JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)

DEPARTMENT OF WATER AFFAIRS AND FORESTRY
REPUBLIC OF SOUTH AFRICA

THE STUDY ON THE EXPANSION OF CAPACITY OF MAGALIES WATER IN THE REPUBLIC OF SOUTH AFRICA (PHASE 2 AND 3)

FINAL REPORT

VOLUME 1 : EXECUTIVE SUMMARY

JANUARY 1998

SANYU CONSULTANTS INC.
NIHON SUIDO CONSULTANTS CO.,LTD.

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CURRENCY EQUIVALENTS

(As of September, 1997)

Currency Unit = South African Rand (R)

US$1.00 = 4.69 R

US$1.00 = 122 Yen (Japanese Yen)

PREFACE

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

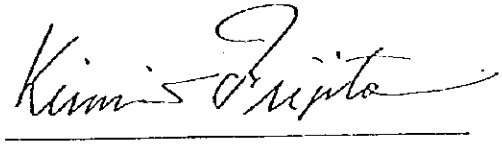
JICA sent to South Africa a study team headed by Mr. Satoshi Kadowaki, SANYU CONSULTANTS INC., and composed of staff members of SANYU CONSULTANTS INC. and NIHON SUIDO CONSULTANTS CO. LTD., two times between February 1997 and November 1997.

The team held discussions with the officials concerned of the Government of South Africa, and conducted field surveys at the study area. After the team returned to Japan, further studies were made 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 relation 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.

January 1998



Kimio Fujita
President
Japan International Cooperation Agency

January 10, 1998

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 Phases 2 and 3 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. It is also included the comments made by the Department of Water Affairs and Forestry, Magalies Water and other stakeholders in the Republic of South Africa during the meetings organized by Project Execution Group (PEG) and Project Steering Committee (PSC) in both Rustenburg and Pretoria where the Draft Final Report was discussed.

According to the South Africa's new water supply and sanitation policy, the specific challenges are to consolidate appropriate water supply infrastructures and to transform and empower institutions in the sector to deliver service so that all communities in the country can have access to safe water and sanitation in the near future. JICA has prepared Master Plan Reports for the area following these policies and strategy guidelines in 1996.

The main objectives of the Phase2 and Phase3 were to focus on the realisation of recomendations made in the Master Plan until the target year of 2015. Accordingly Phase2 dealt with the Feasibility Studies for the selected priority projects and Phase 3 implemented the pirot projects which were selected in the Master Plan.

This report contains the findings, conclusions and recommendations as outcome of the Phases 2 and 3 in which Feasibility Studies for three regional water supply projects and implementation of four pilot projects where involved.

The report consists of seven volumes. They are Executive Summary (1), Feasibility Reports (3), Boundary Issues (1), Pilot Projects (1) and Data Book (1).

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 Repubic of South Africa for their cooperation and the assistance extended to us during our study.

Very truly yours,

Satoshi KADOWAKI
Team Leader, Phases 2 and 3
Study on the Expansion of
Capacity of Magalies Water
in the Republic of South Africa

JICA STUDY ON THE EXPANSION OF CAPACITY OF MAGALIES WATER PHASE 2 AND 3

LOCATION MAP OF PILOT PROJECTS AND FEASIBILITY STUDY AREAS

LEGEND :

- RIVERS
- DAMS
- TOWNS & VILLAGES
- WATER TREATMENT WORKS
- SEWAGE TREATMENT WORKS
- JICA STUDY AREA
- FEASIBILITY STUDY AREAS
- PILOT PROJECT AREAS

SUPPLY ZONES :

- WESTERN ZONE
- CENTRAL ZONE
- EASTERN ZONE
- SUPPLY BLOCK BOUNDARIES

KEY MAP

NORTH MANKWE
KAMEELBOOM
THABAZIMBI
RUSTENBURG
KLIPVOOR
PROPOSED KLIPVOOR WTW
GA-RASAI
BAPONG
MORETELE 2
SEHOKO
EKANGALA
BRONKHORSTSPRUIT
PRETORIA
JOHANNESBURG
BELFINDORA

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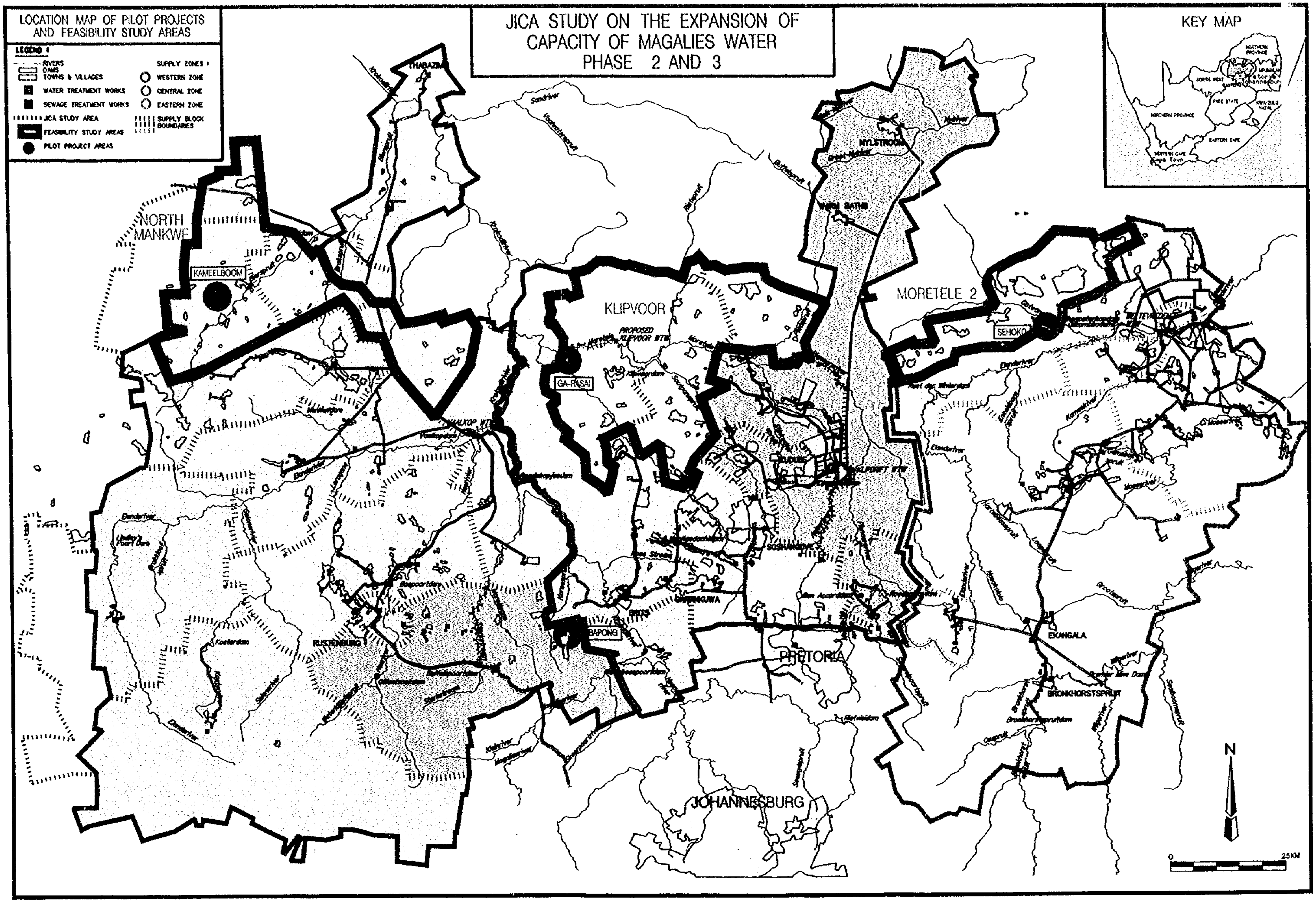
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RIVERS
DAMS
TOWNS & VILLAGES
WATER TREATMENT WORKS
SEWAGE TREATMENT WORKS
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WARM BATHS
RUSTENBURG
BAPONG
BRITS
GARANKUWA
SOSHANGUVE
PRETORIA
EKANGALA
BRONKHORSTSPRUIT
JOHANNESBURG
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SUMMARY OF THE STUDY

1. Objective and Background of the Study

The Reconstruction and Development Program (RDP) aimed at social upliftment is the central social and economic development program of the Government of South Africa. The new water supply and sanitation policy is a specific challenge to transform and empower institutions in the water sector so that all communities in the country have access to water and sanitation services at the beginning of 21st century.

JICA has been undertaken Master Plan Study for the development target year 2015 on the Expansion of Capacity of Magalies Water in 1996. In compliance with the requirements identified in the Master Plan Study, the primary objective of the Phase 2 (Feasibility Study) and Phase 3 (Pilot Projects) Study is to focus on realisation of a Master Plan by the target year 2015, so that all inhabitants in the Study Area will have access to a safe and stable water supply. In this connection, three (3) Feasibility Study of North Mankwe, Klipvoor and Moretele 2 and four (4) Pilot Projects of Kameelboom, Ga Rasai, Segokgo and Bapong, have been executed by the JICA.

2. Outline of the Feasibility Study (Phase 2)

(1) Level of Service, Water Demand and Infrastructure

The following two different levels of service were developed for this feasibility study with the intention of testing them against the affordability of the FS communities.

Service level A : 100% of households in the community will be supplied through standpipes to the RDP level of service at an average per capita consumption rate of 30 lcd (AADD) including an allowance of approximately 15 % for leakage.

Service level B : 90% of households in the community will be supplied through yard connections (85.6 lcd) and the remaining 10% through standpipes (30 lcd) in accordance with the RDP level of service, giving a weighted average per capita consumption rate of 80 lcd (AADD) including an allowance of approximately 15% for leakage.

Population and Water Demand	North Mankwe		Klipvoor		Moretele 2	
	Level A	Level B	Level A	Level B	Level A	Level B
No. of Communities	24		35		17	
No. of Households	9,436		16,885		16,370	
Population	60,390		114,818		104,768	
No. of Persons per Household	6.4		6.8		6.4	
Water Demand						
Annual Average Day Demand (kld)	1,812	4,834	3,445	9,190	3,143	8,386
Summer Peak Day Demand (kld)	2,718	7,251	5,168	13,785	4,715	12,579

There will be no future growth in population in the FS Areas, as the natural growth will be offset by migration of an approximately equal number of people to urban areas.

In the North Mankwe area, there is extensive existing surface water supply infrastructure already in place in this region, so that the feasibility study for this area has been concerned with extending the existing system into unserved or under served communities in the F/S area. On the other hand, infrastructure plans for Klipvoor and Moretere 2 areas were recommended most optimum options from each three alternatives studies.

(2) Project Implementation Mode and Financial Analysis

In order to find out a realistic and sustainable water tariff, a simulation analysis was conducted for each Area based on several conditions and assumptions for Case A (Project execution for level of service A) and Case B (Project execution for level of service B).

As the results of comprehensive simulations, the Case B is well accepted by the communities, however, a set tariff is far beyond their affordability when the upper level of the affordability considered 3 % of their monthly income.

Based on the above evaluation, a staged development scenario is recommended for all three areas as a possible option (Case C) that will realise the RDP minimum level by year 2002 as the first stage and allow subsequent upgrading to Service Level B as the second stage. The following table is breakdown of capital investment for each projects.

(Unit : 1000 Rand)

Capital Cost and Allocation		North Mankwe	Klipvoor	Moretele 2
1. Stage 1 (Level A) (1998-2002)				
1.1 Bulk Supply	1st Tier	90,888	133,207	144,542
1.2 Retail Supply	1st Tier	20,084	53,718	68,726
1.3 Total		**110,972**	**186,925**	**213,268**
2. Stage 2 (Upgrading) (2003-2007)				
2.1 Bulk Supply	2nd Tier	18,520	35,972	9,986
2.2 Retail Supply	3rd Tier	36,423	80,213	66,070
2.3 Yard Connection.	3rd Tier	24,008	42,974	41,660
2.4 Total		**78,951**	**159,159**	**117,716**

Through the cash flow analysis aiming financial viability of the service provider as well as affordability of beneficiaries, the following tariff system is proposed. The tariff during the first five-year period will not only cover the O&M cost but will also allow a reserve fund to be established for future upgrading of the service level.

Set Tariff and Affordability	Unit	North Mankwe	Klipvoor	Moretele 2
Stage 1				
- Unit Price	R/Kl	1.50	1.18	0.67
- Monthly Tariff	R/HH	36.20	39.02	22.62
Pure Water Cost	R/HH	7.20	6.02	3.22
Deposit for Reserve Fund	R/HH	29.00	33.00	19.40
- Share of Average H.H. Income	%	3.0	3.3	1.5
Stage 2				
- Unit Price	R/Kl	2.83 - 3.05	2.56 - 2.70	2.12 – 2.20
- Monthly Tariff	R/HH	36.95 - 39.82	35.51 - 37.45	27.68 – 28.72
- Share of Average H.H. Income	%	3.0 - 3.3	3.0 - 3.2	1.9 – 2.0

The proposed project implementation mode can be judged that the projects are viable and reasonable ranging 9.0 -10.0 % of Financial Internal Rate of Return compared with real interest of 8 % of the RSA. It is strongly suggested that collection of water tariff should be 100 percent otherwise financial management of the WSA/WSP suffers difficulties of their institutional operation.

(3) Overall Schedule for Staged Development

The proposed project (Case C) will be implemented in three stages. To realise RDP minimum level of service by 2002, the 1st stage (1998-2002) involves preparation of water supply facilities under the service level A with necessary establishment of LWCs (Local Water Committees) and BWSCs (Block Water Service Cooperatives). The 2nd Stage (2003-2007) includes commission and operation of the Level A services and preparation of upgrading the service level as well as restructuring of AWSCs (Area Water Service Cooperatives). The 3rd stage (beyond 2008) does commission and operation of the Level B services by restructured AWSCs.

(4) Institutional Development

The key stakeholders of the water supply sector in RSA consist of First Tier (DWAF) which has responsibilities on the water resources development and its management, Second Tier (Water Board) which has responsibilities on the development and management of bulk water supply infrastructures, and Third Tier (The Local Governments) which has responsibilities to manage retail water supply infrastructures and assign appropriate water service provider(WSP) in each water supply projects.

In order to develop institutional structures of the third tier and clarify responsibilities of stakeholders, the Water Service Bill was published for comments in May 1997. The Bill indicates especially that local government shall appoint the Water Service Authority (WSA) and WSP for water supply project. The former shall be the TLC and or DC with responsibilities on the provision of stable water supply, preparation of water supply development plan and assign WSP in the jurisdiction. The latter, who carry out management of water supply systems, shall be the TLC, DC themselves and or shall be assigned as the Third Sector organisations by the WSA.

The plans of institutional development and capacity building in water sector shall be prepared taking into account current situation of communities, project implementation plan and operation and maintenance schedules. In particular, institutional development of 3rd Tier in the project will be carried out by the agencies concerned in the following Tables.
The master schedules of such development plan for the project divided into three stages.

Staged Development :

- First (1st) Stage (1998-2002) : Implementation of construction work for Water Service Level A and establishment of 3rd Tier organisation
- Second (2nd) Stage (2003-2007) : Implementation of upgrading of infrastructures and restructuring of 3rd Tier organisation
- Third (3rd) Stage (Beyond 2008) : Continuation of O&M and water tariff collection

Bulk Supply Agency and WSA/WSP	North Mankwe	Klipvoor	Moretele 2
1. Bulk Water Supply	Magalies Water	Magalies Water	Highveld Water
2. Retail Water Supply			
WSA (Water Service Authority)	Rustenburg DC	Eastern DC	Highveld DC
WSP (Water Service Provider)			
- Stage 1 and 2	RDC - MW JV and BWSCs	EDC - MW JV and BWSCs	HDC – HW JV or BOTT and BWSCs
- Stage 3	AWSC	AWSC	AWSC

(5) Conclusion and Recommendation

In the proposed staged development approach "Case C", it is anticipated that the accumulation of the reserve fund will greatly improve the financial position of the Services Provider, to reduce the financial burden on the third tier and to motivate positive participation of beneficiary communities. The conclusions therefore is that the Project is technically feasible, economically and financially viable .

3. Outline of the Pilot Project (Phase 3)

(1) Objectives of the Pilot Project

The general pilot project objectives are listed below. Pilot projects are by nature an opportunity to test options and to interpret and share the lessons that emerge. In this context, the pilots are intended to inform both broad community water supply practice and the implementation of the Phase 2 feasibility studies. Specific objectives are:

- To address the overall aim of building an effective water services sector in the Magalies study area.

- To explore, in a practical context, institutional and technical options for water supply in previously unserved or underserved communities.
- To establish or reinforce sustainable management structures and systems which will support effective long term use of the infrastructure developed.
- To develop, test and evaluate innovative institutional development strategies and techniques.
- To make these available beyond the pilot projects themselves.

(2) Infrastructural Development

Infrastructure and expenditure for each project is tablesd below.

Pilot Project	Cost (Rand x 1,000)	Major Facilities
Kameelboom	1,970	- 4 No. borehole pumps - 4 No. storage tanks - 16.2 km of pipelines - 36 No. street taps
Ga Rasai	231	- 23 No. pre-paid water meters - one computer system - 0.2 km pipelines
Segokgo	1,070	- 2 No. sets of booster pumps - 1 No. storage tank - 6.9 km pipelines - 6 No. street taps
Total Cost	**3,271**	

(3) Needs Identified from the Pilot Project Experience

The following is the findings and lessons learned from Pilot Projects must be taken into account in the planning form of the feasibility studies:

- Identification of the WSA and WSP roles are essential first steps in setting up a project.
- The identified WSA and WSP (if not the community) should be involved in the planning process from the start.
- The community must be assessed in the context of the wide area in which resides

taking into account factors in the area / other communities which may impact on the project e.g. illegal connections in neighboring communities and payment history.

- In the context of the above item some area planning initiatives may be necessary if the project is to succeed.
- The establishment of LPSCs need to be carefully coordinated and can be a time consuming process. An effective LPSC is however an essential ingredient for success. Requirements include:
  - Involving all existing committees.
  - Ensuring representivity of all groups in the community e.g. women and young people.
  - Initial training of the LPSC in its role is essential.
  - Ongoing monitoring of the dynamics in the LPSC is important.
  - The LPSC must have decision making authority.
- Business planning must start early in the project life style and directly involve community.
- Needs of arrangement of project budget for promotions of institutional development and their sustainability.
- Arrangement of acceptable period of the development.
- Training and mentoring be prominent in plans and require a substantive budget.

The followings are summaries of experience of linkage and support by key stakeholders from the pilot project implementation

- The pilot project implementation of the Kameelboom located in the North Mankwe FS area was carried out successfully close cooperations with zonal officer of RDC, staff under the Community Service division of MW and members of LPSC. These experiences will contri- bute to act as the core of institutional development of North Mankwe project.

- Although institutional development of GaRasai project was many complications and without involvement and supports, the project activities can be finished with strong cooperation of the MW and study team. Implementation of the Klipvoor project however will be required strong administrative support by the Regional Office of DWAF and MW.

- The Institutional organisation of the Segokgo project within the Moretele 2 F/S area could be established by supporting Mbibane TLC. Since establishment of new water board including project area is scheduled in 1998 and the area falls within the HDC, there are some difficulties to formulate one organisation in the area. Mpumalanga regional office of DWAF with cooperation of public sector should provide strong supports to the communities for capacity building of the institutions.

(4) Recommendations of Post-JICA Follow-up

The major action plans for post-JICA follow-up are to provide appropriate administrative support to the communities in order to continue their water supply management, and to realise establishment of community organisations as core of the body in the FS Areas.

The key stakeholders, especially DWAF should prepare immediately action plan for post-JICA follow-up and arrange necessary budget for the activities.

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ABBREVIATIONS AND TERMINOLOGY

The following abbreviations are used in this report:

AADD	Annual Average Daily Demand
ANC	African National Conggress
APF	Area Planning Forum
AWSC	Area Water Service Cooperative
BOTT	Build, Operate, Train, and Transfer
BWSC	Block Water Service Cooperative
CAPLEX	Capacity Expenditure
CEO	Chief Executive Officer
CIP	Capital Investment Plan
CRDC	Central Reconstructions Development Committee
CSS	Central Statistics Service
CWSS	Community Water Supply and Sanitation
DAF	Dissolved Air Flotation
DANDIA	Danish International Development Agency
DBSA	Development Bank of South Africa
DC	District Council
DCC	Direct Construction Cost
DCF	Discounted Cash Flow
DFA	Development Facilitation Act
DFID	Department for International Development (UK)(formerly British ODA)
DWAF	Department of Water Affairs and Forestry
EDC	Eastern District Council
EIRR	Economic Internal Rate of Return
ESA	Expanded Supply Area of Magalies Water Board as gazetted in April 1996
ESKOM	Electricity Supply Commission
EVN	EVN Consulting Engineers (Pty) Ltd
FIRR	Financial Internal Rate of Return
FS	Feasibility Study
FVDF	Five Villages Development Forum
GIS	Geological Information System
HW	Highveld Water Board
HWSA	Highveld Water and Sanitation Association
IFR	Instream Flow Requirements
IRR	Internal Rate of Return
IMT	Interim Management Team
ISD	Institutional and Social Development Department
JV	Joint Venture

JICA	Japan International Cooperation Agency (the official agency responsible for the implementation of the technical cooperation programmes of the government of Japan)
LDO	Labour Desk Officer
LPSC	Local Project Steering Committee
LRDC	Local Reconstruction and Development Committee (Local RDP Committee)
LWC	Local Water Committee
M&E	Monitoring and Evaluation
MANCO	Management Comittee
MEC	Member of Executive Committee
MP	Management Plan
MW	Magalies Water Board
NGOs	Non-Governmental Organizations
NP	Northern Province
NPV	Nett present Value
NWP	North West Province
NWWA	North West Water Supply Authority
O&M	Operation and Maintenance
ODA	Overseas Development Assistance
ODO	Organisation Development Officer
OECF	Overseas Economic Cooperation Fund of Japan
P&G	Provisional and General
PEF	Project Execution Forum
PEG	Project Execution Group
PLP	Presidential Lead Project
PMC	Project Management Committee
PSC	Project Steering Committee
PWV	Pretoria Wittwatersrand Vereeniging triangle(geographical area)
RDC	Rustenburg District Council
RDP	Reconstruction and Development Program
RF	Representative Forum
ROIP	Relevant Environmental Impact Prognosis
RPM	Rustenburg Platinum Mine
RR	Regional Reservoir
RSA	Republic of South Africa
RSC	Regional Service Council (regional bodies established to facilitate and coordinate service provision across local boundaries - now replaced by Regional and District Councils)
RW	Rand Water
S/W	Scope of Works
SAMWU	South African Municipal Workers Union
SANCO	South African National Civic Organization
SPDD	Summer Peak Daily Demand

SR	Service Reservoir
STW	Sewage Treatment Work
SWET	Sanitation and Water Education Training Programme
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
TT	Task Team
VAT	Value-added Tax
VIP	Ventilated Improved Pit Latrine
WATSAN	Water and Sanitation Management Committee
WP	White Paper
WRYM	Water Resources Yield Model
WSA	Water Service Authority
WSP	Water Service Provider
WTP	Willingness to Pay
WTW	Water Treatment Works

UNITS

ha	Hectare
kg/c/year	Kilograms per capita per year
kl	Kilolitre
kld	Kilolitres per day
km	Kilometre
l/c/yr	Litres per capita per year
lcd	Litres per capita per day
m^3/c/yr	Cubic metres per capita per year
mcm	Million cubic metres
mcm/a	Million cubic metres per annum
mg/l	Milligrams per litres
Mld	Megalitre per day
R	Rand

CHAPTER 1

INTRODUCTION

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CHAPTER 1 INTRODUCTION

1.1 Background and Objective of the Study

The Reconstruction and Development Program (RDP) aimed at social upliftment is the central social and economic development program of the Government of South Africa. The new water supply and sanitation policy is a specific challenge to transform and empower institutions in the water sector so that all communities in the country have access to water and sanitation services at the beginning of 21st century.

The White Paper covers the historical background, development approach, basic policy priciples, institutional framework, standards and guidelines for service delivery, and policy for financing service delivery. Principles of the White Paper require that: "development should be demand driven and community based", "development pursues equitable regional allocation of development resources", "water has an economic value and the user must pay for it," the principles of "integrated development and environmental integrity" are followed.

The White Paper also provides some guidelines of phased goals for institutional reform in the water sector.

- In the short term : To maintain service delivery whilst rationalising DWAF and transforming and democratising the Second Tier (Water Board).

- In the medium term : To support institutional development at the Third Tier level and to provide financial and technical assistance for water supply and sanitation services. The restructured DWAF and Second Tier institutions will work towards this goal together with the private and NGO sectors.

- 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 water supply and wastewater disposal services, and DWAF will manage water resources and monitor and regulate policy implementation.

DWAF has been undertaking infrastructure consolidation and institutional development in water supply sector based on the above mentioned policies. In 1995, Government of Republic of South Africa has requested to the Japanese Government to conduct development study on the Expansion of Capacity of Magalies Water which covers Northern part of the Capital.

In response to the request of the RSA, the Government of Japanese has undertaken the Master Plan Study (Phase 1) with the following components in 1996.

- Situational analysis and constraints for the developments
- Projection of water demands and preliminary design of the water supply infrastructures
- Institutional development plan
- Project implementation plan
- Financial plan

Many projects were identified by the master plan study in order to meet the requirements of the policy. The identified projects cover a range of infrastructure from modernised supply systems to the minimum level of the RDP.

There are priority projects in two-time-frames. Firstly, the project target to the year 2002 involved areas where communities have no water supply, or where supply is below RDP requirements. In this context, the objective is to provide safe and hygienic drinking water to RDP service levels. Secondly, areas where incremental water demands will be high within the selected target years will be given high priority to implement expansion or improvement projects.

In compliance with the requirements identified in the Master Plan during Phase 1 of the Study, the primary objective of the Phase 2 (Feasibility Study) and Phase 3 (Pilot Projects) Study is to focus on realisation of a master plan by the target year 2015, so that all inhabitants in the Study Area will have access to a safe and stable water supply.

Under Phase 2 of the Study, feasibility studies have been conducted for three priority projects (North Mankwe, Klipvoor and Moretele 2) which were identified during the Master Plan. Under Phase 3 of the Study, four pilot projects have been carried out in Kameelboom, Ga Rasai, Bapong and Segokgo.

1.2 Composition of the Report

This Final Report for Phases 2 and 3 comprises a total of seven volumes.

Volume 1 : Executive Summary
Volume 2 : Feasibility Study for North Mankwe
Volume 3 : Feasibility Study for Klipvoor
Volume 4 : Feasibility Study for Moretele 2
Volume 5 : Study on Boundary Issues
Volume 6 : Pilot Projects
Volume 7 : Data Book

This Executive Summary (Volume 1) has been summarised the conclusions of the Study. The other volumes are self-contained to facilitate access by those concerned with only individual parts of the overall study.

1.3 Project Management

A four tiered project management structure for the Study was established during the initial stage. The levels are the "Project Steering Committee" (PSC), the "Project Execution Group" (PEG), "Local Project Steering Committees"(LPSC) and the "Project Execution Forum" (PEF). The above structure was approved by the key stakeholders at the PSC meeting held on 18 February 1997. Meetings of each respective level were held regularly during the Study period.

The followings are summary of the roles and functions of respective committee.

(1) Project Steering Committee (PSC)

- Purpose: Overall study management and decision of the policies
- Members: Chairman (Chief Director CWSS),Directors of CWSS, Regional Directors for NW and Mpumalanga, DWAF, representatives of MW, RDC, EDC and HDC, Embassy of Japan, JICA resident representative and study team
- Function: Review and advice of study progress and reports submitted by the study team,decision of development policies, and approval of the reports

(2) Project Execution Group (PEG)

- Purpose: Overall study coordination between stakeholder and study team
- Members: DWAF regional directors, representatives of MW, three DCs, LPSC of pilot projects and study team
- Function: Provision of study guidance and suggestion, coordination between stakeholders and Study team, and discussion/ evaluation of development plan for FS study and Pilot Projects implementation

(3) Project Execution Forum (PEF)

- Purpose: To facilitate and discuss project development concepts and experiences
- Members: All stakeholders concerned of water sector participated in phase 1 study within four provinces
- Function: It is not a direct project management body for the study but it will provide a vehicle for considering the many capacity building recommendations emerging form phase 1.

(4) Local Project Steering Committee (LPSC)

- Purpose: Pilot project implementation
- Members: Selected community members by each Communities
- Function: Decision of policies, preparation of project management plan and implementation of the project

CHAPTER 2

FEASIBILITY STUDY (PHASE 2)

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CHAPTER 2 FEASIBILITY STUDY (PHASE 2)

2.1 Project Area

2.1.1 Location and General Description of Project Area

During the Phase 1 Master Plan, three regional water supply plans emerged as being the most urgent for implementation within the ESA of Magalies Water. These plans were conceived to provide a surface water supply to the areas where the provision of a safe and assured water supply has not been materialised yet. All of these areas formed part of the former Bophuthatswana at the time of the Apartheid era, and, even after the establishment of the democratically elected South African government in May 1994, have been still suffering to date from a huge backlog in terms of the provision of basic infrastructure including the provision of water supply.

Table 2-1 below presents the locations, populations, number of households and administrative areas of jurisdiction of these priority areas.

Table 2-1 Location and General Description of Project Areas

Item	North Mankwe	Klipvoor	Moretele 2
DWAF Regional Office	North West	North West	Mpumalanga
District Council	RDC	EDC	HDC
Water Board	MW	MW	HW
Population in 1997	60,390	114,818	104,768
Number of Households	9,436	16,885	16,370

2.1.2 Climate and Geophysical Environment

Basic information regarding the climate and geophysical environment for each of the FS Areas is summarised in Table 2-2 below.

Table 2-2 Climate and Geophysical Environment

FS Area	Average Monthly Temperature (°C)	Average Annual Rainfall (mm)	Annual Average Evaporation (mm)	River System	Vegetation
North mankwe	12 to 25	500	2,200	Lower Crocodile	Mixed Veld
Klipvoor	12 to 25	510	2,200	Pienaars/Crocodile	Mixed Veld
Moretele 2	12 to 25	420	2,200	Elands/Olifants	Mixed Veld

2.1.3 Present Water Supply Conditions

Within the three FS Areas the major source of water for domestic use is currently groundwater. Where water from nearby boreholes is unsatisfactory in terms of quality, quantity or both, people buy water from water vendors, of which source is mostly untreated surface water and partly groundwater.

Most of the existing borcholes are shallow in depth and are being used as point sources of supply without any associated reticulation. The quality of groundwater is generally unsatisfactory and in many cases unfit for human consumption. Chlorination of groundwater is currently not practised. At present groundwater quality is not being monitored on a regular basis.

Many of the existing boreholes are equipped with handpumps or a diesel engines. Windmills were used in the past but are not common at present. The majority of FS communities currently encounter frequent problems with respect to the operation and maintenance of boreholes.

Current average water consumption rates for each Area, which were obtained from the questionnaire survey conducted by the Study Team are shown in Table 2-3 below.

Table 2-3 Current Water Consumption

	North Mankwe	Klipvoor	Moretele 2
Average Monthly Consumption Per Household (l)	1,731	2,178	1,761
Average Daily Per Capita Consumption (lcd)	9.1	10.7	9.2

In the provision of water supply, the RDP currently pursues the minimum level of service (RDP minimum) which corresponds with the "Basic Water Supply" defined in the "White Paper on Water Supply and Sanitation Policy" issued in November 1994. The White Paper defines "Basic Water Supply" as "an assured supply of safe and potable water of 25 l/person /day within 200 m cartage distance, to which all South Africans can have access within seven years or less.".

As can be seen in Table 2-3 above, the level of service in all three of the FS Areas is apparently below the "RDP minimum" at present.

2.1.4 Socio Economic Conditions

All of the three FS Areas are essentially rural in nature. Although some arable and cattle farming takes place, many of the residents commute to jobs in urban centres. Others rely on pension income or money remitted from urban areas.

Some basic socio economic information which is closely related to this Feasibility Study is summarised in Table 2-4 below.

Table 2-4 Average Income & Willingness to Pay

		North Mankwe	Klipvoor	Moretele 2
Average Monthly Income Per Household (R/Month)		1,216	1,167	1,466
Willingness to Pay (R/Month)	For Standpipe Supply	8.30	9.00	9.10
	For Yard Connection Supply	29.60	23.80	28.50

2.1.5 Institutional Situation

Key stakeholders in the water sector are shown in Table 2-5 below for each FS Area.

Table 2-5 Major Stakeholders

	North Mankwe	Klipvoor	Moretele 2
First & Second Tiers	DWAF (National) DWAF (North West) MW	DWAF(National) DWAF (North West) MW	DWAF(National) DWAF (Mpumalanga) A New Water Board (HW)
Third Tier	Rustenburg DC	Eastern DC	Highveld DC Mbibane TLC

First Tier : DWAF who's main role is to supply raw water.
Second Tier : WB who's main role is to supply bulk water to third tier.
Third Tier : DC & TLC who's main role is to supply water to end-users.

District Councils are the most important role players as they are responsible for delivering retail water services. They are statutory bodies covering a wide area and are charged with raising finances and providing services to areas of need. Of the three District Councils shown in the table, only Rustenburg DC is considered to be functioning effectively.

Although most of the communities in the Moretele 2 FS Area fall under the jurisdiction of Highveld District Council, several communities on the southern fringe of the Area fall under jurisdiction of Mbibane TLC which also lacks capacity. It is planned that in the long term a new Highveld Water Board will be created in the upper Olifants basin which would encompass Moretele 2, Kwandebele, Bronkhorstspruit and the area east to beyond Groblersdal, Witbank and Middelburg.

2.2 Water Source

An extensive study of water resources conducted during Phase 1 (Master Plan) concluded that for the reasons stated below groundwater, although it is a quick and economical way of providing water, will not be a sustainable solution in the long term, and that as far as domestic water use is concerned the demand should be met from a surface water supply scheme.

In this Feasibility Study which follows the Master Plan recommendation, the viability of a regional surface water supply plan was therefore studied for each of the three FS Areas.

2.2.1 Groundwater

(1) Water Quality of Groundwater

The quality of groundwater is generally unsatisfactory in all three FS Areas and in many cases is unfit for human consumption with localised areas of high fluoride concentrations (maximum 5 mg/l against SABS 241-1984 recommendation of 1.0 mg/l), nitrate nitrogen concentrations (maximum 86 mg/l against SABS 241-1984 recommendation of 6 mg/l) and common instances of faecal contamination. Currently chlorination of groundwater is not practised so the chance of an epidemic of waterborne disease is high.

Many of the existing boreholes are relatively shallow and so are quite susceptible to human contamination resulting from the prevailing poor sanitation environments.

At present, groundwater quality is not being monitored on a regular basis. In the absence of chlorination and with localised areas of high nitrates and fluorides concentrations (both hazardous to human health), the situation appears to be very unsafe.

(2) Yield and Potentiality of Groundwater

The groundwater yield is generally poor in all the three FS Areas. Accessibility (the probability of a borehole yielding more than 0.1 l/s) is relatively high while exploitability (the probability of a borehole yielding more than 2.0 l/s) is generally low.

For this reason many boreholes having a small yield have been constructed. If the existing situation continues and the number of boreholes increases further in the future, it will constitute an enormous workload for the institutions who must undertake the management and maintenance of the boreholes, including regular monitoring of water quality.

(3) Community Preference

On many occasions, FS communities expressed a feeling of disparity. Virtually all of the communities immediately outside the FS Areas already have access to a surface water supply or will soon do so.

Despite having little or no technical knowledge, people in the FS communities realise that a surface water supply is more stable and safer in terms of water quality than a borehole supply. This creates the sense of disparity among communities in the FS Areas.

2.2.2 Availability of Surface Water

There will be sufficient surface water available in the Crocodile River System to meet the projected primary water demands within the river basin including North Mankwe and Klipvoor FS Areas up to the year 2015. This is because of the increasing return flows from a number of large sewage treatment works located upstream.

Due to the location of the proposed development in Moretele 2 this Area can be most economically fed from Mkombo Dam (which is partly fed from Rust de Winter Dam) through Weltevreden WTW. Although a water balance study conducted during Phase 1 (Master Plan)indicated that there will be sufficient water available from Mkombo Dam to meet the existing demands in the former Kwandebele region plus the additional demand of Moretele 2, if this is not the case at some point in the future, the boundary between the supply area of Weltevreden WTW and that of Bronkhorstspruit WTW should be shifted northwards slightly.

2.3 Water Demand

2.3.1 Level of Service

Generally communities express dissatisfaction with the RDP level of service and show a preference for supply through yard connections. The results of questionnaire survey conducted in March 1997 for FS communities also demonstrated this well. As can be seen in Table 2-4, people in FS communities expressed a view that they are willing to pay approximately three times more for supply through a yard connection than for supply through a standpipe.

In some areas, communities have rejected newly installed RDP schemes and cite the following as the major reasons for their views.

- A long cartage distance
- A uniform water charge per household being applied irrespective of the actual consumption rate of each household

Experience indicates that community acceptance of service level is the key to the success of any water supply project including achieving cost recovery. It is still questionable however whether or not communities can actually afford to pay for the level of service they expect. A decision regarding the appropriate service level can be made only after comparison of the following two parameters has been assessed.

- The level of water tariff which needs to be levied to recover the unsubsidised portion of both the capital cost and the operation and maintenance costs
- The level of affordability of communities

It has been a clear policy of the new South African Government that it will subsidise the full capital cost of providing the RDP level of service (25 lcd within 200 m), but that if communities want a higher level of service, they should pay any additional costs which are necessary to acquire such a service.

In the meantime, the following propositions have been recently adopted as Government policy for the planning and funding of RDP water supply schemes.

- Even for a water supply scheme based on the RDP level of service, certain components of the infrastructure, such as bulk supply and external reticulation pipelines should be provided with a larger capacity from the outset which will facilitate the future upgrading of the service level. The capital cost for providing this extra capacity will also be fully subsidised by Government.
- The level of service to which this policy is applicable is for yard connections with a per-capita consumption rate of approximately 80 lcd on an annual average daily demand (AADD) basis.

Against the background mentioned above, the following two different levels of service were developed for this Feasibility Study with the intention of testing them against the affordability of the FS communities.

Service Level A : 100% of households in the community will be supplied through standpipes to the RDP level of service at an average per capita consumption rate of 30 lcd (AADD) including an allowance of approximately 15 % for leakage.

Service Level B : 90% of households in the community will be supplied through yard connections (85.6 lcd) and the remaining 10% through standpipes (30 lcd) in accordance with the RDP level of service, giving a weighted average per capita consumption rate of 80 lcd (AADD) including an allowance of approximately 15% for leakage.

Service Level A is presumed to be the case in which the communities can acquire only the RDP minimum level of service but incur the least financial burden. In this case, communities will pay only for the O&M costs of the scheme once installed.

Service Level B is presumed to be the case in which the communities can acquire the level of service they want with the minimum financial burden on their part. The households which remain on standpipes are those located around the periphery of each community. Extension of the reticulation to such households is not economically viable, as it will result in a significant increase in the per capita reticulation cost. In the case of Service Level B, communities will have to pay not only for the O&M costs of the scheme but also part of the initial capital cost as illustrated in Figure 2-1.

2.3.2 Population and Water Demand

(1) Population

A comprehensive study on demographic and socio-economic conditions in the wider JICA Master Plan Area was conducted during 1996. The study envisaged that while growth will take place primarily in Pretoria - Ga Rankuwa, Mabopane and Temba areas and secondarily in the Rustenberg area with a growth axis extending up to Monakato - Mogwase - Northam - Thabazimbi, there will be no future growth in population in the FS Areas, as the natural growth will be offset by migration of an approximately equal number of people to urban areas.

In February and March 1997, extensive surveys of the FS communities were conducted as part of this Feasibility Study. These included questionnaires regarding the present population and number of households and were based on interviews with leaders in each community supplemented where necessary by counting the number of houses. A comparison between information obtained from the surveys and 1/10,000 scale ortho-photos of the communities taken in 1989 reinforced the master plan assessment, in that virtually no increase in the number of households in these communities was observed. For this reason, it is also assumed in this Feasibility Study that there will be no growth of population in the FS communities in the future.

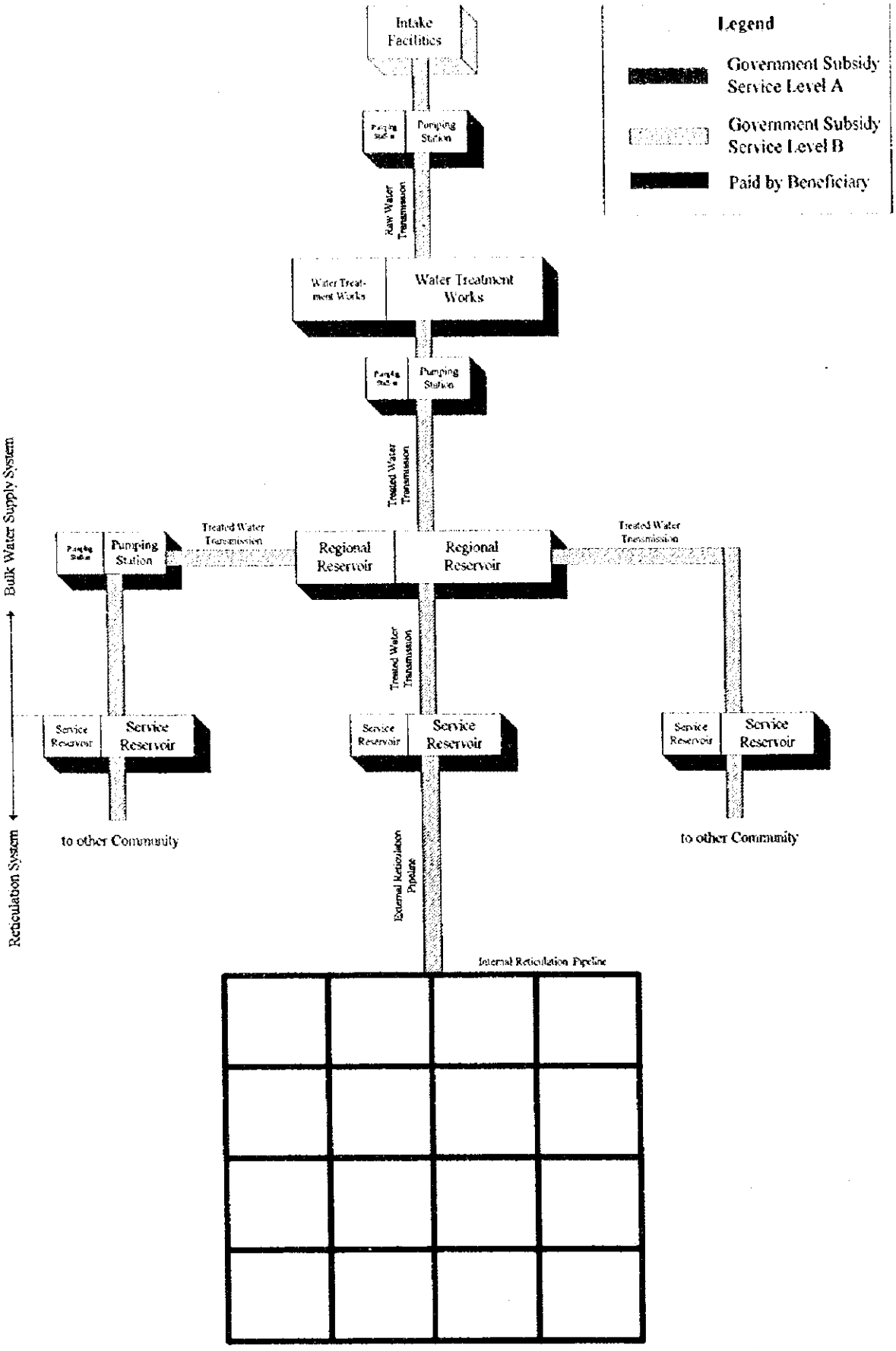

Figure 2-1 Extent of Coverage of Government Subsidy for Service Level B Water Supply Scheme

The population and number of households estimated for each of the FS Areas are summarised in the following Table 2-6.

Table 2-6 Population And Water Demand

	North Mankwe		Klipvoor		Moretele 2	
	Level A	Level B	Level A	Level B	Level A	Level B
No. of Communities	24		35		17	
No. of Households	9,436		16,885		16,370	
Population	60,390		114,818		104,768	
No. of Persons per Household	6.4		6.8		6.4	
Water Demand						
Annual Average Day Demand (kld)	1,812	4,834	3,445	9,190	3,143	8,386
Summer Peak Day Demand (kld)	2,718	7,251	5,168	13,785	4,715	12,579

This Feasibility Study assumed that the proposed water supply plan will serve all the population enumerated in the table.

(2) Water Demand

As can be observed from Table 2-4 which shows the results of questionnaire survey with respect to the willingness to pay of the FS communities, the expectations of the FS communities is already higher than the RDP level of 25 lcd, and that the real questions are (1) whether water supply should, from the outset, be planned on the basis of the RDP standpipes or on the basis of yard connections; and (2) whether or not communities can actually afford to pay for the service which meets their expectations.

The average per capita water consumption rate of 25 lcd (85% of 30 lcd) assumed for standpipes is not likely to increase in the future, given the labour intensive nature of water cartage. Similarly it is unlikely that an average per capita consumption rate of 73 lcd (85% of 85.6 lcd) assumed for yard connections will increase significantly within the next decade or so. In terms of the summer peak day demand, these consumption rates are 38 lcd (150% of 25 lcd) and 110 lcd (150% of 73 lcd) respectively assuming a peak day factor of 1.5.

For these reasons, future increases in the per capita water consumption rates were not considered in this Feasibility Study; instead water demand was estimated for Service Levels A and B. The demands for each level are shown for each FS Area in Table 2-6 above.

In this Feasibility Study a regional surface water supply plan for each of these two service levels has been developed, costed and examined against the affordability of the FS communities.

2.4 Proposed Water Supply Plan and Infrastructure

2.4.1 Proposed Water Supply Plan

The proposed water supply plans for each FS Area are shown in Figures attached at the end of this Report. Three alternative plans utilising different water sources were developed, costed and evaluated for both the Klipvoor and Moretele 2 FS Areas. The arrangements shown for these FS areas in the above Figures are those finally adopted as the most preferable option for each of these two FS Areas.

(1) Klipvoor Area

The following three alternative plans were prepared, costed and assessed for this FS Area.

Alternative 1 : The entire FS Area which consists of Klipvoor West Supply Block, Klipvoor East Supply Block and Moretele North Supply Block is assumed to besupplied from the new Klipvoor WTW, located at Klipvoor Dam.

Alternative 2 : Moretele North Supply Block is assumed to be supplied from the existing Klipdrift WTW, while the other two Supply Blocks are assumed to be supplied from the new Klipvoor WTW.

Alternative 3 : Both Moretele North Supply Block and Klipvoor East Supply Block are assumed to be supplied from the existing Klipdrift WTW, while Klipvoor West Supply Block is assumed to be supplied form the new Klipdrift WTW.

Table 2-7 shows a comparison of these alternative plans. This Study identified Alternative 1 as the most preferable option for this FS Area.

Table 2-7 Comparison Of Alternative Plans (Klipvoor)

Item	Unit	Alternative 1	Alternative 2	Alternative 3
Capital Cost Required	Mil. R	122.3	129.7	142.2
Total Energy Required for Pumping	m^3/secx m	43.3	45.6	55.1
Impact on Operation of Existing System		Low	Medium	High
Operability of New WTW (in terms of scale)		Good	Fair	Poor

(2) Moretele 2 Area

The following three alternative plans were prepared, costed and assessed for this FS Area.

Alternative 1 : The entire FS Area which consists of Moretele 2 West Supply Block andMoretele 2 East Supply Block is assumed to be supplied from the existing Weltevreden WTW.

Alternative 2 : Moretele 2 East Supply Block is assumed to be supplied from the existing Weltevreden WTW while Moretele 2 West Supply Block is assumed to be supplied from the existing Klipdrift WTW.

Alternative 3 : Moretele 2 East Supply Block is assumed to be supplied from the existing Weltevreden WTW while Moretele 2 West Supply Block is assumed to be supplied from a new WTW to be built at Rust de Winter Dam.

Table 2-8 below shows a comparison of these alternative plans. This Study identifed Alternative 1 as the most preferable option for this FS Area.

Table 2-8 Comparison Of Alternative Plans (Moretele 2)

Item	Unit	Alternative 1	Alternative 2	Alternative 3
Capital Cost Required	Mil. R	122.4	134.7	145.6
Total Energy Required for Pumping	m^3/secx m	39.2	40.6	34.5
Impact on Operation of Existing System		Low	Low	Low
Operability of New WTW (in terms of scale)		-	-	Poor

(3) North Mankwe Area

A study of alternative water supply plans was not necessary for the North Mankwe FS Area as Vaalkop Dam is the only potentially viable source of surface water for this FS Area. The Area differs from the two other FS Areas as there is extensive existing surface water supply infrastructure already in place in this region, most of which is operated by MW. The feasibility study for this Area has been concerned with extending the existing system into unserved or under served communities in the FS Area rather than providing a completely new system.

Work is now in hand at to strengthen the current MW supplies to the south of Vaalkop and to the west up to Sun City and the Saulspoort area. This work includes a 90 Mld extension of the existing Vaalkop WTW, provision of a further 25 Mld reservoir at La Patrie and

construction of a new 350 mm bulk supply main from La Patrie to the Mabeskraal area. The feasibility study for the North Mankwe Area has integrated the existing planning for this proposed infrastructure into the proposed scheme.

With respect to the provision of retail supply infrastructure, many initiatives promoted by DWAF and MW are already under way for providing the RDP level of service (25 lcd within 200 m) in the North Mankwe FS Area. The feasibility study in North Mankwe has been concerned with utilising all the retail infrastructure which has already been provided or will soon be provided under fixed planning through those RDP schemes. Such infrastructure include reservoirs and reticulation pipes but exclude boreholes which it is proposed will either be reserved as an emergency source of supply or be used for stock-watering or for other non-domestic purposes.

The water supply plans shown in Figures attached at the end of this Report were first developed on the basis of the Service Level B demand. Each plan was then re-examined on the basis of the Service Level A demand, in which pumping stations, water treatment works, reservoirs and reticulation system were planned or sized to meet the smaller demand. This identified the cost required for implementation of the same water supply scheme but on the basis of the RDP level of service, thus the difference in capital cost between the two different levels of service was calculated for each FS Area.

2.4.2 Proposed Infrastructure

Infrastructure required for each FS Area is outlined for each of the two different service levels in the following Tables 2-9 and 2-10.

Table 2-9 Proposed Infrastructure (Service Level A)

		North Mankwe		Klipvoor		Moretele 2	
BULK SUPPLY INFRASTRUCTURE							
Source of Water (Dam)		Vaalkop		Klipvoor		Mkombo	
Raw Water Supply Pipelines	km	250 mm	1.0	400 mm	0.1	450 mm	0.1
Water Treatment Works High Lift PS	Mld		2.7		6.0		15.0
Regional Reservoirs	No.	0.3 to 0.6 Ml	2	0.5 to 3.0 Ml	3	3.2 Ml	1
Bulk Supply Pipelines	km	90 to 350 mm	151	90 to 400 mm	231	90 to 500 mm	135
Booster Pumping Stations	No.		6		5		6
RETAIL SUPPLY INFRASTRUCTURE							
Service Reservoirs	No.	20 to 160 kl	13	10 to 410 kl	38	20 to 450 kl	23
Reticulation Pipelines	km	63 to 200 mm	84	63 to 200 mm	204	63 to 200 mm	288
Yard Connections	No.		0		0		0
Standpipes	No.		126		440		544

Table 2-10 Proposed Infrastructure (Service Level B)

		North Mankwe		Klipvoor		Moretele 2	
BULK SUPPLY INFRASTRUCTURE							
Source of Water (Dam)		Vaalkop		Klipvoor		Mkombo	
Raw Water Supply Pipelines	km	250 mm	1.0	400 mm	0.1	450 mm	0.1
Water Treatment Works High Lift PS	Mld		7.3		15.0		15.0
Regional Reservoirs	No.	0.3 to 1.0 Ml	5	0.5 to 5.0 Ml	6	3.2 to 5.0Ml	2
Bulk Supply Pipelines	km	90 to 350 mm	151	90 to 400 mm	231	90 to 500 mm	135
Booster Pumping Stations	No.		6		5		6
RETAIL SUPPLY INFRASTRUCTURE							
Service Reservoirs	No.	20 to 480 kl	37	10 to 480 kl	79	20 to 450 kl	52
Reticulation Pipelines	km	63 to 200 mm	190	63 to 200 mm	438	63 to 200 mm	483
Yard Connections	No.		8,490		15,198		14,733
Standpipes	No.		89		340		420

2.5 Construction Cost

Costs estimated for each FS Area are summarised in Table 2-11 below for each of the two service levels.

Table 2-11 Estimated Construction Costs at 1997 Price (R×1,000)

Service Level	North Mankwe	Klipvoor	Moretele 2
Service Level B	68,426	122,307	122,421
Service Level A	45,443	76,624	87,592
Service Level (B) - (A)	22,983	45,683	34,830

The costs shown in the above table are pure construction costs at 1997 prices to which various other costs and fees, such as P&G, contingencies, engineering fee, administration costs, VAT , etc. must be added to derive the actual project cost.

The construction costs for Service Level B includes the cost of providing yard connections to 90 % of households in all communities, which constitutes a significant proportion of the difference of costs between the two levels of service.

All the materials, equipment and goods required for the construction of the proposed infrastructure, such as pumps, motors, pipes, fittings, valves, etc. are assumed to be locally manufactured ones, considering their relatively small sizes/capacities and the sufficient manufacturing capability of local industries.

2.6 Financial Appraisal

2.6.1 Preliminary Analysis on Case A and Case B

In order to appraise the proposed project options, namely, Case A (RDP Minimum Level (stand pipe): 100%) and Case B (Yard Connection: 90% + stand pipe: 10%), both options were preliminarily analysed mainly from financial viewpoints.

(1) Premises

(a) Willingness to Pay and Affordability

The community survey provided basic information on socio-economic conditions in each Area which is summarised in the following table.

Table 2-12 Result Of Community Survey

	Units	North Mankwe	Klipvoor	Moretele 2
1. Average Household Size	Persons	6.4	6.8	6.4
2. Average Household Income				
- Average	R/month	1,216	1,167	1,466
- Low Income Household*	R/month	305	332	337
3. Willingness to Pay				
- for RDP Service Level	R/month	8.3	9.0	9.1
- for Yard Connections	R/month	29.6	23.8	28.5

Note : Household with its income less than 500 R/month is determined as Low Income Household

(b) Implementation Period

It is assumed that both Case A and Case B would be implemented in five year term, starting from the year 1998.

(2) Project Cost

(a) Initial Capital Cost

The initial capital cost was derived from a cost model and consisted of direct construction cost, provisional and general items (15%), engineering fees (10%), institutional development (2.5%), miscellaneous (2%), physical contingencies (15%), price contingency (10% compound rate) and VAT (14%). The following summarises the required capital cost for Case A and B in each sub-project with the following definition:

Bulk Supply : Bulk water supply infrastructures covering from raw water intake to bulk supply pipeline until service reservoirs.

Retail Supply : Retail water supply infrastructures covering from service reservoirs to end user's taps

Table 2-13 Initial Capital Cost (R x 1,000)

	North Mankwe	Klipvoor	Moretele 2
1. Case A			
- Bulk Water Supply	90,888	133,207	144,542
- Retail Water Supply	20,084	53,718	68,726
- Total	**110,972**	**186,925**	**213,268**
2. Case B			
- Bulk Water Supply	102,388	155,542	150,742
- Retail Water Supply	57,607	130,209	135,618
- Total	**159,995**	**285,751**	**286,360**

(b) Operation and Maintenance Cost

In addition to the above capital expenditure, the operation and maintenance cost must also be met to achieve sustainability of the project including raw water, electricity, materials, labour and administration:

Table 2-14 Annual Operation and Maintenance Cost (R x 1,000)

	North Mankwe	Klipvoor	Moretele 2
1. Case A			
- Bulk Water Supply	442.5	778.4	312.2
- Retail Water Supply	243.0	342.3	204.9
- Total	**685.5**	**1,120.7**	**517.1**
2. Case B			
- Bulk Water Supply	1,179.9	2,075.7	832.4
- Retail Water Supply	513.0	695.1	507.3
- Total	**1,692.9**	**2,770.8**	**1,339.7**

(3) Tariff and Implication

In order to find out a realistic and sustainable water tariff, a simulation analysis was conducted for each Area based on several conditions and assumptions: (a) DWAF bears only the initial capital expenditure for the RDP minimum level of service (Case A); (b) average affordability is around 3% of income; (c) 100% tariff collection; and (d) 17% of long term loan interest (8% of real

interest rate). Water tariff which should cover operation and maintenance cost, reserve for replacement and loan repayment, was computed and compared with the affordability as shown below.

Table 2-15 Water Tariff and Affordability

	Unit	North Mankwe	Klipvoor	Moretele 2
1. Unit Retail Water tariff				
- Case A	R/kl	1.49	1.19	0.68
- Case B	R/kl	3.91	3.94	2.97
2. Monthly Tariff (Retail Water)				
- Case A	R/month	7.2	6.1	3.3
- Case B Ave. Income Household (68lcd)	R/month	51.1	54.6	38.8
- Case B Low Income Household (25lcd)	R/month	18.8	20.1	14.3
3. Monthly Affordability				
- Average Income Household	R/month	36.5	35.0	44.0
- Low Income Household	R/month	9.2	10.0	10.1

Note : Retail Water Tariff means fee payed by the consumer in which includes bulk water tariff.

On the basis of comprehensive analysis on the original option of the project proposals, the three sub-projects have been evaluated, of which results are summarised below:

Table 2-16 Comprehensive Evaluation of Case A and Case B

				Original Options	
				Case A	Case B
North Mankwe	Institutional Capacity	Second Tier		No problem	No problem
		Third Tier		No reinforcement	Needs reinforcement
	Financial Capability	Affordability		No problem	Rather difficult
		Funding	2nd Tier	Not necessary	No problem
			3rd Tier	Not necessary	Possibly no problem
	Social Aspect	Preference		Negative	Positive
		Non-payment		Rather risky	Less risky
Klipvoor	Institutional Capacity	Second Tier		No problem	No problem
		Third Tier		Need reinforcement	Needs strong Reinforcement
	Financial Capability	Affordability		No problem	Difficult
		Funding	2nd Tier	Not necessary	Possibly no problem
			3rd Tier	Not necessary	Rather difficult
	Social Aspect	Preference		Negative	Positive
		Non-payment		Highly risk	Less risky
Moretele 2	Institutional Capacity	Second Tier		Unknown	Unknown
		Third Tier		Strong reinforcement	Strong reinforcement
	Financial Capability	Affordability		No problem	Rather difficult
		Funding	2nd Tier	Not necessary	Possibly no problem
			3rd Tier	Not necessary	Rather difficult
	Social Aspects	Preference		Negative	Positive
		Non-payment		Extremely risky	Less risky

While Case A seems to be financially viable, community preference for this level of service is low resulting in a high risk of non-payment including illegal/unauthorised connections. On the contrary, the Case B is well accepted by communities, however, a set tariff is far beyond their affordability.

2.6.2 Staged Development Approach

Based on the above evaluation, it would appear that neither simply implementing Case A nor Case C would be the best alternative. In this context, a staged development scenario is recommended for all three areas as a possible option (Case C) that will realise the RDP minimum level by year 2002 and allow subsequent upgrading to Service Level B. In the Case C option, two alternative plans are further taken into account: Case C-1 includes prior deposit for upgrading cost by beneficiaries in terms of tariff during the level A period; and Case C-2 procures full portion of upgrading cost from an external fund agency.

With similar manner previously applied, water tariff for the two alternative is calculated, and their implications are summarised below:

Table 2-17 Water Tariff for Case C-1 and C-2 at 1997 Price

Case	Period	Unit	North Mankwe	Klipvoor	Moretele 2
Case C-1	2002-2007	R/HH	36.20	39.02	22.62
	2008-2012	R/Kl	2.83	2.56	2.12
	2013-2017	R/Kl	2.90	2.60	2.14
	2018-2022	R/Kl	2.97	2.65	2.18
	2023-2027	R/Kl	3.05	2.70	2.20
Case C-2	2002-2007	R/HH	7.20	6.02	3.22
	2008-2012	R/Kl	3.86	3.93	2.97
	2013-2017	R/Kl	3.93	3.98	2.99
	2018-2022	R/Kl	4.00	4.02	3.03
	2023-2027	R/Kl	4.08	4.07	3.05

On the basis of the above result, both alternative plans were comprehensively evaluated of which results are summarised in Table 2-18. In accordance with the evaluation results, Case C-1 is considered most realistic option to be implemented under the framework of Magalies Water Expansion Project.

Table 2-18 Evaluation on Alternative Plans (Cases C-1 and C-2)

<table>
<tr><th colspan="2" rowspan="2">Particulars</th><th colspan="4">Alternative Plan (Case)</th></tr>
<tr><th colspan="2">C-1</th><th colspan="2">C-2</th></tr>
<tr><td rowspan="5">Water Tariff and Beneficiaries' Share
(While the zero growth for beneficiaries' income is expected, the tariff includes real increase of electricity charge at 3% per annum.)</td><td>1st Stage</td><td colspan="2">Since the tariff includes reserve fund for upgrading service level (a part of retail water supply facility and connection fee), it occupies about 3% of Average household income, while it does 11.9%, 11.8% and 6.7% of low income household in North Mankwe, Klipvoor and Moretele 2 areas, respectively.</td><td colspan="2">The tariff occupies less than 3% of household income in both average and low income household</td></tr>
<tr><td>2nd Stage</td><td colspan="2">Through introduction of quantity base water tariff, it occupies 3.0-3.3% of average household income group in North Mankwe, 3.0-3.2% in Klipvoor and 1.9-2.0% in Moretele 2. On the other hand, it does 4.5-4.8%, 3.9-4.2% and 3.0-3.1% of that of low income household, respectively.</td><td colspan="2">Similar to Case C-1, the tariff occupies 4.1-4.4% of Average household income in North Mankwe, 4.7-4.8% in Klipvoor and 2.6-2.7% in Moretele 2. On the other hand, it does 6.1-6.4%, 6.0-6.3% and 4.2-4.3% of that of low income household, respectively.</td></tr>
<tr><td rowspan="4">Total Water Charges per HH (2002-2027) (Rand)</td><td></td><td>Ave. HH.</td><td>Low HH.</td><td></td><td>Ave. HH.</td><td>Low HH.</td></tr>
<tr><td>North Mankwe</td><td>11,376</td><td>5,556</td><td>North Mankwe</td><td>12,864</td><td>5,003</td></tr>
<tr><td>Klipvoor</td><td>11,089</td><td>5,557</td><td>Klipvoor</td><td>12,678</td><td>5,257</td></tr>
<tr><td>Moretele2</td><td>8,125</td><td>3,846</td><td>Moretele2</td><td>9,296</td><td>3,540</td></tr>
<tr><td colspan="2">Contribution to Improvement of Financial Ground of Service Provider</td><td colspan="2">Through the reserve fund accumulated during the 1st Stage, North Mankwe will be able to secure about 13 million Rand as original fund, 33.4 million Rand and 18.4 million Rand in Klipvoor and Moretele 2, respectively. Due to the original reserve fund, credibility of service providers will be improved for external funding institutions, and it facilitates the service providers to obtain the required loan more easily than Case C-2 in the 2nd Stage.</td><td colspan="2">All the cost to be required for upgrading the service level will be depending on external funding institutions, the proposed service provider, especially District Councils as 3rd Tier will face lack of credibility taking into account the present financial situation.</td></tr>
<tr><td colspan="2">Overall Evaluation</td><td colspan="4">While the tariff in Case C-1 for the 1st Stage exceeds affordability of low income group due to reserve fund as prior investment in the three FS areas, the tariff for the 2nd Stage occupies household income by 1 to 2% lower than Case C-2. As for total expenditure for water charge during the calculation period of 25 years, average household of Case C-1 bears lesser burden than Case C-2, low income household of Case C-1 must expend a little bit more water charge by 100 to 500 Rand for 25 years than Case C-2. In this context, the low income household of Case C-1 situates rather severer position than Case C-2, the average household of Case C-1 could enjoy more favourable condition than Case C-2 in terms of their cost sharing for water tariff. In addition, Case C-1 will be able to improve credibility of service providers. Therefore, the Case C-1 is considered the most realistic option when proper measures will be taken for the low income household.</td></tr>
</table>

2.6.3 Details of Proposed Option (Case C-1)

In order to meet with the basic requirement set out in the "White Paper on Water Supply and Sanitation", the project in each of the FS Areas shall be implemented over a 5-year period starting from 1998 and ending in 2002, the target year for providing the RDP minimum level of service. The five-year term includes time for arranging loan funding, detailed design, construction and institutional development. The infrastructure development in each area shall be divided into two or three separate contracts, corresponding to the number of supply block in each Area, so as to allow partial commissioning as the works are completed to the greatest extent possible.

(1) Project Cost

(a) Capital Cost and Allocation

The required capital cost in each sub-project shall be borne by the respective tier as shown below:

Table 2-19 Capital Cost and Allocation (R x 1,000)

		North Mankwe	Klipvoor	Moretele 2
1. Stage 1 (Level A) (1998-2002)				
1.1 Bulk Supply	1st Tier	90,888	133,207	144,542
1.2 Retail Supply	1st Tier	20,084	53,718	68,726
1.3 Total		**110,972**	**186,925**	**213,268**
2. Stage 2 (Level B) (2003-2007)				
2.1 Bulk Supply	2nd Tier	18,520	35,972	9,986
2.2 Retail Supply	3rd Tier	36,423	80,213	66,070
2.3 Yard Connection	3rd Tier	24,008	42,974	41,660
2.4 Total		**78,951**	**159,159**	**117,716**

(b) Operation and Maintenance Cost

In addition to the above capital expenditure, the operation and maintenance cost must also be met to achieve sustainability of the projects:

Table 2-20 Annual Operation and Maintenance Cost (R x 1,000)

	North Mankwe	Klipvoor	Moretele 2
1. Stage 1 (Level A) 2002-2007			
- Bulk Water Supply	446	778	312
- Retail Water Supply	243	342	205
- Total	689	1,120	517
2. Stage 2 (Level B) 2008 -			
- Bulk Water Supply	1,230	2,171	920
- Retail Water Supply	513	695	507
- Total	1,743	2,866	1,427

(2) Water Tariff

Through the cash flow analysis aiming financial viability of the service provider as well as affordability of beneficiaries, the following tariff system is applicable in the three sub-projects:

Table 2-21 Set Tariff and Affordability

	Unit	North Mankwe	Klipvoor	Moretele 2
Stage 1				
- Unit Price	R/KI	1.50	1.18	0.67
- Monthly Tariff (Flat Rate)	R/HH	36.20	39.02	22.62
Water Cost	R/HH	7.20	6.02	3.22
Deposit for Reserve Fund	R/HH	29.00	33.00	19.40
- Share of Average H.H. Income				
• Average	%	3.0	3.3	1.5
• Low	%	11.9	11.8	6.7
Stage 2				
- Unit Price	R/KI	2.83 - 3.05	2.56 - 2.70	2.12 – 2.20
- Monthly Tariff (Quantity Based)	R/HH	36.95 - 39.82	35.51 - 37.45	27.68 – 28.72
• Average (68lcd)		13.58 - 14.64	13.06 - 13.77	10.18 - 10.56
• Low (25lcd)				
- Share of Average H.H. Income				
• Average	%	3.0 - 3.3	3.0 - 3.2	1.9 – 2.0
• Low	%	4.5 - 4.8	3.9 - 4.2	3.0 - 3.1

In the course of the cash flow analysis on the service providers for the retail water supply so as to set a water tariff system, due attention has been paid for both financial viability of the providers and affordability of beneficiaries. On the other hand, the source of revenue in this proposed project is limited only to the water charge, because (a) the central government, DWAF will no longer extend any financial support for implementation of Level B services in terms of supplementing interest on loans as well as guaranteeing debt payment, (b) the relevant District

Councils who will be a main body of service providers, have quite weak financial ground. As a consequence, the water tariff system set in Table 2-21 is forced to exceed the affordability of low income group, and then necessary measures for the low income group must be duly taken into account, of which details are described in the latter part of this section.

During the stage 1, proposed tariff includes prior deposit for the upgrading cost as a reserve fund. At the end of stage 1, the following cost for upgrading services will be required with beak down.

Table 2-22 Upgrading Cost at 1997 Price

	Unit	North Mankwe	Klipvoor	Moretele 2
Total Upgrading Cost	R Mil.	25.66	52.32	45.75
Sum of Reserve Fund	R Mil.	12.96	32.74	18.41
External Loan Amount	R Mil.	12.70	19.58	27.34

(a) Issues relating to water tariff setting

1) Community level

It is rather difficult to introduce different service levels into a single community from technical viewpoint, hence the community must obtain consensus of community members on the service level. During the process on the above, community members should discuss on appropriate consideration for the low income group including:

- Possibility of cross-subsidisation within the community
- Positive utilisation of low income group for labour works during construction stage as income increase even temporary basis
- Mobilisation of low income group for O & M works of water supply facilities within the community

2) Service Provider level

In order to attain full recovery of water tariff, the following items will be examined:

- It is defined that the operation and maintenance of facilities and water charge collection are responsible for the community itself, and incentive and penalty system will be applied on the occasions
- To prepare and distribute easily understandable document on the impact of the reserve fund and to remove uneasiness of beneficiaries through preparation of separate accounting system for the reserve fund for which periodical audit will be applied

3) Low income group level

In order that the group will be able to participate for the higher service level, the following item must be examined:

- To reduce cost burden of connection cost between the retail supply pipe and yard tap, the low income group shall contribute by offering their efforts for the required labour works

4) Feedback of experience obtained from Pilot Project

In order to realise the various measures stated above, experiences and best practices obtained during the process and the implementation of the pilot projects, must be reflected including on the following items:

- Approach method and process of establishing Local Project Steering Committees in the three pilot project communities ; and
- Method of water tariff computed on the own initiative of the concerned communities (Kameelboom and Segokgo) and the process to obtain consensus of community members on the set tariff.

(3) Funding

(a) Viability of Stakeholders

The stakeholders who are responsible for providing community water supply to the FS areas are as follows.

Table 2-23 Responsible Stakeholders in Community Water Supply

	North Mankwe	Klipvoor	Moretele 2
First Tier	DWAF, North West	DWAF, North West	DWAF, Mpumalanga
Second Tier	Magalies Water	Magalies Water	Higheveld Water
Third Tier	Rustenburg DC	Eastern DC	Highveld DC

There is no question concerning the institutional and financial capacity of the first tier. While MW as the second tier has a sound financial position, Highveld Water Board is an unknown factor due to the ongoing process to establish the board, for which the first tier is providing support. In connection with the third tier, RDC has greater capacity, both in institutional and financial terms, than the other two district councils of EDC and HDC, because the latter two were established very recently and are basically dependent on levies, subsidies and grant (see Table 2-24).

Table 2-24 Financial Status of Stakeholders

(Unit: '000R)

Description	1996 Magalies Water	1996 Rand Water	1996 Eastern DC	Bud. 6/77 Highveld DC	1996 Rustenbrg DC	1996 Brits TLC
Revenues/Income						
Bulk water sales	36,227	948,899	22,300	0	14,246	8,682
Levy income	0		16,000	65,132	36,597	
Central/Provincial Govt. transfers/allocations	0					166
Subsidies & grants	0		10,063		670	
Interest on investments					3939	
Other (sundry income, regional function)	611		2,448	2,790	647	146
Total (budgeted) revenues	**36,838**	**948,899**	**50,811**	**67,922**	**56,099**	**8,994**
Less expenses/budget allocations						
Water purchases	5,002	109,369	20,300	0	14,246	256
Lesotho Highlands Water Project Levy		123,591				
Operating costs	13,262	433,059	4,505	6,677	4,261	8,849
Contributions: provisions and reserves	0				28,264	105
Regional function			14,927	29,270		
Contributions/Allocations to: local bodies, capital outlay			6,607	25,659	1,106	104
Other						
Total expenses	**18,264**	**666,019**	**46,339**	**61,606**	**47,877**	**9,314**
Net operating income/surplus	**18,574**	**282,880**	**4,472**	**6,316**	**8,222**	**-320**
Net margin %	50.42%	29.81%	8.80%	9.30%	14.66%	-3.56%
Less:						
Interest and finance charges	8,339	39,241				
Statutory Transfers		130,088				
Betterment Fund		52,298				
Redemption Fund	0	77,790		25		
Annual Appropriations/Net Surplus	**10,235**	**113,551**	**4,472**	**6,291**	**8,222**	**-320**
Appropriation to Funds						
Betterment Fund		51,985				
Reserve Fund		54,566				
Depreciation & Renewals Fund		7,000				
Current assets (cash, inventory, accounts receivable)	22,560	326,264		22,987	20,632	6,625
Current liabilities (accounts payable)	10,893	230,028		21,238	10,239	6,625
Net current assets (working capital)	**11,667**	**96,236**	**0**	**1,749**	**10,393**	**0**
Fixed assets	194,912	2,301,850		2,735	113	16,765
Investments	69,139	35,560		22,987	24,000	11,027
Other assets	16,162	0			167	
Total	**280,213**	**2,337,410**	**0**	**25,722**	**24,280**	**27,792**
Total assets	**302,773**	**2,663,674**	**0**	**48,709**	**44,912**	**34,417**
Long-term debt (loans, long-term commitments)	184,670	900,205		2,735	113	16,765
Reserves and provisions	44,444			22,094	34,560	9,335
Capital contributions	62,766	73,700		0		
Accumulated Funds	0	1,459,741		2,642		1,692
Total	**291,880**	**2,433,646**	**0**	**27,471**	**34,673**	**27,792**
Total liabilities	**302,773**	**2,663,674**	**0**	**48,709**	**44,912**	**34,417**

Source: RW 1996 Annual Report; MW 1996 Annual Report; Eastern DC, Highveld DC; Rustenberg DC, Brits TLC

(b) Funding Source

DWAF is responsible for allocating fund for RDP projects, and has allocated its budget for RDP programmes 1, 2, 3 and 4. Under the RDP 4, total of R639 million has been allocated for new water projects during four years, in which KwaNdebel (Project No. 4101) receives the highest budget, R28.9 million. Taking into account the required initial cost for the Level A services, amounting to R111 million in North Mankwe, R187 million in Klipvoor and R213 million in Moretele 2, it is prerequisite for DWAF to secure external loan fund such as international financing agencies and/or bi-lateral source.

It is planned in the proposed and possible option "Case C-1" that the portion of the tariff over and above the O&M component be transferred to a reserve fund and invested with reasonable and safe return on investment over the five year period for operating at Service Level A. It is also hoped that the financial position of the Services Provider in each Area would have greatly improved after the five-year period so that loan funding will be possible.

The possibilities for obtaining funding in the form of soft loans or grants are low due to the current policy of DWAF of not obtaining loans, grants or guaranteeing loans on behalf of local authorities. This limits the funding sources to primarily DBSA, Commercial Banks (including special infrastructure and developments funds), and Merchant Banks (e.g. public finance departments) who would lend at commercial interest rates.