million m³ per year from boreholes. However, the 1991 Olifants basin study adopted lower levels of service provision and lower volumes per capita for rural settlements than what recent water service policies aimed at.

The DWAF of 1999 report lists more recent domestic use estimates but only for the Steelpoort Valley—a portion of the basin. It is important to notice that the 1999 DWAF values exclude water demand for industrial use, whereas these demands are included in the 1991 Olifants study values. Yet, the DWAF low-demand scenario for only a portion of the Steelpoort basin equals the Olifants basin study estimates for the entire basin. The DWAF low-demand estimate for 2010 even exceeds the Olifants basin study estimate for 2010: 11.5 million m³ per year versus 9.2 million m³ per year. The DWAF high-demand scenario predicts even more: 22 million m³ per year in 2010. It is unclear if these estimates differ because they are based on different values for water use per capita per day or on different demographic projections.

An interview was carried out with the Belfast Municipality and its results are shown in table 3.7. The Belfast Municipality manages the Belfast dam to supply the town with domestic water. They run a closed system where wastewater is purified and flows back to the main dam through the wetland. They are situated next to the watershed and thus have no upstream water users. The different reservoirs they own are used for purposes of recreation and tourism, including the Belfast reservoir.

Except for their domestic water users (urban consumers) they do not have water-related contacts with users in the area, and are hardly aware of, or informed on, the CMA establishment process.

3.2.6 Water for livestock

The Olifants basin study states that the livestock population in the Steelpoort basin was about 217,000 large stock units (LSUs) in 1987, that use million 4.0 m³ of water per year. A large stock unit is defined as 1 head of cattle, 6 sheep or goats, 12 pigs or 100 chickens. The study expects the stock to grow to 281,000 LSUs in the year 2000, using 5.1 million m³ of water per year, and growing to 310,000 LSUs in 2010, using 5.7 million m³ of water per year.

3.2.7 Aquaculture

Breeding of trout under controlled conditions for commercial purposes takes place near Stoffberg and Lydenburg. The industry is fairly well developed and has growth potential. Apart from evaporation from ponds and streams, the water use for this sector is mainly nonconsumptive (Olifants basin study 1991).

3.2.8 Forestry

The 1991 Olifants basin study locates the forest areas in the basin as shown in figure 3.5. It lists the forest area in the basin at 8,055 hectares in 1985, with an annual water consumption of 6.9 million m³. It estimates the forested area in 2000 at 13,655 hectares, with an annual water consumption of 11.6 million m³. The estimate for 2010 is 16,055 hectares of forest using 13.7 million m³ per year.

3.2.9 Recreation

Apart from the Lydenburg and Gustav Klingbiel Nature Reserves and a few private game farms, very little of the area's potential, as a tourist attraction, has been developed. The topography and the fact that the area is suited for game farming could be explored. Trout fishing and canoeing are becoming increasingly popular as recreational activities in the mountainous areas around Belfast, Dullstroom and Lydenburg. The Sterkspruit Nature Reserve on the Sterkspruit is a trout hatchery open to the public. Apart from evaporation from reservoirs and streams, the water use for this sector is mainly nonconsumptive (Olifants basin study 1991).

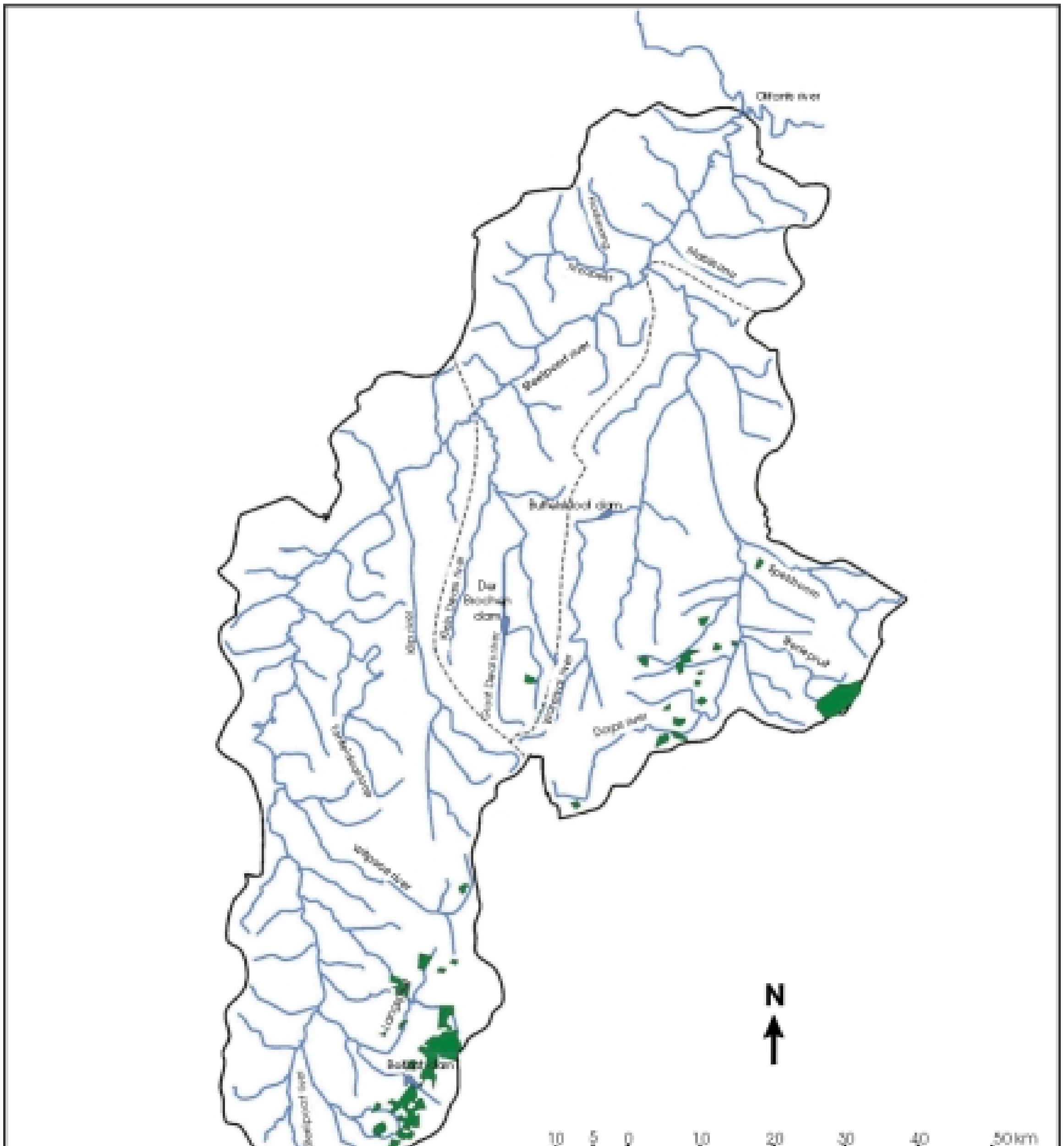
3.2.10 Environment

To date, no water reservations have been made for the environment in the Steelpoort basin. At present, there is a process going on to calculate the Reserve for several rivers. The Reserve is defined in the National Water Act of 1998 (NWA) as the portion of every significant water resource (watercourse, surface water, estuary or aquifer) required to satisfy basic human needs and to protect aquatic ecosystems. The NWA requests that the Reserve must be maintained in all significant rivers in the country. Experience with other eastward flowing rivers in the Northern and Mpumalanga Provinces indicates that the Ecological Reserve amounts to between 15 and 25 percent of the natural mean annual runoff (DWAF 1999). For the Steelpoort river, this would come to a volume of between 55 and 100 million m^3 per year.

Table 3.7. Water use by a selected municipality.

Water use	Water resource	Infrastructure	Institutions involved in water use	Relationship with those institutions	Relationship with other users	Issues
Belfast Dam, Belfast Municipality						
Domestic water. Recreation (canoeing, fishing).	Belfast dam: runoff + wastewater cycle. Kruitspruit dam: Steelpoort river.	Belfast dam. Kruitspruit dam. Several recreation dams. Sewage treatment plant. Pumps.	Municipality (management). DWAF (permit). Highveld District Council (funding). Poor information on CMA and no involvement yet.	Good.	Management of water level for recreation purposes. Dams rented to trout fishing associations. No contact with farmers.	No current problems. Sewage system to be upgraded in 2010-15. Enough domestic water until 2010 with the current system.

Figure 3.5. Afforestation in the Steelpoort river basin.



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Source: Olifants river basin study 1991.

CHAPTER 4

Water Issues in Vulnerable Communities

4.1 Organization of This Chapter

The overview visits provided the team with a general idea about different types of water use in the basin, water problems that users face, and the relationships they have with other water users in the basin and with government institutions involved in water management. The visits confirmed that the former Lebowa part is the basin's most vulnerable area in terms of access to domestic water, water for community industry and irrigation. Moreover, the team found that there are many more diverse institutions involved in water management in this part of the basin than in other parts, and noticed that the relations between water users and these involved institutions are diverse and complex. Above all, it became clear that water management in this part of the basin is fragmented and defective.

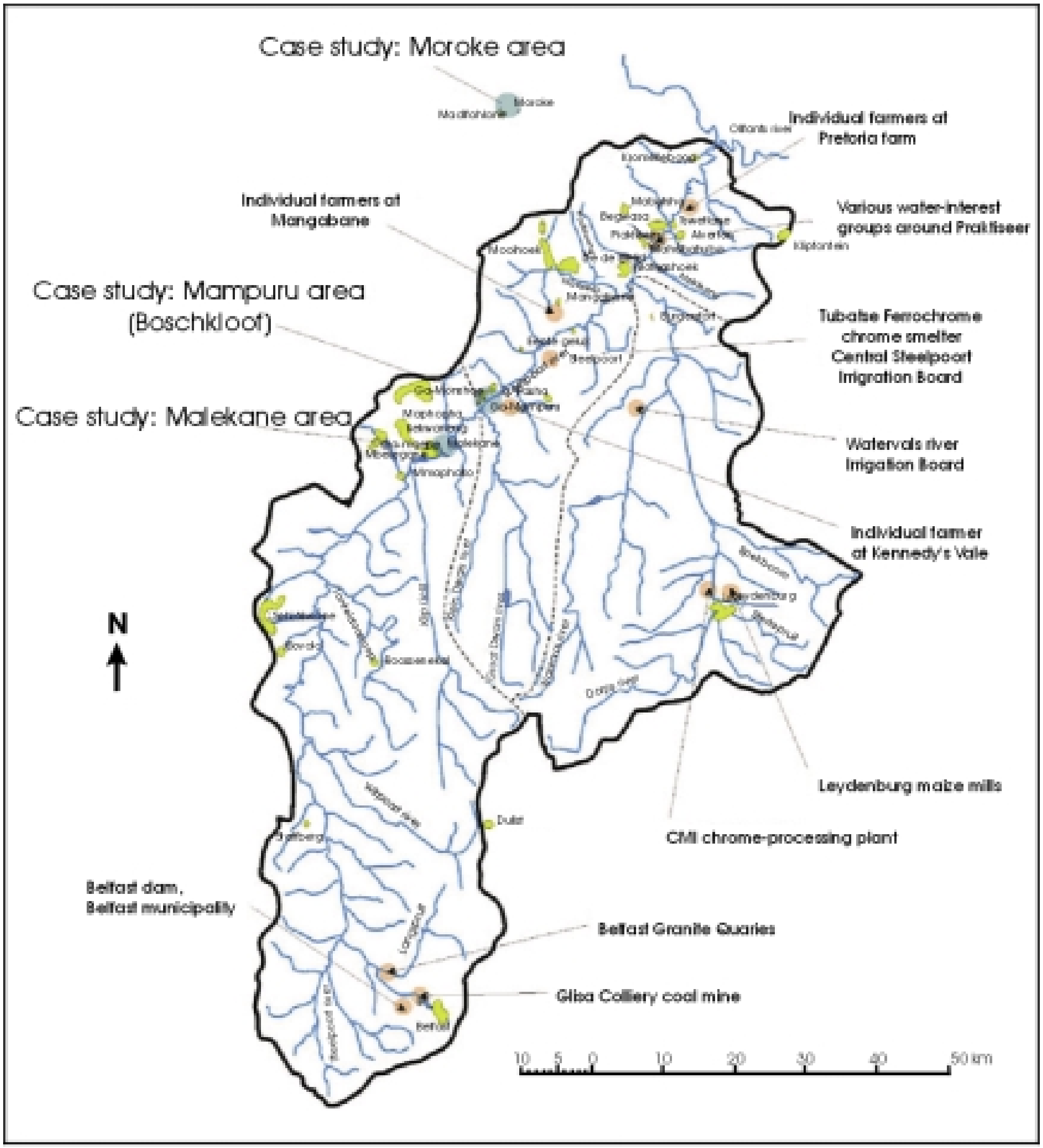
To illustrate this situation the team selected three case study areas, Malekane, Mampuru and Moroke/Madifahlane areas, where part of the team did a week's additional fieldwork. Figure 4.1 shows the locations of the three areas. Note that Moroke/Madifahlane area is part of former Lebowa and of the Olifants river basin but lies just outside the Steelpoort river basin. Because the team identified a high concentration of water problems similar to those in the Lebowa part of the Steelpoort basin, Moroke/Madifahlane was selected as a case study area, despite its location outside the subbasin.

This chapter presents the three case studies in order of increasing complexity. Each case study starts with a map that shows the area's watercourses, water infrastructure and water use, followed by a history about the development of water infrastructure, management and water use in the case study area. Then each area's water problems are identified with an annotated map, and a table that classifies these problems in five categories the team found relevant. These categories include the following:

- lack of a water infrastructure
- problems with the design of the water infrastructure
- problems with the operation and maintenance of the water infrastructure
- water resources problems with causes within the community
- water resources problems with causes outside the community

Next we discuss the institutional arrangements and show who carries out each of the five water management tasks the team considered relevant to the case studies. These tasks are the following:

Figure 4.1. Names and locations of case study areas and of organizations and individuals met during overview visits.



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- water distribution and operation of water schemes
- maintenance of water schemes
- modification of existing schemes and development of new schemes
- measures against floods and erosion
- measures against water pollution

Annotated maps are provided for two of these tasks, namely water distribution and operation of water schemes, and maintenance of water schemes. These maps illustrate who carries out each of these two tasks for different infrastructure portions in the area.

The subsequent section for each case study is titled “interactions to address water problems.” For each case study, quotes from interviews with informants highlight relationships and interactions among water users and between water users and institutions involved in water management. Each case study presents different kinds of relationships and interactions, dependent on what the team came across in the field and considered relevant.

This chapter is based on only a few days’ fieldwork per case study. Therefore, it is by no means exhaustive and much of the presented information comes from one source only. Despite the drawbacks, the chapter clearly illustrates the complexity, fragmentation and defectiveness of water management in the former Lebowa part of the Steelpoort river basin and touches on some of the causes. Above all, it highlights the urgent need to improve the situation.

4.2 Malekane Case Study

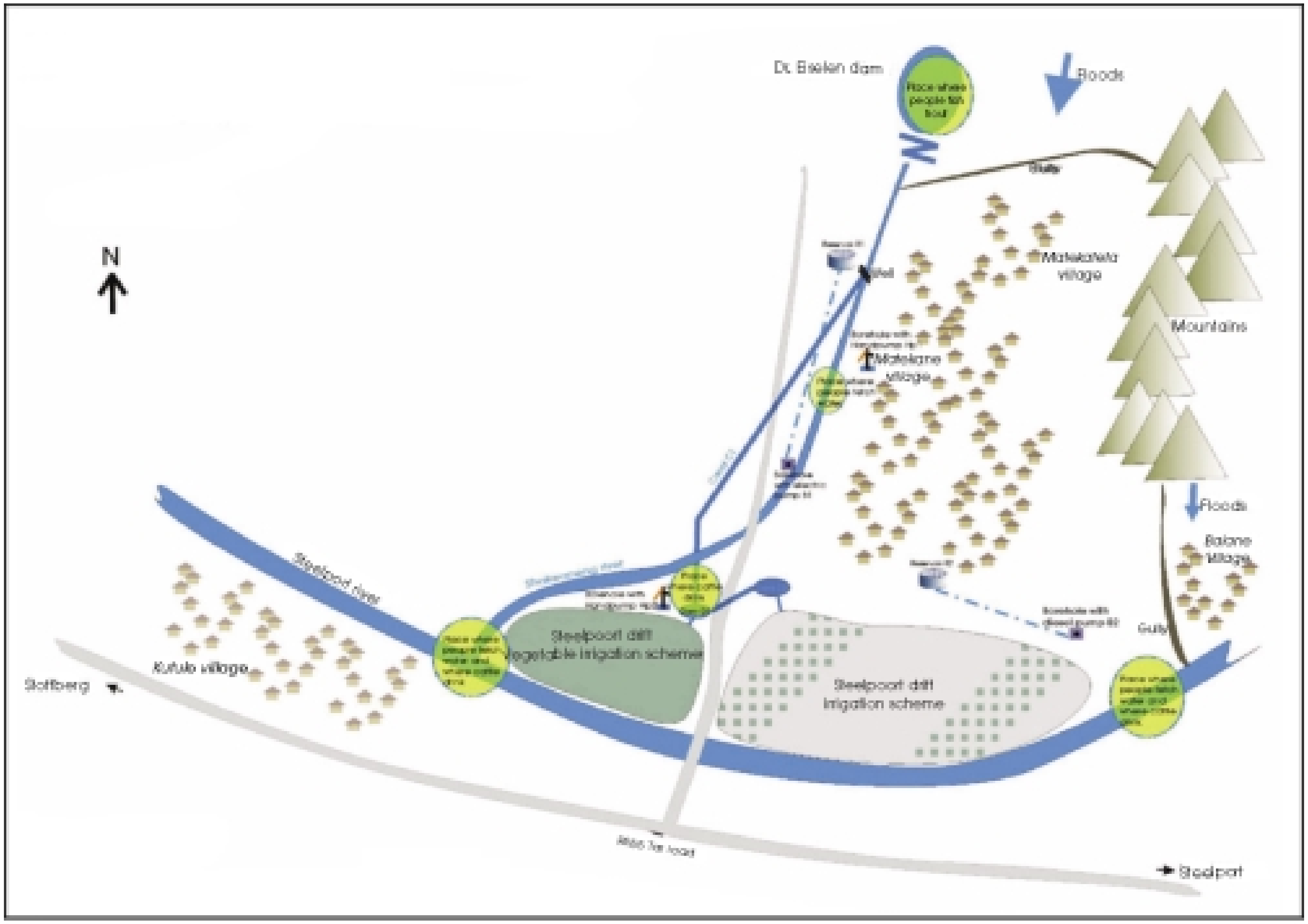
4.2.1 Water infrastructure and water use

The case study area falls within the area of Chief Malekane and is part of the Tubatse Steelpoort Rural TLC. Figure 4.2 is a schematic representation of the watercourses, water infrastructure and water use in the area. The Malekane people used to live in the area near the present Dr. Eiselen dam. In 1970, the chief of the village requested farming land, on behalf of the community, from the Lebowa Department of Agriculture and Environmental Conservation. The community was given land downstream and moved to the Malekane village to live next to their lands. The Rantho people settled on the land that was vacated. In 1971, the Lebowa Department of Agriculture and Environmental Conservation built the Dr. Eiselen dam—in whose reservoir the Rantho people currently fish—and in 1972, they built the Tubatse Steelpoortdrift Vegetable Irrigation Scheme. In those days, the department managed both the reservoir and the scheme.

Only the vegetable irrigation part of the scheme is presently in use. It covers approximately 35 hectares and is farmed by 61 women and 8 men. From the Dr. Eiselen dam the water flows to a weir in Shakwaneng river that diverts it to the lined canal C1. The canal serves two dams, D1 and D2, that divert the water to the vegetable part and the other part of the irrigation scheme. Small furrows convey water to individual plots.

The farmers state that the Dr. Eiselen dam outlet was blocked 10 years ago. At present, the outlet is still blocked and the farmers use the little water that flows in the Shakwaneng river to irrigate the vegetable part of the scheme. Due to water shortage the other part is not irrigated anymore.

Figure 4.2. Watercourses, water infrastructure and waste use in the Malekane area.



Sources: Participatory drawings, Malek 1/2 and interviews 090200a/b.

The Government of Lebowa also installed, probably in the seventies, and managed, two domestic water-supply systems in the area. One system consists of borehole B1 with an electric pump that pumps water to reservoir R1. From there, pipes distribute the water to the connected villages. The other system consists of borehole B2 with a diesel pump that pumps water to reservoir R2. Again, pipes distribute the water to the connected villages.

The villagers also get domestic water from two boreholes HP1 and HP2 equipped with hand pumps, and from several places along the Steelpoort and Shakwaneng rivers. Livestock gets water from some of these places as well.

4.2.2 Present water problems

Figure 4.3 shows the water problems in the Malekane area, expressed by representatives of the water committee and the irrigation committee during the mapping exercise. Table 4.1 categorizes these problems.

4.2.3 Institutional arrangements

Operation of water schemes

Figure 4.4 shows the institutions involved in operation and water distribution in each (portion) of the water schemes. The DWAF employs the pump operators for pumps P1 and P2. The water committee collects about R10 (in 2000, US$1.00 = R7.00) per household per month for electricity and diesel. Apparently, the village does not experience payment problems because: "If somebody does not pay, she cannot fetch water because people will know her."

The Department of Agriculture employs somebody who distributes water in the Steelpoortdrift irrigation scheme and fines people if they steal water. The Department of Agriculture also employed somebody to control the flow of the Dr. Eiselen dam, but since the dam is blocked the person is no longer working.

Maintenance of the schemes

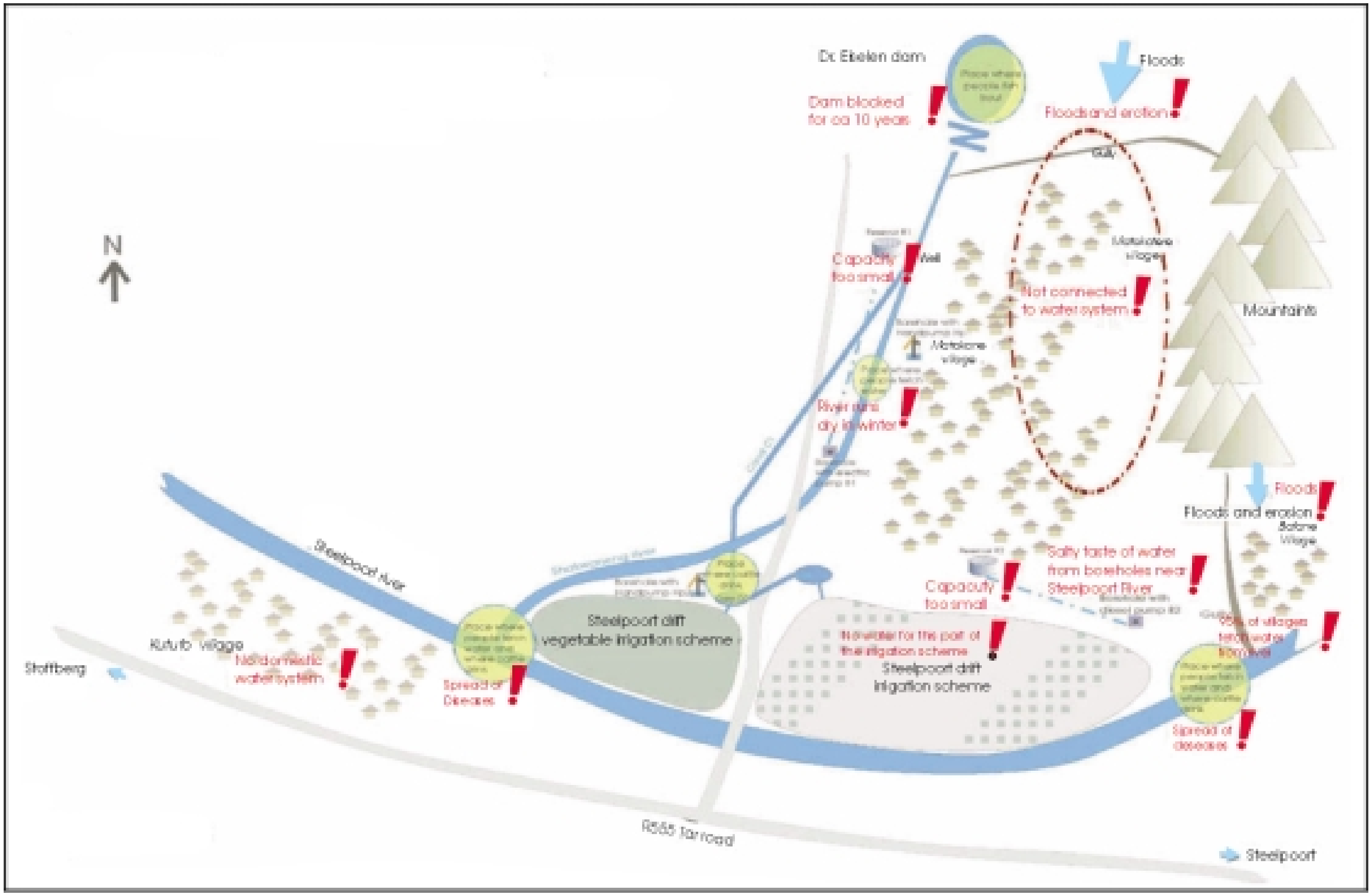
Figure 4.5 shows the institutions involved in maintenance operation of each (portion) of the water schemes. The DWAF maintains the main domestic supply system. The people themselves maintain the smaller pipes.

Members of the irrigation scheme—mainly women—clean the canal or furrows when they are blocked. The Department of Agriculture hired a contractor around 1996/97 who removed several stones from the blocked outlet of the Dr. Eiselen dam. But he stopped his work because he did not have enough expertise to clear the outlet completely.

The department wrote a letter to the DWAF, about the blocked outlet, inviting them to inspect the problem. The DWAF came up with two options: empty the dam or use expert divers to remove the stones. Both options turned out to be too costly.

Last year, a mine requested the DWAF for water from the Dr. Eiselen reservoir and offered to clear the outlet. The mine mentioned the amount of water they wanted and promised that farmers and the community would get the remainder of the water in the reservoir. The community and the DWAF agreed. The last time the DWAF had contact with the mine, it was still preparing the planning documents.

Figure 4.3. Water problems in the Malekane area.



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Sources: Participatory drawings, Malek 1/2 and interviews 090200a/b.

Table 4.1. Water problems at Malekane.

Water problems	Problem category	
No domestic water system. Not connected to domestic water system. 95% of people fetch water from river.	Lack of water infrastructure	Infrastructural problems
Insufficient capacity of the domestic supply system.	Infrastructural design problems	
Dr. Eiselen dam blocked for 10 years. *Resulting in:* Shakwaneng river running dry in winter. *And:* Steelpoortdrift irrigation scheme out of order.	Infrastructural operation and maintenance problems	
Spread of diseases. *Probably caused by:* People and cattle drinking from the same places. Erosion, and floods from the mountains around the village. *Probably caused by:* Overgrazing and settlements without erosion control within the area.	Water resources problems, caused within the community	Resources problems
Salty taste of water from boreholes near Steelpoort river. *Probably caused by*: Upstream mining and farming. Floods from the direction of Dr. Eiselen dam. *Probably caused by:* Upstream overgrazing and settlements without erosion control.	Water resources problems, caused outside the community	

Modification of existing schemes and development of new schemes

The TLC has organized some modifications of the domestic water schemes but, according to the irrigation committee, it did not finish the job properly. The mines drilled some boreholes in the past but they are not working.

Measures against floods and erosion

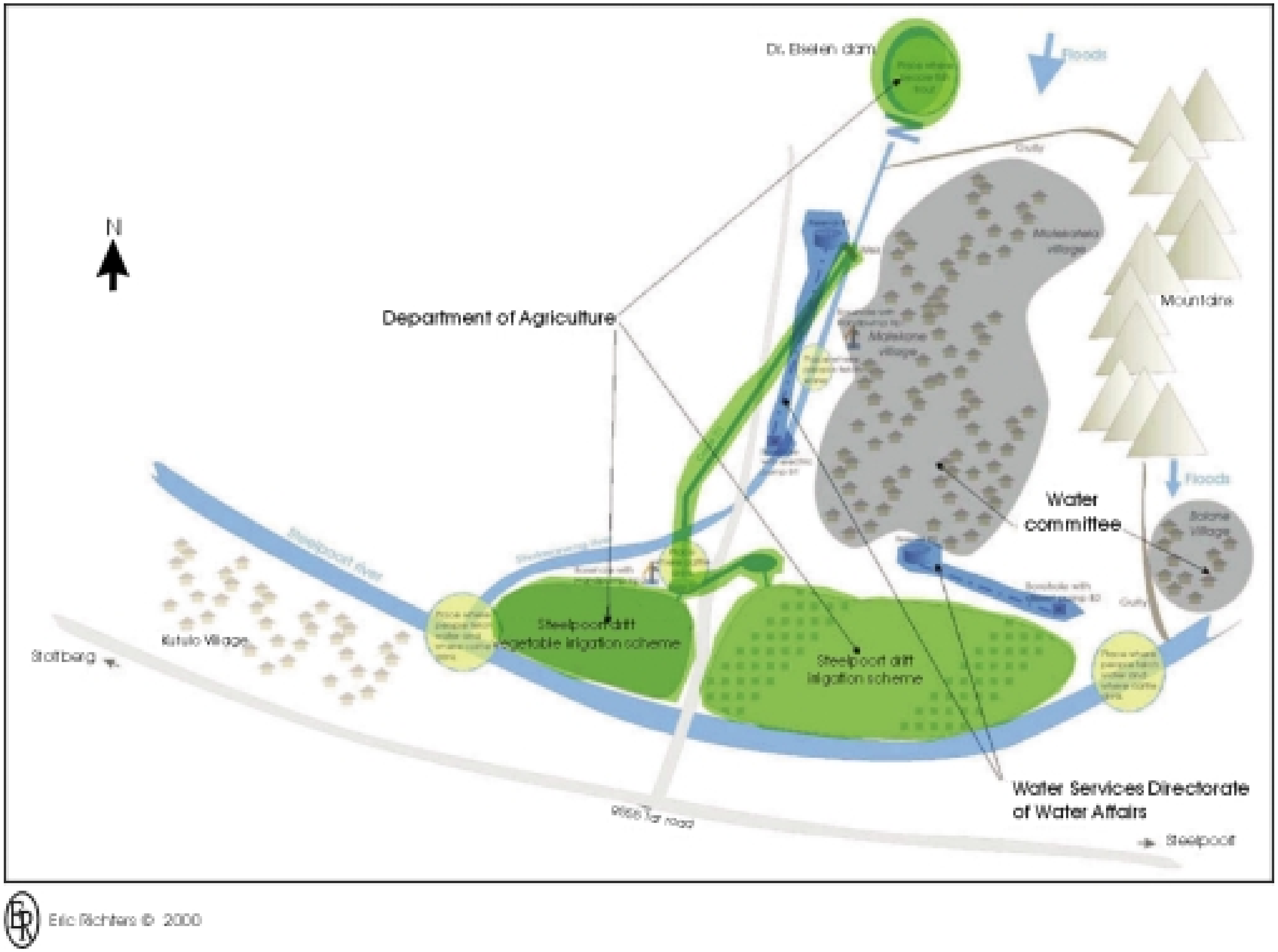
Nobody takes significant measures against flood and erosion damage in Malekane.

Measures against water pollution

Formerly, the DWAF monitored the water quality in the area and the 1995 DWAF central Steelpoort water quality study shows some results. However, it is unclear how often and how thoroughly the DWAF monitors and what actions it takes to improve the water quality in the area. The Department of Health also monitors the water quality in the area, more or less independently from the DWAF. They note, “Water affairs is responsible for water quality but it is difficult for a department to assess itself.” Recently, the monitoring activities of the Department of Health collapsed because of financial problems.

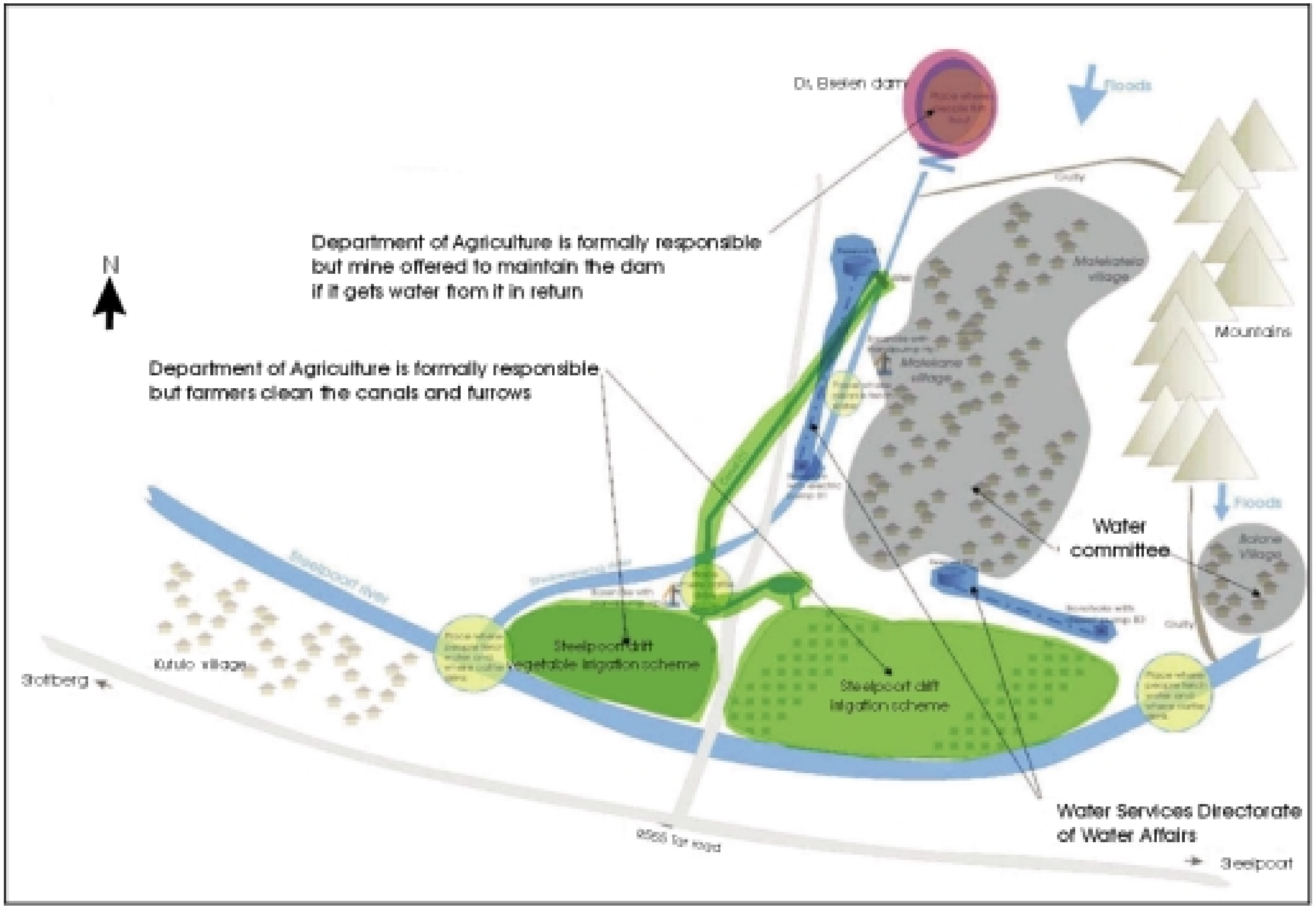
The villagers also referred to the people at the clinic who teach the villagers to boil the water first before drinking it.

Figure 4.4. Institutions involved in operation of irrigation and domestic water schemes in the Malekane area.



Sources: Participatory drawings, Malek 1/2 and interviews 090200a/b.

Figure 4.5. Institutions involved in maintenance of irrigation and domestic water schemes in the Malekane area.



Sources: Participatory drawings, Malek 1/2 and interviews 090200a/b.

4.2.4 Interactions to address water problems

Villagers and the chief

The villagers seem to have a very close relationship with the chief: "We go often to the chief to talk about water issues. He is aware of the problems and he sympathizes with us. He talked a lot with government departments about the water problems."

Villagers and CIVIC and the Department of Public Works

The villagers stated that the CIVIC and the Department of Public Works are not involved in solving water problems in the Malekane area.

Villagers and the TLC

The relation with the villagers and the TLC does not seem very good: "[The TLC] does nothing. They talk a lot but they are very weak."

Villagers and the Department of Agriculture and the DWAF

The informants perceived the DWAF and the Department of Agriculture as being very far from them as well, mainly because they also fail to address their water problems.

Villagers and mines

Despite a mine's offer to maintain the Dr. Eiselen dam, the villagers do not seem to value their relationship with the mines in the vicinity: "We don't communicate with the mines anymore. We are sick and tired of them because they are doing nothing."

4.2.5 General observations and remarks

Farmers were not aware of CMAs and WUAs. They asked the team to explain them.

The mine wants water from the Dr. Eiselen reservoir but the reservoir is relatively small, so it is doubtful that there will be enough water for both the mine and the whole Steelpoortdrift Irrigation Scheme. The Department of Agriculture agreed with the mine because it lacks funds to maintain the dam. The farmers probably agreed, because they do not have much choice: either the dam remains blocked and they have no water from it, or the mine maintains the dam, gets water from it in return, and the farmers get a bit of water from it too.

4.2.6 Assessment

The people in Malekane area use water for irrigation, stock watering, fishing and domestic use and the water infrastructure in the area is mainly used for domestic use and irrigation. The main water infrastructural problems in the area are insufficient capacity or lack of domestic water infrastructure and poorly maintained irrigation infrastructure. Apart from the insufficient domestic water system capacity, there do not seem to be serious infrastructural design problems.

The tribal authority, the TLC, the water committee and the Directorate for Water Services from the DWAF are the main actors that try to address the insufficient capacity and lack of domestic water infrastructure. Despite their efforts, they do not seem to be effective, as many people in the area do not have access to water services.

The Department of Agriculture, the farmers and a mine are the main actors that try to address the problem of the ill-maintained irrigation infrastructure. The Department of Agriculture and the farmers seem powerless in this matter and only the mine seems to have the resources to solve this problem, although it has not done so yet. The fact that the mine wants water from the reservoir in return is a matter of concern, since the Dr. Eiselen reservoir is relatively small.

The main water resources problems in the area are erosion and flooding, and contamination of drinking water with diseases. The respondents did not perceive the salty taste of the water from boreholes near the Steelpoort river as a major problem. But according to the research team it is a matter of concern, since the 1995 DWAF water quality study in the middle Steelpoort river concluded that the water from most boreholes near the Steelpoort river is not of high enough quality for livestock watering or human consumption.

The team did not meet anybody that takes significant action against erosion and flooding although such action is the responsibility of the Department of Agriculture. As erosion and flooding problems are likely to increase with the growing population in the area, this is again a matter of concern. The Department of Health addresses the problem of contamination of drinking water by health education. However, this problem could also be addressed by either arranging or creating separate water sources for livestock and humans. Apart from limited attempts to enhance the domestic water infrastructure in the area, the team did not see much development in this area. Obviously, the fact that this problem still persists is a matter of concern.

The quantity of water resources seems to be sufficient in the Malekane area but the quality of the water resources is poor and there are insufficient measures against erosion and flooding. Furthermore, most people's access to the water resources is troublesome. The water infrastructure in the area is insufficient and part of it is not well maintained. However, the infrastructure is fairly simple and from the eighties onward, its complexity has not increased. It is the complexity of water management that has increased over time. New actors on the scene are the TLC, the water committee and, more recently, the mine that wants to take over the Dr. Eiselen dam. Water management in the area has become more fragmented and the amount of water problems in the area shows that the present water management is not effective.

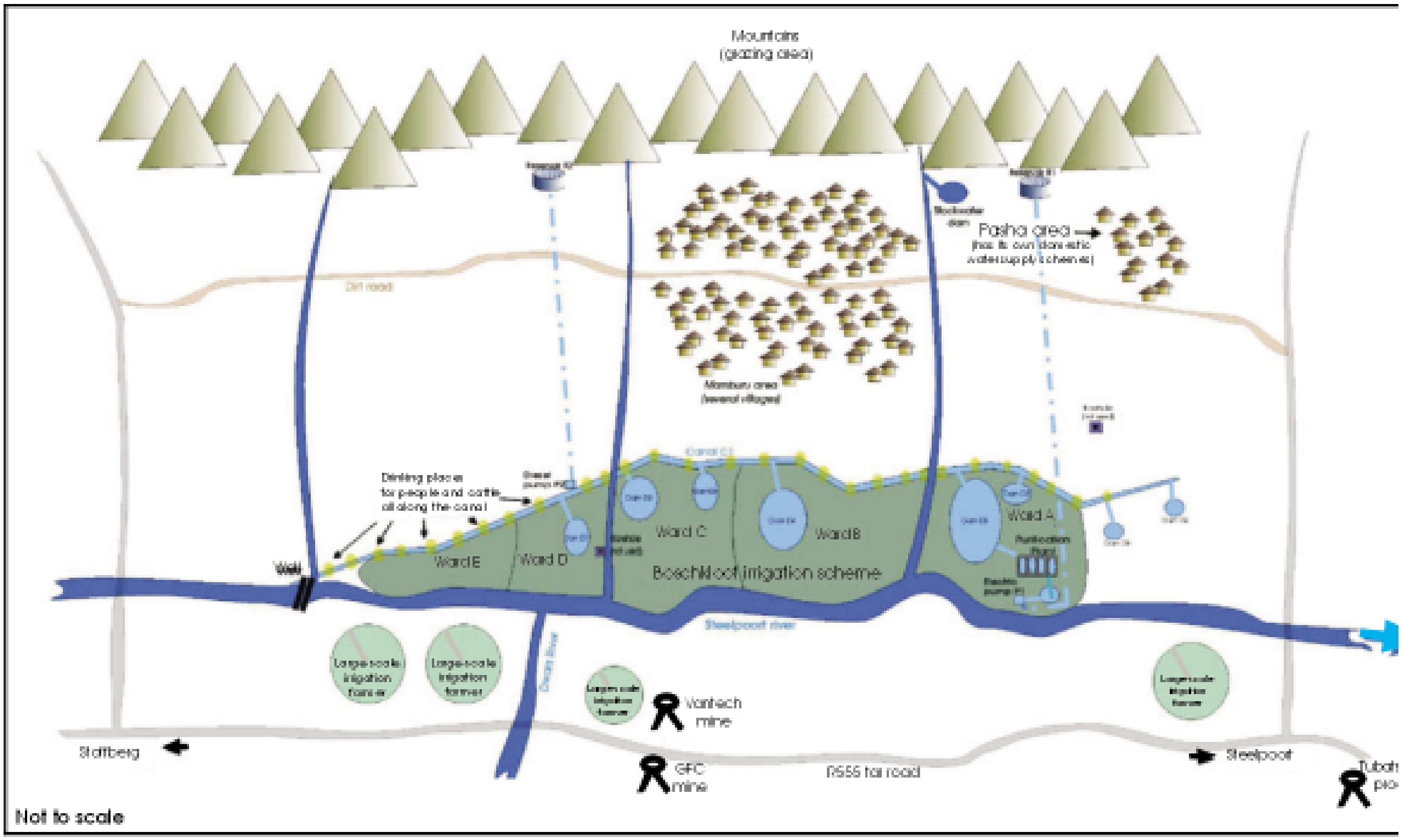
4.3 Mampuru (Boschkloof) Case Study

4.3.1 Water infrastructure and water use

The Mampuru (Boschkloof) area lies in the central Steelpoort catchment, on the north bank of the Steelpoort river and falls within the area of Chief Mampuru. It is part of the Tubatse Steelpoort Rural TLC. Figure 4.6 schematically shows the watercourses, water use and water infrastructure at Boschkloof.

In the nineteenth century, the area now known as Boschkloof fell under paramount Chief Sekukuhne. The grandfather of the present chief of the area, Chief Mampuru, was one of the chiefs serving under this paramount chief. But Chief Sekukuhne and the grandfather of Chief Mampuru

Figure 4.6. Watercourses, water infrastructure and water use in the Mampuru area.



Eric Richters © 2000

Sources: Participatory drawings, Boschkloof 1 and interviews 080200a/b, 260100d.

had a fight and, sometime in the nineteenth century, Mampuru fled to a place called Brakfontein in what is now the Middelburg district.

Later in the nineteenth century, white settlers settled in the Boschkloof area. They drilled a borehole for domestic water and built a weir of packed stone to divert water from the river for irrigation. It fed the 12-km long canal, C1. At that time, it was an earth canal and it served the night storage ponds 1 to 9, from where the farmers distributed the water to their lands. By the beginning of the 1970s the land was used for citrus farming.

But in 1973, the government bought out the citrus farmers in the area and removed the Mampuru people from Brakfontein to settle them in Boschkloof. The area became the South African Development Trust land. A farmer from Boschkloof irrigation scheme remembered:

> "On 3 September 1973, we came here. We were deported from the Middelburg district, because they didn't want us Blacks living in that area. It became a White area. But even the White farmers of this side of the river were removed, to make space for us."

However, the compensation that the White farmers received was much higher than what the Mampuru people received. At present, approximately 11,000 people live in an area formerly owned by three farmers. When the Mampuru people moved in, the borehole came under more and more pressure due to population increase. It collapsed and people started to use the canal for drinking purposes.

Around 1985, floods damaged the weir and the canal. As a response, the Lebowa Department of Agriculture and Environmental Conservation, which was also responsible for water affairs in Lebowa, built a concrete weir, lined the canal and built a purification plant at its end. At present, the plant draws water from pond D5 served by the tail end of the canal. Electrical pump P1 pumps the purified water up to reservoir R1, from where pipes distribute the water to standpipes and individual households.

At the time the Government of Lebowa built the purification plant, there was an agreement that the canal was mainly meant to supply the purification plant with the proviso that the excess water could be used for irrigation. Now, farmers take water directly from the canal or from one of the night storage ponds. From there, they distribute the water to their lands through earth canals. About 85 farmers (Boschkloof Predevelopment Survey 1998) farm the approximately 140 hectares of the scheme presently in use (Boschkloof Rehabilitation Plan 1999).

Somewhere in the 1980s, the Government of Lebowa also built a second domestic supply scheme. Presently, it consists of the diesel pump P2 that pumps the water straight from canal C1, the same canal that serves the irrigation scheme, to reservoir R2. Pipes distribute the unpurified water to individual households and community taps. Moreover, many people fetch water straight from the canal for drinking and washing and the canal is also an important water resource for stock-watering.

Until 1994, the Lebowa Department of Agriculture and Environmental Conservation was responsible for both the irrigation scheme and the domestic supply schemes. However, in 1993, Lebowa was incorporated in South Africa again and the Northern Province Department of Agriculture took over the irrigation scheme. The National Department of Water Affairs and Forestry took over the two domestic water supply schemes. As both the irrigation and domestic supply schemes draw water from the same canal, two departments now have responsibility for one canal. Up to now, it is unclear which department owns the canal and is responsible for its maintenance.

By the end of 1998, consultants appointed by the Northern Province Department of Agriculture started to train the farmers in crop production and management, and began rehabilitating the irrigation infrastructure. They also established a development committee, elected by the farmers. Under the guidance of the consultants, the development committee is in the process of applying to form a WUA. They envisage that the WUA will support the farmers with access to inputs, credit and markets, and that it will take over the operation, maintenance and ownership of the Boschkloof irrigation scheme.

4.3.2 Present water problems

Figure 4.7 summarizes the water problems that the development committee, water committee, tribal authority and the TLC representative expressed during meetings, interviews and the mapping exercise. Table 4.2 categorizes these problems.

4.3.3 Institutional arrangements

Operation of the schemes

Figure 4.8 shows the institutions involved in the operation of each (portion) of the water schemes and in water distribution. The DWAF employs five people who run the purification plant and pump P1. They also employ a person who arranges the rotation of the water from R1 to two different sections of the Mampuru community; on Monday one section gets water, on Tuesday the other one, and so on. It seems that the community runs pump P2, but most of the time there is no diesel to keep it going.

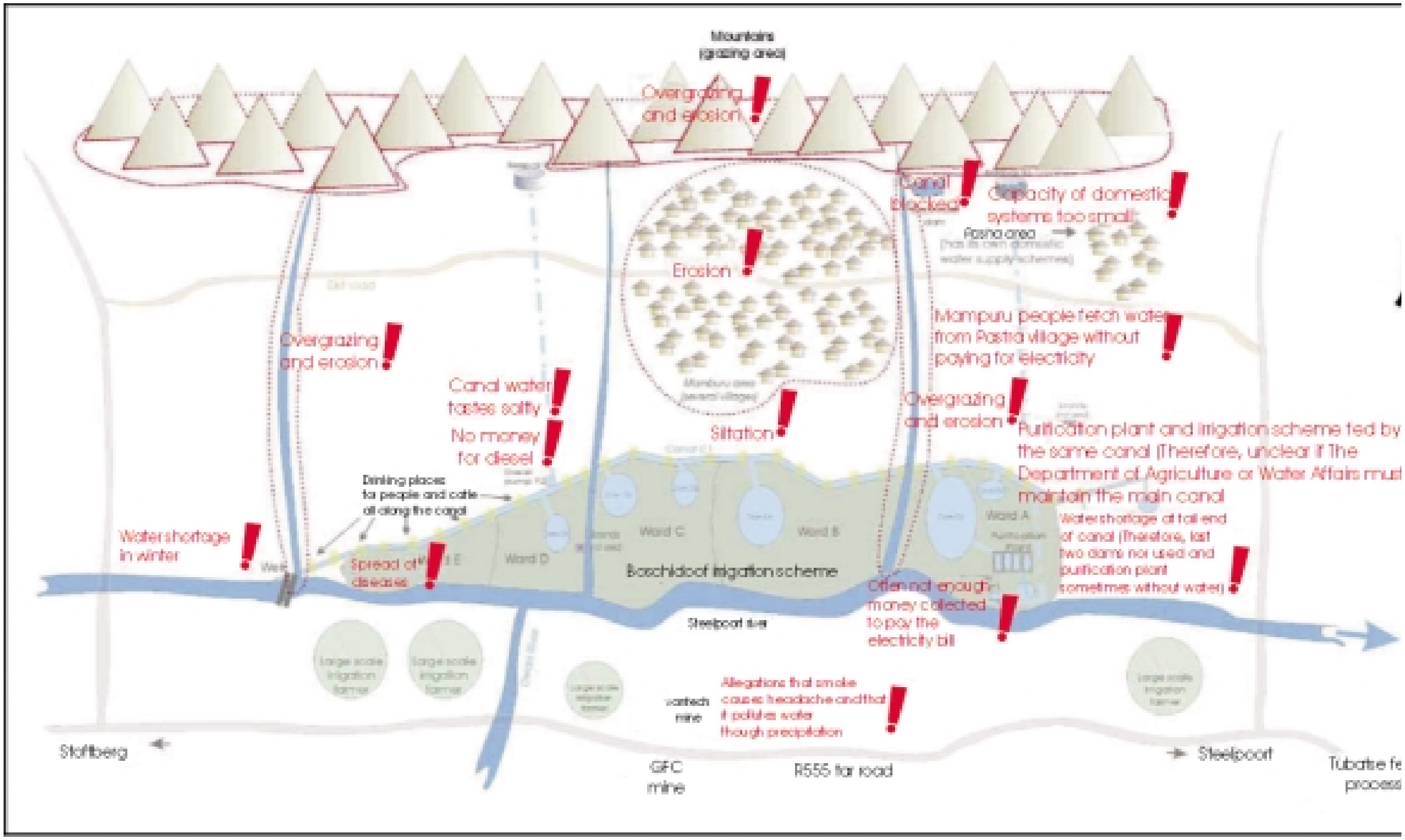
There is no specific person who distributes water along the main canal, C1. Although the farmers and the villagers have agreed on a rough distribution schedule that divides the water between the irrigation scheme and the purification plant, and the farmers have agreed on a rough distribution schedule between the different wards, they do not really seem to follow it. Instead they take water from the canal whenever they need it.

Maintenance of the schemes

Figure 4.9 shows the institutions involved in maintenance of each (portion) of the water schemes. In the past, the Lebowa Department of Agriculture and Environmental Conservation, which included water affairs, did the major canal maintenance. The villagers used to clean the canal, as it was mainly used for domestic purposes.

Nowadays, the canal is mainly used for irrigation and the villagers do not clean it anymore. The farmers clean it and every ward in the irrigation scheme has a ward committee that stops farmers from taking water when they do not help with the cleaning of the canal. To be able to do that, some ward committees have installed lockable valves at the outlets of their night storage reservoirs. The committee also charges penalties from farmers who do not show up at the canal cleaning of R10, for every day that a farmer is absent. When the ward committees cannot resolve a conflict of water distribution or maintenance, they ask the help of the chief, who has the last word.

Figure 4.7. Water problems in the Mampuru area.



Eric Richters © 2000

Sources: Participatory drawings, Boschkloof 1 and interviews 080200a/b, 260100d.

Table 4.2. Water problems at Boschkloof.

Water problems	Problem category	
None	Lack of water infrastructure	Infrastructural problems
Purification plant and irrigation scheme fed by the same canal (therefore, unclear if Water Affairs or NPDAE must maintain the main canal) *Resulting in:* Occasional water shortage at the tail end of the canal. Capacity of the domestic supply system too small.	Infrastructural design problems	
No money for diesel (the DWAF used to supply diesel). Often not enough money collected to pay the electricity bill. Canal feeding stock water dam blocked. Occasional water shortage. *Caused by:* No integrated community owned water management system in place.	Infrastructural operation and management problems	
Spread of diseases *Probably caused by:* People and cattle drinking from the same canal. Erosion and siltation. *Caused by:* Overgrazing and settlements without erosion control within the area. Mampuru people fetch water from the Pasha village without paying for electricity.	Water resources problems caused within the community	Resources problems
Allegations that smoke from the mine pollutes water through precipitation. Salty taste of water. Water shortage in winter. *Probably caused by*: Upstream mining and farming.	Water resources problems caused outside the community	

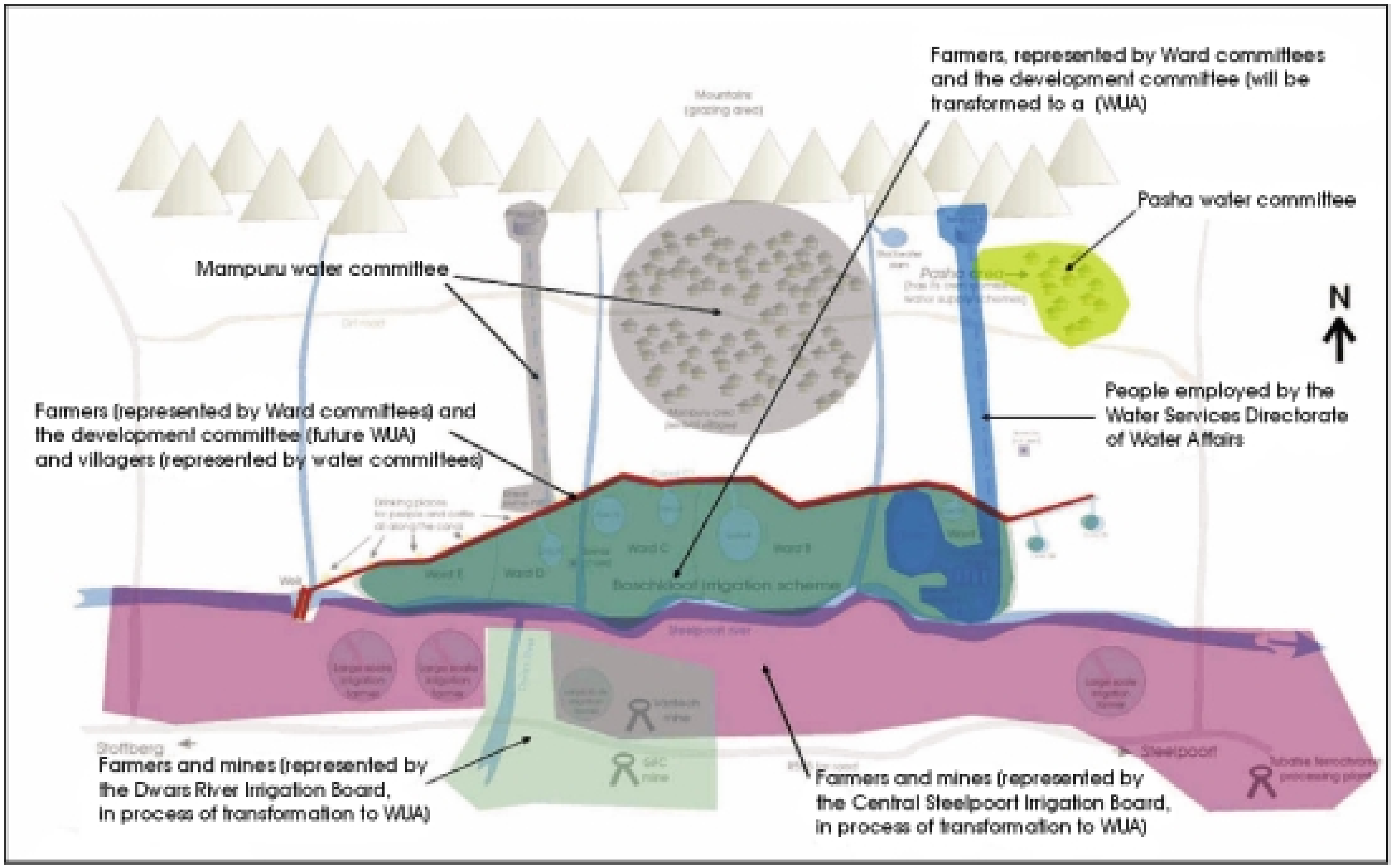
The Department of Agriculture is presently rehabilitating the main canal, but it has announced that it is the last time that it involves itself in scheme maintenance. When the rehabilitation is finished, the farmers have to take over the maintenance. The DWAF maintains the purification plant, pond D6 and the pumps and main distribution pipes.

Modification of existing schemes and development of new schemes

The villagers and farmers negotiate through many channels for modification of the existing schemes and the development of new ones. A few years ago, Chief Mampuru arranged a meeting at his Kraal to see what to do about the malfunctioning main canal. The people present at the meeting sent the TLC representative and somebody from the Reconstruction and Development Program (RDP) committee to the Department of Agriculture, which recently attended to the scheme as part of the scheme's rehabilitation. It constructed, for example, a storm drain above the canal and constructed several storm crossings. However, the Department of Agriculture wants to withdraw from modification of existing schemes as well as from the development of new irrigation schemes.

In future, it will only check if new schemes are developed within existing legislation. The people also negotiate, through the TLC and the RDP committee, with mines in the vicinity. Recently, the Eastern Tubatse TLC and, apparently, the Tubatse Ferrochrome, electrified pump P1.

Figure 4.8. Institutions involved in the distribution of water and operation of irrigation and domestic water schemes in and around the Mampuru area.



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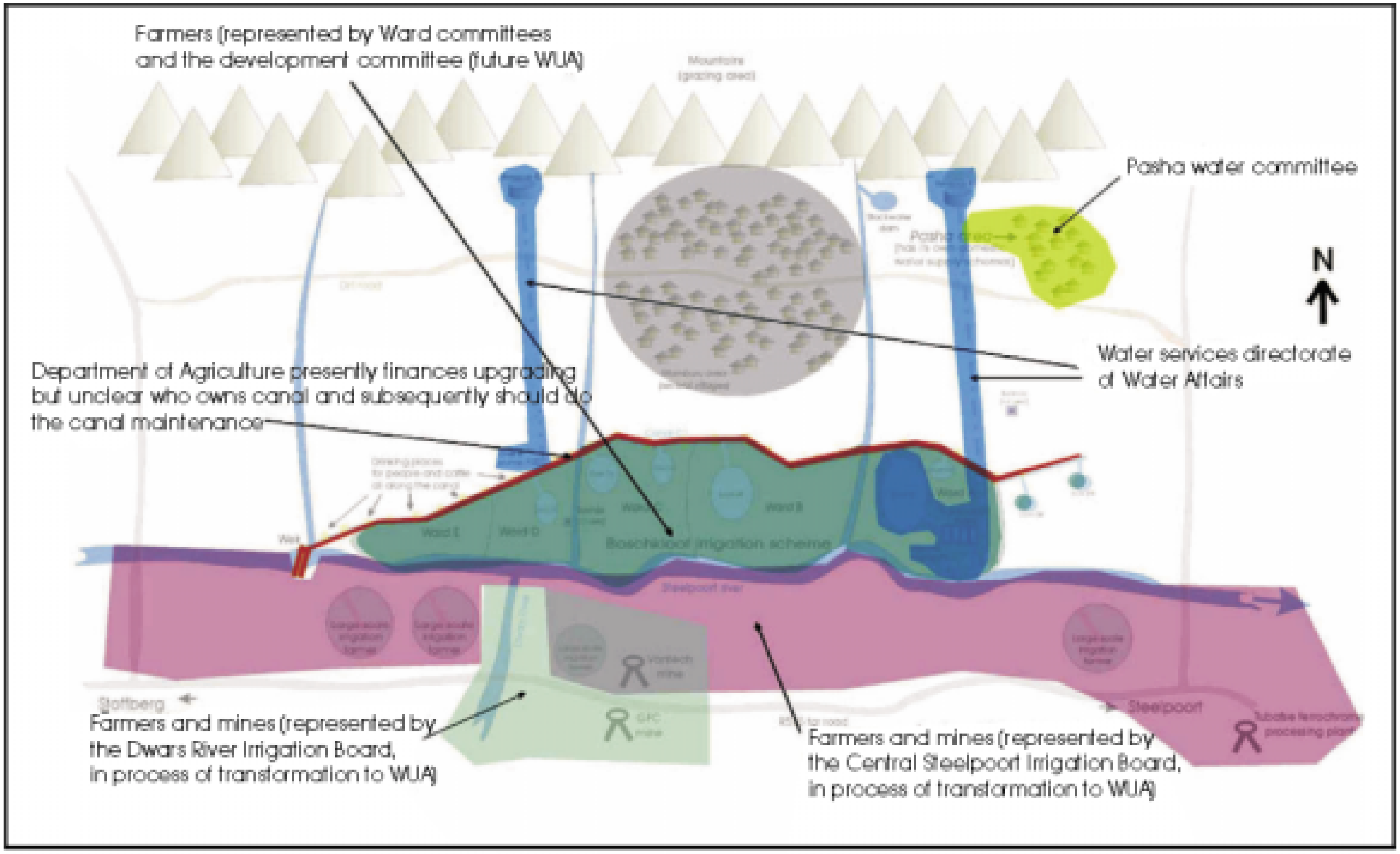
Sources: Participatory drawings, Boschkloof 1 and interviews 080200a/b, 260100d.

Figure 4.9. Institutions involved in maintenance of irrigation and domestic water schemes in and around the Mampuru area.



Sources: Participatory drawings, Boschkloof 1 and interviews 080200a/b, 260100d.

Measures against floods and erosion

During the rehabilitation of the scheme, the Department of Agriculture constructed a storm drain and several storm crossings over the main canal, to protect it against erosion and siltation.

Measures against water pollution

The DWAF formally monitors the water quality in the area and the 1995 central Steelpoort DWAF water quality study shows results. However, it is unclear how often and how thorough the DWAF monitors and what actions it takes to improve the water quality in the area. The Department of Health also monitors the water quality in the area, more or less independently of the DWAF, but recently their monitoring activities have collapsed because of financial problems.

According to the Boschkloof community, the environmental justice commission, a body unknown to the research team, recently looked at water and air pollution in the Boschkloof area but the community has not yet received any feedback from them. However, the community has noticed a change: "We saw chimneys being erected at the mines and we heard that the companies [mines] have tried to neutralize their water."

4.3.4 Interactions to address water problems

Negotiations about the ownership and use of the Boschkloof main canal

The water purification plant draws water from the main irrigation canal and pumps it into the reticulation system but, some time ago, the pump broke down and the canal got silted with the result that the plant went out of order. With the rehabilitation of the irrigation scheme at Boschkloof, the canal conveys water to the plant and the irrigation scheme again. At the same time, the local DWAF office took the pump from the clinic to the purification plant, started the purification works again and claimed that the canal was theirs. This caused a disagreement between the community (represented by the TLC), the farmers (represented by the development committee), the DWAF and the Department of Agriculture.

The development committee asked one of the consultants involved in the rehabilitation to invite the DWAF at a development committee meeting, to solve the conflict. The text below is an abstract of this meeting and provides insight into interactions between the development committee, the TLC, the DWAF and the Department of Agriculture.

> TLC member: Right now, the community is raising funds to electrify the water system, because the DWAF is nowhere to be found.
>
> DWAF: We are here to find out: To whom does the canal belong to whom does the weir belong and what is the history of the problem? The responsibility of the DWAF is 1) to look after rivers, canals and dams and 2) maintain the existing primary water service to the community. The weir should be the responsibility of the DWAF, but we don't know about these irrigation schemes ever being handed over to the DWAF. We don't know if the canal is yet the responsibility of the DWAF. We do know that the purification plant is

the responsibility of the DWAF, but we don't know about the canal. I will ask Pretoria to look into this problem.

Consultant: If the DWAF maintains the canal, the weir and the plant, then they can raise water levies. If the Department of Agriculture does the job, there is no [mechanism] for cost recovery.

DWAF: We have to speak about the transfer of the canal. We are not yet responsible. We were not aware of this system here. The transfer of the canal was not done by the Ministry of Agriculture.

TLC member: It is very bad that the DWAF does not know their responsibilities and I am very concerned about the half-done works by the DWAF. We have done THEIR job. Now the DWAF should contribute to enhance the water system and supplement the water supply.

DWAF: If the transfer is complete, all the water from the canal to the purification plant is for domestic use. Now the DWAF and the Department of Agriculture must sit together and see where additional water for agriculture must come from.

Farmer: Earlier, there was a method: an engine pumping directly into the purification system. Is that not a better idea? The farmers upgrade and clean the canal, so why is the canal for the DWAF?

Other farmer: There is also a small stream from the mountain. Maybe that can be used for the purification system?

Farmer: Maybe it can be done with a 4- or 5-inch pipe. The water from the stream is almost clean.

(There was then a lot of discussion in Sotho, and unrest among people, unable to grasp the discussion.)

Consultant: Our concept is to upgrade the irrigation system and turn it over to the farmers. In future, there will be water user associations and Catchment Authorities established. I think the way forward is: How can we get the DWAF and the Department of Agriculture together? Maybe we can set dates for a meeting between them.

TLC: In 1991, we agreed over a water right: We could use 7 percent of the water in the river each year. The Department of Agriculture and the DWAF do not work together. And farmers clean after every rainfall. The key questions is: how can all responsibilities be matched on the ground? A lot of resources have been spent, but the situation has only become worse. But let us not point our fingers. In years of drought, the canal carries too little water to supply enough. That is why the pumps came in. There must be an engineer appointed to make a plan so that our water will not be exhausted. The DWAF should commit itself to pay an engineer and secure the water supply for drinking purposes. We have already 400 meters of pipe, the machine is here [pump], so let's fix it.

Farmer: Let us farmers task the consultant again to bring the departments together.

DWAF: Is the pump only for domestic purposes?

Farmer: Yes.

One of the women attending: The DWAF must not mix water for agriculture and water for domestic purposes.

The members at the meeting agree that the Department of Agriculture and the DWAF must reach an agreement over the canal: a certain percentage of water for domestic purposes and another percentage for agricultural use.

DWAF: If the community wants our help, there must be a business plan for expenses over R1,000. The TLC must come up with a plan.

TLC: We are busy with a business plan for water for domestic use pumped out of the river. Let the equipment that is there function and then hand over the system. The community will pay for it!

DWAF: We want a business plan for pumps.

After some words of thanks, the DWAF people leave the meeting.

The Boschkloof community took the lead in trying to solve the conflict by asking the consultant to bring the DWAF to Mampuru. It is obvious that the DWAF did not know what was going on in Boschkloof. The responsibilities of the parties involved are unclear and are subject to continuous negotiation. The brokerage of the consultant in these negotiations proved helpful, but his support is only temporary. Another point of concern: one of the farmers suggested that a clear stream in the mountain could be used for domestic purposes. This suggestion could have some advantages: less need for purification and less pumping costs. But it seems that nobody will investigate whether it is a viable suggestion.

4.3.5 Assessment

The people in the Mampuru area use water for irrigation, stock watering and domestic use, and the water infrastructure in the area is mainly used for domestic purposes and irrigation. Most of it is not well designed, operated or maintained. Over time, the complexity of the water infrastructure has increased. The present infrastructure was built upon an "old layer" of infrastructure—the main canal and the night storage reservoirs—that was designed for a few users and for irrigation only. During the Lebowa days of the area, a new layer—the two domestic water systems—were added. But the old layer is still in the present infrastructure and does not match the many users and different types of water use in the area.

The chief, the TLC, the water committee, the Directorate for Water Services from the DWAF, the development committee, the RDP committee (Tubatse Ferrochrome), and the Department of

Agriculture are the main actors that try to address the water infrastructural problems. Despite their efforts, they do not seem to be effective. The main water resources problems in the area are erosion, water shortage in winter and contamination of drinking water with diseases and pollution from upstream water users. The Department of Agriculture constructed some storm crossings and a storm drain to protect the main canal against erosion but, apart from that, the team did not come across other measures against erosion. As these problems are likely to increase with the growing population in the area, this is a matter of concern.

The environmental justice commission recently tried to address the problem of water pollution by upstream water users and it seems that it has had some effect, but the respondents stated that the problem still exists. Also the contamination of drinking water with diseases is likely to persist because people and animals drink water straight from the main canal and there are no real attempts to create separate sources for each of these two types of water users. Another option would be to really enhance the purified water system, so that people do not have to drink water straight from the main canal anymore, but this is also not likely to happen in the near future due to lack of financial resources.

The problem of water shortage in winter is not really addressed by anyone. The attempt to establish a WUA in Mampuru is not likely to solve this problem, unless the cooperation with the main water users drawing from the Steelpoort river is effectively established. There is, as yet, no formal structure or platform where the Mampuru people can negotiate with these users for more water. Creating an umbrella organization comprising the main water users in the vicinity and the small users like Mampuru could be a big step forward in solving Mampuru's winter water-shortage problem.

Both the quality and the quantity of water resources seem to be insufficient in Mampuru and there are insufficient measures against erosion and flooding. Over time, the complexity of both the water infrastructure and the water management in the area has increased. New "actors on the scene," like the TLC, the water committee, the RDP committee and the development committee, have made water management in the area more complex. The responsibilities of these actors are subject to continuous negotiation and the amount of water problems in the area shows that present water management is not effective.

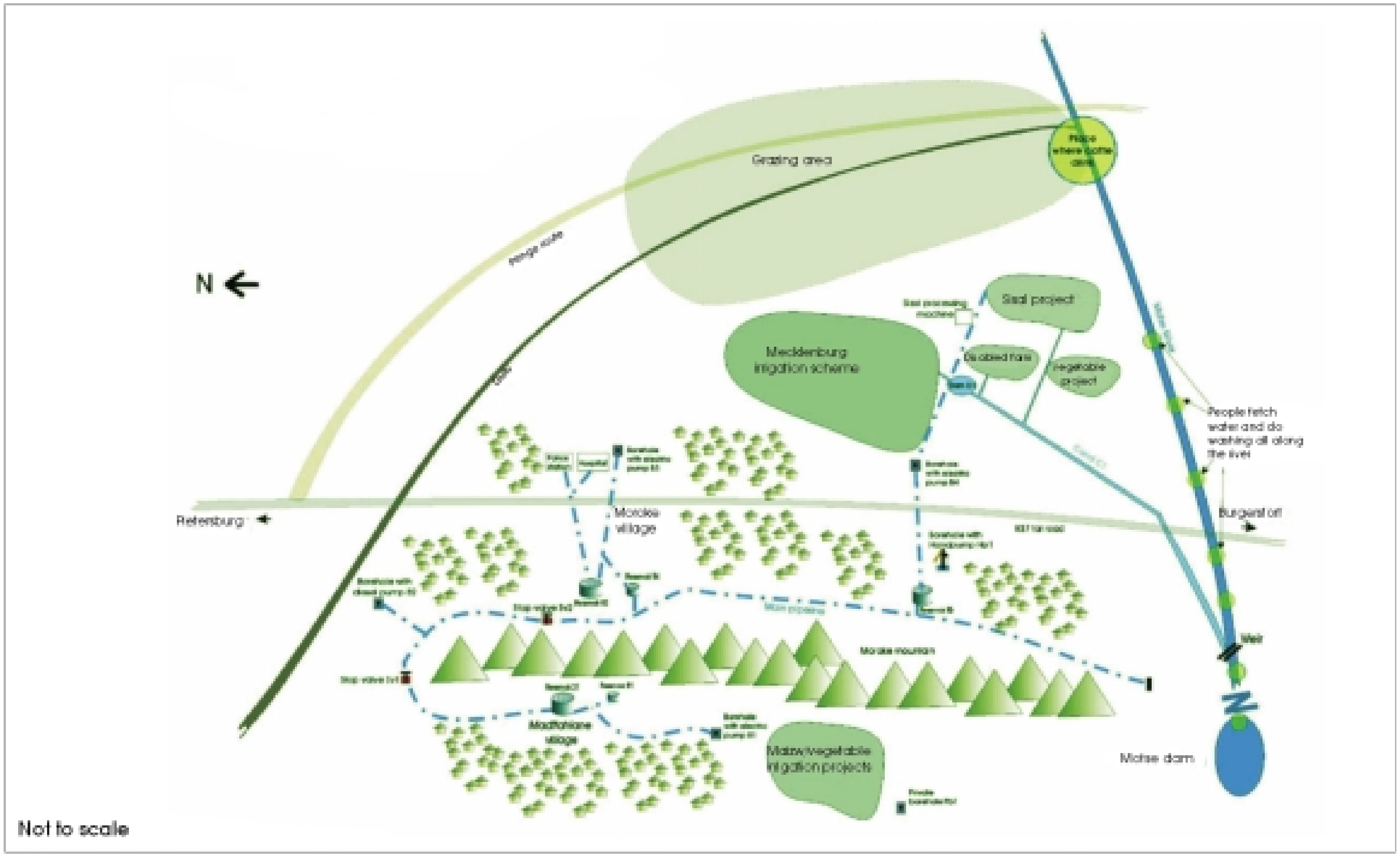
4.4 Moroke/Madifahlane Case Study

4.4.1 Water infrastructure and water use

The Moroke/Madifahlane area falls under Chief Ndwanbe and the villages are part of the Dilokong TLC. Figure 4.10 schematically shows the watercourses, water infrastructure and water use in the area.

The Motse dam and the Mecklenburg irrigation scheme were built either in the 1930s or 1950s. At first, White farmers used it. Later, Black people took over the scheme. When the area became Lebowa, the Lebowa Department of Public Works regularly cleaned the reservoir. In 1994, the responsibility for the dam and the irrigation scheme was transferred to the Northern Province Department of Agriculture. At present, a weir diverts water from the Motse river to a canal that supplies the sisal project, approximately a 5-ha project for the disabled, a small vegetable project, and a reservoir, D1, that is connected to the 75-ha large Mecklenburg irrigation scheme. However, at present the reservoir is silted up and the dam outlet blocked resulting in water shortage in the connected irrigation projects. When there is water in the Motse river, it is also an important water resource for washing and stock watering.

Figure 4.10. Watercourses, water infrastructure and water use in in the Moroke/Madifahlane area.



Sources: Participatory drawings, Moroke 1/2 and interviews 100200a/d, 250100c.

The two villages have one complicated domestic water system that consists of a main pipeline that runs from the Madifahlane village around the Moroke mountain to the end of the Moroke village. It includes two stop valves Sv1 and Sv2, five reservoirs R1 to R5, and four boreholes B1 to B4. The Lebowa Department of Agriculture and Environmental Conservation built the domestic water system. In the past, it consisted of the main pipeline, without the stop valves, the reservoirs R1 to R5 and only the three boreholes B1, B3 and B4. Recently, the pumps on these boreholes were electrified but initially they were equipped with diesel engines.

The Department of Health and Welfare operated borehole B3 and the Department of Agriculture and Environmental Conservation operated boreholes B1 and B4. All the boreholes supplied the main pipeline, but borehole B4 also supplied the sisal project and the sisal-processing machine. Borehole B3 also supplied the police station and the hospital. The government operated and maintained the whole system free of charge; it even supplied diesel free of charge.

Around 1997–98, the government stopped paying for the pumping costs, and made it clear that the users must pay the bills of each of the four pumps. The DWAF installed two stop valves, Sv1 and Sv2, that divided the main pipeline into three sections. The idea was that the people connected to each section would pay for the costs of the pumps connected to that section.

- One section reaches from borehole B1 to stop valve Sv1 and serves the Madifahlane villagers; these villages must pay the pumping bill of borehole B1.

- The second section serves the upper part of the Moroke village and stretches from stop valve Sv1 to stop valve Sv 2. The Moroke villagers connected to this section have to pay the bill for the pump on borehole B2. A few years ago, the TLC installed this new pump and borehole. The TLC did not have enough money to build an extra reservoir so it connected the borehole straight to the main pipeline. As a result, the pump must pump 24 hours a day to maintain pressure on the pipe.

- The last section reaches from stop valve Sv2 to the end of the main pipeline. The villagers connected to this pipeline should pay for the pumping costs of B4, but up to now, the Department of Agriculture still pays it, as the borehole is on their premises and they own the borehole. It is connected to the main pipeline and supplies the lower part of the Moroke village with water, but it also supplies water to the 127-ha sisal project and the sisal-processing machine.

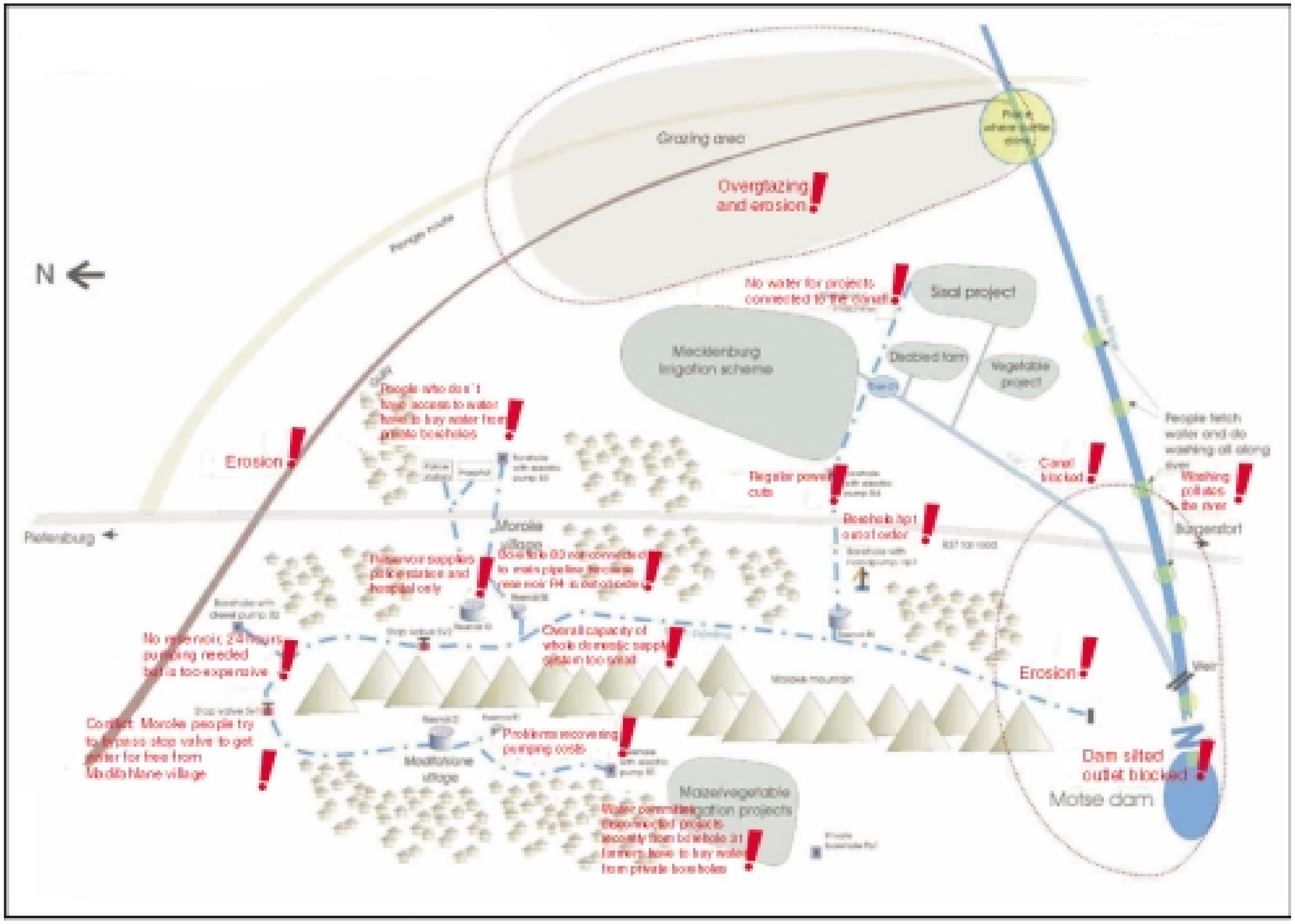
Borehole B3 is not connected to the main pipeline anymore, because reservoir R4 is out of order. It only supplies the police station and the hospital and, therefore, the villagers do not have to pay the pumping bill for this borehole.

In the lower part of the Moroke village there is also a borehole with the hand pump, Hp1, but the pump is now out of order. A private borehole, Pb1, supplies water to small maize and vegetable projects in the Madifahlane village while several other private boreholes, not located by the team, supply people with water who otherwise do not have access to it.

4.4.2 Present water problems

Figure 4.11 summarizes the water problems in the Moroke area, expressed by the meetings and the mapping exercises. Table 4.3 categorizes these problems.

Figure 4.11. Water problems in the Moroke/Madifahlane area.



Sources: Participatory drawings, Moroke 1/2 and interviews 100200a/d, 250100c.

Table 4.3.Water problems at Maroke/Madifahlane.

Water problems	Problem category	
People who do not have access to water have to buy water from private boreholes.	Lack of water infrastructure.	Infrastructural poblems.
Water Committee disconnected irrigation projects recently from borehole B1 because it states that the borehole is nowadays for domestic use only. Farmers have to buy water from private borehole. Overall capacity of whole domestic supply system too small. No reservoir connected to borehole B2. 24 hours pumping needed but is too expensive. *Resulting in:* Conflict: Moroke people try to bypass the stop valve to get water for free from the Fahlane village, as was the case in the past.	Infrastructural design problems.	
Dam silted, outlet blocked, canal blocked. *Resulting in*: No water for projects connected to the canal. Regular power cuts. Borehole Hp1 out of order. Problems in recovering pumping costs. - Borehole B3 not connected to main pipeline because reservoir R4 is out of order.	Infrastructural operation and maintenance problems.	
Overgrazing and erosion. Washing (by people within the community) pollutes the water from the Motse river.	Water resources problems caused within the community.	Resources problems.
Washing (by people outside the community) pollutes the water from the Motse river.	Water resources problems caused outside the community.	

4.4.3 Institutional arrangements

Water distribution and operation of irrigation and domestic supply schemes

Figure 4.12 shows the institutions involved in the operation of each (portion) of the water schemes and in water distribution. A pump operator paid by the Department of Agriculture operates the pump at borehole B4. The DWAF pays a pump operator that operates the pump at borehole B1 and a volunteer from the community operates borehole B2. The Department of Health and Welfare operates borehole B3. The Department of Agriculture employs someone who operates the sluices at the Motse dam but there is no one from the Department of Agriculture who distributes the water in the irrigation projects. The farmers do that themselves.

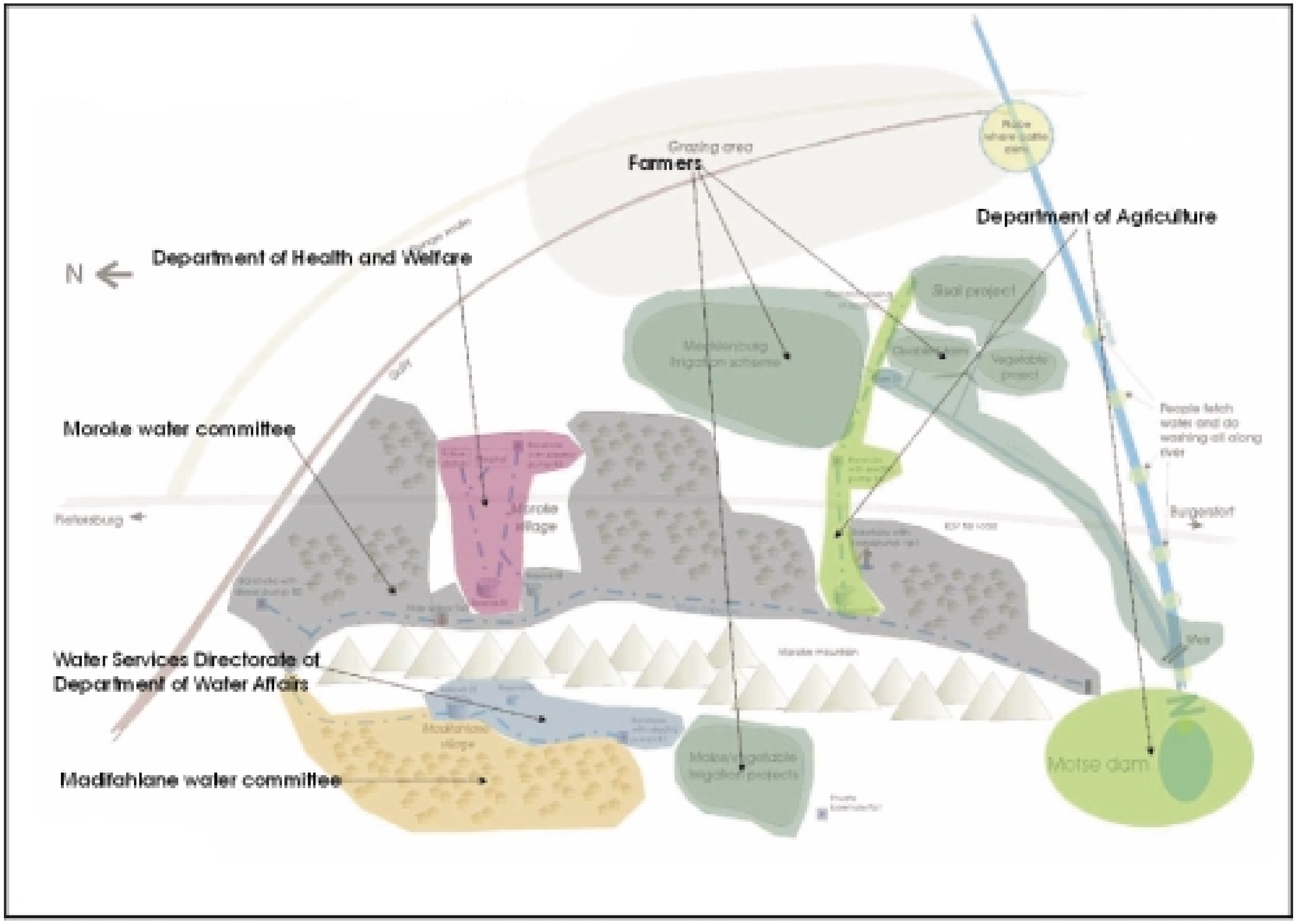
Maintenance of the schemes

Figure 4.13 shows the institutions involved in the maintenance of water schemes. The Department of Agriculture started upgrading canal C1 and the Motse dam but left the job unfinished. The farmers do not know why they did not finish it. The DWAF maintains the main pipeline and some of the boreholes.

Modification of existing schemes and development of new schemes

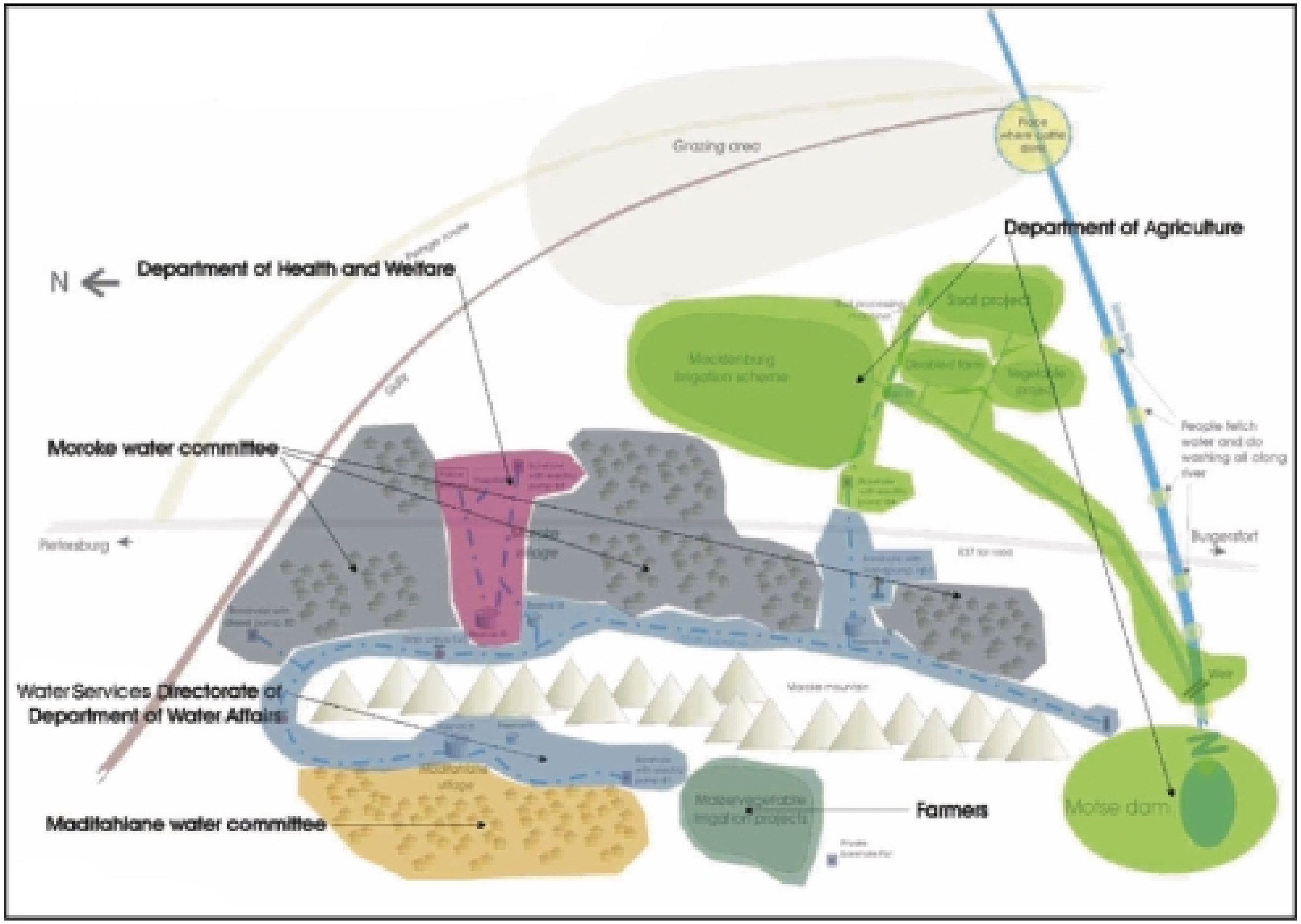
The DWAF recently installed stop valves to split up the main pipeline into three separate parts. The TLC recently modified the domestic water supply scheme by adding another borehole.

Figure 4.12. Institutions involved in the operation of water schemes in the Moroke/Madifahlane area.



Sources: Participatory drawings, Moroke 1/2 and interviews 100200a/d, 250100c.

Figure 4.13. Institutions involved in the maintenance of irrigation and domestic water schemes in the Moroke/ Madifahlane area.



Sources: Participatory drawings, Moroke 1/2 and interviews 100200a/d, 250100c.

Furthermore, the water committee of Madifahlane cut off the Madifahlane maize and vegetable irrigation projects from borehole B1.

The Department of Agriculture started line canal C1 but they did not finish the job.

Measures against floods and erosion

It seems that nobody takes measures against floods and erosion damage in Moroke.

Measures against water pollution

Nobody mentioned that anybody takes measures against water pollution.

4.4.4. Interactions to address water problems

Conflict between the Moroke and Madifahlane villagers

Borehole B2 serves the upper part of the Moroke community. It is not connected to a reservoir; instead it pumps straight into the main pipeline. A member of the Madifahlane water explains: "We believe that they [the TLC] mishandled the funds for the RDP borehole. The TLC was given R 109,000 for the project. Of this money, R 90,000 was spent on the feasibility study alone; in the end there was not enough money left to finish the project. For example, there was no money to build a reservoir. The TLC even apologized to the community for mishandling the funds due to lack of capacity and experience."

Because there is no reservoir the pump at B2 has to pump 24 hours a day to maintain the water pressure in the pipe. The Moroke people found these pumping costs too expensive and solved their problem by bypassing stop valve Sv1 to access the water from borehole B1 in the Madifahlane village. However, they do not contribute to the payment of the B1 electricity bill.

Therefore, a conflict rose between the Moroke and Madifahlane villagers. A Madifahlane water committee member stated: "When this problem started, the TLC was asked to intervene, but they seemed reluctant to do so. … We believe that the TLC did not want to intervene, lest the issue of the [mishandled] funds resurface."

The DWAF intervened and disconnected the main pipe between the two villages but the Madifahlane water committee representatives believe that the conflict can pop up any moment again because the valve that disconnects the villages is not properly secured.

Conflict between the Madifahlane water committee and the Madifahlane maize and vegetable projects

The Department of Health and Welfare funded the Madifahlane maize and vegetable projects. In the past, borehole B1 supplied water to the projects but recently the Madifahlane water committee disconnected the projects from B1. The water committee stated that: "According to the new Water Act the borehole cannot be used for agriculture anymore." This has created tension between the water committee and the farmers of the project. The representative of the Madifahlane water committee believes that Dilokong TLC should help the projects to get water but that the TLC is not doing so.

Water committee and chief and government departments

The wife of Chief Ndwanbe mentioned the following channel to address water problems: "Now each village has a water committee. Each committee has a chairperson and these chairpersons go first to the chief to discuss. When he gives them a go-ahead they will go directly to government departments."

4.4.5 Assessment

People in the Moroke/Madifahlane area use water for irrigation, stock watering, community industry and for domestic purposes. The water infrastructure is mainly used to provide irrigation and domestic water. Most of it is not well designed, operated or maintained, and there is a lack of infrastructure at several places. Over time, the complexity of the water infrastructure has increased. The complicated main pipeline with its many boreholes worked in the past because one agency operated and maintained it and paid for all costs as well. Recently, the DWAF installed the stop valves with the aim to facilitate cost recovery from the users.

However, the remainder of the old design makes the stop valves easy to bypass. The fact that the department still pays for the pumping costs of borehole B4 stems from the Lebowa era. Borehole B2, newly installed by the TLC, can be seen as a continuation of past patchy design practices. It does not really solve the area's water problems and makes the system, as a whole, more difficult to operate and maintain.

There are many actors involved in trying to address the water infrastructure problems in the area: the TLC, two water committees, the Department of Agriculture, farmers, private borehole owners, the DWAF and the Department of Health and Welfare. Despite their efforts, the problems seem to worsen.

Other major water resources problems in the area are erosion and water pollution by people from both within and outside the community. There does not seem to be anybody who addresses these problems. As these problems are likely to increase with the growing population in the area, this is a matter of concern.

Both the quality and the quantity of water resources seem to be insufficient in the Moroke/Madifahlane area and there are insufficient measures against erosion. The amount of water problems and conflicts in the area shows that present water management is not effective.

4.5 Concluding Remarks

Assuming that the three case studies are more or less representative for the former Lebowa part of the Steelpoort basin, they show that the complexity of the water infrastructure and especially water management in that part of the basin has increased over time. Water service delivery and management have clearly become more fragmented due to the increase in the number of actors involved and now they are still largely defective.

CHAPTER 5

Conclusions

These conclusions are discussed under the headings of methodology, institutional arrangements, governmental influences, rural communities, urban areas, essential tasks and the way forward. The comments in this chapter should not be seen as criticism of any institution, but as findings of the project team and recommendations for further work.

5.1 Methodology

The methodology is still being developed for hydro-institutional mapping. This means that the project team had to operate within a very broad scope and direction. This created uncertainty in the project team of what the project exactly entailed. Because the greater project in several countries is drawing to a close, this project needed to be finished within a few months and the project team found it unfortunate to have had to rush this important project.

Rather than attempting to do the whole Olifants river basin, the project team, after consultation with the client, decided to study the Steelpoort river basin, a subbasin of the Olifants basin. To even explain every institution in the Steelpoort basin in terms of its responsibility, links and problems was also impossible within the time frame available. The project team therefore did an overview of the users in the subbasin, but concentrated on a few rural communities as typical case studies. This approach proved useful to the team and many insights were gained, especially in the rural areas of the subbasin. In view of the recent transformation in the country, it is still unclear what the exact roles and perceptions of the spectrum of water users are.

5.2 Institutional Arrangements

Water resources management and provision of water services are carried out by various institutions, which can be grouped as regulators, facilitators, conflict resolvers, water users and other stake holders.

The institutional framework within which these have to operate is very complex due to the uneven spatial and temporal distribution of water in South Africa. The framework is dynamic and has been adapted to satisfy various needs in terms of water use, politics or strategic positioning.

Water resources management is an exclusive national government function, where water-related waste management and land use responsibility could be national, provincial, local or shared, depending on the circumstances. Restructuring of water-related institutions and their roles is already tabled. The establishment of a CMA for the Olifants river basin, with its strategy, would assist in water resources management and provision of services. The White Paper on local government and the provision of water services could assist the CMA in achieving its management goals.

Even though close to each other, and often sharing the same resource, these users and institutions were found to be extremely diverse. These differences manifest as follows:

- Major differences in usage and in the practices of these users, from strictly productive to broad domestic use.
- Large differences in the range of perceptions on water and its management—from sheer economic rationality to struggle for daily domestic water supply.
- Large differences in the level and nature of information reaching the users.

In particular, rural community water users are vulnerable because of lack of water (quality and quantity), water services, water management, information, etc. The different social and economic values of water for different users are also evident.

5.3 Governmental Influences

The team found that policy decisions of the past still have major effects on the present. Rural people were used to getting free services from the former homeland governments. They find it difficult to accept that they have to pay for operational costs, for example for diesel for pumping drinking water.

We also found that inadequate drinking water is the major issue in rural areas. Where there were efforts to improve services through diverse government institutions, conflicts often arose because there is no integrated and participative approach. One case study illustrates this point where at least three different government departments provide drinking water, each with its own rules, but using a common pipeline. At many villages, services have deteriorated in recent years because of previous and current mistakes.

The team also found that the transitional third level of government officials is frustrated because of lack of funds and expertise to perform their duties. It also seems that the population has lost trust in them to solve their problems. Conflicts between the local government structures and the traditional tribal authority did also show themselves at a few localities.

It seems to the project team that government departments operate in an uncoordinated fashion. This causes confusion and distrust amongst the people.

There is clear governmental influence on water use by mines. Mines have to comply with DME environmental requirements, through EMPR, and the DWAF carries out water-quality controls. Thus, they show a higher level of awareness about the CMA process and the NWA implications.

The team found pre-1994 documents biased towards the old RSA with very little information on the former homelands and self-governing territories.

5.4 Rural Communities

In the rural areas, there is extreme complexity of water issues:

- Complexity of water-related problems that communities face (water quality, water quantity, water services, infrastructure design and ownership, economic affordability, etc.), due to the huge backlog in equipment, infrastructure and management structures.

- Institutional complexity, generating local conflicts, institutional interference, overlapping or lack of competencies, lack of follow-up, lack of management, lack of human capacity, etc., due to poor information and to a still emerging overall management system at the TLC level.

The study team had the feeling that these vulnerable settings were on the edge of two systems, as the observed current practices refer to erstwhile rules and habits (generated by the previous arrangements) and that they tend to abide by new emerging regulations, still to be well defined. Lack of information is obvious and is one of the causes of this situation.

Although one case study falls outside the subbasin it highlights such important aspects that the project team still included it. In this case, four government departments supply drinking water to a common reticulation system. The concept of handover points in these cases becomes blurred because of the overlapping of responsibilities. The team, therefore, recommends that a single government agency deals with rural communities, which then involve other institutions as and when necessary.

It was very noticeable that more detailed information was available at field offices than in provincial and national government offices. The real practical situation and thus the effects of policy can only be seen at village level. One village meeting is not adequate to gather reliable information. The project team had time to visit case study communities for a second time where participatory exercises confirmed information and revealed more relevant detail.

From the case studies it also became clear that the rural communities have little or no contact with the new water policies being implemented in the country. The commercial farmers that we visited had reasonable contact with the new policy where mines had very close contact with them. Industrial users getting water from municipalities have very little or no contact with the NWA (1998) activities.

Overall, it was highlighted that those communities are struggling with domestic water supply problems including: severe backlogs and deficiencies in infrastructure, lack of service delivery, perceived lack of attendance to their problems by the TLC, complexity of the local institutional fabric, rising conflicts, and misunderstanding of the new arrangements in terms of water supply and services, which are often seen as more constraining than the previous ones.

They are unaware of the implications of the NWA (e.g., the CMA establishment process). Finally, they do not interact with other users in the area. However, some are aware of, or suffer from, water pollution problems, attributed to the mines.

Irrigation farmers are a partial exception. Both irrigation boards interviewed are quite aware of the new rules on water resources management (e.g., the CMA establishment process). They argue too that a specific Steelpoort river CMA would better address their problems than a whole Olifants river CMA.

On the other hand, individual commercial or emerging farmers, or groups of small-scale farmers under irrigation show a lack of awareness about the current regulations and processes (CMA, NWA). For instance, they are not informed of the registration requirements as water users.

5.5 Urban Areas

Water users within municipal boundaries seem to have no major problems with access to water. However, they exhibit a total lack of awareness on the new context of water resources management (CMA, NWA). The common traits to the users that have been interviewed in urban areas are:

- no knowledge of the CMA, and no involvement.
- little information on the NWA.
- no links with other users, except for the municipality, as water supplier.

Urban and peri-urban users (industrial users, Belfast municipality) are only interested in their own water concerns.

5.6 Essential Tasks Related to Irrigation and Rural Domestic Water

The essential tasks are described in table 5.1 with a typical irrigation situation in view. To illustrate the difference between small-scale and commercial irrigation as well as the difference between the pre-1994 and the current arrangements, each task is indicated by four columns. To fit in with the rest of the study the table is focused on the Steelpoort river subbasin, but most of the definitions are applicable countrywide.

It is clear that the DWAF plays a dominant role in any water-related issue in South Africa. Under the NWA of 1998 many of the functions of the DWAF will be transferred to the CMAs when they have the necessary capacity. This delegation of duties could take 10 years or more to become effective.

5.7 The Way Forward

The project team feels that this study reveals a lot of information. In particular, it highlights the lack of understanding and coordination when working with rural communities. The suffering and hardship of rural communities also come to the forefront. It seems that people in general, and specifically rural communities, have experienced deterioration in the level of water services in the current situation.

For this study to be most useful for policy makers, it should be followed up with an in-depth study to yield more comprehensive results. It would also be interesting to combine the experiences of project teams from other countries to develop a meaningful methodology to tackle these kinds of projects.

The team also felt that an integrated management approach should be followed for surface water and groundwater in terms of quantity and quality because of the interaction that exists in practice. Soil and water conservation should be an important part of this management approach. The CMAs are destined to carry out the task of integrated basin management. The current formulation of water demand/water conservation strategy by the DWAF for all the sectors provides an environment and a need for studies like this. Catchment management strategies are to be formulated soon for the pilot basins, of which the Olifants river basin is one. Further work to provide practical information and strategic direction for this process will be of great value. In this light, an in-depth water accounting study will be useful to clarify water use in the subbasin and the greater Olifants river basin.

Table 5.1. Essential tasks for irrigation and rural water supply: Arrangements before and after 1994.

Task	Rural communities (domestic and agricultural water)		Commercial farmers (irrigation only)	
	Pre-1994	Post-1994	Pre-1994	Post-1994
Governance	Regulated by Lebowa Department of Agriculture and Water Affairs (LDAWA).	Schemes regulated by PDA (provincial boundaries differ from basin) boundary. Irrigation schemes to be transferred to farmers–possible future governance by WUA. The DWAF regulates water supply until CMA and WUAs become effective.	Regulated by DWAF on national level. Irrigation boards-scheme level.	DWAF regulates countrywide. CMA–basin level. WUA–scheme level.
Master planning	Resource development planning by DWAF–national level. LDAWA–homeland area.	Resource development planning by DWAF–national level. TLC, DC and CMA plan for service delivery.	Resource development planning by DWAF–national level. Domestic water own arrangement.	Resourced development planning by DWAF–national level. CMA-basin. Domestic water–own arrangement.
Water allocation	LDAWA in accordance to DWAF.	DWAF – task to be transferred to CMA.	DWAF Water Court for disputes. Listing linked to landownership. Riparian rights.	DWAF (CMA). Non-permanent permit system Demand management.
Water distribution	LDAWA.	DWAF (CMA) through WC, TLC and WUA.	Farmers in full control within Irrigation Board area. DWAF–national level.	DWAF (CMA)–basin level. WUA–scheme level.
Management of system	LDAWA.	Village Water Committee under TLC and WUA.	Irrigation Board or individual user.	WUA or individual user.
Operation of system	LDAWA.	Village Water Committee and WUA.	Irrigation Board or individual user.	WUA or individual user.
Water-quality protection	LDAWA and DWAF.	DWAF–scaled down.	DWAF litigation for extreme cases.	DWAF(CMA) litigation for extreme cases.
Flood protection (repairing of flood damaged water works)	DWAF – bigger structures LDAWA–farm level.	DWAF–bigger structure lines NDA and PDA–agricultural structures.	DWAF and Department of Agriculture.	PDA and NDA for agriculture.

Continued table 5.1.

	Rural Communities (domestic & agricultural water)		Commercial farmers (irrigation only)	
Task	Pre-1994	Post-1994	Pre-1994	Post-1994
Design and construction of new water infrastructure	DWAF–national bulk supplies LDAWA–local schemes (e.g. Boschkloof)	DWAF PDA for local level	DWAF–bulk supply structure. Farmers at own cost or IB with a subsidy from DWAF and decision making support.	Individual farmers and IB at own cost. Decision making support by DWAF (scaled down).
Wetland protection	Practically not done	Greater awareness but little activity yet.	Actions done in specific areas e.g. Natal by interest groups.	NWA contain strict environmental measures, apart from environmental laws.
Maintenance of water infrastructure	LDAWA (even delivered diesel for pumps)	DWAF–in the process to transfer responsibility to communities	Farmer's own responsibility. DWAF subsidized large works (e.g. large dams).	Farmer's own responsibility. DWAF recovers full cost recovery for maintenance from farmers.
Resource mobilization	Community requested government – got infrastructure, services etc. according to funds available	Community requests government and gets less because of fewer funds available.	Farmer funded but enhanced with government subsidy. Some-times used political pressure to achieve ends.	Own funds, means and information. Subsidies practically stopped.
Impact assessment	Government (research institutes) – very little done	Government (research institutions) slightly more than in the past.	Few known cases–usually by DOA. or DWAF for IB or even larger areas.	Little done, if any, funded by donor organizations.
Soil and water conservation	LDAWA–not effective	NDA and PDA still not effective	DOA effective with subsidies.	DOA subsidies practically stopped, less effective.

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