



JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

DEPARTMENT OF WATER AFFAIRS AND FORESTRY
THE REPUBLIC OF SOUTH AFRICA

THE STUDY
ON
THE EXPANSION OF CAPACITY OF
MAGALIES WATER
IN
THE REPUBLIC OF SOUTH AFRICA
(PHASE 1)

FINAL REPORT

MAIN REPORT

DECEMBER 1996

JICA LIBRARY



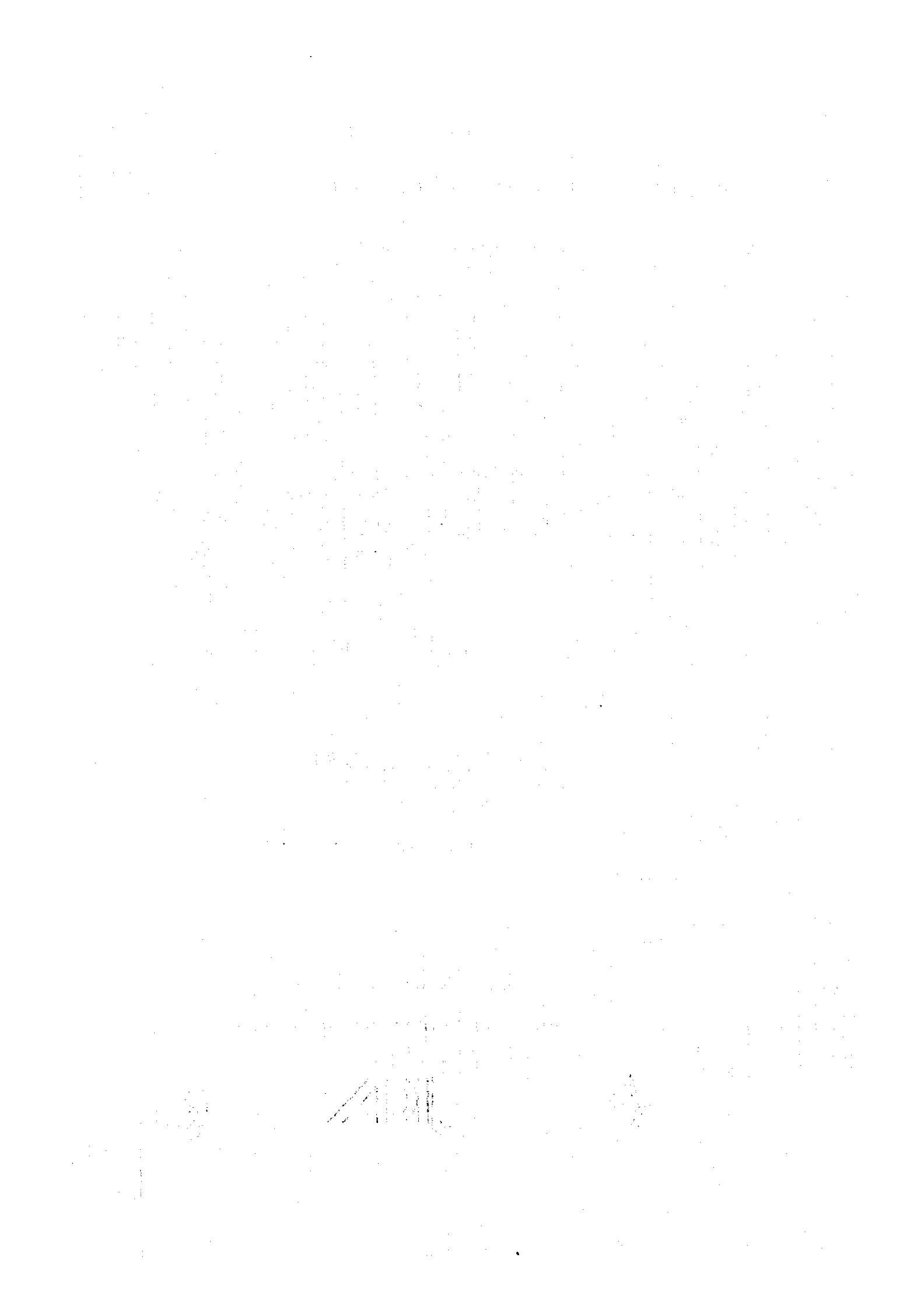
J 1141073 [5]

SANYU CONSULTANTS INC.

NIHON SUIDO CONSULTANTS CO., LTD.



SSS
JR
96-131



PREFACE

In response to request from the Government of the Republic of South Africa, the Government of Japan decided to conduct a master plan study on the Expansion of Capacity of Magalies Water and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to South Africa a study team headed by Mr. S. Kadowaki, SANYU CONSULTANTS INC., and composed of staff members of SANYU CONSULTANTS INC. and NIHON SUIDO CONSULTANTS Co., LTD., two times between November 1995 and December 1996.

The team held discussions with the officials concerned of the Government of South Africa and conducted field surveys at the study area, and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of South Africa for their close cooperation extended to the team.

December 1996



Kimio Fujita

President

Japan International Cooperation Agency



1141073 (5)

December 2, 1996

Mr, Kimio FUJITA
President,
Japan International Cooperation Agency
Tokyo, Japan

Letter of Transmittal

Dear Sir,

We are pleased to submit the final report of the Phase 1 on the Study on the Expansion of Capacity of Magalies Water in Republic of South Africa. This report incorporates the views and suggestions of the authorities concerned of the Government of Japan and your Agency. Also included are comments made by the Department of Water Affairs and Forestry, Magalies Water and other stakeholders in the Republic of South Africa during Project Management Committee and Project Steering Committee meetings held in Pretoria where the draft report was discussed.

In terms of South Africa's new water supply and sanitation policy, a specific challenge is to transform and empower institutions in the sector to deliver service so that all communities in the country can have access to water and sanitation in future. The basic elements of this water supply and sanitation policy are presented in the White Paper on Water Supply and Sanitation, which in turn is based on RDP principles. The study has followed these policy and strategy guidelines.

The Study contributes to the above challenge by considering a specific region of South Africa (Magalies Water Board Supply Area) with the following objectives:

To formulate an overall strategic framework/master plan for the appropriately phased, long term, sustainable development of water supply infrastructure and the development of sanitation, including appropriate Second and Third Tier support, in the extended supply area of Magalies Water. By developing a priority programme to the year 2002, and an extended programme to 2015 should be included.

To share technology on planning methods and skills with counterpart personnel of Magalies Water and DWAF, and other participating organisations.

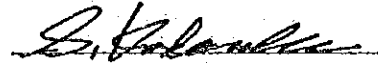
This report contains the findings, conclusions and recommendations and important outputs of this phase have been Policy and Strategy recommendations, Water Supply Infrastructure development plans, Capital Investment plan and Institutional Development proposals.

Feedback from the key stakeholders involved in discussions indicates that the Study is already yielding findings of considerable value. The opportunity to have a team working on this master plan is particularly important in South Africa where there is a shortage of skilled resources.

The report consists of nine volumes being and Executive Summary, Main Report and seven volumes of Supporting Reports.

We wish to take this opportunity to express our sincere gratitude to your Agency, the Ministry of Foreign Affairs and the Ministry of Welfare of the Government of Japan for their valuable advice and suggestions. We would also like to express our deep appreciation to the relevant officers of the Department of Water Affairs and Forestry, Magalies Water and other related agencies of the Government of the Republic of South Africa for their cooperation and the assistance extended to us during our study.

Very truly yours,



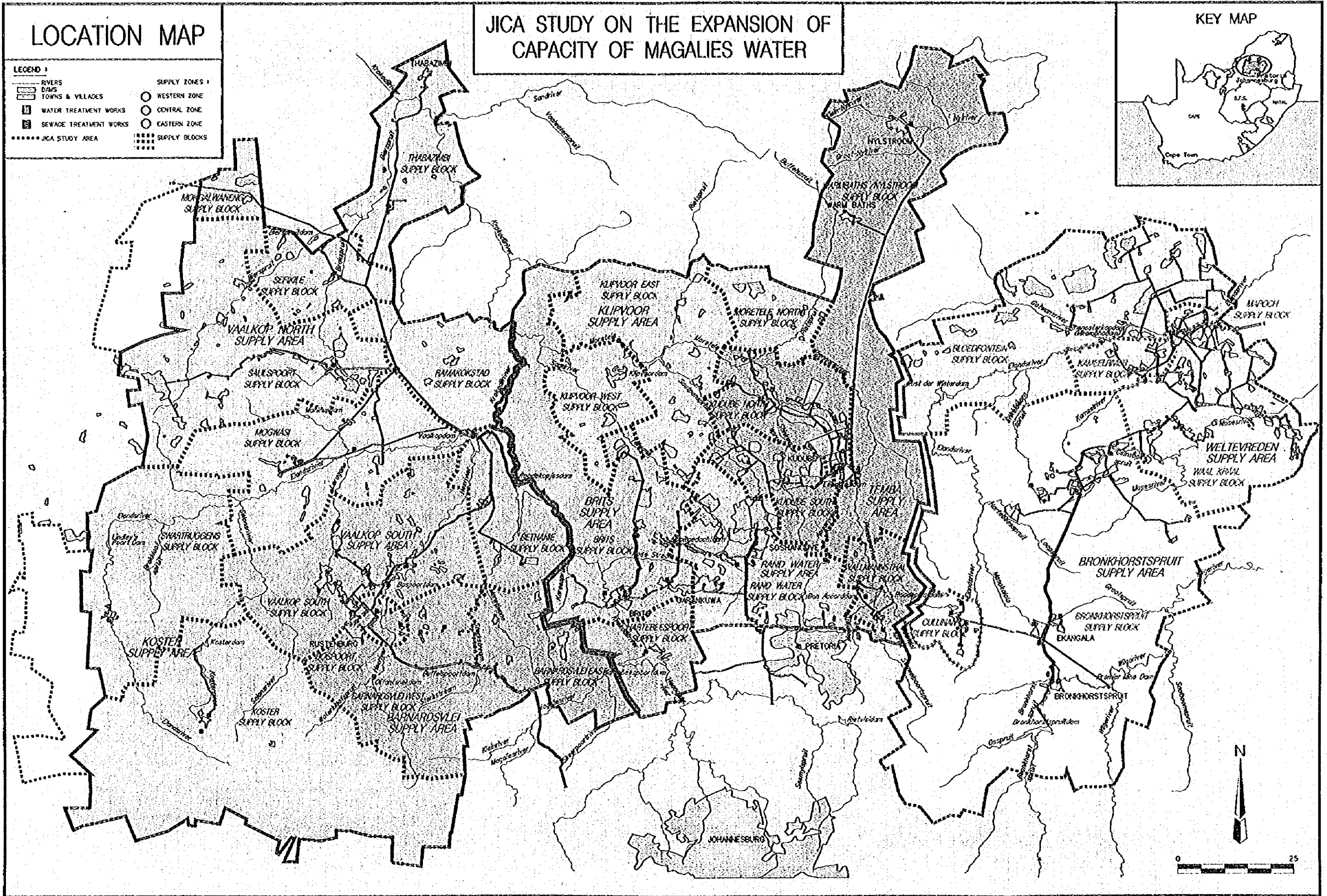
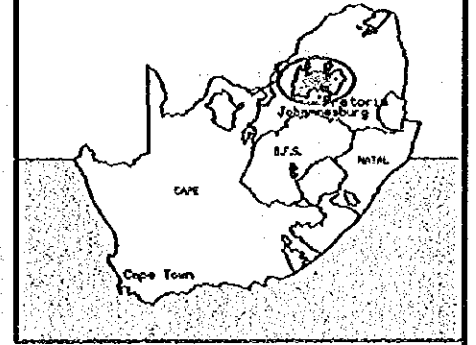
Satoshi KADOWAKI
Team Leader, Phase 1
Study on the Expansion of
Capacity of Magalies Water
In the Republic of South Africa

LOCATION MAP

- LEGEND :**
- RIVERS
 - ▭ DAMS
 - ▭ TOWNS & VILLAGES
 - ⊠ WATER TREATMENT WORKS
 - ⊠ SEWAGE TREATMENT WORKS
 - ⋯ JICA STUDY AREA
- SUPPLY ZONES :**
- WESTERN ZONE
 - CENTRAL ZONE
 - EASTERN ZONE
- SUPPLY BLOCKS :**
- ▭

JICA STUDY ON THE EXPANSION OF CAPACITY OF MAGALIES WATER

KEY MAP



LOCATION MAP

JICA STUDY ON THE EXPANSION OF CAPACITY OF MAGALIES WATER

KEY MAP

- LEGEND :**
- RIVERS
 - ▭ DAMS
 - TOWNS & VILLAGES
 - WATER TREATMENT WORKS
 - ▣ SEWAGE TREATMENT WORKS
 - JICA STUDY AREA
- SUPPLY ZONES :**
- WESTERN ZONE
 - CENTRAL ZONE
 - EASTERN ZONE
- SUPPLY BLOCKS :**
- ▣

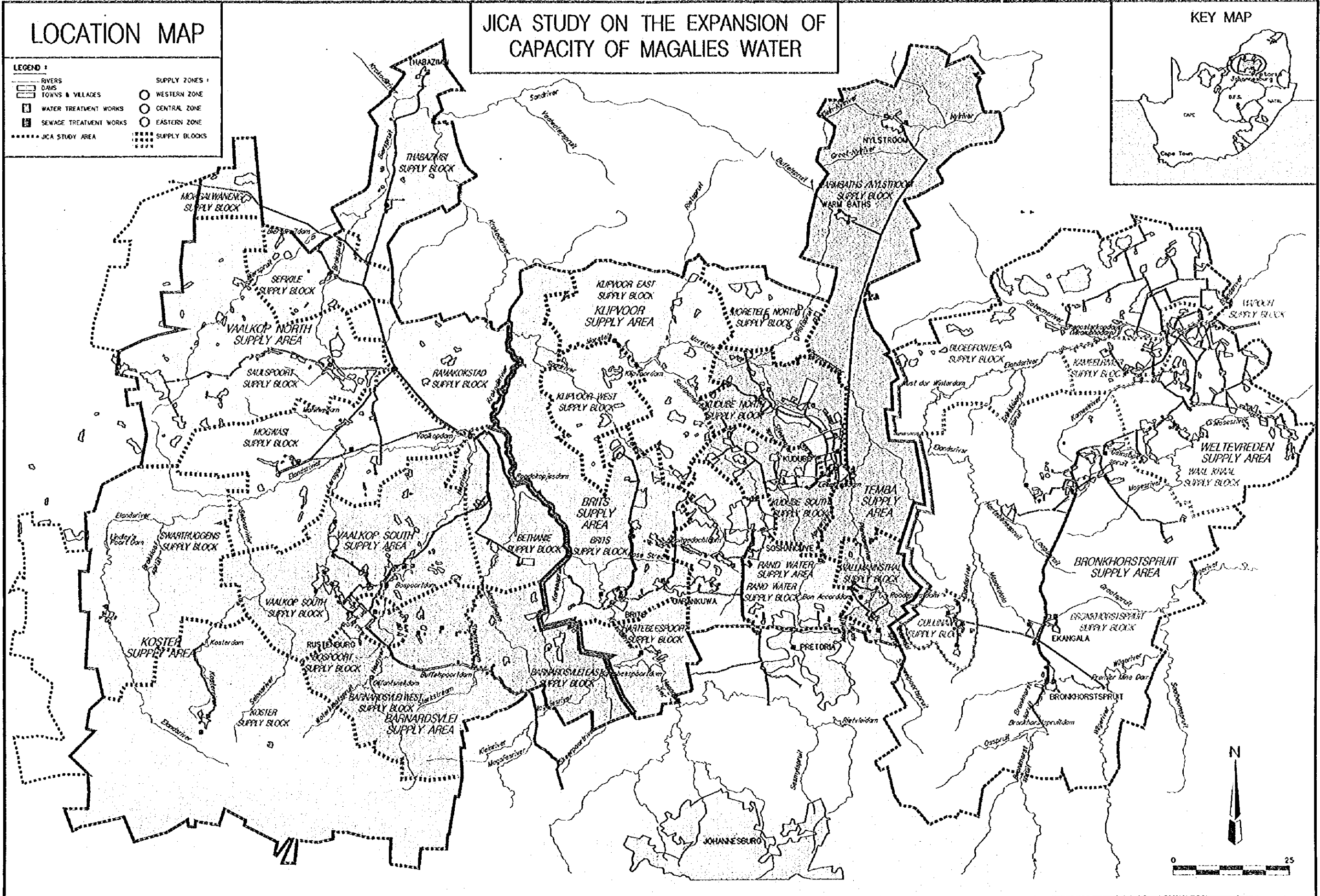
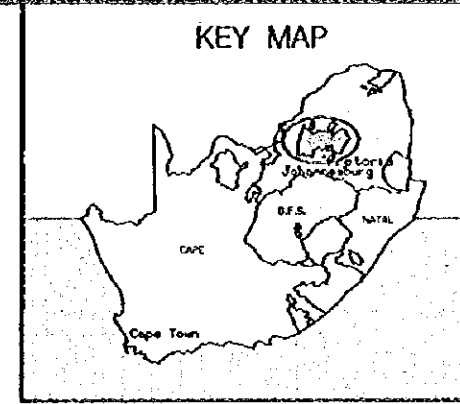


TABLE OF CONTENTS

LOCATION MAP

ABBREVIATIONS

CHAPTER 1 : INTRODUCTION

1.1	Background of the Study	1-1
1.2	JICA Study Arrangements	1-7
1.3	Composition of This Report	1-11
1.4	Acknowledgements	1-12

CHAPTER 2 : STUDY AREA

2.1	Natural Conditions	2-1
2.2	Socio-Economic Conditions	2-11
2.3	Inventory of Existing Infrastructure and that Subject to Planning	2-15
2.4	Institutional Environment of the Water Sector	2-19
2.5	Water Tariff and Cost Recovery	2-22

CHAPTER 3 : DEVELOPMENT POLICY AND CONSTRAINTS

3.1	Development Objectives	3-1
3.2	Peripheral Area Issues	3-2
3.3	Development Constraints	3-4
3.4	Policy and Strategy Options	3-12

CHAPTER 4 : WATER DEMAND AND SOURCE OF SUPPLY

4.1	Zoning of Study Area	4-1
4.2	Population Projection	4-2
4.3	Water Demand Projection	4-4
4.4	Water Balance Study	4-9
4.5	Water Quality	4-17

CHAPTER 5 : INFRASTRUCTURE DEVELOPMENT PLANNING

5.1	Assumed Design Standards and Cost Curves	5-1
5.2	General Planning Approach	5-1
5.3	Development Planning for the Western Zone	5-3
5.4	Development Planning for the Central Zone	5-8
5.5	Development Planning for the Eastern Zone	5-13
5.6	Cost Estimates	5-18
5.7	Recommendations on Sanitation Options	5-19
5.8	Environmental Impact	5-21

CHAPTER 6 : INSTITUTIONAL DEVELOPMENT PLAN

6.1	Institutional Development in the Water Sector	6-1
6.2	Third Tier Focus	6-3
6.3	The Capacity of the Third Tier	6-3
6.4	Institutional Development Plan	6-13

CHAPTER 7 : INITIAL CAPITAL INVESTMENT PLAN

7.1	Basic Concept and Framework	7-1
7.2	Preliminary Tariff Calculation	7-2
7.3	Fund Mobilization	7-4
7.4	Financial Viability of Stakeholders/Role Players	7-5

CHAPTER 8 : IMPLEMENTATION ARRANGEMENTS

8.1	Implementation Schedule	8-1
8.2	Institutional Structures	8-3
8.3	Budgetary Schedule	8-11

CHAPTER 9 : EVALUATION AND PRIORITISATION

9.1	Project Evaluation	9-1
9.2	Prioritisation	9-6

CHAPTER 10 : T.O.R. FOR PHASE 2 AND 3

10.1	Major Outstanding Issues in Phase 1	10-1
10.2	Selection of Priority Project	10-1
10.3	Basic Approach of the Next Phase and Work Schedule	10-3
10.4	Terms of Reference	10-6

LIST OF TABLES

Table 2-1 :	Distribution of the Major Geological Formations	2-26
Table 2-2 :	Overview of the Third Tier	2-27
Table 2-3 :	Average Number of People per Dwelling	2-27
Table 2-4 :	Water Tariffs in Former NWWA Areas	2-28
Table 2-5 :	Year to Date Water Tariff Collection in Former NWWA Areas	2-28
Table 2-6 :	Water Tariff Rates in Other Former NWWA Areas	2-28
Table 3-1 :	Symptomatic Recommendations by Extension Challenge	3-20
Table 3-2 :	Policy and Strategy Recommendations	3-23
Table 3-3 :	Initiating Ongoing Planning and Coordination	3-27
Table 4-1 :	Zoning of Study Area	4-20
Table 4-2 :	Summary of Projected Population	4-21
Table 4-3 :	Projected Mixes of Levels of Services	4-22
Table 4-4 :	Summary of Projected Primary Water Demand	4-23
Table 4-5 :	Summary of Water Usage in Irrigation	4-24
Table 4-6 :	Acceptable Return Periods and Allowable Shortages(%)	4-24
Table 4-7 :	Water Demand in the Target Year 2015	4-24
Table 4-8 :	Probable Drought River Runoff in the Study Area	4-25
Table 4-9 :	Estimated Return Flows and Urban Runoff	4-26
Table 4-10 :	Projected Return Flow and Urban Runoff in the Crocodile River	4-26
Table 4-11 :	Assumed Return Flows and Urban Runoff	4-26
Table 4-12 :	Present and Projected Groundwater Utilization	4-27
Table 4-13 :	Required Surface Water Amount for Projected Primary Water	4-27
Table 4-14 :	Water Availability from Rand Water	4-28
Table 4-15 :	Summary of Water Balance of Case 1	4-29
Table 4-16 :	Summary of Water Balance of Case 2	4-29
Table 4-17 :	Summary of Water Balance of Case 3 (Alt. 1)	4-30
Table 4-18 :	Summary of Water Balance of Case 3 (Alt. 3)	4-30
Table 4-19 :	Summary of Water Balance of Case 3 (Alt. 2)	4-31
Table 5-1 :	Summary of Additional Infrastructure Required for Vaalkop North S/A ..	5-4
Table 5-2 :	Summary of Additional Infrastructure Required for Vaalkop South S/A ..	5-6
Table 5-3 :	Summary of Additional Infrastructure Required for Barnardsvlei S/A	5-7
Table 5-4 :	Summary of Additional Infrastructure Required for Koster S/A	5-8
Table 5-5 :	Summary of Additional Infrastructure Required for Brits S/A	5-10
Table 5-6 :	Summary of Additional Infrastructure Required for Klipvoor S/A	5-11
Table 5-7 :	Summary of Additional Infrastructure Required for Rand Water S/A ...	5-12
Table 5-8 :	Summary of Additional Infrastructure Required for Temba S/A	5-13
Table 5-9 :	Summary of Additional Infrastructure Required for Weltevreden S/A ...	5-17
Table 5-10 :	Summary of Additional Infrastructure Required for Bronkhorstspuit S/A	5-18
Table 5-11 :	Summary of Costs From Infrastructure Planning - Western Zone	5-24
Table 5-12 :	Summary of Costs From Infrastructure Planning - Central Zone	5-25
Table 5-13 :	Summary of Costs From Infrastructure Planning - Eastern Zone	5-26
Table 6-1 :	Third Tier Structures with Water and Sanitation Roles	6-4
Table 6-2 :	Components of Internal Institutional Capacity	6-6
Table 6-3 :	External Determinants of Capacity	6-7
Table 6-4 :	Classification of Third Tier Organizations/Structures in the Study Area .	6-10
Table 6-5 :	Overview of Third Tier Capacity	6-20

Table 6-6 :	Issues Informing the Structure and Positioning of Magalies Water	6-14
Table 6-7 :	Training Requirements for Support Programme	6-19
Table 7-1 :	Total Requirement of Fund for 2015 Demands	7-7
Table 8-1 :	Training Assessment	8-10
Table 8-2 :	Project Cost	8-12
Table 8-3 :	Disbursement Schedule of the Project	8-13
Table 9-1 :	Category of Beneficiary	9-7
Table 9-2 :	Incremental Primary Water Demand in 2015 (MCM/year)	9-7
Table 9-3 :	Summary of Capital Expenditure for Infrastructure Development	9-8
Table 10-1 :	Incremental Water Demand	10-25
Table 10-2 :	Selection of Pilot Projects	10-26
Table 10-3 :	Feasibility Study Roles and Responsibilities : February 1997 - October 1997	10-27
Table 10-4 :	Feasibility Study Roles and Responsibilities : 1998 - 2002	10-28
Table 10-5 :	Feasibility Study Roles and Responsibilities : 2003 - 2015	10-29

LIST OF FIGURES

Figure 1-1 :	Project Management Structure	1-10
Figure 2-1 :	ESA of Magalies Water	2-29
Figure 3-1 :	The Gap Analysis and Policy and Strategy Processes	3-28
Figure 3-2 :	Linkages Between Gaps	3-28
Figure 3-3 :	Elements of an Initiating Framework	3-29
Figure 3-4 :	Components of Capacity	3-29
Figure 4-1 :	Storage Water Allocation Plan (Western Zone)	4-32
Figure 4-2 :	Storage Water Allocation Plan (Central Zone)	4-33
Figure 4-3 :	Storage Water Allocation Plan (Eastern Zone)	4-34
Figure 5-1 :	Flow chart for Improvement of Sanitation	5-27
Figure 6-1 :	Institutional Relationships and Capacity Building	6-2
Figure 8-1 :	Implementation Schedule	8-14
Figure 8-2 :	Existing Organisation of Magalies Water	8-15
Figure 8-3 :	Implementing Structure : Conceptual Framework	8-5
Figure 8-4 :	Proposed Magalies Water Functional Organization (Target Year 2002)	8-16
Figure 8-5 :	Proposed Magalies Water Functional Organization (Target Year 2002)	8-17
Figure 10-1 :	Northern Mankwe Priority Project	10-30
Figure 10-2 :	Klipvoor Priority Project	10-31
Figure 10-3 :	Moretele 2 Priority Project	10-32
Figure 10-4 :	Proposed Phase 2 / Phase 3 Management Structure	10-33
Figure 10-5 :	Proposed Set-up Schedule	10-34
Figure 10-6 :	Implementation Plan of Feasibility Study	10-35
Figure 10-7 :	Implementation Plan of Pilot Projects	10-36

ABBREVIATIONS AND TERMINOLOGY

The following abbreviations are used in this report:

AADD	Annual Average Daily Demand
ANC	African National Congress
BLA	Black Local Authorities
BODA	British Overseas Development Agency
CAPEX	Capital Expenditure
CASE	Community Agency for Social Inquiry
CBOs	Community Based Organisations
CDE	Centre for Development and Enterprise
CIP	Capital Investment Plan
CRDC	Community Reconstruction and Development Committee
CRCS	Crocodile River Catchment Study
CSIR	Council for Scientific and Industrial Research
CWSS	Community Water Supply and Sanitation
DAF	Dissolved Air Flotation
DANIDA	Danish International Development Agency
DBSA	Development Bank of Southern Africa
DC	District Council
DCF	Discounted Cash Flow
DFA	Development Facilitation Act
DWAF	Department of Water Affairs and Forestry
ESA	Extended Supply Area of Magalies Water Board as gazetted in April 1996
ESCOM	Electricity Supply Commission
GIS	Geological Information System
GNU	Government of National Unity
GSWCA	Government Subterranean Water Control Area
GWCA	Government Water Control Area
GWS	Government Water Scheme
IB	Irrigation Board

IBS	Irrigation Board Scheme
IDT	Independent Development Trust (NGO)
IFR	Instream Flow Requirements
IMT	Interim Management Team
INR	Institute of National Resources
JICA	Japan International Cooperation Agency (the official agency responsible for the implementation of the technical cooperation programmes of the Government of Japan)
LAPC	Land and Agricultural Policy Centre
LRDC	Local Reconstruction and Development Committee (Local RDP Committee)
LWC	Local Water Committee
MSF	Medicines Sans Frontiers
MEC	Member of Executive Committee
MW	Magalies Water Board
NELF	National Electrification Forum (ESKOM Database)
NGOs	Non-Governmental Organisations
NPV	Nett Present Value
NWP	North West Province
NWWA	North West Water Supply Authority
O&M	Operation and Maintenance
ODA	Official Development Assistance
ODO	Organisation Development Officer
OECF	Overseas Economic Cooperation Fund of Japan
PLP	Presidential Lead Project
PMC	Project Management Committee of the JICA Study
PSC	Project Steering Committee of the JICA Study
PWB	Phalaborwa Water Board
PWG	Project Working Group of the JICA Study
PWSSD	Provincial Water Supply and Sanitation Directorate
PWV	Pretoria Witwatersrand Vereeniging triangle (geographical area)
RBC	Rotating Biological Contactor
RDP	Reconstruction and Development Programme

RSA	Republic of South Africa
RSC	Regional Service Council (regional bodies established to facilitate and coordinate service provision across local boundaries. To be replaced by Regional and District Councils)
RWB	Rand Water Board
S/W	Scope of Works
SAMWU	South African Municipal Workers Union
SANCO	South African National Civic Organisation
SCOWSAS	Standing Committee on Water Supply and Sanitation
SDD	Summer Daily Demand
Setplan	Settlement Planning Services Consulting Engineers
SGT	Self-Governing Territories
SR	Service Reservoir
STW	Sewage Treatment Work
SWET	Sanitation and Water Education and Training Program
TA	Tribal Authority
TBVC	Transkei, Bophuthatswana, Venda, Ciskei (former ""independant"" homelands)
TDS	Total Dissolved Salts
THM	Trihalomethanes
TLC	Transitional Local Council
TMC	Transitional Metropolitan Council
TOR	Terms of Reference
TRC	Transitional Rural Council
VIDP	Ventilated Improved Double Pit toilet (latrine)
VIP	Ventilated Improved Pit Latrine
WP	White Paper
WRC	Water Research Commission
WRYM	Water Resources Yield Model
WTW	Water Treatment Works

UNITS

c	Cent (100c = R1)
ha	Hectare
kg/c/year	Kilograms per capita per year
kl	Kilolitre
kld	Kilolitres per day
km	Kilometre
km²	Square kilometre
l/c/yr	Litres per capita per year
lcd	Litres per capita per day
m³/c/yr	Cubic metres per capita per year
mcm	Million cubic metres
mcm/a	Million cubic metres per annum
mg/l	Milligrams per litre
Mld	Megalitres per day
R	Rand (R1 = 100c)

1 Rand = 25 Japanese Yen (as of November 1996)

CHAPTER 1 INTRODUCTION

TABLE OF CONTENTS

1.1	Background of the Study	1-1
1.1.1	Overall Framework of the Water Sector	1-1
1.1.2	Reconstruction and Development Programme (RDP)	1-2
1.1.3	White Paper on Water Supply and Sanitation	1-3
1.1.4	Water Law Review	1-5
1.1.5	Quantitative Overview of the Water Supply Scenario	1-6
1.2	JICA Study Arrangements	1-7
1.2.1	JICA's Preliminary Survey and Scope of Work	1-7
1.2.2	Overall Framework of the Study	1-8
1.2.3	Study Management Structure	1-8
1.2.4	Study Implementing System	1-11
1.3	Composition of This Report	1-11
1.4	Acknowledgements	1-12
	Figure 1-1 : Project Management Structure	1-10

CHAPTER 1 INTRODUCTION

1.1 Background of the Study

1.1.1 Overall Framework of the Water Sector

(1) Historical Background

Historically the water sector in South Africa has been administered within the framework of The Water Act (Act 54 of 1956) which established centralised control over public water resources in South Africa and made some attempt to accommodate the expanding urban and industrial economy. The Act however still primarily served the interests of the agricultural sector. Homelands had their own water legislation which covered the areas under their jurisdiction.

(2) Transition

Since the transformation of South Africa with the election of a democratic government and the reincorporation of the former homelands, a process of transition has commenced in the water sector. The first step in this process was the passing of the Water Laws Rationalisation and Amendment Act (Act 32 of 1994). While a major purpose of the act was to rationalise laws in force in the former homelands it also provided the Minister of Water Affairs and Forestry with the authority to provide water supply and sanitation services. This changed the emphasis in the public sector to the provision of basic services to the majority of the population who had not had these services in the past.

(3) Future Vision

The democratically elected government in South Africa has as its vision the total transformation of many aspects of society. The supply of basic services to those people who have been deprived of these services is central to this vision. To achieve this a number of strategies and programmes have been developed. Those relevant to the water sector are:

- (a) The Reconstruction and Development Programme (RDP).
- (b) White Paper on Water Supply and Sanitation Policy
- (c) Water Law Review Program

Each of these three key initiatives is discussed in further detail in the paragraphs which follow.

1.1.2 Reconstruction and Development Programme (RDP)

(1) Background

The Government of National Unity's main focus is to transform South Africa. While there are many aspects of this, the *Reconstruction and Development Program (RDP)* which is aimed at social and economic development is the central program. It is an integrated and comprehensive initiative which is based on an extensive process of consultation and joint policy formulation.

A *National Growth and Development Strategy* has been formulated which sets out the objectives, priorities and strategies required to accelerate growth/development so as to reduce poverty and increase employment. This strategy provides a guiding framework for the RDP and facilitates making strategic choices and trade-offs during implementation of the RDP.

(2) Principles of the RDP

The RDP has as its foundation six principles which not only apply to the overall programme but to RDP projects as well.

- (a) It must be an integrated and sustainable programme.
- (b) The programme must become a people-driven process.
- (c) The program and process must be closely bound to creating peace and security for all.
- (d) As peace and security are established it will be possible to embark upon nation building.
- (e) Nation building is an integral part of reconstruction and development.
- (f) The preceding five principles all depend upon thorough and ongoing democratisation.

(3) Programs of the RDP

To achieve its aims the RDP has been structured into five sub programs: meeting basic needs, developing human resources, building the economy, democratising the state and society, and implementing the RDP itself i.e. projects in various sectors.

(4) Implementation Roles

All levels of government have a role to play in implementing the RDP: Central Government sets the broad objectives and programmes; provincial governments develop the strategies and programmes for their own provinces; and local authorities are the key institutions for delivering basic services, extending local control and managing local economic development. Obviously the role of local authorities is closely integrated with the activities of communities they serve.

(5) RDP Projects in the Study Area

It is important to note that there are several RDP programmes being implemented in the study area as these can provide valuable lessons and need to be taken into account in the master plan. These are:

- (a) North West Rural Water Supply Program.
- (b) Moretele 1 Water Supply Scheme.
- (c) Winterveldt Water Supply Project.

1.1.3 White Paper on Water Supply and Sanitation

(1) Purpose

The White Paper was published in November 1994 as a policy document with the aim of clearly setting out the position and strategies to be followed by the Department of Water Affairs and Forestry (DWAF) and other institutions involved in water supply. It covers the historical background; explains the development approach which has guided policy formulation; puts forward basic policy principles; outlines the institutional framework for water supply and sanitation services; provides standards and guidelines for basic service delivery; sets out policy for financing of service delivery; outlines some immediate initiatives being taken and provides supplementary briefing information on important related topics.

(2) Principles

The White Paper outlines a number of principles to guide the formulation of policy and strategy in the supply of water and sanitation services. These are:

- (a) Development should be demand driven and community based.
- (b) Basic services are a human right.
- (c) The philosophy of "some for all" rather than "all for some."

(d) Equitable regional allocation of development resources.

(e) Water has an economic value.

(f) The user of the service must pay for it.

(g) Integrated development and environmental integrity.

To give effect to (c) above a minimum standard has been set for water supply in the country which is referred to as the RDP minimum. This is that all persons shall have access to 25 litres of water per day within 200 m of their household.

(3) Institutional Development

The White Paper also provides some guidelines for institutional reform in the water sector. This is particularly important because of the government's emphasis on service delivery and obviously this requires institutional capacity. In terms of the White Paper there are phased goals:

(a) In the short term:

To maintain service delivery whilst rationalising DWAF and transforming and democratising the second tier (i.e. Water Boards)

(b) In the medium term:

To support institutional development at the third tier level (i.e. local level) and to provide financial and technical assistance for water supply and sanitation services. The restructured DWAF (especially at provincial level) and second tier institutions will work towards this goal together with the private and NGO sectors.

(c) In the long term:

To ensure that the provision of services to customers is the function of local government supported by provincial government. The second tier will provide bulk and wastewater disposal services, and DWAF will manage water resources and monitor and regulate policy implementation.

(4) Review

It is intended to review and update the White Paper in the first half of 1997.

1.1.4 Water Law Review

(1) Background

As indicated there has only been a rationalisation of legislation since the democratically elected government came to power in 1994 (Water Laws Rationalisation and Amendment Act) (Act 32 of 1992). A major review of legislation to transform the water sector in accordance with the ideals of the RDP and White Paper is therefore necessary. To this end the Minister appointed a special Water Law Review Panel in June 1995 to develop a set of policy principles on which a new act could be based. The brief has been to make the new law simple, equitable, environmentally integrated and sustainable, economically viable and conducive to equitable economic growth, non-bureaucratic, and capable of simple and easy administration.

(2) Progress

The Panel has completed its work and reported (Fundamental Principles and Objectives of a New Water Law in South Africa). Nine sets of fundamental principle categories were developed. These were:

- (a) Hydrological cycle.
- (b) Aquatic ecosystem.
- (c) Legal status of water.
- (d) Demand apportionment and usage.
- (e) Water quality management.
- (f) Value of water.
- (g) Existing rights to the use of water.
- (h) Management, administration and enforcement.
- (i) Water supply and sanitation services.

There are a number of areas identified which are not included in the above and need further investigation. It is noted that one of these is institutional and administrative structures.

(3) Next Steps

A Steering Committee is taking the law review process forward. A major step in this process has been a Water Law Review Conference. A final set of principles will be

embodied in a White Paper which when approved by the Minister and then the Cabinet will form the basis from which a new act will be drafted.

1.1.5 Quantitative Overview of the Water Supply Scenario

The preceding paragraphs describe the overall framework of change in which the JICA study is taking place. To more fully illustrate the necessity for change the following statistics illustrate the historical imbalances and lack of service provision which the changes seek to address.

Historically, the population of the RSA was classified in terms of population groups, namely, blacks, whites, coloureds and Asians. The classification is no longer enshrined in law, but it has relevance when considering demographic and socio-economic characteristics. Some baseline statistics are summarised below:

Population (1 000)	Black	White	Coloured	Asian	Total
1984	17,940 (68%)	4,810 (18%)	2,930 (11%)	890 (3%)	26,570 (100%)
1994	23,600 (71%)	5,180 (16%)	3,450 (10%)	1,040 (3%)	33,270 (100%)
Annual Growth (%) 1984 - 1994	2.8	0.7	1.6	1.6	2.3

Generally, the level of water supply services is classified according to population groups as follows:

Delivery Method	Black	White	Coloured	Asian
House Connection	17.5	99.7	78.9	99.2
Yard Connection	25.8	0.2	16.5	0.8
Public Standpipe	23.8	0.1	3.0	-
No Service	32.9	-	1.6	-
Total	100%	100%	100%	100%

Especially for the black group, water supply the condition is further classified below:

Delivery Method	Rural Community	Peri-Urban	Urban Area
House Connection	7.7	27.5	40.0
Yard Connection	13.9	41.8	48.9
Public Standpipe	26.8	27.8	10.9
No Service	51.6	2.9	0.2
Total	100%	100%	100%

In the entire RSA, the diffusion rate of flush toilets is identified as follows:

Population Group	Black	White	Coloured	Asian
Diffusion of Flush Toilet (%)	34.2	99.8	88.0	99.6

The sanitation condition of the black group is further identified as follows:

Type of Toilet	Rural Community	Peri-Urban	Urban Area
Flush Toilet	13.1	55.9	83.0
VIP	1.8	2.0	0.6
Infiltration	59.7	13.3	6.4
Bucket	1.4	24.5	6.9
Others	24.0	4.3	3.1
Total	100%	100%	100%

As clearly expressed the above, the black population group (who comprise about 70 percent of the total population) have access to characteristically low level of services in the water supply and sanitation sector. In view of RSA's policy to upgrade the quality of life of all South Africans, it is appropriate that high priority should be given to those people who are facing inferior service quality in the water supply and sanitation sector.

1.2 JICA Study Arrangements

1.2.1 JICA's Preliminary Survey and Scope of Work

In response to the request of the Government of the Republic of South Africa, the Japanese Preparatory Study Team headed by Mr. Ryuzo Nishimaki was sent by JICA from 18th July to 11th August, 1995. The composition of the Team is as follows:

Mr. Ryuzo Nishimaki	Leader
Dr. Yuji Maruo	Water Resource Development
Mr. Yoshiki Omura	Water Supply Planning
Mr. Makoto Saito	Water Supply Administration
Mr. Kazuchika Sato	Management, Finance, Human Resources Development, Social Analyst
Mr. Kazuhiko Kikuchi	Study Planning

The objectives of the Team were: to conduct a preliminary survey of the proposed study area; and to discuss and finalise the Scope of Work (S/W) for the proposed study among key stakeholders concerned, including DWAF, Dept. of Finance, Dept. of Foreign Affairs, MW, NWWA and the Embassy of Japan.

Through a series of discussions, the implementing arrangement termed "Scope of Work for the Study on Expansion of Capacity of the Magalies Water in the Republic of South Africa" was agreed upon between DWAF and JICA on 4th August 1995. The Scope of Work and the Minutes of Meeting on S/W are compiled in Supporting Report A.

1.2.2 Overall Framework of the Study

The Study has three phases, the first to be completed in 1996. Phases 2 and 3 will be completed during 1997. The Phases are the following:

(1) Phase 1: Formulation of a Master Plan.

Phase 1 has three stages, each building on the preceding stage.

(a) Stage 1:

Situational Analysis. This stage includes an investigation to understand the present circumstances of the Study Area. Issues covered include policy, socio-economic conditions, institutional arrangements, water resources, water demand, physical infrastructure, water tariffs and cost recovery systems.

(b) Stage 2:

Formulation of a Master Plan up to the year 2015 and priority projects to the year 2002. This stage incorporates a process leading to: the formulation of policy and strategy recommendations; an investigation of technical solutions to water supply challenges identified throughout the Study Area; an institutional development plan; and an initial capital investment plan.

(c) Stage 3:

Recommendations on study methods and terms of reference for Phases 2 and 3.

(2) Phase 2: Feasibility study on priority projects.

(3) Phase 3: Implementation of selected water supply and sanitation pilot initiatives.

This report is the culmination of Phase 1. Terms of reference for subsequent phases are presented in Chapter 10.

1.2.3 Study Management Structure

The JICA Study has a three-tiered project management structure (see Figure 1-1). The three levels are as follows:

(1) Project Steering Committee

The PSC is a high level body which discusses and resolves matters of policy and major issues relating to implementation. It has the following responsibilities:

- (a) To discuss and resolve matters of policy relating to the agreement between the governments of Japan and South Africa.
- (b) To discuss and resolve matters of study design, management and implementation that have major implications for the governments of Japan and South Africa, and for JICA, DWAF and MW; and
- (c) To monitor overall project progress, especially with reference to the delivery and quality of major products.

(2) Project Management Committee

The PMC guides and monitors the Study, and provides a forum for the participation of key stakeholders. Roles and responsibilities are:

- (a) To oversee the efficient implementation of the study.
- (b) To provide guidance to ensure the successful completion of agreed sub-outputs.
- (c) To monitor and discuss policy and other contextual issues which might influence the study.
- (d) To discuss and recommend operational changes outside the agreed Scope of Work.
- (e) To provide a forum for the high-level participation of relevant parties (see Figure 1-1).
- (f) To ensure that all relevant and necessary resources are engaged in support of the overall aims.

(3) Project Working Groups

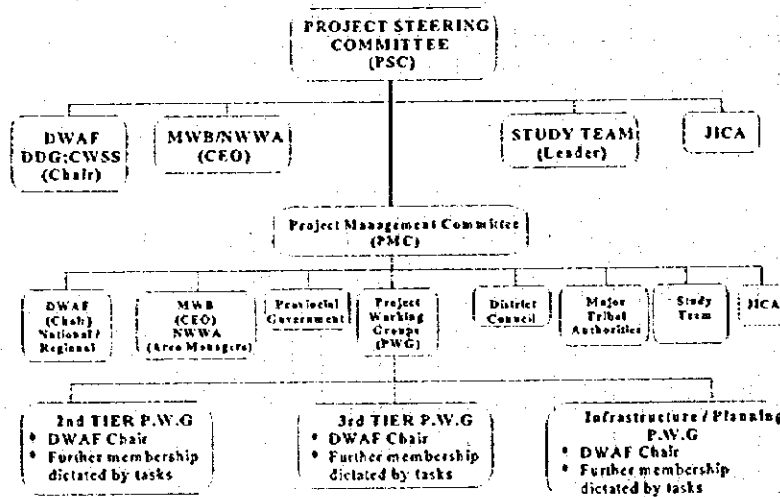
The PWGs are flexible and open structures which oversee specific work areas. Participation is determined largely by the work being undertaken. The PWGs are structured as follows:

- (a) A 2nd Tier PWG concerns itself with Study activities relating to MW itself, other actors in the 2nd Tier and policies and practices pertinent in this context. Many of the institutional development tasks fall under the aegis of this PWG.
- (b) A 3rd Tier PWG focuses on tasks relating to communities, local and district authorities and other actors at the 3rd Tier level. The Study tasks concerned with community development and capacity building are the responsibility of this PWG.
- (c) A Planning, Finance and Infrastructure PWG covers infrastructural and financial planning. Many technical responsibilities reside with this PWG.

The following roles and responsibilities are common to all three PWGs:

- (a) To monitor Study activities.
- (b) To identify and rectify operational difficulties.
- (c) To co-ordinate tasks and the production of reports.
- (d) To facilitate and support the activities of local consultants.
- (e) To act as a forum for specialists working on related tasks.

Figure 1-1: Project Management Structure



1.2.4 Study Implementing System

On the basis of the Scope of Work, JICA has entrusted the study works to a Japanese consortium of consultants, consisting of Sanyu Consultants Inc. (SCI) as a managing company and Nihon Suido Consultants Co., Ltd. (NSC) who were selected by an open tendering procedure.

SCI and NSC jointly set up the study team headed by Mr. S. Kadowaki as team leader. The Study Team is composed of 10 members including six Japanese, one English and three South African Nationals. Their overall manning schedule is shown in Supporting Report A.

As stated already, the Study is divided into three phases and the current Phase 1 is further divided into three stages. Due to the Japanese governmental budgeting system, the works included in Stage 1 were conducted under the 1995 financial year budget, and the remaining stages have been completed under the FY1996 budget.

During Stages 1 and 2, the Study Team entrusted several components of the study works to South African Consultant Companies in the form of sub-contracting. These components include the situational analysis for both engineering and institutional aspects, the gap analysis and the preliminary study of water supply systems. The Supporting Reports B: SITUATIONAL ANALYSIS, C: GAP ANALYSIS and E: PRELIMINARY STUDY OF WATER SUPPLY SYSTEM are prepared on the basis of the work of the local consultants..

1.3 Composition of This Report

The Final Report is composed of an Executive Summary, Main Report, Supporting Reports and a Data Book. Each Supporting Report covers an individual part of the Study and has been prepared to provide detailed information to the more interested or specialist reader. The Supporting Reports are as follows:

- A: General Affairs
- B: Situational Analysis
- C: Gap Analysis
- D: Policy and Strategy Options
- E: Preliminary Study of Water Supply System
- F: Institutional Development Plan
- G: Economic/Financial Analysis

The Data Book contains primary data and information, and only a limited number of hard copies will be produced. These will be held by key stakeholders (such as DWAF and MW). The contents of the Data Book will be made available in electronic format whenever applicable.

1.4 Acknowledgements

From the inception of negotiations around the JICA Magalies Expansion Study to the conclusion of Phase 1, numerous organisations and individuals have contributed to the work of the Study Team. Whilst taking responsibility for this report, the Study Team wishes to acknowledge the value added by the following:

- (1) The Japan International Cooperation Agency (JICA) and the Government of Japan. The Magalies Expansion Study has, in many ways, pioneered Japanese technical assistance to South Africa. JICA and the Japanese Government are thanked for providing the vision and the resources for this important bridge-building venture. The JICA Advisory Team, led by Dr Y Maruo, has provided constructive and insightful guidance and support to the Study Team.
- (2) The Department of Water Affairs and Forestry (DWAF) and the Government of South Africa. The South African government has embarked on an ambitious programme of reconstruction and development to entrench the democratic transformation process that culminated in the formation of the Government of National Unity in 1994. DWAF is a leading agent of reconstruction and development, and the Minister and his Department are thanked for including international support in this exciting venture.

DWAF and its officials also assisted the Study Team in a number of practical but essential ways:

- (a) The organisation provided the study team with a "home", in the form of offices and support infrastructure like security, parking and telephone lines.
 - (b) DWAF officials (in Pretoria and the Regions) acted in numerous management and technical roles, participating in meetings, workshops and consultations, and reviewing the voluminous paperwork generated by the team. Particular gratitude is extended to the chairs of the various management structures: Mike Muller, Kalinga Pelpola, Louise Colvin, Peter Pyke, Fred van Zyl (and Peter McMurray who stood in for Mr van Zyl on some occasions).
- (3) On the surface, the focus of the study was Magalies Water. However, the Chief Executive, Nic Fenner, stood steadfastly by the view that water sector institutions should not be examined in isolation. Mr Fenner and his Board have supported the study throughout Phase 1, and the CEO and his colleagues have committed many hours to site visits, meetings, workshops and report review. In addition, MW has hosted a number of study meetings. Without this investment by MW, the study would not have been possible.

- (4) There are more stakeholders in the Magalies Expansion initiative than can be listed in this short acknowledgement. The Study Team interacted with many of these, and was pleased with the level of involvement and commitment. The various workshops drew representation from Provincial departments, District Councils, transitional local authorities, Local Water Committees and local RDP structures. Since the Study area is large, many of the stakeholders demonstrated their interest by travelling long distances to meetings. The Team extends thanks to all participant stakeholders.

CHAPTER 2 STUDY AREA

TABLE OF CONTENTS

2.1	Natural Conditions	2-1
	2.1.1 Study Area and ESA of MW	2-1
	2.1.2 Topography	2-1
	2.1.3 Geology	2-2
	2.1.4 Climate	2-4
	2.1.5 Hydrology	2-4
	2.1.6 Hydrogeology	2-5
	2.1.7 Water Quality	2-7
	2.1.8 Environment	2-9
2.2	Socio-Economic Conditions	2-11
	2.2.1 Political and Administrative Environment	2-11
	2.2.2 Demography	2-12
	2.2.3 Regional and Urban Planning	2-14
2.3	Inventory of Existing Infrastructure and that Subject to Planning	2-15
	2.3.1 Abstraction, Purification and Wastewater Treatment	2-15
	2.3.2 Distribution and Internal Infrastructure	2-18
2.4	Institutional Environment of the Water Sector	2-19
	2.4.1 Overall Institutional Arrangement	2-19
	2.4.2 First Tier - Community Water Supply and Sanitation	2-20
	2.4.3 Second Tier - Water Boards	2-20
	2.4.4 Third Tier - Local Authorities	2-21
	2.4.5 Merger Process	2-22
2.5.	Water Tariff and Cost Recovery	2-22
	2.5.1 Magalies Water	2-22
	2.5.2 NWWA	2-23
	2.5.3 Others	2-23
	Table 2-1 : Distribution of the Major Geological Formations	2-26
	Table 2-2 : Overview of the Third Tier	2-27
	Table 2-3 : Average Number of People per Dwelling	2-27
	Table 2-4 : Water Tariffs in Former NWWA Areas	2-28
	Table 2-5 : Year to Date Water Tariff Collection in Former NWWA Areas	2-28
	Table 2-6 : Water Tariff Rates in Other Former NWWA Areas	2-28
	Figure 2-1 : ESA of Magalies Water	2-29

CHAPTER 2 STUDY AREA

2.1 Natural Conditions

2.1.1 Study Area and ESA of MW

The JICA Study Area is shown on the Location Map and covers an area of approximately 28,000 km². It comprises parts of four Provinces namely North-West, Gauteng, Mpumalanga and Northern Province.

The JICA Study Area differs from the existing proclaimed supply area of Magalies Water (the ESA as shown in Figure 2-1) and the recommended future supply area of Magalies Water (the Recommended ESA). The area considered for hydrological and hydrogeological purposes which was modelled for the water balance study (the Modelled Area) comprises the relevant catchments of the Crocodile, Olifants and Upper Mogalakwena River which encompass the Study Area and cover an area of 37,500 km².

During the Inventory Survey the current situation in the JICA Study Area was considered in respect of the various peripheral areas that are described in Section 3-2.

2.1.2 Topography

The Study Area is situated between 24°30' S and 26°08' S and 26°28' E and 29°19' E, and extends from the Limpopo River in the north to Gauteng in the south and from the western part of the Limpopo River to the confluence of the Olifants and Elands rivers in the east.

On the western side of the Study Area, the Crocodile River rises on the Witwatersrand, just north of Roodepoort at a height of approximately 1,700 m above sea level. It then flows in a generally north-westerly direction for 280 km, during which it is joined by the Marico River, at just below 900 m above sea level. After the confluence the river becomes the Limpopo River which forms the border of South Africa with Zimbabwe and Botswana.

The watershed in the south, between the Vaal River catchment and the Crocodile River catchment, is formed by the Witwatersrand with the Magalies Mountains situated just to the north. The average slope of the area decreases from south to north.

The Crocodile River flows through the Witfonteinrant and the Vlieëpoort Mountains, which run in an east-westerly direction, in the region of Thabazimbi. The Hoek mountains form the watershed in the north-east between the Crocodile River and the Mogol River. The well known Pilanesberg is in the west of this catchment.

Towards the east, the Waterberg mountains, which are about 1,800 m above sea level, are located between the Crocodile and Mogalakwena Rivers. The Mogalakwena River rises as the Nyl River, just north of Nylstroom, at an altitude of between 1,000 and 1,500 m above sea level. It then flows in an easterly direction through the flat, poorly drained Nylvlei wetland, at approximately 1,100 m above sea level, after which it flows through a wetland. About 45 km

north west of Potgietersrus, the Mogalakwena River is joined by one of its main tributaries, the Sterk River, and as it flows northwards it is fed by numerous small tributaries, until it finally flows into the Limpopo River at approximately 600 m above sea level.

The Olifants River Basin is situated south of the Nyl River. Within the Olifants River Basin, both the Wilge and Olifants Rivers rise at a height of between 1,200 m and 1,800 m above sea level. To the east, the Wilge River rises near Devon on the Highveld and then flows in a northerly direction until its confluence with the Olifants River, upstream of Loskop Dam. The major tributaries of the Wilge River are the Bronkhorstspuit, Saalboomspruit, and Grootspuit.

The Olifants River rises to the east of the Wilge River, at an altitude of between 1,200 m and 1,800 m above mean sea level. The Olifants River is joined by the Trichardtspruit, Steenkoolspruit and the Rietspruit, before its confluence with the Klein-Olifants River of which the Keeromspruit and the Rietkuilspruit are the major tributaries. After the confluence of the Olifants River with the Klein-Olifants River, it is joined by the Klipspruit and the Wilge River respectively.

To the north-east, the Olifants-Loskop area is encountered into which the Selons, Bloed and Moses rivers flow. This catchment includes the Springbok Flats area (900 m to 1,200 m above sea level), in the north and the undulating Highveld (1,200 m to 1,800 m above sea level) in the south.

The Elands River rises near Kaztan and is situated to the south-west of the Olifants-Loskop area. The Elands River flows in a northerly direction through hilly country for about 60 km, until it reaches the Rust de Winter Dam where it turns in a westerly direction to its confluence with the Olifants River, just to the south of the Springbok Flats.

2.1.3 Geology

(1) Lithology

The lithologies represented in the Study Area comprise a wide variety of sedimentary, igneous and metamorphic rock types. These span a geological history of some 3,500 million years, the oldest being represented by unnamed gneiss and migmatites formed towards the end of the Swazian Erathem and the youngest by Quaternary alluvium, sand and calcrete formed less than 18 million years ago. Other chronological periods of significance are recognised as the following:

- (a) Between approximately 2,300 and 2,100 million years ago, during the Vaalian Erathem, when the Chuniespoort, Pretoria and Rooiberg Group rocks as well as the Bushveld Complex were formed;
- (b) Around 1,300 million years ago, during the Mokolian Erathem, when the alkaline intrusive Complexes such as Pilanesberg were formed; and
- (c) Between 345 and 190 million years ago, during the late Palaeozoic and early

Mesozoic Eriathems, when the Eccca Group shales, the Clarens and Irrigasie Formation sediments and the Letaba Formation basalts were formed.

A broad subdivision of the major geological formations is presented in Table 2-1 together with a brief description of the rock types relevant to each and statistics pertaining to their surface extent. Note that the order of their listing from top to bottom mirrors their chronostratigraphic relationship to one another from youngest to oldest.

(2) Structural Geology

The structural geology of the Study Area is characterised by numerous large scale features such as the regionally extensive Bushveld Complex and the smaller ring-like Pilanesberg Complex, an alkaline intrusive. More specific to the groundwater regime, however, are smaller structural features such as linear fault zones and dyke intrusions.

Subsequent to the solidification of rocks emplaced during the final phase of igneous activity associated with the Bushveld Complex, tensile conditions in the earth's crust led to the development of normal faults in the western part of the Study Area. The strike of these features is mainly north-northwest. The Rustenburg fault represents one such structure. Others are recognised in the vicinity of the Crocodile River between Thabazimbi and Brits. The existence of these regional scale features points to the likely existence of many more similar, but smaller, features. An inspection of the 1:250,000 and 1:50,000 scale geological maps confirms this. These structures offer preferred targets for the siting of successful water supply boreholes.

Intrusions of syenite and diabase characterise the dyke structures, which are of pre-Karoo age. The Pilanesberg swarm of north-northwest trending dykes are representative of these intrusions. They are characterised by their generally negative magnetic signatures relative to that of the surrounding country rock (Day, 1980). These structures generally constitute important targets for the siting of successful boreholes in the Study Area.

(3) Economic Geology

The economic geology of the Study Area is characterised by a rich assemblage of minerals. According to Coetzee (1976), these range from precious metals, (the nonferrous platinum-group metals, gold, copper and lead), to basic metallic minerals, (the ferrous minerals chrome, manganese, iron molybdenum and nickel), and non-metallic minerals, (kaolin, dimension stone, wollastonite, limestone, phosphate, glass sand, fire clay and road-building materials). The mineral wealth of the Study Area is exploited by both larger scale mining operations centred on the extraction of the more valuable minerals such as the platinum-group metals, chrome and iron ore and smaller operations such as those producing dimension stone.

2.1.4 Climate

(1) Precipitation and evaporation

The Study Area is located in a semi-arid to arid part of the country where summer rainfall is predominant. The western portion of the Study Area receives rainfall from November to February, and the northern and eastern regions receive rainfall between October and March. The mean annual rainfall in both the eastern and western portions of the Study Area ranges from 500 to 800 mm per annum. Rainfall occurs mostly from November to February. Within the northern region, the mean annual rainfall decreases from the source of the Nyl river (1,060 mm) towards the north. The occurrence of frost increases from west (little frost), to east (May to September). The occurrence of hailstorms follows a similar pattern, with hailstorms being common in the eastern portion of the Study Area. In contrast annual evaporation (A - Pan) decreases from west (2,240 mm) to east (1,700 mm). Summer evaporation exceeds that of winter. Runoff in the area is strongly seasonal and very variable from place to place.

(2) Temperature

Average temperatures range from 8°C to 28°C in the west and between 11°C and 27°C in the east. Temperatures are more extreme in the west, with fluctuations between -11°C and 41°C being encountered.

(3) Wind

In the east of the Study Area the prevailing wind direction is south-east, while in the north the prevailing winds are north-easterly and occasionally south easterly. Average wind speeds are generally low.

2.1.5 Hydrology

The drainage system in South Africa has been subdivided into quaternary sub-catchments, ie four levels of subdivision, for purposes of water resource evaluation. The quaternary sub-catchments covering the Study Area are shown in Figure 5-1 of Supporting Report B: Situational Analysis. From this figure it will be observed that the boundaries of the Study Area do not coincide well with the sub-catchment boundaries.

The Study Area is located in a semi-arid to arid part of the country with predominantly summer rainfall. Runoff is strongly seasonal, and very variable from place to place. The rivers draining the Study Area (Crocodile and Olifants River Systems), are all main tributaries of rivers of common interest to neighbouring states in the north (Botswana, Zimbabwe and Mozambique). Accordingly, international releases form part of the hydrological regime of the Study Area.

Of the total catchment area of 37,500 km² which was considered, 26,200 km² lies within the Crocodile catchment, 1,100 km² within the Mogalakwena and 10,200 km² within the Olifants system. The former two are tributaries of the Limpopo River. The Crocodile catchment comprises the Upper Crocodile, Elands River, Pienaars River and Lower Crocodile River sub-

systems. The Upper Crocodile and Pienaars sub-catchments encompass the northern part of Johannesburg and Greater Pretoria. The catchments of the Olifants River comprise the eastern part of the Study Area and include the Wilge, Moses and Elands rivers.

Water resources development in South Africa is the responsibility of Central Government (DWA). Water resources are controlled in South Africa under the RSA Water Act (No 54 of 1956), which classifies water resources as either private or public. The greatest portion of the available water is public water, and is thus not privately owned. The rights to public water are attached to riparian properties under the Water Act. The Water Act was primarily developed to serve agriculture, although the emphasis has now changed. A redrafting of RSA water law is currently in progress.

Due to the semi-arid nature of the Study Area, storage is necessary in order to regulate the variable river runoff, and so to meet the increasing water demands of all sectors of the economy of the Study Area.

In order to ensure the equitable allocation of public water to consumers, and to regulate abstraction more strictly than provided for by other sections of the Water Act, the Act provides for the creation of Government Water Control Areas (fourteen within the Study Area), Government Subterranean Water Control Areas (two within the Study Area), and Government Water Schemes (containing most large dams). Irrigation Boards (nineteen within the Study Area) are also provided for by the Act, in order to allow local land owners to operate and maintain communal water works, and to regulate the distribution of water (including uncontrolled run-of-river) for irrigation. Irrigation allocations from Government Water Schemes and from Irrigation Board Schemes are recorded in schedules (with quotas between 5,300 and 10,000 m³/ha per annum, depending on the crop type, irrigation technology etc), but are subject to periodic shortages as the demand frequently exceeds the supply.

The naturalised mean annual runoff available to the dams within the Study Area is around 883 mcm/a. Large storage dams with a total volume of 840 mcm have already been developed within the Study Area.

The firm yield from dams within the Study Area is strongly influenced by the supply assurance criteria that are adopted for the different demand sectors. Where options are considered for the reallocation of supplies from major dams between user sectors, the effect of such reallocation on supply assurance must be taken into account. The firm yield of the major dams from naturalised runoff has been put at approximately 330 mcm/a, for levels of reliability appropriate to the present demand pattern. Several of the large dams within the Study Area (Roodekoppies, Vaalkop and Klipvoor) are operated as a system. The yield of each of the dams in this system is dependant on the actual operation of the entire system, as well as on the way in which Rietvlei, Hartbeespoort and Roodeplaat Dams are operated.

2.1.6 Hydrogeology

Groundwater is widely used within the Study Area, particularly in northern rural areas which are currently not served by surface water schemes. The following is a summary of the detailed information in Supporting Report B:

(1) Borehole statistics

Statistics regarding groundwater were collected by accessing the various databases held by DWAF and various consultants for portions of the Study Area. A hydrogeological database was then compiled for purposes of this Study. For a significant percentage of boreholes, information relating to status and current borehole equipment does not exist.

(2) Hydrological regimes

The characterization of groundwater occurrence in the Study Area recognizes both primary and secondary aquifers representing four hydrological regimes, viz: i) an intergranular regime, ii) a weathered and fractured regime, iii) a fractured regime, and iv) a karst regime.

(3) Groundwater utilization

Groundwater resources in the Study Area are utilized for potable water supply to rural communities, for stock watering purposes, for irrigated agriculture and, in a few instances, for urban supply. Due to limited statistics on borehole operation it is difficult to quantify the volume of groundwater abstracted for potable water supply to rural communities and for stock watering purposes. In relation to irrigated agriculture, partly reliable figures are only available for those areas where the activity and resource form a geographic concentration.

(4) Groundwater quality

Based on electrical conductivity (or TDS), the ambient quality of groundwater in the Study Area might be classed as good. This is based on 46% of the chemical analyses exhibiting electrical conductivity values of less than 70mS/m, which meets the recommendations of SABS 241 (drinking water standard). Excessive concentrations of nitrates and fluorides are, however, present in many areas and bacteriological contamination due to poor sanitation is widespread.

(5) Groundwater accessibility

Groundwater accessibility is more favourable in the eastern portion of the Study Area than in the western portion, and the greater part of the Study Area has a borehole accessibility in the range 40% to 60%.

(6) Groundwater exploitability

A small area to the south of Warmbaths represents the only part of the Study Area where the groundwater exploitability is better than 50%. Most portions of the Study Area have groundwater exploitabilities of between 20% and 30%.

2.1.7 Water Quality

(1) Surface Water Quality

South Africa is a water deficient country therefore the Water Act (1956) requires that effluent be treated and returned to the water course from which it was abstracted. As a result of this practise, salination, pollution and eutrophication occur and the quality of many water sources in the Study Area is declining. The urban areas of Pretoria, northern Johannesburg and the surrounding communities are located in the upper catchments of the Crocodile and Olifants river systems which flow through the Study Area and as a result many of the sewage treatment works serving these communities are located just outside or just within the southern fringe of the Study Area and discharge into watercourses which in turn feed most of the large impounding reservoirs therein.

In the peri-urban and rural parts of the Study Area, particularly in the north and east, poor sanitation comprising the use of pit latrines or other low-flow sanitation options is widespread. This has a particularly adverse effect on groundwater quality which is discussed in more detail elsewhere.

Effluent standards were introduced in South Africa for the first time in the Water Act, 1956. The treatment of any water resulting from industrial use is obligatory and three types of standards are currently applicable:

- (a) General Standard, (applied universally);
- (b) Special Standard, (for specified streams); and
- (c) Special Standard for Phosphorous, (for sensitive catchments).

The requirements apply only to physical and chemical (but not biological), parameters. The pollution prevention policy has been formulated primarily on the polluter pays principle.

In addition to these standards, DWAF has established water quality guidelines for various uses based on the Receiving Water Quality Objective (RWQO) approach to ensure that water remains fit for use by downstream users. This is done by imposing stricter standards than the general requirements where necessary due to local conditions. Catchments studies for the Olifants and Crocodile catchments include guidelines for critical parameters.

In order to make an assessment of the conditions prevailing in the rivers and raw water storage reservoirs (dams) within the Study Area, use was made of information from the water quality database of DWAF. Representative points were selected from all of the survey stations within the Study Area. The locations selected included all impounding reservoirs, intermediate stations, when available, located on the watercourses between such reservoirs, and such additional points as were necessary to provide an overall picture

of water quality in the major rivers. Recent data was analysed statistically and the results are summarized in Supporting Report B and the detailed data obtained from DWAF is included in the Databook.

An assessment of the prevailing water quality suggests that the raw water can in all cases be treated using the conventional treatment processes that are widely used at the significant water treatment works within the Study Area. That is flocculation / sedimentation / dissolved air flotation (DAF) / rapid gravity filtration.

Raw water for treatment at Kudube WTW is currently abstracted immediately downstream of Leeukraal Dam on the Apies River which is the most heavily polluted water source in the Study Area. Leukraal Dam has a capacity of 0.55 mcm and is located approximately 19km downstream of Rooiwal Sewage Treatment Works, one of the largest in the Study Area, which treats wastewater from western Pretoria, Akasia and Rosslyn and has a capacity of 205 Mld. Return flows therefore comprise most of the inflow to the reservoir.

As mains sewerage systems are extended in years to come, the proportion of return flows and hence the loading of contaminants is likely to increase further. The reservoir is highly eutrophied with an average total phosphorous concentration of 1.36mg/l. Average TDS levels are around 540 mg/l and conductivity is around 80 mS/m. The nitrite/nitrate levels are relatively high with an average level of 3.1 mg/l as N and, as the source of nitrogen is mostly sewage effluent, the concentration is likely to rise further in the future. The reservoir has a relatively low storage volume and as such provides little buffering capacity in the event of high concentration effluents being dumped into the Apies River upstream.

Water quality analysis carried out for the Study indicated a faecal coliform level in Temba WTW raw water from Leeukraal Dam of 2,080 per 100 ml which confirms heavy contamination by sewage. This necessitates pre-chlorination which, given the high degree of eutrophication, gives rise to chlorine byproducts which have potentially adverse health effects. During July when algal growth was relatively low, a THM level of 114 µg/l was detected in treated water from Kudube WTW.

(2) Water Quality Standards

The South African Water Quality Guidelines (1993) published by the DWAF govern water quality and will comprise eight volumes of which Volume 1 is for domestic use. Only volumes 1 to 4 have been published to date; the first five will relate to inland surface water and groundwater. A revision of Volume 1 is due to be issued shortly. It must be noted that compliance with these Guidelines is not mandatory and cannot be enforced nor does non-compliance warrant punitive measures. The 1993 edition of Volume 1: Domestic Use, was based on South African Standards 241-1984 "Specification for Water for Domestic Supplies" where applicable, and reference was also made to standards used in other countries. SABS 241 specifies a "Recommended Maximum Limit" and a "Maximum Allowable Limit" for various physical, chemical and

bacteriological parameters.

In Supporting Report B, the guideline levels in SABS 241 and Volume 1, the Water Quality Guidelines and the Department of National Health and Population Development criteria are shown for comparison purposes with WHO, Japanese and EU water quality standards.

2.1.8 Environment

As part of the Study, an initial Relevant Environmental Impact Prognosis (ROIP 1 - the Afrikaans acronym), was prepared. The ROIP was conducted at a scoping level and did not include site investigation. Phase 2 of the Study will include for the preparation of a ROIP 2 and will involve a site investigation and input from specialists as necessary. The environmental impact is also discussed in Section 5.7. The situation in the Study Area can be summarised as follows:

(1) Environmental Sensitivity

It is necessary to consider the sensitivity of the natural environment to water resource development, because of the interrelationships within the river ecosystem. Human activities can have major impacts on the ecological system, which in turn can result in changes in the quality and quantity of water available for water users.

There are a number of proclaimed nature reserves and other areas of special conservation importance in the Study Area.

The Magaliesberg Mountain range, from Pretoria to Rustenburg, has been declared an area of special conservation importance in terms of the Environmental Conservation Act of 1989, Act 73 of 1989.

(2) Threatened Plant Species

Threatened plant species are found on the eastern side of the Study Area, where there are usually less than 10 threatened species present, except within the Wilge River catchment, where 20 threatened plant species are found. The number of vulnerable plant species increases in the wetter areas of the confluence of the Wilge River with the Bronkhorstspruit and Olifants River.

(3) Alien Vegetation and Bush Encroachment

The presence of alien plant species has a number of serious ecological implications for both indigenous vegetation and the production potential of the land. The banks of rivers are the habitats which are most affected by the presence of alien plant species. The most significant of these alien plant species are; *Syringa*, the grey poplar (*Populus canescens*) and the giant reed (*Arundo donax*).

In places where the *Syringa* is present, it becomes the dominant canopy tree and is a

serious threat to indigenous riverine vegetation and the associated fauna. The grey poplar occurs in dense thickets, which suppress indigenous vegetation, as well as blocking and narrowing river courses.

The giant reed, invades water courses and tends to displace the indigenous riparian vegetation.

(4) **Wildlife**

- (a) **Fish life** - In the northern and central portions of the Study Area 26 species of fish (24 of which are indigenous) occur. Further eastwards within the Olifants River Basin 61 fish species are encountered. The Olifants Basin is subdivided into the Wilge River (13 species, of which 4 species are sensitive and 1 is of special conservation concern), the Elands River (29 species, 6 of which are sensitive and of conservation concern), the Bloed Olifants and Moses Rivers (44 species, 9 of which are sensitive and 1 of conservation concern). Further eastwards, within the Upper Olifants River, 17 species are encountered, 5 of which are sensitive and one of which is classified as threatened. No data is available for the western part of the Study Area.
- (b) **Reptiles and Amphibians** - In the northern and central regions, a variety of rare and vulnerable reptile and amphibian species are found within the Mosdene area. Further eastwards in the Olifants River Basin, there are no endangered species within the Wilge and Elands River regions. Within both the Upper Olifants River and the Olifants- Loskop Reach, fewer than 5 species have been classified as endangered, rare or vulnerable. There is no data available for the western region of the Study Area.
- (c) **Mammals** - The northern and central regions have a variety of rare and vulnerable mammal species. (eg Cape hare, bushbabies and leopard). Within the Olifants River Basin a variety of mammals are encountered (eg 63 in the Elands River region, 14 of which are red data species). Certain of the species have aquatic habitats, which are affected by both increased and decreased river flows. Again there is no available data for the western region.
- (d) **Birds** - In the northern and central regions over 300 bird species are encountered (25 of which are red data species). In the Olifants River catchment the number of species varies greatly between regions. Around 350 species are found around Settlers, and 300 species at each of the Loskop Dam and the Wilge River. The lowest variety is found in the Upper Olifants region (50- 100 species). Generally there are less than 5 red data species present.

(5) **Environmental Laws**

Many organizations are actively involved in, or have responsibilities for the planning, management, local administration and data collection of natural resources within the Study Area. The main laws governing these activities are the following:

- (a) **Environmental Conservation Act (Act 73 of 1989)**

- (b) Mountain Catchment Areas Act (Act 63 of 1970)
- (c) Conservation of Agricultural Resources Act (Act 43 of 1983)
- (d) Weeds Act (Act 42 of 1937)
- (e) Water Act (Act 54 of 1956)

(6) Environmental Management

Environmental management for the Study Area is undertaken on a provincial basis. The following institutions are involved in the Study Area:

- (a) Department of Nature Conservation, Gauteng
- (b) Department of Environmental Conservation, North West Province
- (c) Department of Environmental Management, Mpumalanga

2.2 Socio-Economic Conditions

2.2.1 Political and Administrative Environment

The structure of the political/administrative environment in South Africa is usually described as having three tiers or levels of government. This is a useful categorisation and has therefore been adopted by the Study and the different tiers are referred to extensively throughout the study documentation.

(1) First Tier

Central Government forms the First Tier of the political and administrative environment and is the tier responsible for:

- (a) overall policy and the enactment of legislation to give effect to this policy; and
- (b) allocation of resources in particular funding on a national basis according to priorities.

In the case of the Study the main First Tier organisation of relevance is the Department of Water Affairs and Forestry which initiated the Study and is responsible through the Project Steering Committee for its implementation. DWAF operates at two levels:

- (a) A head office operation based in Pretoria which is involved in policy formulation and water resources management on a national basis.
- (b) Regional offices concerned with implementation of policy at provincial level and

for aspects of water supply operations which are not in the hands of either water boards or local authorities. The Study falls primarily within the areas of the regional offices in North West Province (located in Mmabatho) and Mpumalanga (located in Kwanhalanga).

(2) Second Tier

Provincial level organisations make up the Second Tier with provincial government itself being the main institution at this level. For the purposes of the Study, water boards are the main Second Tier institutions and these are discussed more fully in Section 2.4 dealing with the institutional environment of the water sector. The main functions of Provincial government which are of relevance are:

- (a) development planning on a Province wide basis; and
- (b) budgeting and disbursement of funds from the national budget which have been allocated to the Province.

(3) Third Tier

The Third Tier represents local government and is the level at which there is direct interaction with the constituencies and communities served by government. Water supply to communities is the responsibility of the Third Tier. Because of the history of transition to democracy in South Africa there are many formal and informal players at this level. The informal organisations have played an important part in the Third Tier role and much of the capacity at this level still resides with these organisations.

Table 2-2 provides an overview of the many players at the Third Tier level and therefore indicates the complexity of this tier.

2.2.2 Demography

For the purposes of planning, the Study has considered three main aspects of demography: population, household size and income-expenditure. These are described in Chapter 3 of Supporting Report B and data for these areas is included in Part B of the Data Book. A brief overview is as follows:

(1) Population

Since 1990 South Africa has seen unprecedented demographic shifts in the population arising from migration away from rural areas and rapid migration into the urban centres and surrounding peri-urban areas. The Study Area, located immediately adjacent to the PWV area (which is the economic heartland of the country), has been directly impacted by these changes. Some studies indicate that population growth rates in recent years have been as high as 26% per annum in some peri-urban settlements.

In the Urban Development Strategy and the Rural Development Strategy published in 1995 it was forecast that 75% of the national population will be urbanised by the year 2020 (compared to the present level of 38%).

In the Study Area it is envisaged that whilst movement of the rural population from outside the area to Soshanguve, Wonderboom, Brits, Moretele 1 and Odi 1 will continue, less significant numbers of the rural population within the area will move out to the PWV and other urban areas. The overall growth rate of the population in the Study Area will therefore remain slightly higher than the national natural growth rate which is 2.3%.

(2) Household Size

Household size has a direct bearing on the study as it affects both the level of consumption of water and the ability of households to pay for services. No single source of data provides statistics on the number of persons per dwelling for the whole Study Area. However a study done by Setplan, "The Southern Odi-Moretele Development Appraisal" which is summarised in Table 2-3, can reasonably be assumed to be representative of the Study Area.

In general it is noted that households in formal urban areas have the lowest household sizes and that these are white and Asian households of size 3.2 to 4.0 persons and 3.5 to 5.0 persons respectively. By contrast rural and peri-urban villages have the highest household sizes 6.0 to 7.8 persons and these are largely black households.

(3) Income and expenditure

Detail of the per capita income distribution by race and gender per magisterial district is included in Supporting Report B and the Data Book. This also shows the split between urban and non-urban.

It is noted that there is a high disparity of incomes in the Study Area and that, as with household size, averages are of little use. The income distribution is characterised by:

- (a) a high proportion of predominantly white population in the higher income categories, particularly in the urban areas, e.g. Wonderboom;
- (b) the subsistence rural population (predominantly black), with nobody in the higher income categories, e.g. Mankwe;
- (c) areas with a high proportion of commuters having a high proportion in the middle income categories, e.g. Moutse; and
- (d) a relatively high income level in the formal townships, e.g. Soshanguve.

2.2.3 Regional and Urban Planning

In 1995 the Development Facilitation Act was passed which will have a major impact on all aspects of planning and development.

(1) Objectives

The major objectives of the DFA as it will impact on the local scenario, can be summarised as follows to:

- (a) Speed up implementation of the RDP;
- (b) Set principles governing land development;
- (c) Provide for the establishment of Provincial Development Tribunals;
- (d) Facilitate the formulation and implementation of land development objectives;
- (e) Provide uniform procedures for land development; and
- (f) Provide Security of Tenure.

(2) Implications

The implication of this legislation will be significant as it removes much of the uncertainty around regional and urban planning. In the past there was a variety of legislation in this area leading to confusion and conflict. Legislation previously applicable included:

- (a) Provision of Certain Land for Settlement Act, 1993 (Act 126 of 1993);
- (b) Less Formal Township Establishment Act, 1991 (Act 113 of 1991);
- (c) Town Planning and Townships Ordinance of Transvaal, 1986 (Ordinance 15 of 1986);
- (d) Communal Property Associations Act, 1996 (Act 28 of 1996); and
- (e) Upgrading of Land tenure Act, 1991 (Act 112 of 1991).

Unfortunately the regulations required for the proper application of the Act have not yet been promulgated.

(3) Importance

The White Paper sees development planning as integrally tied in with the supply of water. The following principles of White Paper are particularly relevant:

- (a) Development should be demand driven and community based.
- (b) Equitable regional allocation of development resources.
- (c) Integrated development and environmental integrity.

The Development Facilitation Act will provide the framework for achieving these principles.

2.3 Inventory of Existing Infrastructure and that Subject to Planning

2.3.1 Abstraction, Purification and Wastewater Treatment

(1) General

The objective of the inventory of existing and planned infrastructure was to establish both records and an understanding of the infrastructure and of the planning status quo within the Study Area, so as to serve as a basis for the future preliminary planning of water supply systems, and thus as a basis for the master plan of the Study Area. The location and capacities of existing bulk infrastructure as well as those of fixed planning are shown on the preliminary 1:250 000 infrastructure drawing included in a folder at the back of this report. Information in respect of components, status, operation and maintenance was collected separately for each community. The various RDP Programmes of DWAF have resulted in substantial new ongoing projects being undertaken. RDP projects are concentrating on primary water supply at this stage in order to achieve water for all by the year 2002.

Sanitation projects are still enjoying a lower profile, and can be expected to increase in number in future, once the primary water supply backlog has been largely addressed.

(2) Western Region

The western region includes the western portions of the Brits magisterial district, large portions of the Thabazimbi, Koster and Swaruggens magisterial districts, and the entire Mankwe, Bafokeng, Odi II and Rustenburg districts.

Development within this area is largely concentrated around the Rustenburg to Brits axis, the Rustenburg to Thabazimbi axis, the southern Pilanesberg (Mogwase and Sun City) and the northern Pilanesberg (Saulspoort villages). The entire western region falls within the Crocodile River Basin, although substantial quantities of primary water (maximum capacity 140 Mld) are supplied to the Rustenburg district by Rand Water from the Vaal River system, via Randfontein and Barnardsvlei. Besides imported water, water for

primary purposes is obtained largely from the Vaalkop Dam on the Elands River, which in turn is augmented from the Crocodile River system (Hartbeespoort and Roodekopjes Dams) via a transfer channel between Roodekopjes and Vaalkop. Primary water is also obtained from the Hex River for Rustenburg and its environs (Bospoort Dam), from the Koster River for Koster and its environs, and for Swartruggens from the Upper Elands River. Thabazimbi obtains a substantial portion of its primary water from underground sources. Vaalkop WTW has a current capacity of 120 Mld and is owned and operated by Magalies Water. Extensions are planned in order to increase the capacity of this plant to 180 Mld. Bospoort WTW has a capacity of 13.7 Mld (greater than the firm yield of the Bospoort Dam), and is jointly owned and operated by the Rustenburg TLC and by Rustenburg Platinum Mines.

Sewage treatment plants are mainly limited to the urban and peri-urban areas, with a few smaller schemes within the rural areas. The Rustenburg Works is by far the largest, and has a capacity of 22.5 Mld. Effluent is largely used for irrigation. A second plant operated by the Rustenburg TLC serves the developments of Boitekong and Meriting in a 8.0 Mld plant. This plant is new and therefore has substantial reserve capacity. Sun City is served by a 10 Mld privately owned plant, Mogwase/Boridello by a 4.0 Mld plant, the George Stegman Hospital (Saulspoort - northern Pilanesberg) by a 0.2 Mld pond system, and the Bafokeng Civic Centre at Mogono by a 0.6 Mld bio-disc package plant.

(3) Central Region

The central region includes the eastern portion of the Brits magisterial district, as well as the Odi I, Moretele I and Wonderboom districts, and the portion of the Warmbaths district that falls within the Study Area. The urban and peri-urban development axis, Ga-Rankuwa- Mabopane-Winterveld-Kudube, falls into the central region. All raw water sources for the central region form part of the Crocodile River catchment, with potable water being supplied into the Study Area from the Vaal River System by Rand Water. Raw water is abstracted for primary purposes from the Roodeplaat Dam (Pienaars River), the Leeukraal Dam (Apies River) and the Hartbeespoort Dam (Crocodile River). Potential exists for future abstraction from the Klipvoor Dam downstream of the confluence of the Pienaars and Apies Rivers, but before these join the Crocodile River (downstream of the Vaalkop Dam). At present water is purified by Magalies Water at Wallmannsthal WTW (14 Mld from the Roodeplaat Dam), Temba WTW (18 Mld, also from the Roodeplaat Dam), Kudube WTW (20 Mld, from the Leeukraal Dam - further extensions to 30 Mld are planned), and at two small local plants at Bosplaas and Makapaanstad (soon to be redundant). Brits TLC purifies Hartbeespoort Dam water within its own area of jurisdiction (60 Mld). Nylstroom TLC has a plant with a capacity of 4.0 Mld (Nyl River), and groundwater sources of an equivalent capacity. Warmbaths TLC operates a plant of 1.2 Mld capacity (local river). The plant operated by Naboomspruit TLC has a capacity of 1.7 Mld (Frikkie Geysers Dam) and alternatives for upgrading are being investigated. Generally the plants are in good to excellent condition and recent upgrades have enhanced both capacity and operational efficiency. A large volume of potable water (capacity recently increased from 140 Mld to 300 Mld) is supplied into the central region by Rand Water, for consumption in the urban and peri-urban areas of Rosslyn, Ga-Rankuwa, Soshanguve, Mabopane, Winterveld and the surrounding villages.

Several major wastewater treatment works are encountered within the central region, this being the region with the greatest population concentration, the most development and the highest primary water demand. The regional facilities within the Study Area operated by Pretoria City Council are the Baviaanspoort Works, (34 Mld from eastern Pretoria / Mamelodi discharged into the Pienaars River), the Zeekoeigat Works, (30Mld from northern Pretoria discharged into the Roodeplaat Dam), and the Rooival Works, (205 Mld from western Pretoria, Akasia and Rosslyn discharged into the Apies River upstream of the Leeukraal Dam). Most of the sewage treated in these works is generated outside the Study Area (from Vaal River water), but the return flows are of great importance as a water resource to the Study Area, meeting future predicted water demands from the Roodeplaat, Leeukraal and Klipvoor Dams, especially beyond the year 2005. Sewage from northern and eastern Soshanguve drains to the Soshanguve Works (5.7 Mld discharged by the Northern Pretoria Municipal substructure into the Soutpanspruit and currently being investigated for upgrading), while western Soshanguve, Mabopane, Ga-Rankuwa and Winterveld drain to the Klipgat Works (55 Mld discharged by Rand Water into the Tholwane River). A new sewerage scheme is being planned at present for the Klip-Kruisfontein development to the north of Rosslyn. Babelegi sewage is treated in Babelegi (8.2 Mld discharged into the Apies river), while sewage from Kudube, Temba and Hammanskraal is treated in the Kudube Works (4.5 Mld discharged by Magalies Water into the Apies River downstream of the Leeukraal Dam), and from the Makapaanstad College by Magalies Water in a local bio-disc plant. Sewage from Brits drains to the Brits Works (8.5 Mld discharged by Brits TLC into the Crocodile River), Mothutlung to its own pond system (1.85 Mld discharged by Brits TLC into the Rose Stream, being a tributary to the Crocodile River), and Lethlabile to its own works (2.5 Mld discharged by Brits also into the Rose Stream). Extensions to both the latter plants are being investigated by Brits. In the north, Nylstroom and Phagameng are served by the Nylstroom works (3.4 Mld discharged to the Klein Nyl River), Warmbaths by its own pond system (3.2 Mld) and Naboomspruit by a small municipal plant (1.2 Mld).

(4) Eastern Region

The eastern region includes the Cullinan, Bronkhorstspuit, Kwandebele and Moretele II districts, and falls entirely within the Olifants River Basin. Raw water is abstracted from the Bronkhorstspuit and Premier Mine Dams, (to be augmented from the Grootdraai Dam under an OECF project (Vaal River System) in the short to medium term future), from the Mkombo (Renosterkop) Dam on the Elands River, and from the Loskop Dam, (by way of a transfer channel to the Weltevreden Works). Abstraction from the Rust de Winter Dam can also be considered in future planning, especially for supply to the Moretele II district which is currently entirely dependant on inadequate groundwater supplies. At present water is purified at Bronkhorstspuit WTW (41 Mld from the Bronkhorstspuit Dam), Cullinan WTW (16 Mld from the Premier Mine Dam) and Weltevreden WTW (60 Mld from the Mkombo Dam). Recent upgrades have enhanced both capacity and operational efficiency. Magalies Water operates the Cullinan plant, DWAF the plant at Weltevreden and Bronkhorstspuit TLC the plant at Bronkhorstspuit.

Wastewater treatment works within the eastern region are mostly small local works, and there are no major regional facilities. DWAF operates wastewater plants at Siyabuswa (4

Mld), Tweefontein (0.4 Mld), Kwamhlanga (1.0 Mld), Ekandustria (4.1 Mld), Ekangala (2.5 Mld) and minor plants at Vaalbank and Mmamethlake Hospital. Operating conditions vary from overloaded to trouble free, depending on the specific plant. Bronkhorstspuit TLC operates its own municipal plant (80 Mld), Cullinan TLC the plants at Rayton (0.5 Mld) and Refilwe, and Premier Mine the Cullinan municipal works (1.6 Mld). Upgrading work is required on all the latter plants, and is currently in planning.

2.3.2 Distribution and Internal Infrastructure

- (1) General - Distribution pipelines and the location of specific towns, villages and other demand centres are shown on the map attached to this report.
- (2) Western Region - Magalies Water operates the Vaalkop Northern Supply Scheme, supplying water from Vaalkop WTW to the urban areas and mines of Northam, Thabazimbi and Dwaalboom via La Patrie, to the Saulspoort and Mabeskraal villages also from La Patrie, to Mogwase and Sun City from La Patrie, and to Doornhoek, Ledig and Sun City directly from Vaalkop. Magalies Water also operates a Southern Supply Scheme from Vaalkop WTW, with a current capacity just under 20 Mld to Kortbegrip.

This scheme is at present being extended as an RDP project to the rural areas of Bethanie, Berseba and Modikwe in the Odi II district. A major augmentation scheme to Rustenburg and its environs (85 Mld) is also being planned at present by Magalies Water in co-operation with Rand Water. A local scheme exists from the Bospoort Dam supplying primary water to Rustenburg and the RPM mines to the east of Rustenburg. Water supplied by Rand Water to the region from Randfontein is introduced to the Study Area at Barnardsvlei. From this point water is distributed eastwards to Western Platinum, the Bapong villages and villages within the Odi II district of the former Bophuthatswana homeland. The Barnardsvlei Western Supply provides water to Karee Mine, to Marikana, to Rustenburg Platinum's Waterval, Frank, Paardekraal and Eastern Platinum Mines, to the Impala Platinum mines on the farm Wildebeesfontein, to Rustenburg TLC and to various smaller consumers along these supply mains. The only major upgrade planned for the Barnardsvlei supply area before 2010 is a dedicated supply to the Bapong villages in the western part of Brits magisterial district. Other growth will be accommodated by reducing the Rustenburg supply, which will in turn be met by the new regional scheme from Vaalkop WTW.

- (3) Central Region - Several separate distribution systems exist for this region. Firstly, the Wallmannsthal area is served by pipelines belonging to Magalies Water, the Eastern Services Council and the Department of Prisons. Moretele I district is served from a major RDP regional scheme being implemented at present by Magalies Water (water from both the Kudube WTW and Temba WTW). This scheme includes supply to the Babelegi industrial complex. A scheme to serve Warmbaths and Nylstroom from Temba WTW was recently commissioned. A connection to this pipeline is possible for the northern Moretele I and Odi I areas, which are thinly populated and have no population growth. Alternative sources for these areas are the Klipvoor Dam, and groundwater. Rand Water pipelines enter the Study Area from Hartbeeshoek Reservoir in the south, and supply Rosslyn, Ga-Rankuwa, Soshanguve, Klip and Kruisfontein (all urban and

peri-urban areas) and Winterveld (a rural area). Most of the Rand Water supply area is reticulated with house connections, except for the Winterveld area, which is being upgraded at present. Both Schoemansville and Cosmos have local supply schemes, while Brits and environs is served by a regional scheme. This scheme serves Losperfontein, Sonop, Oukasie, Damonsville, Mothutlung and Lethlabile. New RDP extensions are being implemented at present to Oskraal and Madidi in the east, and to Maboloka and Jericho in the north.

(4) Eastern Region

An extensive distribution network, fed from both the north-east (Weltevreden WTW) and from the south-west (Bronkhorstspuit WTW), feeds most towns and villages within Kwandebele. The Moretele II district is dependant on groundwater sources, and in certain instances on water tankers, and generally has a low level of service.

2.4 Institutional Environment of the Water Sector

2.4.1 Overall Institutional Arrangement

(1) National water policy

National water policy in South Africa is laid down in the Water Act of 1956 (Act 54 of 1956) which has had 34 amendments since its inception. The Act lays down regulations governing the construction and maintenance of water works and the responsibility for managing different parts of the water network. It defines three types of water management institutions:

(a) State Water and Irrigation Schemes.

(b) Irrigation Boards; and

(c) Water Boards.

State Water and Irrigation Schemes are managed by DWAF and financed from the Central Government's consolidated budget. Irrigation Boards are statutory bodies established by groups of farmers to provide a service in an area in which they all have a common interest. In the case of water boards, the Minister of Water Affairs and Forestry recommends the establishment of a Water Board for a specific area to distribute bulk water for urban, industrial or agricultural use by local, state, and some central government authorities.

(2) Changes to policy

Act 54 of 1956 did not clearly define the functions and responsibilities of the Central and Provincial governments. The new Government of National Unity (GNU) has been mindful of these problems and has taken a number of important steps:

- (a) a new Department of Water Affairs and Forestry (DWAF) was established in July 1994 to replace the old Department of Water Affairs and to assume responsibility for water resources management, water supply, sanitation, and forestry functions and to better meet and manage the water related objectives of the RDP.
- (b) a policy document, the *White Paper on Water Supply and Sanitation Policy* was published in November 1994 to clearly set out the policy for the new department in regard to water supply and sanitation services.

2.4.2 First Tier - Community Water Supply and Sanitation

DWAF has the national responsibility for ensuring that the water supply and sanitation needs of the people and of the economy which sustains them are met effectively. As part of the reform process within DWAF, a new *Chief Directorate of Community Water Supply and Sanitation* was established to promote water supply and sanitation. The responsibilities of the Chief Directorate are to:

- (1) assure effective on-going operation of potable water supply systems for which DWAF is responsible;
- (2) to plan and promote the expansion of services in collaboration with provincial governments;
- (3) to develop organisations at the local and regional level to achieve the goals of the RDP; and
- (4) to monitor and regulate water supply and sanitation activities in accordance with the constitution.

The White Paper on water supply and sanitation is geared towards the establishment of a clear framework to enable Third Tier institutions to play their role in implementing service provision at the local level.

2.4.3 Second Tier - Water Boards

(1) Traditional role

Water Boards will continue to function as autonomous, not-for-profit utilities, but will assume expanded responsibilities:

- (a) they will continue to supply water to organized communities and individual consumers which may also include the provision of sanitation services;
- (b) they will assist in the establishment of statutory LWC's and will provide technical and administrative training to LWC's and local authorities. To ensure that water boards fulfill their new role DWAF has made the board of directors of water boards more representative; changed their supply areas to include former homelands;

redefined their functions to include supplying water to local communities where no authority exist and to include sanitation; and established new water boards where none exist.

(2) Changes to role

A national study on the Scope and Functions of Water Boards was conducted to provide a framework for instituting necessary changes to existing as well as new water boards in areas not serviced by water boards so that they can undertake the duties and responsibilities outlined in the white Paper. The White Paper proposed that water boards increase the scope and extent of their functions to ensure that all South Africans have access to basic water supply and sanitation. To this end their new role is to:

- (a) establish a system of communications with communities within their area and explain the services and capabilities that the water board can offer;
- (b) establish procedures for the establishment of LWCs, including application for funding, technical assistance and training;
- (c) make funds available to LWCs including the provision of technical assistance in the planning of any local water supply and sanitation schemes; and
- (d) monitor the expenditure and application of funds for projects.

2.4.4 Third Tier - Local Authorities

Following the provision of The Local Government Transition Act 209 of 1993, some 700 transitional metropolitan, local, and rural councils have been established throughout South Africa. There are approximately 15 transitional local councils (TLC's) and 25 transitional rural councils (TRC's) in the Study Area whose members include farmers, women and traditional leaders. Their major task is to maintain services, collect revenues and assume the functions of municipalities, but many of the TRC's are small in terms of the number of councillors and lack critical resources. Members of some communities are in no position to pay for services because the rural areas are underdeveloped with few employment opportunities. Most TRC's are therefore totally dependent on proceeds from district councils and on central government grants. District Councils (DC's) were created as a conduit to channel through levies paid by communities in the more affluent areas towards supporting TRC's. Some 5 DC's have since been established in the Study Area.

The November 1995 local elections in North West Province which aimed at electing local government representatives to improve the efficiency and delivery of services at the local level have left many formal and informal community and local government institutions unclear of their roles. Responsibilities for managing different parts of the water supply and sanitation network are still unclear and much still needs to be done to assign responsibilities to appropriate local authorities. The question of institutional development and change needs to be addressed including the adequacy of current institutional arrangements for managing the water supply and sanitation network and the factors underlying the poor performance of the institutions presently

involved in water supply and sanitation.

2.4.5 Merger Process

North West Water Authority and Magalies Water were requested by the Minister in late 1995 to propose a plan for the rationalization of the area of supply and functions of the two boards within the Study Area. The draft proclamation of 12 April 1996 was to serve as the basis for the merger negotiations. For the purpose of the investigation, four task groups were constituted, viz a technical task group, a financial task group, a personnel task group and a task group dealing with areas of jurisdiction. The most important findings of the task groups were as follows:

- (1) Only the operation and maintenance of certain infrastructure was handed over to Magalies Water.
- (2) All movable assets used to execute these responsibilities would also be handed over.
- (3) All personnel connected with the operation and maintenance of the infrastructure within the affected region/district (around 350 in number), should be integrated with Magalies Water. For the first twelve months such staff members were to be seconded to Magalies Water, to allow for the negotiation of individual employment contracts.
- (4) The supply areas of the boards should be altered as set out in the draft proclamation, eventually promulgated on 12 April 1996. The Director General of DWAF should be requested to make the necessary directive empowering Magalies Water to act within these revised areas of jurisdiction.

The hand over plan was accepted by the Minister and implemented as from 1 April 1996. Certain problems and constraints were identified as part of the merger process. These are:

- (1) The merger process absorbs a large portion of management's time.
- (2) Salary discrepancies exist for equivalent posts.
- (3) Different accounting systems are operated by the two boards.
- (4) Certain infrastructure marked for transfer is in a poor condition; and
- (5) NWWA management responsible for the sewage treatment works have been transferred to Rand Water.

2.5. Water Tariff and Cost Recovery

2.5.1 Magalies Water

Prior to 1 April 1996, MW operated and managed four water purification schemes namely Vaalkop, Temba, Cullinan and Wallmannsthal. Although they are geographically dispersed, for the purposes of this analysis it is appropriate to treat them as a single Second Tier entity. Water

tariffs have varied quite significantly between the four schemes (Temba 94/95 - 54.5 c/kl compared to Vaalkop 94/95 - 106 c/kl), and the more profitable schemes (eg. Vaalkop) cross subsidize those that are less financially viable (especially Temba). The financial policy of MW is to operate and finance all the schemes as one business unit. Because MW schemes are largely for the wholesale of bulk water, this reduces the risk of bad debts and the figures available indicate that costs are fully recovered.

2.5.2 NWWA

Prior to 1 April 1996, NWWA acted as agents for DWAF for water and wastewater treatment in former Bophuthatswana areas within the Study Area. The situation regarding water tariffs and cost recovery for the NWWA schemes was as follows:

(1) Mabopane, Ga-Rankuwa and Temba Areas

Temba WTW and Klipgat and Temba wastewater treatment works are the main facilities in the area. Makapanstad WTW and STW, Bosplaas WTW and Marapyane STW are all small package plants in the area serving small communities. Klipgat is the only plant managed from Mabopane, the others are managed from Temba. Water tariffs over the last four years have varied depending upon consumption as shown in Table 2-4.

NWWA employed the electricity company to collect payments on their behalf. Historically, cost recovery was not been good and although there was a big drive at the start of the year to get consumers to pay for services, it remains a problem. Year to date collection figures for the ten months ending January 1996 are presented in Table 2-5.

(2) Other Areas

Tariffs charged to various areas of supply as shown in Table 2-6 were administered by NWWA regional offices who performed their own billing and revenue collection services.

Although the cost to NWWA of producing water fell from R1.37/kl in 1994/95 to R1.09/kl in 1995/96, the total for bad debts increased from R2.1 m to R2.6 m over the same period. Profits also fell sharply from the R23.7 m in 1994/95 to R13.7 m in 1995/96.

2.5.3 Others

(1) Kwandebele Regional Water Supply and Sanitation Scheme

Up until 1994/95, Moutse was the only area being billed for water. As far as could be established for all other areas in Kwandebele, no billing systems existed, therefore no billing was done. The tariffs charged for water that was billed rose from 90c/kl to 113c/kl between 1991 and 1994. There is no sales information available for sanitation services as there is no billing system and no levies are charged. Operational costs for water supply more than doubled during the last five years. This is largely due to the increase in salaries and wages that has occurred. Cost recovery has been less than 10% over the last five years due to the policy of not billing. The managers responsible for the

scheme believe that the current workforce of approximately 686 employees represents over staffing and that levels of efficiency are extremely low. Operational costs for the sanitation schemes are not available by individual treatment plant, but for the region as a whole, they have increased from R1.8 m in 1993 to R2.1 m in 1995. None of these costs are recovered.

(2) Bronkhorstspuit Water and Wastewater Treatment Schemes

The tariffs charged to private consumers have increased from 59c/kl in 1991 to 94c/kl in 1996. A municipal billing system is in operation in both Bronkhorstspuit and Ekandustria. The retail tariffs charged by Ekandustria have increased from 75c/kl to 130c/kl during the same period. Charges for sanitation services are calculated based on the quantity of water consumed by each household. Operational costs of water treatment in Bronkhorstspuit increased from R1.5 m per annum to R3.5 m per annum between 1991 and 1995 while costs for sanitation rose from R0.33 m to R0.63 m over the same period. Operating costs incurred for water distribution in Ekandustria are currently approximately R0.10 m per annum while the cost of operating the sanitation treatment plant is approximately R0.35 m per annum. There is a major cost recovery problem in the Bronkhorstspuit area and the 1995 audit report highlights that 44% of the debtors book is more than 120 days old and is most probably unrecoverable. Many of these debts were inherited from local authorities during the political transition but the culture of non-payment appears to be pervasive amongst both white and black communities. Ekandustria does not have a problem with cost recovery as their customers are largely industrial entities and strict credit control is followed.

(3) Rustenburg TLC (Bospoort WTW, Kloof WTW, Rustenburg STW and Boitekong STW)

Rustenburg TLC administers a two tariff system: one for an annual consumption of up to 750 kl and the other in excess of 750 kl. Tariffs for consumption up to 750 kl increased from 112c/kl in 1991 to 168c/kl in 1995 while the tariff for consumption in excess of 750 kl increased from 116c/kl to 168c/kl over the same period. The data also indicates that Rustenburg TLC has an efficient billing and collection system and costs are fully recovered, particularly from their traditional consumers. In fact, total income increased by 116% from R10.7 m in 1991 to R23.3 m in 1995 while operation and maintenance costs increased by 82% from R9.4 m to R17.2 m in 1994 and 1995 respectively. Rustenburg TLC's excellent financial health will be affected by the integration of the townships resulting in the TLC writing off a substantial amount of bad debts caused by the culture of non-payment. In addition, the possible flat rate which black consumers are expected to pay to the TLC for water supply and sanitation will also result in Rustenburg's more affluent consumers subsidizing the less advantaged ones.

(4) Brits TLC

Water sales increased by 10.6% from R7.7 m in 1994 to R8.5 m in 1995 while total operating costs increased by 11.9% from R2.9 m to R3.3 m over the same period. The data shows a 10.3% decline in water tariffs from 116c/kl in 1994 to 104c/kl in 1995.

Although the schemes operated by Brits TLC are still profitable, a substantial amount of bad debts from the townships is being written off as a result of integration with the formerly urban town councils.

(5) Koster/Swartruggens

Water sales in Koster and Swartruggens increased by 150% and 4.1% respectively while operating costs for Koster declined by 11% over the same period. The data also showed an increase of 20% in water tariffs in Koster. No O&M or tariff data was available for Swartruggens.

Table 2-1 : Distribution of the Major Geological Formations

Major Geological Formation / Rock Type		Extent	
		Area (km ²)	Percentage of Total
1	Quaternary sediments (alluvium, sand calcrete)	903	3
2	Letaba Formation (basalt)	496	2
3	Irrigasie / Clarens Formations (sandstone, siltstone, mudstone)	2,160	8
4	Ecca Group (shale)	1,468	5
5	Dvyka Tillite Formation (tillite, diamictite)	475	2
6	Basic intrusive rocks and alkaline Complexes (foyalite, syenite)	2,939	11
7	Waterberg Group (sandstone)	730	3
8	Lebowa Granite Suite (hornblende and biorite granites)	4,694	17
9	Bushveld Complex (gabbro, norite, anorthosite)	5,200	19
10	Rooiberg Group (porphyritic and amygdaloidal rhyolite)	1,449	5
11	Pretoria Group (quartzite, shale)	6,122	22
12	Chuniespoort Group (dolomite, chert, quartzite)	664	2
13	Unnamed Swazian rocks (gneiss, migmatite)	20	1
Total		27,320	100

Table 2-2 : Overview of the Third Tier

Institution	Role	Potential
District Councils	Needs assessment, sub-regional planning, financing	Greater developmental role, capacity development at community level
Local Councils	Delivery of services	Capacity development at community level, greater degree of scheme and systems financing.
Tribal Authorities	Welfare of tribe in homeland	Component of local government if democratised
RDP Committees	Needs identification and prioritisation	Liaison with local government
Local Water Committees	Needs identification, developing community awareness, basic scheme maintenance	Not as autonomous statutory bodies, but could become components of local government, or agents of cost recovery
NGOs	Broadly developmental, strategic planning, scheme and project support and implementation	Long-term support in the development of capacity at community level, support for the development of effective civic bodies.
Capacity building organisations	Broker work for parent company, basic management and technical training at community level	Extended training role, identify development role of private sector

Table 2-3 : Average Number of People per Dwelling

Communities	Average Number of People per Household	Average Number of People per Dwelling
Proclaimed Towns	5.7	5.7
Central Areas	6.5	6.8
Odi Villages	6.2	7.7
Winterveld	5.8	7.4
Apies East Bank	5.9	5.9
Apies West Bank	5.5	5.6

**Table 2-4 : Water Tarrifs in Former NWWA Areas
(Mabopane, Ga-Rankuwa and Temba)**

Year	Consumption (kl/month)	Tariff (c/kl)
1995/96	0 - 10	100
	10 - 45	165
	>45	225
1993/94	0 - 15	70
	>15	130
1992/93	0 - 18	59
	>18	115

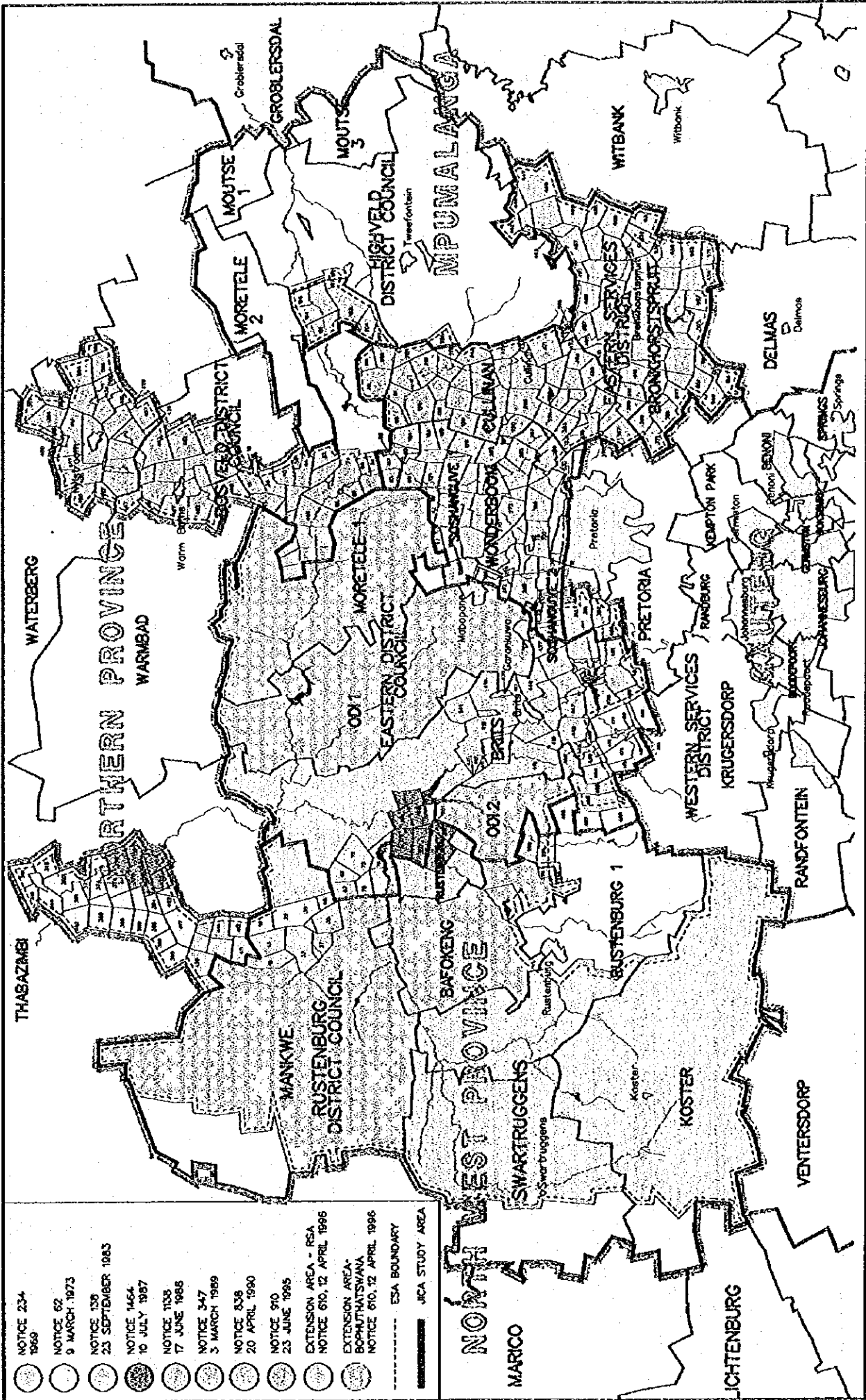
Table 2-5 : Year to Date Water Tariff Collection in Former NWWA Areas

Period	Area	Amount Billed	Payment Received	Percent Recovery
YTD Jan 1996	Ga-Rankuwa	R3.6 m	R2.0 m	55.6%
YTD Jan 1996	Ga-Rankuwa/industrial	R1.9 m	R1.6 m	84.2%
YTD Jan 1996	Mabopane/Winterveld	R6.5 m	R2.5 m	38.5%
Total		R12.0 m	R6.1 m	50.8%

Table 2-6 : Water Tariff Rates in Other Former NWWA Areas

Area	Tariff (c/kl)	Penalty Tariff (c/kl)
Motopo	70	165
Kudube	33	165
Bafokeng Rand Water	108	225
Bafokeng - Other	100	225
La Patrie/Doornhoek	139	225
Non-Specified Area	100	165

NB: Tariffs include VAT at 14%. Penalty tariff is applicable to consumption in excess of allocation.



- NOTICE 234
1969
- NOTICE 62
9 MARCH 1973
- NOTICE 136
23 SEPTEMBER 1983
- NOTICE 1464
10 JULY 1987
- NOTICE 1138
17 JUNE 1988
- NOTICE 347
5 MARCH 1989
- NOTICE 838
20 APRIL 1990
- NOTICE 910
23 JUNE 1995
- EXTENSION AREA - RSA
NOTICE 610, 12 APRIL 1996
- EXTENSION AREA - BOPHUTHATSWANA
NOTICE 610, 12 APRIL 1996
- ESA BOUNDARY
- JICA STUDY AREA

ESA OF MAGALIES WATER

FIG. 2 - 1

**CHAPTER 3 DEVELOPMENT POLICY
AND CONSTRAINTS**

TABLE OF CONTENTS

3.1	Development Objectives	3-1
3.2	Peripheral Area Issues	3-2
3.2.1	Background	3-2
3.2.2	Approach	3-2
3.2.3	Naboomspruit	3-2
3.2.4	TLC's Acting as Water Boards	3-3
3.2.5	Boundary Between Magalies Water and NWWA	3-3
3.2.6	Eastern Supply Zone	3-3
3.2.7	Boundary Between Magalies Water and Rand Water	3-4
3.3	Development Constraints	3-4
3.3.1	Policy and Legal Framework	3-4
3.3.2	RDP Minimum vs. Community Expectations	3-7
3.3.3	Non-Payment	3-9
3.3.4	Third Tier Capacity	3-10
3.3.5	Coordination and Planning	3-11
3.4	Policy and Strategy Recommendations	3-12
3.4.1	General Description and Context	3-12
3.4.2	Link to Gap Analysis	3-12
3.4.3	Objectives of the Policy and Strategy Task	3-13
3.4.4	The Planning Context	3-13
3.4.5	Overview of Steps in the Policy and Strategy Process	3-14
3.4.6	Evaluation of the Process	3-14
3.4.7	Background to Policy and Strategy Recommendations	3-15
3.4.8	"Symptomatic" Policy and Strategy Recommendations	3-16
3.4.9	Background to Systematic Policy and Strategy Options	3-17
3.4.10	Integrated Policy and Strategy Recommendations and Action Plan	3-17
3.4.11	Prerequisites for Action	3-17
3.4.12	Dynamics of Change in Study Area	3-18
3.4.13	Implementation Strategy and Structure	3-18
Table 3-1 :	Symptomatic Recommendations by Extension Challenge	3-20
Table 3-2 :	Policy and Strategy Recommendations	3-23
Table 3-3 :	Initiating Ongoing Planning and Coordination	3-27
Figure 3-1 :	The Gap Analysis and Policy and Strategy Processes	3-28
Figure 3-2 :	Linkages Between Gaps	3-28
Figure 3-3 :	Elements of an Initiating Framework	3-29
Figure 3-4 :	Components of Capacity	3-29

CHAPTER 3 DEVELOPMENT POLICY AND CONSTRAINTS

3.1 Development Objectives

The Study is being undertaken within the context of the goals of South Africa's first democratically elected government. In the broadest sense the overall goal of the government is to redress the imbalances of the past. A major challenge is therefore to provide services to the people and communities who have not had access to them. Water and sanitation are major areas of past service deficiency with most of South Africa's population not having access to even the most basic levels of service.

This section provides an insight into the development policy which serves to meet government and community expectations of water supply and sanitation.

Many of the constraints to achieving these goals are also noted. It is inevitable that there will be differences between the views of government and communities. This in itself is a constraint.

In the section two main sources of development objectives were considered in some depth:

- (1) The RDP
- (2) The White Paper on Water Supply and Sanitation

The latter document draws heavily on the RDP principles and the two are therefore highly integrated. Objectives and principles flowing from these two sources are very useful and in our opinion clearly set out a vision of the future.

It is an objective of the study to interpret these overall objectives and principles in the context of the expanded area of supply of MW. Recommendations made in the course of the study will serve the overall goals of government. In this sense the study is a proving ground for ideas that could accelerate water supply and sanitation in South Africa.

The study has pursued an interactive approach to the identification and definition of more detailed development objectives. The Gap Analysis (see Section 3.4) revealed several key objectives, around which there was considerable consensus:

- (1) All South Africans should enjoy at least the RDP minimum level of water supply and sanitation service, but should also have the opportunity to pursue higher levels of service, if desired, and if consumers are able and willing to pay.
- (2) For service delivery in the water sector to be effective, roles and responsibilities should be clearly assigned and accepted.
- (3) The economic value of water has to be recognised and accepted by all users. In this context cost recovery is an important development objective and a foundation to further development.

- (4) Participation is a fundamental development objective, based on the notion of demand-driven planning and service provision.

These development objectives underpin the study and its recommendations.

3.2 Peripheral Area Issues

3.2.1 Background

The Scope of Work requires that any sensitive areas peripheral to the Study Area should be identified during the Study, and taken into account where relevant to the creation of a master plan for the extended supply area of Magalies Water. Peripheral area issues usually relate to the identification and proclamation of supply areas for water boards, and are therefore sensitive issues. A number of criteria have been developed for setting the boundaries of water boards or water authorities. These criteria are set out in Chapter 9 of Supporting Report B and should also govern peripheral area debates. Where urgent issues relating to peripheral areas need to be resolved, or where the most optimal long term solution needs to be an output from the Study, the JJICA Advisory Committee has offered to provide a budget to facilitate such work, during Phases 2 and 3 of the Study.

3.2.2 Approach

At the commencement of the Study, Magalies Water supplied bulk water to consumers within those portions of the Study Area that were proclaimed in favour of the Board. These supply areas were, for historical political reasons, restricted to the former White Group Areas, and the Board's water supply function excluded any form of retail supply or support. The White Paper on Water Supply and Sanitation (dealt with elsewhere in this report), requires that the areas of supply of the various water boards should be rationalised and extended, and that new water boards should be created where necessary, in order to achieve the goals and objectives of the White Paper, thereby extending access to affordable and hygienic water supply and sanitation to all residents of the Republic, including previously neglected rural communities within the former TBVC States and within former self-governing territories.

In order to achieve the objective of creating rationalised areas of jurisdiction for water boards within North West Province, the Minister approved, in a Government Gazette dated 12 April 1996, revised proclamations for those water boards that operated within the Province at that stage. A proclamation for the Ga-Rankuwa and Mabopane region in favour of Rand Water was approved by the Minister and gazetted on 21 June 1996 (Government Notice No 1025).

Specific peripheral areas that were investigated and the associated issues are described briefly below, and in more detail in Chapter 9 of Supporting Report B.

3.2.3 Naboomspruit

Water demand in Naboomspruit (located in Northern Province north-east of Nylstroom), is at present met locally from the Frikkie Geyser Dam and from boreholes within the Nyl River Basin. These sources are under pressure from growth in demand.

When Magalies Water was planning the Temba to Nystroom pipeline, they approached Naboomspruit TLC regarding the towns requirements for a supply from that scheme. The town council of Naboomspruit elected not to be included in the supply area of Magalies Water. Naboomspruit TLC is therefore excluded from the Recommended ESA of Magalies Water, for purposes of the Study.

3.2.4 TLC's Acting as Water Boards

The situation has arisen that certain TLC's within the Study Area (Bronkhorstspuit and Brits), at present fulfil the role of water boards, ie these TLC's supply water to consumers that do not fall within their area of jurisdiction. In fulfilling this role, the TLC's are not subject to the provisions of the Water Act. The current situation is confusing for consumers and effectively places the function of bulk water supply under the control of the Provincial Government instead of DWAF.

3.2.5 Boundary Between Magalies Water and NWWA

The task team on areas of supply that was set up by Magalies Water and North West Water as part of the merger process, considered this boundary as part of their assignment. The recommendations of the task team were incorporated in the Government proclamation of 12 April 1996, part of which comprised the inclusion of most of Mankwe District within the ESA of Magalies Water. For reasons of water resources management, the ESA excludes the entire Madikwe District (Marico River - NWWA). The existing boundary between Magalies Water and NWWA in Koster and Swartsruggens districts is also formed by the approximate watershed between the Crocodile and Marico river basins.

The alternative sources of surface water supply to the north-western Mankwe region, are from Vaalkop Dam in the south-east and from Moletedi Dam in the north-west. This water resource however falls outside the Study Area, and further study by NWWA will be necessary before a final decision can be taken in this regard.

3.2.6 Eastern Supply Zone

The issue of water board boundaries within the Eastern Supply Zone (either Magalies Water or a completely new board), is currently the subject of a separate study commissioned by DWAF, and involving interested stakeholders within Kwandebele and the surrounding districts. A task team has been set up by the various stakeholders for this purpose. Provisionally the stakeholders have expressed their desire for an independant water board. An interim solution to provide the necessary institutional support might be to place the Eastern Zone under the management of Magalies Water as a separate business unit. Unfortunately, the task team's report will not be completed within the time frame of Phase 1 of the JICA Study.

In considering the future of the Eastern Supply Zone it is important to note that Magalies Water does not supply water to Kwandebele at present, the existing supplies being from Weltevreden WTW (Mkombo and Loskop Dams) and from Bronkhorstspuit WTW (Bronkhorstspuit and Grootdraai Dams). At present the only supply by Magalies Water within the Eastern Zone is to Cullinan and the surrounding area.

3.2.7 Boundary Between Magalies Water and Rand Water

The boundary debate between Rand Water and Magalies Water is concentrated in two separate supply regions; the extent of the area of supply of Rand Water along the Rustenburg to Western Platinum axis, (Barnardsvlei Supply Area and peripheral areas); and the extent of the area of supply of Rand Water from its Hartbeeshoek Reservoir, (Rand Water Supply Area).

(1) Barnardsvlei Supply Area

The Barnardsvlei Supply Area is described in Supporting Report E. The peripheral area debate in respect of this area of supply is two-fold:

- (a) Should Rand Water continue in the long term to be the bulk water supply authority for the Barnardsvlei Supply Area, or should this area be eventually placed under the management of Magalies Water?
- (b) If Rand Water continues to manage the Barnardsvlei Supply Area, what should be the actual supply area boundaries of Rand Water on the western and eastern peripheries of the Barnardsvlei Supply Area?

These issues are discussed in some length in Chapter 9 of Supporting Report B.

(2) Rand Water Supply Area

The Rand Water Supply Area is also described in Supporting Report E. Briefly, water is supplied to the area by Rand Water from Zuikerbosch Treatment Works to its Klipfontein and Hartbeeshoek Reservoirs in the south of the Western Pretoria Municipal Substructure's area of jurisdiction. The supply is at present being upgraded by Rand Water from a capacity of 140 Ml/d to 300 Ml/d (both based on peak day demands). No argument has been made to date that Rand Water should discontinue its involvement in this supply area. It is also not expected to be necessary to adjust the current supply boundaries in this region. The estimated 2015 primary demand of the Rand Water Supply Area almost matches the existing capacity of the supply system via Hartbeeshoek SR.

3.3 Development Constraints

3.3.1 Policy and Legal Framework

- (1) It is clear that many policies, laws and regulations were inherited from the previous system of government and that while a process of revision is taking place this will take some time. The constraints to development caused by this transition arise from:
 - (a) Old legislation and regulations not yet repealed.
 - (b) Interim frameworks which are not adequate.

(c) New policy positions not yet promulgated as legislation.

(d) New policy and legislation which is problematic.

In this section we discuss some of the key areas that arise from the four above mentioned causes and which are constraints to development.

(2) Rural water supply

Current policy does not differentiate rural from other forms of supply. Findings of the study and views of key people involved in the study are that this area may require special treatment in policy. Some of the issues are:

(a) A complete lack of resources (financial and other) amongst people in many rural areas. Paying for water may be an impossibility;

(b) The isolated nature of schemes, many of which are small stand alone units (e.g. borehole);

(c) Dispersed communities with little or no organisation; and

(d) Limited potential for longer term development of supply schemes beyond the most basic arrangements.

The possible policy implication is that DWAF may have to accept responsibility (both financially and physically) for water supply to very rural communities.

(3) Minimum Standards vs. Community Expectation

This is becoming an important issue and it is discussed in greater depth in Section 3.3.2. below.

(4) Tariff Policy

This is currently under review and a report by the Task Team looking at policy is due to be handed to the Minister by the end of this year (1996). Until a new policy is formulated uncertainty will undermine planning and act as a constraint.

(5) Water Law Review

As indicated in Chapter 1 there has only been a rationalisation of legislation since the democratically elected government came to power in 1994. (Water Laws Rationalisation and Amendment Act)(Act 32 of 1992). A major review of legislation to transform the water sector in accordance with the ideals of the RDP and White Paper is therefore necessary. To this end the Minister appointed a special Water Law Review Panel in June

1995 to develop a set of policy principles on which a new act could be based. The brief has been to make the new law simple, equitable, environmentally integrated and sustainable, economically viable and conducive to equitable economic growth, non-bureaucratic, and to be able to be administered simply and easily.

A Steering Committee is taking the law review process forward. A major step in this process has been a Water Law Review Conference. A final set of principles will be embodied in a White Paper which when approved by the Minister and then the Cabinet will form the basis from which a new act will be drafted.

Until the new act is in place there will be many gaps between legislation and policy (as embodied in the White Paper on Water Supply and Sanitation).

(6) Roles and Responsibilities of Water Boards.

A number of general recommendations have been made in the "Draft Report on the Scope and Function of Water Boards" concerning the extended function of the water boards. These recommendations are:

- (a) that a water board establish a system of communication with the communities within its area of establishment;
- (b) that water boards explain to the communities the services and capabilities that the water board can offer them;
- (c) that water boards establish procedures to be followed by the communities for their own local water committees, applications for funds, applications for technical assistance and applications for training;
- (d) that water boards monitor the expenditure and application of funds made available for projects;
- (e) that water boards provide technical assistance in the planning of any proposed local water supply or sanitation scheme;
- (f) that water boards monitor the expenditure and application of funds made available for projects;
- (g) that water boards provide appropriate training to provide the requisite managerial, administrative and technical skills to build the capacity to plan, construct, operate and maintain the water supply and sanitation schemes;
- (h) that water boards provide ongoing support and monitoring service in the future; and
- (i) that water boards are to maintain ongoing contact and communication with the communities that they serve, to provide assurance on the nature of the water supply

and of any tariff changes or matters of that nature.

The Draft Report makes the following recommendations regarding the financial viability of water boards:

- (a) Water boards should set bulk water and wastewater tariffs on a cost-recovery basis.
- (b) Services should operate on sound business principles, with the responsibility of the consumers for paying for services provided clearly defined and understood.
- (c) Water boards should function in a publicly accountable fashion as transparently as possible, particularly when relating to the issue of subsidies.
- (d) Subsidies, where applied, should be clearly identified, goal orientated and carefully targeted, so as to keep distortions to a minimum, and at a level which is sustainable whilst meeting their objectives for as long as justified.
- (e) Ideally all tariffs, including the cost of raw water charged by DWAF to the boards, should show the full cost of operating and maintaining the scheme and separately, the full cost of the capital component (in order that subsidies are transparent and to facilitate determination of life line tariffs).
- (f) The construction or refurbishment of water supply and sanitation schemes will require considerable capital input. The role that the water boards should play in raising this equity should be determined.

The Draft Report on the Scope and Function of Water Boards provides a vision of water boards taking positive steps to accept their responsibility for supporting local government with the provision, maintenance and operation of water services. The Draft Report envisages this support to be both of a financial and technical nature.

Finalisation of the role of water boards will contribute significantly to development thereby eliminating many constraints to development.

3.3.2 RDP Minimum vs. Community Expectations

(1) Goals in Terms of Level of Service Provision

The White Paper sets a key goal for DWAF in terms of service provision. The goal is that by spending an additional 1% of the national budget over seven years (from November 1994), a universal basic water supply and sanitation service can be provided to all citizens.

This universal basic level of water supply is described by the following parameters:

- (a) Quantity of water supply: 25 litres per person per day.

- (b) Cartage: The maximum distance which a person should have to cart water to their dwelling is 200m.
- (c) Availability: The flow rate at the outlet should not be less than 10 l/min and the water should be available on a regular daily basis.
- (d) Assurance of supply: Schemes for domestic water supply should ensure the availability of raw water for 98% of the time.
- (e) Quality: The quality of water provided as a basic service should be in accordance with generally accepted minimum standards with respect to health related chemical and microbial contaminants.
- (f) Upgradability: The desire of many communities to upgrade a basic service to provide for household connections should be taken into account.

(2) Expectation Gap

During the course of the study it became clear that the general expectation of communities is for yard connections. The RDP minimum standard is essentially a stand pipe service and this is often unacceptable to the communities involved.

The rejection of standpipe service levels is related to limited community involvement in design and implementation of projects but must be seen against a broader backdrop. Standpipe service provision has been generally implemented in a non-consultative way. Poor administration and lack of funds have created problems of lack of maintenance, long tap queues, time spent waiting in line, breakdowns, unauthorized connections and long distances to taps. In these circumstances it is easy to understand that users will feel in some way stigmatised, especially when they see the levels of service that prevail in the nearby affluent towns.

(3) The Challenge

Financing is the main problem in providing for the higher level of service that communities demand. These communities often cannot pay upfront for the provision of yard connections, therefore bridging finance in the form of loans must be obtained. Water boards are unwilling to borrow without government guarantees while government will only provide guarantees or lend itself for the basic level of service. The Gap is therefore not only the lack of government funding available, but also the lack of government guarantees for loans required to finance a higher than basic level of service.

There is an issue around how such upgrading would be practically implemented. From a technical point of view it would not just be a case of attaching yard connections to existing systems as the volumes being carried in bulk pipes is sometimes not sufficient for the higher levels of consumption. The entire system, including bulk supply, pumps

and dam, would have to be upgraded to cater for yard connection consumption on a wide scale.

(4) Implications

Government will not guarantee funding above the basic service level and the private sector will be reluctant to invest in higher service levels in this situation. There is therefore no source of funding for a yard connection level of service. Failure to recognize the desire for yard connections will no doubt place continuous pressure on all levels of government.

3.3.3 Non-Payment

(1) Willingness to Pay and Affordability

In global terms, about 61% of the respondents in North West and about 78% in Mpumalanga get access to water without paying. This includes water from stand pipes, government boreholes, relief tanks, yard connections with no meter and rivers. Of those with house connections or metered yard connections, a good number are also not paying for water.

Those who are not paying do not seem to expect to pay for water in the near future or have no intention of doing so. Around 46% of the respondents in the Mpumalanga sample stated that water should not be paid for against 37% in North West.

Of those not paying, 14% in Mpumalanga and 8% in North West stated that poor service is the reason for not paying for water, 8% and 13% for Mpumalanga and North West, respectively, stated that they have never paid for water. Other reasons for not paying for water are that water facilities are seen to belong to the community (9% and 5%), and that water is perceived as a gift from God (7% and 12%, respectively).

Willingness to pay seems to be partly related to a sense of poor service derived from stand pipes. Children and women have to walk long distances, spend time in queues, walk back home, with considerable disruption to school or domestic routine in order to fetch water. The work of collecting water represents a considerable hardship, is particularly intolerable for aged or disabled people, and makes payment senseless in the eyes of those carrying out these activities. A good number of the stand pipes are in a poor state of repair, leaking or with broken or missing taps.

However, willingness to pay is also related to affordability. About 63% of sampled households in Mpumalanga have an income below R600 per month; amongst those, 45% are below R300. North West is more or less the same with 56% below R600, and of these 50% below R300. It is possible that respondents understate their income deliberately. Many may not be able to account for the regular income provided by relatives from urban areas. Despite this there seems to be some consistency between reported incomes and figures related to type of housing.

(2) Unauthorised Connections

In almost all the settlements considered in the Community Case Study formal sources of water were insufficient to meet family needs and various methods are used to overcome this, principally:

- (a) Yard connections with no meter;
- (b) Private boreholes;
- (c) Private vendors; and
- (d) Natural water sources.

Of these, yard connections with no meter may be termed unauthorised or illegal connections and are discussed briefly below.

Yard connections with no meter imply that a person has secured an individual level of service and is not paying for it. This is possible by attaching a pipe to a street tap or a tap on a nearby property, or by drilling a hole in a pipe in the reticulation system. The practise of unofficial connections characterised 35 % of the households surveyed in Mpumalanga but only 9 % in North West. Essentially, this practise is much more common in the former Kwandebele than it is in the former Bophuthatswana, and the reasons lie in different historical development.

Unauthorised connections constitute a serious threat to efforts to encourage consumers to pay for services and are also very damaging to the water supply system. Such connections effectively deprive some areas of any water supply and cause the system to work at a much higher level of capacity. However, there is widespread dissatisfaction with the lower service levels (street taps), that were provided to communities (in many instances with limited consultation), and illegal connections must be seen in the light of the past poor service provision, as well as the lack of visible delivery of improved services in these areas. The issue is whether to legalise these connections, and thus be able to deal with them on an official basis, or declare them illegal and punish the offenders (a difficult task, given the lack of institutional capacity in these areas).

3.3.4 Third Tier Capacity

Policy recognises the so-called "Third Tier" to be a critical component of the broad water supply and sanitation system. In essence it is to be organisations at this level that will express demand. They will also provide and manage local water and sanitation services. Given the importance of the Third Tier, a great deal of concern has been expressed about its capacity. The lack of third capacity was identified as a key development constraint by participants in the gap analysis process (see Section 3.4 and Supporting Report C). A number of institutional development and capacity building programmes initiated by DWAF and others have sought to address Third Tier

capacity issues. Among these are the appointment and deployment of Organisational Development Officers (ODOs), the establishment and training of Local Water Committees, initiatives to convene area planning forums (DWAF), and zonal planning initiatives (Rustenburg DC).

In the Study Area, Third Tier capacity problems take a variety of forms. Among these are the following:

- (1) Capacity has both internal and external dimensions. Internally, the capacity of Third Tier structures revolves around organisational, process, technical and financial resources. External determinants of capacity are an enabling policy and regulatory framework, access to support structures and a recognised mandate. Many organisations lack the necessary mix of internal and external capacity.
- (2) Capacity is unequally distributed among Third Tier structures. Some have considerable organisational, technical and financial capacity (eg the Eastern Gauteng District Council and bigger TLCs such as Rustenburg, Brits and Bronkhorstspuit), whilst in other cases such capacity is almost entirely absent (eg various rural local authorities and the Eastern District Council). This variable spread of capacity is both an impediment to development and an opportunity to share resources more effectively.
- (3) There is an acute lack of capacity in rural areas. This is especially serious where undercapacity local authorities are unable to call for assistance from a District Council, because the DC also has limited resources. Cases are evident in the area of jurisdiction of the Eastern District Council.
- (4) Many smaller TLCs and most rural local authorities lack the means to generate their own capacity. Critical shortcomings are limited capacity and skill to plan (including planning for organisational development), and limited access to sources of finance.
- (5) The capacity of Local Water Committees and local RDP structures remains to be optimally deployed in certain areas. The relationships between these bodies and local authorities are unclear in some areas, and strained in others.

3.3.5 Coordination and Planning

The gap analysis identified a number of coordination and planning problems that were seen to constrain effective delivery in the water sector (see Supporting Report C).

- (1) Roles and responsibilities among water sector institutions are often not clearly defined, assigned or understood. Actors are sometimes reluctant to negotiate roles for themselves.
- (2) Despite a broad spread of forums and similar planning and communication vehicles, communication and coordination among these is still limited. In some cases this appears to relate more to a lack of will to share agendas than to limitations on opportunities to interact.