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DEPARTMENT OF WATER AFFAIRS AND FORESTRY
DIRECTORATE NATIONAL WATER RESOURCE PLANNING

INTERNAL STRATEGIC PERSPECTIVE:
LIMPOPO WATER MANAGEMENT AREA

Version 1: November 2004

DEPARTMENT OF WATER AFFAIRS AND FORESTRY
DIRECTORATE NATIONAL WATER RESOURCE PLANNING

INTERNAL STRATEGIC PERSPECTIVE

LIMPOPO WATER MANAGEMENT AREA

APPROVAL

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DWAF Report No:	P WMA 01/000/00/0304
Consultants:	Goba Moahloli Keeve Steyn in association with Tlou & Matji Engineering & Management Services (Pty) Ltd and Golder Associates (Pty) Ltd.
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INVITATION TO COMMENT

This report will be updated on a regular basis until it is eventually superceded by the Catchment Management Strategy to be devloped by the Catchment Management Agency. Water users and other stakeholders in the Limpopo WMA and other areas are encouraged to study this report and to submit any comments they may have to the Version Controller (see box overleaf).

ELECTRONIC VERSION

This report is also available in electronic format as follows:

- DWAF website:
  - Internet: http://www.dwaf.gov.za/documents/
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  mailto:apm@dwaf.gov.za

  or from the Version Controller (see box overleaf)

The CD contains the following reports (all available on DWAF website)

- Limpopo WMA Internal Strategic Perspective (*this Report*)
  (Report No: P WMA 01/000/00/0304
- The National Water Resource Strategy
- The Limpopo WMA – Overview of Water Resources Availability and Utilisation
  (Report No: P WMA 01/000/00/0203
- The Limpopo WMA – Water Resources Situation Assessment
  (Report No: P WMA 01/000/00/0301)

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VERSION CONTROL

LIMPOPO WMA
INTERNAL STRATEGIC PERSPECTIVE

Version 1	November 2004
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Current Version Controller	Mr Zacharia Maswuma Limpopo Regional Office Department of Water Affairs and Forestry Private Bag X9506 Polokwane 0700 Tel: +27 15 290 1200 e-mail: MaswumZ@dwaf.gov.za

The most significant amendments included in the latest version will be indicated here.

EXECUTIVE SUMMARY

1. INTRODUCTION

The primary objective of this Internal Strategic Perspective (ISP) is to ensure that there is synergy within the Department of Water Affairs and Forestry (DWAF), at both head office and regional office levels, regarding water resources management in the Limpopo WMA. The ISP presents a common and consistent departmental approach to guide officials at all levels when addressing water resources management related queries and evaluating water licence applications.

2. BACKGROUND AND APPROACH

Water is one of the key and most fundamental and indispensable of all our natural resources. It is fundamental to life (and the quality of life), the environment, food production, hygiene, industry, and power generation. Water can be the limiting factor when it comes to economic growth and social development, especially in South Africa where it is a relatively scarce resource that is distributed unevenly both geographically and through time as well as socio-politically. Prosperity for South Africa depends upon sound management and utilisation of our many natural and other resources, with water playing a pivotal role.

DWAF is striving for an integrated planning and management approach, referred to as Integrated Water Resource Management (IWRM). The ultimate aim of this IWRM process is to arrive at:

- an allocation schedule that meets the requirements of the National Water Act (NWA) (Act 36 of 1998);
- water resources yield and other models that are representative of the flow regime of the river systems in the area;
- management class scenarios for the river (i.e. Reserve and Resource Quality Objectives set);
- a Catchment Management Strategy.

These deliverables can only be finalised once the Catchment Management Agencies (CMA) assume responsibility for managing the water resources of their respective Water Management Areas (WMA). In the interim, DWAF's Regional Offices will continue to manage the water resources in their area of jurisdiction until such time as they can hand over these management functions to established and fully operational CMAs. In accordance with the NWA, DWAF (the Minister) will still remain ultimately responsible for the management of the water resources.

In light of this responsibility, DWAF's corporate perspective (including all relevant Directorates in the Department) on how the water resources should be managed needs to be formally expressed in order to manage the water resources in a consistent and predictable manner. The purpose of the ISP is to document these perspectives and offer sound motivation to demonstrate proper and reasonable governance.

3 OVERVIEW OF THE LIMPOPO WMA

The Limpopo Water Management Area (WMA) is the northern most water management area in the country and represents part of the South African portion of the Limpopo Basin which is also shared by Botswana, Zimbabwe and Mozambique. The WMA borders on Botswana and Zimbabwe, where the Limpopo River forms the entire length of the international boundary before flowing into Mozambique.

The region is semi-arid, with economic activity mainly centred around livestock farming and irrigation, together with increasing mining operations. Approximately 760 rural communities are scattered throughout the water management area, with little local economic activity to support these population concentrations.

The WMA consists of a number of catchments which are mostly independent of each other. As a result, separate and mostly independent strategies are required to manage each catchment. The main catchments are the Matlabas, Mokolo, Lephalala, Mogalakwena, Sand, Nzhelele and Nwanedi (see **Figure 2.1)**. An overview of each of the above catchments is as follows.

The Matlabas Key Area

The Matlabas Key Area is a dry catchment with non-perennial flow and hence no sustainable yield from surface water. The limited water use in this catchment is mostly from groundwater, which is under-exploited. There are no major water resources or water supply issues within this Key Area and hence no management strategies are required for this Key Area.

New allocations in this Key Area can only be made from groundwater or from additional yield which could conceivably be created by the construction of farm dams.

The Mokolo Key Area

From a water resource point of view, the Mokolo Key is the most developed in the WMA and has more surface water available than any of the other Key Areas in the WMA (see **Figure 4.1)**. Apart from the higher than average rainfall, the large Mokolo Dam is situated in this Key Area, which provides water for a multitude of uses, the most important being the supply to the Matimba Power Station and Grootgeluk coal mine.

There are a large number of farm dams in the Mokolo Key Area which has effectively moved much of the yield of the Mokolo Dam upstream where it is used to supply large areas of irrigation, with an estimated requirement of 68 million m^3/annum. There is also a significant amount of irrigation from groundwater in this Key Area.

The Mokolo Key Area appears to be approximately in balance and no further allocations should be made from surface water without carrying out detailed analyses to verify a sustainable source of supply. Groundwater is under-utilised and should be the first option to supply increased domestic requirements, provided the water quality is acceptable. Where water of acceptable quality cannot be sourced, additional small dams may be required to supply increased domestic requirements.

The Lephelala Key Area

The Lephelala Key Area has limited water resources but surprisingly high water requirements, dominated by the irrigation sector with its water requirement estimated at 33 million m^3/a. Irrigation takes place mainly in the higher rainfall upper reaches of the

Key Area where there are a large number of farm dams, while lower in the catchment irrigators make use of water from alluvial aquifers. Nevertheless, the catchment appears to be stressed and no new allocations should be made for irrigation purposes. Additional water for domestic purposes should be sourced from groundwater.

The middle reaches of the Lephalala Key Area are of high conservation value. Development should be limited in the Lephalala to maintain this important conservation area.

The Mogalakwena Key Area

The Mogalakwena Key Area is a catchment with limited surface water resources but large groundwater resources which have already been extensively exploited by the irrigation sector. The water use in the Key Area is dominated by irrigation with an estimated requirement of 90 million m^3/annum.

This Key Area is rapidly gaining strategic importance in the provincial and National economy due the rapid expansion of mines in the area and the water supply to these mines must be secured as a matter of priority. Mines with limited water requirements should be able to source their water from groundwater while larger mines may require transfers in from the Olifants WMA since there is little scope for further development of the local surface water resources. Various options to secure a sustainable water supply to the mines in the Mogalakwena are currently be investigated.

New allocations for domestic use should be sourced from groundwater. New allocations to the irrigation sector are possible from groundwater but this would need to be studied in more detail since there is a risk of over-exploiting the groundwater resources in this Key Area.

The Sand Key Area

The Sand Key Area is a dry catchment with very limited surface water resources. However, it has exceptional groundwater reserves which have been fully and possibly over-exploited. The water requirements are large compared to the rest of the WMA, but again irrigation is the largest water user, with a requirement of 185 million m^3/a. Urban requirements, estimated at 24 million m^3/a, are supplied mostly from transfers in from other WMAs.

The catchment is in serious deficit due to the over-development of irrigators relying mostly on groundwater and the very sparse surface water resource. There is a very real concern that the groundwater resource has been over-exploited but this will require further studies to confirm this. In the interim, no new licences should be issued except for domestic use. In the longer term, if can be shown that the groundwater resource has been over-exploited, compulsory licencing may be required in order to reduce abstractions from groundwater to sustainable levels.

The Nzhelele Key Area

The Nzhelele Key Area is a small catchment dominated by irrigation, with an allocated area of 4 800ha, but not all of this is currently in use due to insufficient water resources. Uncharactersitically for the Limpopo WMA, there is a small area of afforestaiton, estimated at 31 km^2, but this has only a very limited impact on the water resources of this Key Area. The only other signifcant water use in the area is domestic use by the rural sector.

The second largest dam in the WMA, the Nzhelele Dam, is situated in this Key Area and

most of the surface water of the Key Area is derived from this dam while groundwater is also used extensively.

The catchment is clearly stressed and this is due to over-allocation and/or over-development of the irrigation sector. This is the current situation before implementation of the ecological Reserve. In order to sucessfully implement the Reserve, it will probabaly be necessary to carry out compulsory licensing, but there is no urgency for this. No new allocations to the irrigation sector are possible at present, while additional allocations for domestic use will have to be sourced from groundwater.

There is potential to develop the surface water resources of the Nzhelele catchment further and potential dams sites were identified as part of the Nzhelele Basin Study (DWAF, 1993). The preferred option for making more water available is water conservation and demand management. There are apparently large losses from the canals which distribute water from the Nzhelele Dam to irirgators and these losses should be addressed before considering the construction of new dams.

The Nwanedi Key Area

The Nwanedi Key Area is a small catchment in the north-eastern corner of the WMA, characterised by large areas under irrigation (relative to the size of the catchment), estimated to be in the order of 20 km^2. The water resources of the Key Area are limited to that provided by a few small dams and run-of-river, and the catchment is in deficit. This is due to over-allocation or over-development by the irrigation sector.

The broad strategy for this catchment is basically the same as that for the Nzhelele Key Area, in that compulsory licencing may eventually be required to deal with the over-development by irrigators and to implement the Reserve. In the interim, no new licences should be issued for irrigation and any additional water requirements for domestic use will have to be sourced from groundwater.

4. RECONCILIATION OF WATER REQUIREMENTS AND AVAILABLE WATER RESOURCES

A summary of the water requirements, water resource and a reconciliation between the two is given in **Table 1.**

This reconciliation differs considerably from that of the NWRS in the detail, although the overall perspective, that being a WMA which is in deficit, is the same. The deficits in the WMA relate to opportunistic irrigation situated in the Sand and Lephalala Key Areas and over-allocated irrigation in the Nzhelele and Nwanedi Key Areas.

The water requirements and groundwater resources of the WMA, as documented in this ISP, are much higher than those given in the NWRS. The reason for this is that new information became available on the groundwater use through the registration process as well as the GRIP project (DWAF, 2004a).

Table 1: Reconciliation of water requirements and available water for the year 2003 (units are million m^3/a)

Sector/ Key Area	Available water			Water requirements/allocations			Balance
	Local yield	Transfers In	Total	Local requirements	Transfers out	Total	
Matlabas	4	0	4	6	0	6	(2)
Mokolo	83	0	83	83	0	83	0
Lephalala	24	0	24	36	0	36	(12)
Mogalakwena	112	3	115	114	0	114	1
Sand	105	15	120	222	0	222	(101)
Nzhelele	36	0	36	41	0	41	(5)
Nwanedi	10	0	10	16	0	16	(6)
Main stem Limpopo	79	0	79	79	0	79	0
Total	**453**	**18**	**471**	**595**	**0**	**595**	**(123)**

The other major difference between this ISP and the NWRS is that the main stem of the Limpopo has been considered as a separate entity with its own resource and requirements. While the water balance given for the Limpopo main stem is very much a first order estimate, it does at least separate out the large irrigation abstractions made from the Limpopo from the major tributaries which make up the Limpopo WMA. This is important since these abstractions are utilising the resource of the Limpopo itself, which also receives inflow from the Crocodile River and other tributaries of the Limpopo River rising in Botswana and Zimbabwe. The actual resources available from the Limpopo River would be difficult to determine since the surface flow is very erratic but contributes to the alluvial aquifer associated with the Limpopo. Abstractions are mostly from this aquifer and not from the surface flow as such. Since the sustainable yield of this aquifer has not been determined, it has been assumed in this ISP that the Limpopo main stem is in balance.

5. WATER RESOURCES MANAGEMENT STRATEGIES

Through existing reports, interviews and workshops, the key issues of the Limpopo WMA were identified and strategies developed to resolve these issues with the overarching objective of giving effect to the NWA and the NWRS.

The strategies were divided into two broad categories; those which apply to the whole WMA (referred to as WMA Level Strategies) and those, which require more detail to resolve issues, that are specific to the catchments which make up the Limpopo WMA.

WMA level strategies include:

- Water Balance & Reconciliation
- International Obligations
- Water Quality Management
- Water Use Management

- Water Conservation and Demand Management
- Co-operative governance
- Monitoring and information
- Waterworks Management
- Poverty eradication
- Support to Local Authorities
- Implementation of the ISP

Specific strategies for each catchment were developed to deal with:

- Reconciliation of water requirements and the available resource
- Water Quality

Each strategy addresses the following aspects:

- **Management Objective**
  What the strategy must aim to achieve
- **Situation assessment**
  Presents the background information and the relevant issues identified in each catchment. This provides a motivation for the strategy and actions.
- **Strategy**
  The strategy states what needs to be done to resolve the issues and give effect to the NWA and NWRS.
- **Management Action**
  Specific actions to give effect to the strategies are listed, together with the responsible Directorate/Institution and a priority rating.

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CCAW	Co-ordinating Committee for Agricultural Water
CEIMP	Consolidated Environmental Implementation Plan
CMA	Catchment Management Agency
CMS	Catchment Management Strategy
DM	District Municipality
DWAF	Department of Water Affairs and Forestry
ECA	Ecological Conservation Act
EMC	Ecological Management Class
EMF	Environmental Management Framework
GDP	Gross Domestic Product
IDP	Integrated Development Plan
ISP	Internal Strategic Perspective
IWRM	Integrated Water Resource Management
MAIS	Monitoring, Assessment Information System
MAR	Mean Annual Runoff
NEMA	National Environmental Management Act
NWA	National Water Act
NWRS	National Water Resource Strategy
RDM	Resource Directed Measures
RQO	Resource Quality Objective
PLC	Provincial Liaison Committee
SDI	Spatial Development Initiative
SEA	Strategic Environmental Assessment
SFRA	Stream Flow Reduction Activity
WARMS	Water Use Authorisation and Registration Management System
WC&DM	Water Conservation and Demand Management
WIMS	Water Quality Information Management System
WFW	Working for Water
WMA	Water Management Area
WMI	Water Management Institution
WMU	Water Management Unit
WRSA	Water Resources Situation Assessment Study
WSA	Water Services Authority
WSDP	Water Services Development Plan
WTW	Water treatment works

PART A

1. BACKGROUND TO THE LIMPOPO WMA INTERNAL STRATEGIC PERSPECTIVE

1.1 LOCATION OF THE LIMPOPO WMA

The location of the Limpopo WMA is shown in **Figure 1.1.** The WMA falls entirely within the Limpopo Province.

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Figure 1.1: Location of the Limpopo WMA

1. WATER LEGISLATION AND MANAGEMENT

Water is one of the most fundamental and indispensable of all natural resources. It is fundamental to life and the quality of life, to the environment, food production, hygiene, industry, and power generation. The availability of affordable water can be a limiting factor for economic growth and social development, especially in South Africa where water is a relatively scarce resource that is distributed unevenly – geographically, seasonally, and socio-politically.

Prosperity for South Africa depends upon sound management and utilisation of our many natural and other resources, with water playing a pivotal role. South Africa needs to manage its water resources optimally in order to further the aims and aspirations of its people. Current government objectives for managing water resources in South Africa are set out in the National Water Resource Strategy (NWRS) as follows:

- **To achieve equitable access to water,** that is, equity of access to water services, to the use of water resources, and to the benefits from the use of water resources.
- **To achieve sustainable use of water**, by making progressive adjustments to water use to achieve a balance between water availability and legitimate water requirements, and by implementing measures to protect water resources and the natural environment.
- **To achieve efficient and effective water use** for optimum social and economic benefit.

The NWRS also lists important proposals to facilitate achievement of these policy objectives, such as:

- Water will be regarded as an indivisible national asset. The Government will act as the custodian of the nation's water resources, and its powers in this regard will be exercised as a public trust.
- Water required to meet basic human needs and to maintain environmental sustainability will be guaranteed as a right, whilst water use for all other purposes will be subject to a system of administrative authorisations.
- The responsibility and authority for water resource management will be progressively decentralised by the establishment of suitable regional and local institutions, with appropriate community, racial and gender representation, to enable all interested persons to participate.

1.2. The National Water Act (NWA)

The NWA of 1998 is the principal legal instrument relating to water resource management in South Africa. The Act is now being implemented incrementally. Other recent legislation which supports the NWA includes the Water Services Act (Act 108 of 1997) and the National Environmental Management Act (Act 107 of 1998).

1.2.1 The National Water Resource Strategy (NWRS)

The NWRS is the implementation strategy for the NWA and provides the framework within which the water resources of South Africa will be managed in the future. All authorities and institutions exercising powers or performing duties under the NWA must give effect to the NWRS. This strategy sets out policies, strategies, objectives, plans, guidelines, procedures and institutional arrangements for the protection, use, development, conservation, management and control of the country's water resources. The purpose of the NWRS is to provide the following:

- The National framework for managing water resources;
- The framework for preparation of catchment management strategies in a nationally consistent way;
- Information, in line with current legislation, regarding transparent and accountable public administration; and
- The identification of development opportunities and constraints with respect to water availability (quantity and quality).

1.2.2 Catchment Management Strategies (CMS)

The country has been divided into 19 Water Management Areas (WMAs). The delegation of water resource management from central government to catchment level will be achieved by establishing Catchment Management Agencies (CMAs) at WMA level. Each CMA will progressively develop a Catchment Management Strategy (CMS) for the protection, use, development, conservation, management and control of water resources within its WMA.

The Department's eventual aim is to hand over certain water resource management functions to CMAs. Until such time as the CMAs are established and are fully operational, the Regional Offices (ROs) of DWAF will have to continue managing the water resources in their areas of jurisdiction.

1.3 INTERNAL STRATEGIC PERSPECTIVES (ISP)

1.3.1 The objectives of the ISP process

The objective of the ISP is to provide a framework for DWAF's management of the water resources in each Water Management Area, until such time as the Regional Offices can hand over the management functions to the established CMA. This will ensure consistency when answering requests for new water licences, and informing existing water users (including authorities) on how the Department will manage the water resource within the area of concern. Stakeholders must be made aware of the bigger picture as well as the management detail associated with each specific water resource management unit.

1.3.2 Approach adopted in developing the Limpopo ISP

The ISP for the Limpopo WMA was developed in the following five stages:

Stage 1: **Determining the current water resource management regime and relevant water resource management issues and concerns in the WMA**. This was done by collating information from the Water Resource Situation Assessment Report and other catchment study reports, and by conducting interviews with the members of the Department of Water Affairs and Forestry's regional and head office staff. A starter document of the identified issues and strategies was produced as a discussion document for the first workshop.

Stage 2A: A first workshop covering the Matlabas, Mokolo, Lephalala and Mogalakwena catchments was held on 28 and 29 November, 2002. The attendees of the workshop included Limpopo Regional Office officials, National Water Resources Planning Directorate and other directorates of DWAF, including Professional Service Providers who are facilitating the process. The workshop focused on the list of issues common to the whole Limpopo WMA, catchment-specific issues and key area/management unit issues documented in ***Stage 1*** of the process.

Stage 2B: A second workshop was held on 4 February 2003, with the same attendees as the first workshop, to cover the remaining catchments in the Limpopo WMA, namely, the Sand, Nzhelele and Nwanedi catchments.

Stage 3: The third stage involved the preparation of the first draft of the ISP report for discussion at a third workshop held on 1 February 2004 at which issues arising from this draft report were clarified.

Stage 4: A third workshop was held on 15 and 16 April 2003. During this workshop the overall management of the water resources in the Limpopo WMA catchments was be discussed along with any ISP issues and management strategies. The priorities and responsibilities of carrying out the ISP was assigned during the workshop.

Stage 5: The fifth stage was the finalisation of this ISP document for the Limpopo WMA.

1.3.3 Updating of the ISP Report

The ISP strategies should not lag behind national developments, become outdated or differ from related ISPs regarding trans-boundary management. There is therefore a need to have a standard process for updating strategies, and to prevent strategies becoming outdated by ensuring adequate feedback from national developments. Furthermore, the proposal and introduction of new strategies needs to be accommodated. It is suggested that each strategy has a version-control system. The following is necessary:

- Keep abreast of changes in national legislation and policy changes or refinements by keeping a list of all relevant legislation and supporting documents relevant to the ISP;
- Ensure consistency between the ISP strategies and national strategies through a regular review and update procedure;
- Annually review and ensure consistency and agreement regarding trans-boundary ISP management issues by liaising with the responsible managers of other areas and updating relevant ISP strategies if necessary;
- Annually review the priorities of required management actions and align budgets accordingly;
- Monitor the implementation of the ISP (review actions, progress, implementation and stumbling blocks);
- Incorporate feedback from stakeholders;
- Rigorously apply ISP version control.

Updating and Version Control

The actual frequency of ISP revision will be determined by the number and extent of revisions to management approaches as reflected in Strategy amendments. All updates to this report, particularly with respect to amendment to the Strategies, need to be passed on to and vetted by the Catchment Manager for the Limpopo WMA. The current incumbent is Mr Z Maswuma, who has been delegated the task of managing version control.

1.3.4 The Authority of Information Contained in the ISP

The NWRS is a statutory document, subject to a high level of public scrutiny and input, and signed off by the Minister. The NWRS contains the best information and knowledge available at the time of its preperation. The information in Chapter 2 and Appendix D of the NWRS Strategy on water requirements, availability and reconciliation was updated with comments received from the public participation process in the second half of 2002. To enable the finalisation of the NWRS, these figures were "closed" for changes in February 2003.

Underlying the figures in Chapter 2 and Appendix D is a set of 19 reports "Overview of Water Resources Availability and Utilisation", one for each WMA. These reports contain more detailed information on each WMA than was summarised for the NWRS and are referred to, in short, as "WMA Reports". The WMA reports were also finalised with the February 2003 information.

Still deeper in the background lies another set of reports (one per WMA), the so-called Water Resource Situation Assessment Reports. These reports contain a wealth of information on each WMA, but the figures on requirements, availability and reconciliation have been superseded by the WMA report and the NWRS.

The ISPs for all WMAs used the information contained in the NWRS and WMA reports as the point of departure. However, an inevitable result of the ISP process has been

that better information has, in some cases, emerged. The level of study has been very detailed and intense for the ISP. This has included very close scrutiny of the numbers used in the NWRS, and in some cases a reworking of base data and some re-modelling. Where the ISPs contain yield balance data which differ from the NWRS, these discrepancies are carefully explained as are all other instances of divergence. Where other differences from the NWRS are necessary these are also detailed in the ISP, with accompanying explanations.

It is required that the Department work with the best possible data so that the best possible decisions can be taken. Where the ISPs have improved upon the NWRS then this is the data that should be used. The new data contained in the ISP will also be open to public scrutiny with the ISP reports published on the Internet and in hardcopy, and presented and discussed at WMA forums. Comments received will be considered and worked into subsequent versions of the ISP on a regular (annual) basis. The NWRS will be updated to reflect the latest understanding in each new edition.

1.4 INTEGRATED WATER RESOURCE MANAGEMENT (IWRM)

It is imperative that the natural, social, economic, political and other environments and their various components are adequately considered when conducting water resources planning and management. Water as a strategic component also interacts with other components in all environments. For example, human activities such as the use of land, the disposal of waste, and air pollution can have major impacts on the quantity and quality of water, which is available for human use and for proper life support to natural biota.

Taking an even broader view, water must also be managed in full understanding of its importance for social and economic development. It is important to ensure that there is conformity between the water-related plans and programmes of the CMAs, and the plans and programmes of all other role players in their management areas. The CMAs must therefore establish co-operative relationships with a wide range of stakeholders, including other water management institutions, water services institutions, provincial and local government authorities, communities, water users ranging from large industries to individual irrigators, and other interested persons.

This integrated planning and management approach is intended, through co-operative governance and public participation, to enable water managers to meet the needs of all people for water, employment, and economic growth in a manner that also allows protection and, where necessary, rehabilitation of aquatic ecosystems. Above all, Integrated Water Resource Management (IWRM) will enable water managers to use our precious water resources to assist in poverty eradication and the redressing of inequities.

One of the big opportunities to formally integrate a large number of actions in water resource management presents itself during the compulsory licensing process. Compulsory licensing is identified in the NWRS as a very important action for implementing the NWA. However, it is not a simple action of issuing licences but a complex process of closely related and interdependent activities that will in itself formalise IWRM to a great extent. The process of IWRM is diagrammatically depicted in **Figure 1.2**.

Before an allocation schedule can be determined and the legal steps followed to finalise compulsory licensing (through the issuing of licences to all users), many other aspects must be addressed:

- Existing use and the lawfulness of that use must be verified, all users (existing and new) must apply for licences, a good understanding of future use scenarios must be developed and water required for equity purposes and rural development must be clearly understood.

- Water availability must be understood as thoroughly as possible with "best available" existing information used to model all possible reconciliation options.

- Reserve scenarios must be developed for all significant resources in the catchment, for instance, the river flow requirements for all possible classes that may be considered.

- The development of strategies for implementing the licensing (abstraction controls, for example), the Reserve and Resource Quality Objectives (i.e. incrementally over time) must go hand in hand with the rest of the processes to ensure that practical, workable solutions are found.

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Figure 1.2: Diagram showing DWAF Integrated Water Resource Management approach

The processes will then enter a very intensive, interactive phase of developing realistic reconciliation options. This would entail, for example, the selection of a specific management class to be scrutinised for its impact on the number of licences that could be issued for use, with its concomitant impacts on the social and economic structure of the catchment.

The active participation of stakeholders in this process will then hopefully crystallise clear recommendations on an allocation schedule, management classes for the various reaches of the rivers and the resultant ecological Reserve and Resource Quality Objectives, as well as strategies for the implementation. Although the Department will play a very strong role in guiding this process, it is extremely important to have the CMA actively involved. Preferably, at least the Board of the CMA must be in place to drive the public participation for the process.

1.5 CARING FOR THE ENVIRONMENT

DWAF is responsible for water resource development and management in terms of the NWA, and within the broader framework of other environmental legislation. The Department also strongly reflects the will to make sound decisions which ensure the development of society and the economy whilst maintaining, and where possible enhancing, ecological integrity. The concept of management of the environment has evolved from the exclusivity of protection of plants and animals to balancing the complex interaction of society, the economy, and ecology. "Environmental management is the integration of social, economic and ecological factors into planning, implementation and decision-making so as to ensure that development serves present and future generations" (NEMA).

The key legislative Acts to which DWAF is required to refer are the National Environmental Management Act (NEMA, Act 107 of 1998) and the Environment Conservation Act (ECA, Act 73 of 1989).

DWAF has prepared a Consolidated Environmental Implementation and Management Plan (CEIMP) as a requirement of NEMA. This describes the Department's functions, policies, plans and programmes, and states how these comply with environmental legislation. Through the CEIMP the Department has committed itself to developing and implementing an integrated Environmental Management Framework (EMF) to ensure that its approach is aligned with the principles prescribed in NEMA and the ECA. The EMF will inform the Department at a strategic decision-making level, bring about environmental legal compliance, and help in achieving environmental sustainability through the promotion of sound environmental management practices. Integrated Environmental Management is a co-operative governance effort with DWAF as a full partner in the process.

This ISP has the responsibility of raising and maintaining the environmental consciousness of the Department's water resource planners and managers. The control over water has a very broad range of influence and impact for which strategies and planning need to account. Impacts come from many different angles.

Some of these angles of impact which are considered through this ISP are noted below:

- The direct impact of physical structures (environmental constraints to construction e.g. of weirs or dams).
- The implications of allocating and licensing water for use. Forestry and irrigation are examples of uses where development based on water can mean the transformation of extensive areas of otherwise 'natural' environments.
- The allocation of water for equity. Here we can include approaches towards the application of Schedule 1 Use, General Authorisations, the revitalisation of irrigation schemes, etc.
- Failure to support equity, or appropriate development – noting the consequential impacts of poverty.
- Sanitation systems and the impacts on groundwater quality.
- The implementation of the Reserve.
- The ability to monitor and manage compliance, thus protecting the resource and with it the environment.

All decisions regarding water are critical to the environment. Decisions must be

made on a balance of social, economic and ecological costs and benefits, considering both the immediate and the long-term, and always with an eye for the unintended consequence. It is the intention of the ISP to provide the basis for integrated decision-making. The principles of environmental management underpin every strategy developed in this document.

There are a number of strategic areas with a particularly strong biophysical/ ecological emphasis. These include:

- The Reserve (groundwater, rivers, wetlands and estuaries)
- Water quality - surface and groundwater
- The approach towards the clearing of Invasive Alien Plants
- The management of wetlands
- Land degradation. Erosion and sedimentation (land care)
- Land use and especially how this is impacted by land reform and the re-allocation of water.

The roles of Co-operative Governance and the need for awareness raising and capacity building are key strategic elements of many strategies.

In reality all strategies and all aspects of management have a strong interaction with the biophysical environment. This ISP endeavours to capture all of these concerns in discussion and through a strategic approach which emphasises the will of the Department to manage the environment to the best benefit of the country and its people.

The approach set out above applies to all Water Management Areas and associated ISPs, and is not repeated within the Strategy Tables (Part B of this ISP). It reflects the way the Department views Integrated Water Resource Management and the importance of the biophysical aspects of decision-making. There may nevertheless be specific ecological and biophysical aspects of management, which require specific attention and which may not be captured in the above-mentioned or other strategies. The ISP therefore still includes an Environmental Strategy, which serves to make pertinent those issues of the environment, which might not otherwise be covered.

1.6 THE SOCIAL ENVIRONMENT

The utilization of water resources is aimed at the benefit of society, and at society through the economy. As noted in Section 1.5 this should not be at undue cost to ecological integrity.

Impacts on society are a core element of this ISP, and decisions are often complicated by the risk of unintended consequence. As a typical example the over-zealous implementation of the ecological Reserve may benefit the river, to the intended benefit of society, but the cost of lack of use of that water to employment and to livelihoods may lead to other strains on natural resources that undo the benefits.

The implementation of the NWA requires that society be kept at the forefront of all decision-making. This principle is now deep-seated within the Department and is integral to all strategies. Water resource allocation and use has critical social impact, as does water quality management. But pivotal to the social component is the question of equity. What can be done and what is being done to redress past inequities? Within this, strategies have been developed to consider the provision of

water to Resource Poor Farmers, the use of water under Schedule 1, Licensing and General Authorisations, etc. Whilst water supply and sanitation are not part of the brief of the ISP, the provision of water to meet these needs most certainly is. The urban poor, and the poor in rural villages, are as important in the consideration of the distribution and use of water resources as are the rural subsistence poor, and this should not be forgotten in the urgencies of land reform and the enthusiasm to establish a substantial class of farmers from amongst the previously disadvantaged.

This ISP aims to see water benefiting society. This can be through access to water in livelihood strategies, through small-farmer development programmes, through water supply and sanitation and especially the provision of good quality drinking water, and through the maintenance and growth of income-producing, job-creating, and tax-paying agricultural, commercial and industrial strategies.

Consultation and public participation are cornerstones of the social component of any strategic document. These requirements are repeatedly stressed throughout the National Water Act. This ISP has been prepared as DWAF's position statement with respect to the management of water resources and, although strategies and plans have been captured without consultation with the stakeholders, it remains an open and transparent document where the understanding of the Department, its visions and its principles are made clear for all to see and to interact with. This is amplified in the Implementation Strategy **(Part B: Strategy no 11)** of this ISP.

1.7 WATER QUALITY MANAGEMENT

Much of the emphasis in water resource management has revolved around ensuring that users have sufficient quantities of water. However, as more water gets used and re-used, as quantities get scarce and feedback loops get even tighter, it is quality that begins to take on a dominant role.

Water availability is only as good as the quality of that water. Both quantity and quality need to be considered at the correct level of detail, and this can mean that at times they should be considered with similar emphasis and with similar expenditure of resources. Too often we have failed to integrate the issues of quantity and quality – both with regard to surface water and groundwater. The concept of Available Assimilative Capacity, the ability of the water resource to absorb a level of pollution and remain 'serviceable', is as important in water resource management as is the concept of Systems Yield.

Quantity and quality can no longer be managed in isolation of each other. Not that this isolation has ever been total. The consequences of irrigation, the leaching of fertilisers, and more importantly the leaching of salts from deeper soil horizons can render both the lands themselves and the receiving rivers unsuitable for use. Diffuse agricultural 'effluent' may be less visible than direct discharges of sewage or industrial effluent, but are no less pernicious.

Surface water quality is affected by many things including sediment and erosion, the diffuse discharges from irrigated farmland (both fertilisers and salinity through leaching), domestic and urban runoff, industrial waste, and sewage discharges. Of these, industrial waste and sewage discharges are the easiest to licence and control, but this does not mean that this is problem-free. The Department has found that the situation with regard to sewage discharges often far exceeds the standards and conditions demanded by licences. There is a problem of compliance with regard to Local Authorities and private operators responsible for waste management systems. Diffuse discharges only compound the problem by reducing

the assimilative capacity until the water becomes unfit for use, very expensive to purify, and a danger to human health.

Direct discharges to rivers are licensed and managed on the basis of assimilative capacities of those rivers, and on Receiving Water Quality. Where these limits are exceeded, often through the cumulative impact of diffuse discharges, water becomes unavailable to some, or even all, users downstream. DWAF will licence users to take water, and again to discharge it in recognition that there is generally a cost to the resource in terms of a reduction in quality and a reduction in its further assimilative capacity. It is for this reason, and in order to bring about additional management and a strong incentive, that the Waste Discharge Charge System is being developed. Discharge users will be obliged to pay, depending on the quantity and quality of their discharge.

Groundwater quality requires equal attention, and more so as we recognise the importance of groundwater in supplementing our meager resources, and providing water to remote communities. Although our groundwater resources are for the most part to be found at a relatively deep level (50-100 m is quite typical) this water can easily be polluted by surface activity. The leaching of fertilisers is one such problem but of greater concern is the influx of nitrates, primarily a consequence of human habitation and sanitation. Pit latrines are on the one hand so necessary, and have the huge advantage of not requiring volumes of water, but disposal is 'on-site', and often responsible for the longer-term pollution of the underlying aquifers which feed and water the communities above.

Water quality is a very important aspect within this ISP – considered primarily within the **Water Quality Strategies** and also under **Groundwater (Strategy G1).** Industrial wastewater discharge, diffuse agricultural discharges, wastewater treatment works, the location and management of solid waste disposal sites, the siting of new developments, informal settlements and the impacts of sanitation systems, are all elements considered with great concern in this and other ISPs. Despite this attention it may be that Water Quality has still not taken its rightful place in the integrated management of the water resource. But the Department is moving towards IWRM and the integration of quantity and quality issues. Managers have now been given crosscutting responsibilities that will ensure a far more integrated approach in future.

Actions recommended within the Department include:

- The need to actively workshop the integration process of Resource Management, Planning and Allocations of Groundwater and Surface Water Quantity and Quality.
- The review and incorporation of knowledge from recent Water Research Commission Studies on both radioactivity and nitrates (groundwater quality issues).
- A review of all water quality literature reflecting situational knowledge and understanding within this WMA (and each and every WMA).
- Ensure that Water Quality monitoring is fully integrated into WMA water resources monitoring.

Refer to both the catchment specific strategies and to the General Strategies **Part B** of this ISP.

1.8 GROUNDWATER

The ISP process in all of the Water Management Areas of South Africa has highlighted the role and importance of groundwater as part of the total water resource. Although groundwater has always been important in some areas this overall vision is a significant advance on our previous understanding of the potential for groundwater use. With the surface water resources in many WMAs now fully utilised, almost the only opportunity left for further development lies in the exploitation of groundwater. More particularly it is recognised that many of the more remote towns and villages, far from surface supplies, can in fact supply or supplement existing sources through groundwater, and that this must become a priority option. So, too, many small communities and subsistence farmers can avail themselves of groundwater when it would otherwise be impossible or impractical to lay on piped supplies. This can also reduce the pressure on existing users and perhaps even circumvent the need for Compulsory Licensing. The Department will be developing its capacity to explore and encourage the use of groundwater.

Of obvious concern is the likelihood of an interaction between groundwater and surface water. If the interaction is strong then additional use of groundwater may simply be reducing the surface water resource already allocated to someone else. In some instances (such as in the case of dolomitic aquifers) this interaction can indeed be very strong, whilst across many areas of the country it is so weak as to be negligible. In the case of endoreic areas there is no interaction at all. Where interactions are weak, groundwater can very significantly add to the availability of water to users, much in the way the construction of a dam would do, but without all the negative impacts a dam can have on the environment and and the flows in rivers. Groundwater often comprises a huge pool of available water which is only of benefit if it is utilised. Care must always be taken with the issuing of licenses to ensure that both the Groundwater Reserve and other downstream users do not end up being the losers.

The realisation in this and other ISPs is that groundwater offers a huge resource of water which can be tapped, and that this can be a very significant supplement to the national water resource. This is especially the case in the Limpopo WMA (the reader is referred to **Groundwater Strategy No G1,** in **Part B** of this ISP).

1.9 PUBLIC RECREATION - THE USE OF DAMS AND RIVERS

The use of water for recreational purposes is one of the 11 water uses regulated in terms of the NWA (Section 21 j). The Department is developing a national policy towards 'Recreation on Dams and Rivers' and this should, in the first instance, be adhered to. Recreational use can take many forms and only occasionally has any direct impact on the water resource. Most obvious are activities such as power-boating, sailing and swimming which can have quality / pollution impacts. Far more significant in terms of both quantity and quality is the release of water to allow for canoeing and other water sports downstream, although there are no such activities in the Limpopo WMA. These activities can bring very significant economic benefits to the WMAs concerned, and where water releases can be accommodated, particularly through alignment with the needs of the ecological Reserve or other downstream users, then so much the better.

It is noted in this ISP that water resources offer a very significant recreational outlet and that recreation is an important public and social asset necessary for national health and productivity. A central philosophy is that recreational opportunity should not be unreasonably and unnecessarily denied to users, and that the

implementation of policy should ensure that disadvantaged and poor people should also be able to avail themselves of opportunities.

The Department has already transferred responsibility for the management of many public waters to Local Authorities and will continue with this process. Responsibility will therefore devolve upon these Authorities, but within the broad principles as laid down by the Department.

1.10 CO-OPERATIVE GOVERNANCE – THE PLACE OF THE ISP

The ISP is DWAF's approach to the management of water resources within the WMA. This will, in the longer term, be replaced by a fully consultative Catchment Management Strategy. What is most important, in the medium term is that the ISP has a good fit with the Provincial Growth and Development Plan, with regional and other Environmental Management Plans, with plans and expectations of the Departments of Agriculture, Land Affairs, the Environment and others. It must also be aligned with the Integrated Development Plans and Water Services Development Plans now required for each District Municipality. Water is very often a constraining feature in development and co-operative governance planning and implementation is essential in matching what is wanted with what is possible.

2. GENERAL OVERVIEW OF THE WMA

2.1 LOCALITY AND PHYSICAL CHARACTERISTICS

The Limpopo WMA is the northern most WMA in the country and contains a large part of the South African portion of the Limpopo Basin, which is also shared with Botswana, Zimbabwe and Mozambique. The water management area borders on Botswana and Zimbabwe, with the Limpopo River forming the entire length of the international boundary before flowing into Mozambique. The Crocodile West and Marico WMA borders on the Limpopo WMA in the south-west, the Olifants WMA in the south-east, and the Letaba/Levuvhu WMA in the east.

The Limpopo WMA has a a total surface area of 60 420 km^2 (Midgely et al, 1994) and is drained by seven major rivers, the Matlabas, Mokolo, Lephalala, Mogalakwena, Sand, Nzhelele and Nwanedi, as shown in **Figure 2.1.** These catchments are mostly independent of each other and as a result separate and mostly independent strategies are required to manage each of these catchments. For reporting purposes, the catchment has been divided into eight Key Areas, seven of which relate to the above catchments. These rivers all drain into the Limpopo River, which is dealt with in this report as a separate Key Area. The runoff from these Key Areas is vital to the water resources of these catchments, and this is summarised in **Table 2.1.** The mean annual runnoffs given in this table differ from that of the WMA report (DWAF, 2003b) because the WMA report used the gross MAR from Midgely, et al (1994) which does not take into account the endoreic areas in this WMA.

Table 2.1: Summary of the hydrology of the Limpopo WMA

Key Area	Natural runoff	
	million m^3/annum	mm/a
Matlabas	49	8
Mokolo	312	37
Lephalala	142	21
Mogalakwena	255	13
Sand	64	1
Nzhelele	89	29
Nwanedi	25	22
Total	**936**	**15**

Source: Midgely, et al (1994)

The distribution in runoff in the Limpopo WMA is directly associated to the higher than average rainfall in the mountainous areas of the Waterberg and Soutpansberg ranges. Catchments such as the Mokolo, which have large areas situated in the mountainous ares of the Waterberg therefore have much higher unit runoffs than catchments such as the Sand and Matlabas which are situated in predominantly flat areas of the WMA.

Some of the larger towns in the Limpopo WMA include Polokwane, Mokopane, Modimolle, Makhado, Lephalale and Musina.

2.1.1 Topography

While the topography of the Limpopo WMA is mostly flat, the Waterberg mountain range forms an escarpment along the south-western border with altitudes in excess of 1 800m. From here the WMA slopes gradually down to the Limpopo River, hence all rivers in the Limpopo WMA drain in a northerly direction and flow into the Limpopo River.

Figure 2.2 shows the major mountain ranges in the Limpopo WMA. These are:

- The Waterberg in the south and east, with an altitude of over 1 800m. The Waterberg also forms an impressive escarpment between the Lephalala and Mogalakwena River catchments as well as between the Mokolo and Mogalakwena River catchments.
- The Soutpansberg range, with an altitude of over 1 700 m, intrudes into the Sand River catchment extending about 50 km west of Makhado and forms the upper reaches of the Nzhelele and Nwanedi River catchments.
- The Blouberg mountain, a free-standing massif of quartsite, is situated in the Mogalakwena River catchment and is the highest peak in the Limpopo WMA, at over 2 000 m.
- The Buffelshoek mountain range, with an altitude of over 2 000m in places, extends east from Mokopane.
- There are numerous free-standing granite massifs in the Mogalakwena River catchment, the largest of which has an altitude of over 1 700m.

To summarise, the topography of the WMA is characterised by mountain rages surrounded by vary flat areas which offer very few suitable dams sites. The few suitable sites that do exist have already been exploited.

2.1.2 Geology and Soils

The geology of the Limpopo WMA is summarized in this section from the Limpopo Water Resources Situation Assessment Report (DWAF, 2001b).

The Limpopo WMA is underlain by a wide variety of different lithologies. In the north, the Limpopo Mobile Belt occurs as well as the Soutpansberg Group rocks, of which the Soutpansberg Range and Blouberg mountains form a part. The western and southern portion of the WMA consists of Waterberg sandstone which overlies Nebo Granite and the Lebowa Granite Suite which form the northern slope of the Bushveld complex. This is very important for mining since the Bushveld Complex is rich in minerals, especially Platinum, and there has been rapid development of mines in the Limpopo WMA recently. The central part of the WMA is underlain by the Houtrivier and Mashashane gneisses which have been intruded by younger granite plutons; for example, the Mashashane and Matlala granites.

The soils in the Limpopo WMA can be summarised as deep sandy soil in the north, moderate to deep sandy loam in the central regions, and a mixture of sandy loam and clayey soil in the south. In the Soutpansberg area, the soil type is clayey loam. The deep soils of the Limpopo WMA are generally well-suited to agriculture, but the lack of surface runoff has been the limiting factor in agricultural development.

2.1.3 Climate

The mean annual temperature of the Limpopo WMA ranges from 16° in the south to 22° in the north, with an average of 20° for the WMA as a whole. The average maximum monthly temperature is 30° in the month of January, while the average minimum monthly temperature is 4° in the month of July.

The Mean Annual Precipitation (MAP) in the WMA ranges widely (see **Figure 2.3)**, with rainfall ranging from as little as 200 mm/annum in the north to over 1 200 mm/annum in the Soutpansberg mountains. In general rainfall decreases from the south to the north, with the lowest rainfall occurring in the Limpopo valley in the north-east of the WMA.

2.1.4 River classification and ecologically sensitive areas

During the course of the Water Resources Situation Assessment study (DWAF, 2001b), a first-order estimate of the ecological importance of all the river reaches in the Limpopo WMA was made. This involved an assessment of the following ecological aspects:

- The presence of rare or endangered species
- Habitat diversity
- The importance of a river reach in providing connectivity between different sections of the river
- The sensitivity of the reach to environmental changes.

The ecological management classes (EMC) were determined during the above study (DWAF 2001b), and are listed per quaternary in **Appendix A**.

From a water resources management perspective, the three main areas of ecological importance in the Limpopo WMA are:

- The Nylsvley wetland in the upper reaches of the Mogalakwena River catchment. This wetland is home to a large number of bird species and is a registered RAMSAR site.
- The Lephalala Wilderness area, which lies in the middle reaches of the Lephalala River catchment. The Lephalala River is largely undeveloped and is important from an ecological perspective due to the large number of red data species found in this river. Numerous wetlands occur in this area.
- The upper reaches of the Nhzelele and Nwanedi rivers, which are situated in the Soutpansberg mountains, are home to several red-data and endangered species, including the snake catfish.

2.2 DEMOGRAPHY

By far the greatest proportion (82%) of the population in the Limpopo WMA is classified as rural, living in approximately 760 rural communities scattered throughout the water management area. These rural communities are concentrated in, but not limited to, tribal or communal land (see **Figure 2.5**). The urban population is limited to only 277000 (estimate for the year 2000 in the WMA report) with almost half of this population found in Polokwane. Other towns with significant population are Modimolle, Mokopane and Mokhado, Lephalale and Musina. The urban population is concentrated near the south eastern border of the WMA where water is very limited. Fortunately this is in close proximity to water resources in other WMAs and this has resulted in inter-basin transfers from the

Letaba, Olifants and Crocodile WMAs. Growth in water requirements will probably also have to be sourced from neighbouring WMAs.

The population of the Limpopo WMA is summarised in **Table 2.2**.

Based on the demographic study undertaken for input into the NWRS (DWAF, 2001a), limited growth in population is expected until the year 2005 after which the total population is expected to remain constant, although the urban centres are likely to grow.

Table 2.2: Population in the Limpopo WMA (Year 2000)

Key Area	Rural	Urban	TOTAL
Matlabas	10 045	0	10 045
Mokolo	23 234	13 128	36 362
Lephalala	63 008	2 923	65 931
Mogalakwena	489 285	76 802	566 087
Sand	543 478	178 434	721 191
Nzhelele	155 324	2 118	5 368
Nwanedi	13 650	3 250	16 890
Total	**1 298 024**	**276 655**	**1 574 679**

Source: WMA Report (DWAF, 2001b)

2.3 LAND USE

Most of the Limpopo WMA is too dry for dryland agriculture and there are limited surface water resources to support irrigation. Land use is therefore dominated by stock farming (mostly cattle) while there is an increasing tendency to replace this with game farming. **Figure 2.4** shows the landuse in the Limpopo WMA from which it is clear that most of the WMA is still covered by natural vegetation. Plantation forestry is very limited and as a land use covers only a very small portion of the total surface area of the WMA (see **Table 2.3**).

Table 2.3: Landuse (in km^2) in the Limpopo WMA

Key Area	Irrigation	Dryland crops	Afforestation	Nature Reserves	Urban	Other	Total
Matlabas	28	37	0	387	0	5 562	6 014
Mokolo	100	733	0	131	0	7 431	8 395
Lephalala	77	372	0	199	14	6 063	6 725
Mogalakwena	103	2 885	0	931	20	15 375	19 314
Sand	76	1 330	12	562	32	13 757	15 769
Nzhelele	21	221	26	86	0	2 713	3 067
Nwanedi	25	83	0	0	0	1 028	1 136
Total	**430**	**5 661**	**38**	**2 296**	**66**	**51 929**	**60 420**

Source: Water Resources Situation Assessment Report (DWAF, 2001b)

The areas referred to as 'other' in the above table is mostly natural veld which is is used for stock or game farming.

2.4 INSTITUTIONS

There are five types of water-related institutions which play a role in the Limpopo WMA. These are:

- District Municipalities [i.e. Vhembe, Waterberg and Capricorn];
- Local Municipalities [i.e. Musina, Makhado; Modimolle, Lephalale, Mogalakwena, Mookgopong, Aganang, Blouberg, Polokwane, Modimolle];
- Irrigation Boards;
- Water Boards [Lepelle Northern Water], and
- DWAF's Regional Office (in lieu of the CMA).

District Municipalities are defined as Water Services Authorities (WSA) in terms of the Water Services Act (Act 108 of 1997), and are responsible for preparing Water Services Development Plans (WSDPs). The Limpopo WMA has three District Municipalities, namely, Vhembe, Waterberg and Capricorn (see **Figure 2.6**). Some of the Local Municipalities in the Limpopo WMA are also WSA's. At the moment the WSDP provides the water component of the Integrated Development Plan (IDP). An IDP is a principal strategic sectoral planning instrument which guides and informs all planning, budgeting, management and decision-making in a municipality. The IDPs tend to be lacking in water resource (supply and demand) information and this ISP makes a contribution in this regard. Water Services Authorities are also responsible for sanitation services and therefore play an important role in maintaining the water quality of the catchment at an acceptable level.

Local Municipalities which do not have WSA status prepare Water Sector Plans (WSP) which provide input to the District WSDP. It must also be noted that all the municipalities must prepare IDPs. There are 10 local Municipalities in the Limpopo WMA (see **Figure 2.7).**

When preparing the IDPs, WSPs and WSDPs, municipalities should take note of all other provincial and national planning strategies to ensure that there is alignment at all levels, more especially with regard to issues such as the source of water required to meet municipal needs. Some of the planning strategies that must be taken into account are:

- Regional Strategy and Infrastructure Plan (RSIP)
- Provincial Planning Strategy
- Catchment Management Strategies (Internal Strategic Perspective - ISP)
- Business plans of water boards
- Business plans of other water services providers.

After liaison with the CMA (or DWAF), the WSDP for the Local Municipality needs to include a statement as to the sources of raw water and discharge of waste within its area of jurisdiction. Since this ISP is a forerunner to the CMS, and contains important water resource and planning information, Local Municipalities must be made aware of this document.

Irrigation Boards were established under the old Water Act to administer the bulk distribution of water to irrigators within a defined area. Under the National Water Act, Irrigation Boards must be transformed to form Water User Associations. These will fulfill a similar function to an irrigation board but need not necessarily be limited only to irrigation practices. The DWAF Regional Office is currently facilitating the transformation of the Irrigation Boards into Water User Associations.

Water Boards are classified in terms of the Water Services Act as Water Services Providers and in this respect fulfill a similar role to Local Municipalities. The difference is that a Water Board deals only with water matters, usually bulk water distribution, and not any other services. Lepelle Northern Water is the only active Water Board in the Limpopo WMA.

The **Department of Water Affairs and Forestry** is the custodian of the water resources of South Africa. Under the National Water Act, DWAF's Regional Office will fulfill the role of the Catchment Management Agency until such time as the CMA is in place and fully functional.

2.5 INTERNATIONAL ASPECTS

The Limpopo River Basin, of which all the rivers in the Limpopo WMA are a part, is shared by South Africa, Botswana, Zimbabwe and Mozambique. There are no water sharing agreements on the Limpopo as a whole, although there is an agreement between South Africa and Mozambique (formerly Portugal) relating to the Massinger Dam situated on the Olifants River, which is a tributary of the Limpopo River.

The Limpopo Watercourse Commission serves as the forum for the Limpopo basin countries and is responsible for the management of the water resources of the Limpopo River. This Commission, formed on 27 November 2003, replaces the Limpopo Basin Permanent Technical Committee. One of this Commissions first tasks is the commissioning of a Joint Basin Study of the Limpopo River and the development of a water use agreement for the Limpopo Basin. Due to the international nature of the WMA, the further development of the resource in the South Africa remains under the authority of the Minister of DWAF and will not be delegated to the CMA (see **Strategy G2**).

2.6 NATIONAL AND REGIONAL WATER-RELATED PLANS AND OTHER LEGISLATION

The NWA, the NWRS and the CMS will form the guiding principles in preparing further water policy and plans in managing the water resources of the catchment. This legislation and the strategy documents are inextricably linked to national policies (e.g. poverty eradication and socio-economic development), other legislation (e.g. environmental laws and regulations), as well as regional integrated development planning. The NWRS has been published for public comment and will be ratified in due course. The CMS will be developed once the CMA is fully functional, with this ISP and any future updates, playing an intermediate role.

Water Service Development Plans (WSDPs) have recently been prepared by all the local and district authorities. It has been noticed that water resource planning has not been considered sufficiently in these WSDPs and it is intended that this ISP inform these planning processes in future. The only information of relevance which could be gleaned from WSDPs and IDPs in terms of this ISP is that approximately half the rural population does not have access to RDP standard water services or sanitation. The IDPs predict growth in their respective regions which is not in line with the population growth projections given in the NWRS. However, if RDP and higher standards of water delivery are to be achieved in the Limpopo WMA, supplies will have to be improved. The IDPs identify groundwater as one practical source of this increased supply across much of the WMA.

The establishment of the Limpopo CMA is not a high priority and there has not been much progress in this regard. In the interim period prior to the establishment of the CMA, this ISP will serve as DWAF's strategy to manage the water resources in the Limpopo WMA. It is expected that this ISP will provide useful input into the eventual development of a CMS by the CMA.

Co-operative governance (co-ordinated planning and co-operation with other national, provincial, district and local authorities) and other legal requirements need to be co-ordinated. Innovative communication strategies need to be developed to encourage this synergy, which is intended to streamline public service inputs into the provision of an enabling environment that can encourage equitable and sustainable social and economic development. The former Directorate of Social and Environmental Services in DWAF gazetted a Consolidated Environmental Implementation and Management Plan (CEIMP) which spells out how the Department will incorporate all relevant environmental and other legislation into its water resources management and other responsibilities (DWAF, 2002). This CEIMP forms the backbone of the Environmental Strategy presented in this ISP (See **Strategy G10**).

The Limpopo Province has produced a Provincial Growth and Development Strategy (Limpopo: Office of the Premier, October 2004). In this document, the important role that water plays in the economic development of the Province and the improvement of the quality of the lives of its people is acknowledged. It also emphasises that developments should be planned in conjunction with national and local government developments. Liaison and co-ordination in this regard is very important. This will ensure that the Limpopo Province is fully informed as to where water is available and how water could be used in support of development initiatives.

27 THE ECONOMY OF THE LIMPOPO WMA

This section is a summary of section 3.1 of DWAF WMA Overview report (DWAF, 2003b).

Approximately 1.5% of the South African Gross Domestic Product (GDP) originates in the Limpopo WMA, which is amongst the lowest of all the WMAs in the country. The composition of the economy in the WMA in terms of contribution to Gross Geographic Product (GGP) is as follows:

- Government 24.2%
- Electricity 17.7%
- Trade 14.9%
- Agriculture 9.0%
- Financial Services 8.3%
- Mining 7.5%

From a regional perspective most of the economic activity is centred on Polokwane (26,6%), followed by Lephalale (19,8%) and Mokopane (12,0%).

The strong influence of the government sector can be attributed to the large number of former homeland governing bodies that have had to be absorbed into the new provincial and local government structures.

Electricity production is significant due to the presence of the Matimba Power station at Lephalale. With a designed output of 4000 MW it is the largest direct dry cooled power station in the world, whilst the Grootgeluk open cast coal mine which supplies fuel to the power station is also regarded as the largest of its kind in the world.

Trade and financial services are fueled by derived demand and are a function of population size and economic activity in the region. Part of the importance of these sectors can be attributed to the population density in the WMA which is nearly 30% higher than the national average.

Agriculture is important as a result of cotton, grain sorghum and tobacco production. Apart from high quality tobacco, about 50% of the annual national cotton yield is produced in the Limpopo WMA. A large part of the population in the WMA is also dependent on subsistence agriculture.

Mining is largely driven by rich deposits of the platinum group metals which extend across the south-eastern part of the WMA. Coal and other metals are also mined in the area. There are huge coal reserves in the Lephelala/Mokolo area, where an estimated 45% of South Africa's coal Reserves are found.

Of the work force of 410 000 people in the WMA in 1994, 46% are active in the formal economy and 43% are unemployed, which is substantially higher than the national average of 29%. The remainder of 11% is active in the informal economy. Of those formally employed, 45% are in the government sector, while 21% are involved in agriculture and 11% in trade.

The economy of the Limpopo WMA is relatively more competitive than the remainder of South Africa with respect to agriculture and mining, which affirms the primary nature and function of the Limpopo WMA is also as an agricultural and mining region. Government expenditure does not offer a comparative advantage due to the fact that it is not a primary activity that drives economic development. The Limpopo WMA also does not possess a comparative advantage in trade and

tourism activities, seen within a national context, even though this sector is fairly important to the regional economy.

With the land and water resources available for agriculture already highly developed, economic growth in the WMA will largely be dependent on new mining developments. The greatest potential lies in the mining and beneficiation of platinum group metals, and coal mining for power generation or as a base for possible petro-chemical industries. There is also natural gas near Lephalale which could be economically exploited.

2.8 WATER-RELATED INFRASTRUCTURE IN THE LIMPOPO WMA

Compared to the rest of South Africa, the Limpopo WMA has few large dams, with only one dam larger than 100 million m^3. Even in terms of smaller farm dams the Limpopo WMA has relatively few farm dams when compared with the rest of South Africa. This can be attributed to the relatively low rainfall in the WMA and the predominantly flat terrain which is not conducive to good dam sites. The main dams in the WMA are discussed below.

2.8.1 The Mokolo Dam

The Mokolo Dam, situated on the Mokolo River (see **Figure 2.1**), is by far the largest dam in the WMA. It has a full supply capacity of about 146 million m^3, with the natural MAR at the dam site estimated at 240 million m^3/a (Midgely, et al). The dam was constructed in the late 1970s primarily to supply water to the Matimba power station but the dam also supplies water to the town of Lephalale as well as for irrigation downstream of the dam. At the time of constructing the dam, the yield of the dam was given as 39 million m^3/a (RSA, 1970). Subsequent to the construction of the Mokolo Dam, there was rapid and extensive irrigation development upstream of the dam, supplied from farm dams as well as from run-of-river. As a result of this, the yield of the Mokolo Dam dropped dramatically to an estimated 23 million m^3/a (DWAF, 1992).

The allocations for the Mokolo Dam are as follows (DWAF, 2001b):

Matimba power station:	7,3 million m^3/a
Iscor coal mine:	9,9 million m^3/a
Lephalale:	1,0 million m^3/a
Irrigation (downstream of dam)	10,4 million m^3/a
Total	28,6 million m^3/a

Although the allocation to irrigators downstream of the dam is at a low assurance, the dam is clearly fully allocated.

2.8.2 The Doorndraai Dam

Doorndraai Dam is situated on the Sterk River near Mokopane and supplies water to Mokopane as well as to irrigators along the Sterk River. The dam has a full supply capacity of 44.2 million m^3, whilst the natural MAR at the dam is estimated at 23 million m^3/a in quaternary catchment A61H. Construction of the dam was completed in 1953 and it was raised in 1975. The yield of the raised Doorndraai Dam is estimated at 8,6 million m^3/a (DWAF, 2001b).

The allocations for the Doorndraai Dam are as follows (DWAF, 2001b):

Mokopane:	4,4 million m^3/a
Irrigation (downstream of dam)	3,7 million m^3/a
Total	8,1 million m^3/a

2.8.3 The Glen Alpine Dam

The Glen Alpine Dam, with a full supply capacity of 20 million m^3, is situated on the Mogalakwena River and commands much of the runoff of the Mogalakwena River. The natural MAR at the dam site is estimated at 222 million m^3/a but the yield of the Glen Alpine Dam (estimated at 5,6 million m^3/a) is limited due to its small size, the ephimeral nature of the runoff into the dam, and the high evaporation rates in this area. The dam was completed in 1967 and supplies water to irrigators downstream. The allocation to irrigators was 5,9 million m^3/a, but of this 1,6 million m^3/a was to irrigators in Lebowa who never took up this allocation. However, 6,9 million m^3/a has been registered by water users as water use sourced from the Glen Alpine Dam, so it will be necessary to verify the lawfullness of these registered water users before re-allocating Lebowa's allocation to other users. If such a re-allocation takes place, at least 1,6 million m^3/a should be allocated to emerging farmers.

2.8.4 The Nzhelele Dam

The Nzelelele Dam is situated on the Nzhelele River near the tourist resort of Tshipise. With a capacity of 55 million m^3/a, it is the second largest dam in the WMA. The dam is used to supply irrigators downstream and 29 million m^3/a has been allocated from the dam for this purpose. This allocation can only meet 80% of the irrigation water requirements (DWAF, 1993). The natural MAR at the dam site is 66 million m^3/a. The Water Resource Situation Assessment Report (DWAF, 2001b) gives the yield of the Nzhelele Dam as 7,8 million m^3/a but this does not appear to be correct because the 1993 Basin Study Report (DWAF, 1993) gives the yield of the Nzelele system as 26 million m^3/a but this includes the yield of the much smaller Mutshedzi Dam (estimated at 1,5 million m^3/a (DWAF, 2001b). The historical yield of the Nzhelele Dam is therefore 24,5 million m^3/a.

2.8.5 The Houtrivier Dam

The Houtrivier Dam, although relatively small with its full supply capacity of 7.5 million m^3, is the largest dam in the Sand River catchment. It is situated in the upper reaches of the Hout River, a tributary of the Sand River, and supplies water to small villages near Polokwane. The natural MAR at the dam sites is approximately 12.5 million m^3/a. The yield of this dam is only about 0,6 million m^3/a (DWAF, 2001b).

2.8.6 Other dams

There are number of smaller dams with full supply capacities ranging from 2 to 5 million m^3. These are the Dikgale, Seshego, Spies and Turfloop Dams in the Sand River catchment, the Donkerpoort Dam on the Nyl River, the Elandsbosch in the upper Lephalala catchment, the Haaskloof Dam on the Sterk River (a tributary of the Mogalakwena), the Mutshedzi Dam on the Nzhelele River, the Nwanedzi and Luphephe dams on the Nwanedi River, and the Schroda Dam, an off-channel dam which draws its water from the Limpopo River.

A list of the registered dams in the Limpopo WMA is attached as **Appendix B**. In terms of the Water Act (Act 54 of 1956), a dam only had to be registered if it was larger than 50 000 m^3 so this list, derived from the Dam Safety register, is not exhaustive. It is known for example, that there are a large number of small farm dams in the upper Lephalala and Mokolo catchments, while the Nzhelele River basin study report (DWAF, 1993) refers to more than 90 dams in the Nzhelele River catchment. However, many of these dams have not been documented anywhere and therefore are not listed in **Appendix B**.

2.8.7 Summary

Table 2.4 summarises the information on major dams.

Table 2.4: Summary of major dams in the Limpopo WMA

Dam	*Catchment*	*Full Supply Capacity* (million m^3)	*MAR* (million m^3/a)	*Historical yield* (million m^3/a)	*Use*
Mokolo	Mokolo	146	240	23	Water supply to multiple users
Doorndraai	Upper Mogalakwena	44	23	8.6	Irrigation, domestic
Glen Alpine	Mogalakwena	20	222	5.6	Irrigation
Nzhelele	Nzhelele	55	66	24.5	Irrigation
Houtrivier	Sand	7.5	12.5	0.6	Domestic

2.9 TRANSFERS

The limited number of dams and very limited run-of-river yield in the Limpopo WMA is not sufficient to meet the water requirements of the urban centres situated in the south-eastern portion of the WMA. A number of transfer schemes from other WMAs have therefore been implemented over the years to meet these water requirements. A summary of these transfer schemes is given in **Table 2.5**.

An amount of 2,4 million m^3/a has been allocated to Makhado from the Albasini Dam in the Lataba/Levhuvhu WMA. However, due to shortages in the Albasini Dam, the transfer to Makhado from this source is often less than the allocated amount. As a result, an additional allocation of 5 million m^3/a was made in White Paper WP A – 98 (Republic of South Africa, 1998) from the recently completed Nandoni Dam in the Levuvhu catchment to Makhado. This additional transfer of 5 million m^3/a is also referred to in the WMA report (DWAF, 2003b).

Polokwane has an allocation of 12 million m^3/a from the Ebeneezer Dam and a further 6,5 million m^3/a from the Dap Naude Dam, but current transfers are less than this at about 10 million m^3/a. The transfer to Polokwane from these sources could therefore conceivably be increased. However, the Ebeneezer Dam is over-allocated and this will need to be resolved and the allocation to Polokwane re-considered. Refer to the ISP report on the Letaba/Levuvhu WMA for more details on this. The intention is to meet the increasing water demands of Polokwane and Mokopane from the Olifants WMA. These options are discussed in **Strategy 5.1.**

Table 2.5: Summary of Inter-WMA transfers

Transfer from (WMA)	Source of water	Transfer to	Main User Sector	Average transfer rate (million m^3/a)
Letaba/Levuvhu WMA	Albasini Dam	Makhado	Urban	2.4
Crocodile West/Marico	Roodeplaat Dam	Modimolle	Urban	3.0
Levuvhu/Letaba	Ebenezer Dam and Dap Naude Dam	Polokwane	Urban	10.1
Olifants	Olifantspoort Weir	Polokwane	Urban	2.6
Total				**18.1**

3 GROUNDWATER

3.1 SITUATION ASSESSMENT

This Chapter summarises the groundwater situation in the Limpopo WMA, while a detailed report is attached as **Appendix C**. Note that the detailed report in **Appendix C** was written before data on the registered water use data became available and which is used in this ISP as the main source of information on irrigation use from groundwater.

Groundwater is available and widely used throughout the entire Limpopo WMA, but in varying quantities depending upon the hydrogeological characteristics of the underlying aquifer.

Much of the Limpopo WMA is populated with widespread rural communities. This is especially the case for the old Lebowa and Venda homeland areas. Groundwater is the main source of water supply to these rural communities although surface water is also used conjunctively where this is available. Groundwater is also used widely for irrigation in this WMA.

The most intensive use of groundwater resources is from the deeply weathered and fractured granite north of Polokwane and in the area around Dendron where large abstractions for irrigation and domestic supply is practiced. Groundwater is used to supply the platinum mines west of Mokopane.

Information concerning groundwater use in the region was obtained for this ISP from the registered water use, which gives the total groundwater use as 310 million m^3/a. This is much more than given in the NWRS (98 million m^3/a) and verification of these very high groundwater use figures was therefore sought. In the latest Groundwater Resource Information Project (GRIP) (DWAF, 2004a), the following groundwater use figures are given for the Limpopo Province:

550 million m^3/a (Haupt, CJ: Consulting groundwater specialist), and
460 million m^3/a (du Toit, W: Assistant Director Geohydrology, DWAF).

Accurate information on how much of this water use, determined during the GRIP, lies in the Limpopo WMA and how much in the other WMAs which lie partially within the Province, is not yet available, but it is clear that the groundwater use in the WMA is substantial.

After consultation with groundwater specialists in the region (DWAF, 2004b), it was concluded that the registered groundwater use probably underestimates actual current groundwater use. One of the reasons for this is the huge increase in groundwater use over the last few years. It is estimated that as many as 30 new boreholes are being drilled every day in the Limpopo WMA, and some of these boreholes are very high yielding, with yields in excess of 5 l/s (DWAF, 2004b). While there is currently no legislation preventing the drilling of boreholes, much of the water use from these boreholes is probably unlawful. A strategy is required to verify actual use, determine whether it is lawful or not, and to terminate (or license) all unlawful use. **See Strategy G1.**

Table 3.1 provides a best guess estimate of the groundwater use in the Limpopo WMA, derived from the registration process and the NWRS, and gives the sectoral breakdown of this use, while **Table 3.2** provides a breakdown of the above

groundwater use into the seven key areas (see **Figure 2.1**). The WARMS database almost certainly underestimates the rural groundwater use since it is not a requirement to register Schedule 1 use, under which category most rural water use falls. A better estimate is to assume that all rural water use in the WMA is sourced from groundwater, in which case the groundwater use by the rural sector, based on the NWRS, is 28 million m^3/a.

Table 3.1: Groundwater Use in the Limpopo WMA

Sector	Groundwater use (million m^3/a)
Rural	28
Industrial	5
Urban	6
Mining	5
Irrigation	266
Total	**310**

Source: WARMS database (DWAF, 2003d) and the NWRS

Table 3.2: Groundwater use per Key Area

Key Area	Groundwater use (million m^3/ a)
Matlabas	4
Mokolo	11
Lephalala	12
Mogalakwena	55
Sand	165
Nzhelele	11
Nwanedi	2
Limpopo Main Stem	50
Total	**310**

In comparison to the annual abstraction, overall groundwater recharge (assuming recharge is 2% of MAP) amounts to 702 million m^3/a. Theoretically therefore, 42% of the annual recharge in the region is currently used. Groundwater recharge is however, not the best measure of the quantity of groundwater that can be utilised on a sustainable basis. A better measure of this is *exploitable potential* which takes into account the factors that limit the full use of the recharge. The exploitable potential was determined by Carl Haupt as part of the water situation assessment studies (DWAF, 2001b), and this is given, per Key Area, in **Table 3.3** together with the groundwater use and a groundwater balance.

In addition to natural recharge from rainfall, sewage effluent from Polokwane is used to recharge groundwater. This is estimated at 50% of Polokwane's gross use, or 10 million m^3/a. This artificial recharge is included in the exploitation potential given in **Table 3.3.**

Based on the simplistic groundwater balance shown in **Table 3.3**, groundwater use in the Sand River Key Area has exceeded, by a significant margin, that which can be abstracted on a sustainable basis. This is reason for grave concern requiring urgent action, and a strategy to deal with this is given in **Part B2, Strategy G1.**

Table 3.3: Groundwater use per Key Area

Key Area	Groundwater use	Exploitable Potential	Groundwater balance
Matlabas	4	28	24
Mokolo	11	47	36
Lephalala	12	37	25
Mogalakwena	55	125	70
Sand	165	95	(70)
Nzhelele	11	11	0
Nwanedi	2	3	1
Limpopo main stem	50	50	0
Total	310	386	76

Units are in million m^3/ annum

Groundwater use in the WMA can be categorised as follows:

Domestic:
Individual boreholes for primary water supply (village hand pumps), this is feasible within a reasonable distance of the user almost everywhere, the exception being in rugged terrain.
Small- scale reticulation schemes for rural villages, schools, clinics, hospitals. This is feasible in most areas with a source available within a reasonable distance, (2 –5 km).
Larger schemes based on several boreholes are often feasible but depends on the hydrogeological conditions of the area.

Agricultural:
Individual boreholes for stock watering and vegetable gardening are feasible virtually everywhere, with the exception of the Sand River Key Area, which appears to be over-exploited.

Irrigation:
Large groundwater schemes are possible in places (and some are already in place), for example in the deeply weathered and fractured granite referred to under **bulk water supply** , and the alluvial aquifer of catchments A63E and A71L. Smaller-scale irrigation schemes are possible throughout the WMA with the exception of the Sand River Key Area.

Industrial (and mining):
Medium to large sized reticulation schemes based on several boreholes are possible in most cases. An example of this is the Mokopane Platinum Mine wellfield in catchment A61F.

3.2 AREAS OF SPECIAL CONCERN

The mountainous area east of Mokopane consists primarily of dolomite and has considerable groundwater resources. The aquifer is however is heavily exploited, both within the WMA (quaternary catchment A61F) and in the Olifants WMA (quaternary catchment B51E) where Zebedelia Estates abstract significant quantities in an uncontrolled manner. Abstraction along the Rooisloot valley for irrigation has caused a decline in groundwater levels, as has abstraction in the Dorps River valley. The Mokopane wellfield, with an abstraction of about 3 million m^3/a, is located in a small area in the west of the Dorps River valley, leading to stress on the aquifer in this area. Abstraction in these areas has resulted in a reduction of groundwater flow down the hydraulic gradient, leading to an impact on downstream users.

Makapan's Gat, a cave of great archeological significance, is found in this area, and the exploitation of the groundwater will certainly hasten the formation of sinkholes in the area and possibly impact on the archeological site. Applications have been made to declare this area a World Heritage Site, in which case the use of this groundwater could be problematical.

The available resources of the entire area needs to be quantified and water use in this area needs to be licensed as a matter of urgency.

The dolomites extend across the surface catchment boundary into the Olifants Catchment and the impact of abstraction in one area on the adjacent area needs to be assessed. The dolomites are an important and currently poorly managed resource and it is proposed that the dolomite aquifer is managed as one unit, even though it crosses the surface water catchment boundary. Refer to **Strategy G1** in **Part B2** of this report.

3.3 CONCLUSION

Despite the high level of groundwater use in the WMA, the available groundwater resources within the WMA are still under-utilised, with the exception of the Sand River Key Area which appears to be over-exploited.

Groundwater use, as estimated from various sources, is much more than the 98 million m^3/a given in the NWRS, which has implications for the water balance given in the NWRS. Estimates of groundwater use vary widely and need to be verified, but in the Sand River Key Area, even the lower reliable estimates indicate that this Key Area is dangerously over-exploited. Initiatives to verify lawful groundwater use and accurately ascertain the exploitable potential are urgently required in the Sand River Key Area. Should the over-exploited situation be confirmed, compulsory licencing may be required to reduce groundwater use to a sustainable level.

Refer to the Groundwater Strategy (**Strategy G1**) in **Part B2** of this report.

4. STRATEGIC WATER RESOURCES/WATER QUALITY PERSPECTIVE OF THE LIMPOPO WMA

4.1 INTRODUCTION

This section of the report focuses on the water resources availability, quality and requirements as obtained through the ISP process for each of the catchments in the WMA. In cases where there are discrepancies between the ISP and NWRS information, these differences are fully explained. The key issues and broad strategies have been identified and developed for each of the catchments in **Part B** of this report. The estimates of water resource availability and requirements are based on the NWRS and on consultative workshops with DWAF personnel held at various stages of the ISP process.

4.2 MANAGEMENT OBJECTIVES

Generic management objectives attributable to the management of water resources of the Limpopo WMA are:

- Effective and sustainable use and management of the water resources in the WMA, which recognises international requirements, the ecological Reserve and the value of water as an asset for economic and socio-economic benefit.

- Equitable allocation of the available water resource to encourage the development of the rural economy to contribute to poverty eradication.

- To make more efficient use of the existing available water resource by all water user sectors. This will enable the CMA to free up additional water, which can be put to beneficial use.

- Achieving water quality that is fit for its intended purpose, with the negative externalities being borne by the responsible institutions (polluter pays principle) and maintaining aquatic ecosystem health on a sustainable basis.

- To ensure availability of reliable data and information on all aspects of integrated water resources management and potential development in the WMA.

In many cases there are more detailed objectives relating to specific issues or problems. These are provided in the strategies attached as **Part B**.

4.3 METHODOLOGY

The approach followed in this ISP was to re-examine all available information in order to form a perspective that is up to date and relates to the actual situation in the Limpopo WMA. The registration of water use has provided new information which became available during the course of this ISP. The use of this registered water use, which appears to be the best source of data curently available, has changed some of the perspectives of the Limpopo WMA from that given in the NWRS.

Irrigation requirements were sourced from the registered water use. In addition, a new Key Area, that of the main stem Limpopo River was introduced and an

estimate made through a GIS system of how much of the irrigation in the Limpopo WMA takes place directly from the Limpopo River and the alluvial aquifer associated with the Limpopo River.

The urban and rural water requirements do not appear to have been captured comprehensively in the registration process, and the estimates given in the NWRS were accepted as the best availabe for these catgeories of users. The reason for the poor registration of rural use is that much of this use is under Schedule 1 and this does not need to be registered. It appears that none of the bulk water supply schemes which provide water to towns in the Limpopo WMA have been included in the WARMS.

The surface water resource of the WMA was checked by carrying out reconnaissance level yield analyses for the whole WMA using the Rapid Simulation Model (Mallory, 2003). These analyses mostly confirmed existing estimates, but the water resources of the Mokolo Key Area appear to have been underestimated while those of the Lephalala Key Area were overestimated. This is discussed in more detail in section 4.4 and section 4.5.

An analysis of the registration data revealed that groundwater is used far more extensively in the WMA than recognised in the NWRS. The groundwater use has been broken down into Key Areas and compared to the annual estimated recharge (see **Table 3.2)** indicating the potential, or lack thereof, for further groundwater use in the WMA.

A water balance was carried out for each Key Area in order to reconcile the water resources with the water requirement. In order to do this it is necessary to express the water use and the water resource at a common level of assurance. Urban, industrial, rural and any abstraction from groundwater was assumed to be at a 1:50 year assurance, while irrigation from surface water was assumed to take place at an asurance of 80%. The average irrigation requirement (from surface water) was therefore adjusted by a factor of 0.85 for use in the water balances.

4.4 SOURCE OF DATA

4.4.1 Surface water resources

Information on the surface water resource was primarily sourced from the WMA report (DWAF, 2003b), but obvious anamolies were investigated using reconnaissance level yield analyses. These analyses were used in this ISP to update the surface water resources of the Mokolo and Lephalala Key Areas and to provide a further breakdown of the water resources of the Matlabas/Mokolo sub-area (NWRS categorisation) and the Nzhelele/Nwanedzi sub-area, each into two Key Areas (ISP categorisation).

Other resources such as return flows, and impacts on the resource such as the ecological requirements, were sourced from the NWRS.

4.4.2 Groundwater resource and use

The groundwater resource has been estimated from groundwater use and the concepts are synonomous in this ISP. In other words, rather than attempt to estimate the groundwater resource *per se,* the assumption is made that current use (as registered) is the volume supplied at a 1:50 year assurance from groundwater. This is the same as the approach taken in the NWRS but it must be stressed that this does not imply that the groundwater resource cannot be developed further.

Groundwater use for irrigation was sourced from the WARMS (DWAF, 2003d) while rural use, sourced from the NWRS, is assumed to be supplied entirely from groundwater.

At the time of compiling the NWRS, it was known that the groundwater use in the Limpopo was substantial, but no accurate reliable figures on this use were available. The estimate at the time was 98 million m^3/a. Subsequently two projects have been undertaken which give a much better indication of groundwater use. These are the Groundwater Resource Information Project (GRIP) (DWAF, 2004a), and the registration of water use which is captured in the WARMS database. The registered groundwater use (310 million m^3/a) was found to be three times more than that given in the NWRS while GRIP indicates that groundwater use could be as much a five times that given in the NWRS. GRIP was based on provincial and not WMA boundaries, so exact comparable figures are not available. For the purposes of this ISP, the registered groundwater use was used as a realistic figure although this must still be verified and actual current use is probably higher. WARMS data has the advantage that it can be dissagregated into Key Areas, which it is difficult to do with the GRIP data which is currently available. The differences between the GRIP and WARMS data needs to be kept in mind when developing groundwater strategies for this WMA.

4.4.3 Irrigation requirements

The registered water use has revealed that much of the irrigation supplied in the Limpopo WMA is sourced from groundwater, and since the groundwater use is much higher than that given in the NWRS, so too is the irrigation use. For the purposes of this ISP, therefore, irrigation water requirements were sourced from the registered water use. The registered water use is summarised per Key Area in **Appendix D.**

4.4.4 Other requirements

All other requirements, namely, mining, industrial, urban and rural use were sourced from the NWRS. Rural use has not been captured accurately in the WARMS because this use is usually Schedule 1 use which does not require registration. Bulk supply to urban users appears to have been omitted from the WARMS, for unknown reasons.

Estimates of the impact of forestry, invasive alien plants, and the ecological Reserve were sourced from the NWRS and no new work was done on these estimates as part of this ISP.

4.5 THE MATLABAS KEY AREA

4.5.1 Introduction

The Matlabas catchment is a largely undeveloped catchment with limited water resources and limited water use. There are no significant dams in this catchment and a significant portion of the water use is from groundwater due to the low assurance of the run-of-river yields. In the NWRS, this catchment is presented together with the Mokolo catchment due to its its relative unimportance.

4.5.2 Water availability

Despite the significant MAR of the catchment (49 million m^3/a), the surface water flow is very erratic, the river flow is ephemeral, and and the 1:50 year yield is effectively zero. The water resource of the Matlabas is summarized in **Table 4.1.**

Table 4.1: Water availability in the Matlabas Key Area (at 1:50 year assurance) in the year 2003

Resource category	Available (million m^3/a)
Gross surface water resource	0
Subtract:	
- Ecological Reserve	0
- Invasive alien plants	0
Net surface water resource	0
Groundwater	4
Return flows (urban)	0
Return flows (irrigation)	0
Total local yield	**4**
Transfer In	0
Grand Total	**4**

4.5.3 Water requirements

The irrigation water requirements given in **Table 4.2** are based on the registered water use (WARMS), while the rural use given in the NWRS has been taken as the best estimate of water use by this sector.

According to the the WARMS, 2 million m^3/a of the irrigation water use is sourced from groundwater while the remaining 2 million m^3/a is sourced from surface water. The surface water resource cannot be supplied at a high assurance and it must be assumed that the irrigation from surface water in this Key Area is mostly opportunistic.

Table 4.2: Water requirements in the Matlabas catchment (at 1:50 year assurance) in the year 2003

User sector	Water requirement/ Impact on yield (million m^3/a)
Irrigation	4
Urban	0
Rural	2
Industrial	0
Mining	0
Power Generation	0
Afforestation	0
Total local requirements	**6**
Transfer out	0
Grand total	**6**

4.5.4 Reconciliation of requirements and available water

A reconciliation of the water requirements and water resource of the Matlabas Key Area is given in **Table 4.3**. This reconciliation indicates that there is a deficit in the

Key Area. This probably relates to irrigation which takes place from surface water. The surface water is only available at very low assurances and hence these irrigators are opportunistic, irrigating only in 1 or 2 years out of 5.

Table 4.3: Reconciliation of the water requirements and the water resource in the Matlabas key Area in the year 2003 (all units are million m^3/a)

Available Water	Local yield	4
	Transfer In	0
	Total	4
Water requirements	Local requirements	6
	Transfers out	0
	Total	6
Balance		**(2)**

4.5.5 Water quality

There are no reported water quality problems in the Matlabas Key Area, either surface or groundwater. Due to the low levels of development in this Key Area, no water quality problems are anticipated.

4.5.6 Future Scenarios

The situation in the Matlabas Key Area is not expected to change much in the future. There are no economic factors driving development in this Key Area and the lack of water resources inhibits economic activity and development in favour of other areas in the WMA. There is potential for greater groundwater use but very little potential for additional surface water use. The potential of individual boreholes in this area is generally low and hence development of the groundwater resource would probably be for small-scale irrigation. Due to the undeveloped nature of this Key Area, it lends itself to the development of a borehole network for the supply to possible future developments in the Mokolo Key Area. Due to the low yield of individual boreholes this is unlikely to be economically viable but should be investigated as a possible option.

4.5.7 Summary, key issues and broad strategy

The Matlabas Key Area is a dry catchment with non-perennial flow and hence no sustainable yield from surface water. The limited water use in this catchment is mostly from groundwater, which is under-exploited in this Key Area. There are no major water resources or water supply issues within this Key Area and hence no management strategies are required in this Key Area.

New allocations in this Key Area can only be made from groundwater or from additional yield which could conceivably be created by the construction of farm dams.

4.6 MOKOLO CATCHMENT

4.6.1 Introduction

The Mokolo catchment is a well developed catchment with industries, mines and extensive agricultural activities. The main industrial development relates to Eskom's Matimba Power Station. Associated with this power station is the Grootgeluk Coal Mine which supplies coal to the power station, local users, as well as for export. Both these bulk users are supplied from the Mokolo Dam. There are opportunities for

further development of the substantial coal reserves and gas fields and other coal-based industries and related devlopment. This area, together with the Lephalala Key Area, have approximately 40% of South Africa's remaining coal reserves and the development of new power stations in this area is inevitable as coal reserves on the highveld become depleted.

The towns of Lephelale (formerly Ellisras) and Vaalwater are situated in this Key Area.

Extensive irrigation occurs in the Mokolo catchment, both upstream and downstream of the Mokolo Dam.

4.6.2 Water availability

The water resources of the Mokolo Key Area are dominated by the Mokolo Dam (formerly the Hans Strijdom Dam), situated in the lower reaches of the Mokolo River. This dam has a full supply capacity of 146 million m^3 and the river at this point a natural MAR of 240 million m^3/a, ie, before all the abstractions for irrigation and the construction of farm dams took place upstream of the dam. During the planning stages of the dam, the yield was given as 39 million m^3/a (RSA, 1970). A more recent evaluation of the water resources of the Mokolo catchment (DWAF, 1992) gives the yield of the Mokolo Dam as only 23 million m^3/a but it must be borne in mind that this is the yield after all the abstractions and development upstream of the dam. The yield of the total Mokolo catchment will not have been reduced due to this development, in fact it probably increased, but some of the yield of the Mokolo Dam was moved upstream through the construction of farm dams.

Table 4.4 summarises the water resource of the Mokolo catchment. It must be pointed out that the surface water resource given in this table refers to the yield of the entire catchment, which, in this case, includes all the farm dams and run-of-river abstraction upstream of the Mokolo Dam.

Table 4.4: Water availability in the Mokolo Key Area (at 1:50 year assurance) in the year 2003

Resource category	Available (million m^3/a)
Gross surface water resource	85
Subtract:	
- Ecological Reserve	17
- Invasive alien plants	0
Net surface water resource	77
Groundwater	11
Return flows	4
Total local yield	**83**
Transfer In	0
Grand Total	**83**

4.6.3 Water requirements

The water requirements of the Mokolo Key Area are summarised in **Table 4.5.** Irrigation, which is by far the largest user this Key Area, takes place mostly upstream of the Mokolo Dam, with water sourced from farm dams and run-of-river. There is an

allocation of 10,4 million m^3/a (at 70% assurance) from the Mokolo Dam to irrigators downstream of the dam. Other allocations from the dam are 9,9 million m^3/a to the Grootgeluk mine and 7,3 million m^3/a to the Matimba power station. The actual use by the mining sector appears to be much less than that allocated, with only 2 million m^3/a registered use by the mining sector. The NWRS estimate of 4 million m^3/a has been used in this case. The urban use is that of the towns of Lephalale and Vaalwater.

Table 4.5: Water requirements in the Mokolo Key Area (at 1:50 year assurance) in the year 2003

User sector	Water requirements / Impact on yield (million m^3/a)
Irrigation	68
Urban	2
Rural	2
Industrial	0
Mining	4
Power Generation	7
Afforestation	0
Total local requirements	**83**
Transfer out	0
Grand total	**83**

4.6.4 Reconciliation of requirements and available water

A reconciliation of the available water resource and requirements is shown in **Table 4.6**.

Table 4.6: Reconciliation of the water requirement and the water resource in the Mokolo Key Area in the year 2003 (all units are million m^3/a)

Available Water	Local yield	83
	Transfer In	0
	Total	83
Water requirements	Local requirements	83
	Transfers out	0
	Total	83
Balance		**0**

The Mokolo Key Area is in balance. The Mokolo Dam itself, while slightly over-allocated, is also approximately in balance because the Grootgeluk Mine does not appear to be using its full allocation of 9,9 million m^3/a and the allocation to irrigators is at only 70% assurance. The implication of this is that irrigators downstream of the dam are probably enjoying a higher level of assurance than the 70% stated in previous reports (DWAF, 2001b). A balance of the Mokolo Dam, based on the above discussion, is given in **Table 4.7** below. Until such time as the Ecological Reserve is implemented and releases made from the Mokolo Dam for this purpose, all users from the dam will continue to experience a high level of assurance.

Table 4.7: Water Balance of the Mokolo Dam based on water allocation

Allocation to	*Allocated amount* (million m^3/a)
Matimba power station	7.3
Grootgeluk coal mine	9.9
Lephalale	1.0
Irrigation (downstream of dam)	10.4*
Total	**28.6**
Historical firm yield	23
Balance	**(5.6)**

*Note that this allocation is at a low assurance

Based on the above, the Mokolo Dam is over-allocated. However, based on actual use and adjusting for the level of assurance of supply, the situation is that given in **Table 4.8.**

Based on estimated current water use, there appears to be a small surplus in the Mokolo Dam. However, this makes no allowance for the Reserve. Implementation of the Reserve will almost certainly result in a deficit situation at the Mokolo Dam. The suggested strategy is not to implement the Reserve for now and to monitor actual water use carefully. Implementation of the Reserve will require a re-allocation from this dam.

The implication of this is that there should be a small surplus in the upper reaches of the catchment. The catchment has not been analysed in sufficient detail to ascertain where this surplus is, but it is probably located in farm dams that are not fully utilised.

Table 4.8: Water Balance of the Mokolo Dam based on allocations

Allocation to	*Water use (at equivalent 1:50 year assurance)* (million m^3/a)
Matimba power station	7.3
Grootgeluk coal mine	4.0
Lephalale	1.0
Irrigation (downstream of dam)	7.0
Total	**19.3**
Historical firm yield	23
Balance	**3.7**

4.6.5 Water Quality

Groundwater quality in much of the Mokolo Key Area is generally poor due to the coal and gas fields. This poor quality groundwater could still be used for industrial purposes or irrigation, however, but is unsuitable for domestic use.

Coal mining activities are also impacting on the surface water quality of the Mokolo Key Area. Kumba Resources are conducting salinity monitoring in the catchment but the catchment lacks a proper water quality management plan. The coal mining activities could also have a negative impact on the groundwater quality.

The rapid and uncontrolled growth of informal settlements around Vaalwater and Alma is a source of concern with regard to the surface and groundwater quality in this area. This needs to be monitored and managed.

4.6.6 Future scenarios

While the Mokolo Key Area is currently in balance, there are a number of planned developments for which additional water resources will need to be sourced. These possible developments, listed below, relate to the natural gas and coal reserves and industries which require a close proximity to large coal reserves.

- Extension of the existing mine and the development of additional coal mines.
- Potential development of gas fields found in this Key Area.
- The construction of new power stations.
- Development of petrochemical industries such as Sasol.
- Fast-growing informal settlements around Vaalwater and Alma
- Iron and steel manufacturing

The following options need to be considered to address future water demands as a result of further developments:

- Raising of the Mokolo Dam (the dam was designed to be raised)
- Transfers of surplus return flows from the Crocodile/Marico WMA to Mokolo catchment. This transfer is mentioned in the NWRS as a possibility and 45 million m^3/a has been provisionally reserved for this.
- Water trading with the irrigation sector.
- Groundwater through the development of large borehole networks in undeveloped areas within this Key Area or neighbouring Key Area.

A detailed yield analysis of the Mokolo Dam is urgently required to update the yield currently available from this dam and investigate the feasibility of raising the dam. A pre-feasibility study of other options to secure the future water supply is also urgently required. It has to borne in mind that the raising of the Mokolo Dam has international implications. Approval for the raising of the dam has to be sought from the Limpopo co-basin states in accordance with the SADC Protocol on shared water-courses.

4.6.7 Summary, key issues and broad strategy

From a water resource point of view, the Mokolo Key Area is the most developed in the WMA and has more surface water available than any of the other Key Areas (see **Figure 4.1**). Apart from the higher than average rainfall, the Key Area includes the large Mokolo Dam, which provides water for a multitude of uses, the most important being the supply to the Matimba power station.

There are a large number of farm dams in the Mokolo Key Area and this has effectively moved much of the yield of the Mokolo Dam upstream where it is is used to supply large areas of irrigation, with an estimated requirement of 66 million m^3/annum. There is also a significant amount of irrigation from groundwater in this Key Area.

The Mokolo Key Area is in balance and no further licences should be issued from surface water without carrying out detailed analyses to verify a sustainable source of supply. Groundwater is however under-utilised and additional licences from this source could be considered. Groundwater should be the first option to supply possible increased domestic requirements, provided the water quality is acceptable. Where water of acceptable quality cannot be sourced, additional small dams may be required to supply the increased domestic requirements. The raising of the Mokolo Dam is an option but this would require a feasibility study to weigh this up against other options.

A detailed yield analysis of the Mokolo dam is urgently required to update the yield currently available from this dam and investigate the feasibility of raising the dam. A pre-feasibility study of other options to secure the future water supply is also urgently required.

4.7 THE LEPHALALA KEY AREA

4.7.1 Introduction

The Lephalala River rises in the Waterberg mountains, where the rainfall is relatively high, and flows north to the Limpopo River. The runoff from this Key Area originates in the upper reaches, and most of the surface water use in the Key Area is found in these upper catchments, where the large number of farm dams support a significant amount of irrigation.

The middle reaches of the Lephalala River consist of a pristine wilderness area, while the dry lower reaches support irrigation from an alluvial aquifer and small weirs which are fed by the Lephalala River.

There are no industries or mines in the catchment.

4.7.2 Water availability

The NWRS gives the surface water resource of the Lephalala Key Area as 38 million m^3/a. This seems very high for a catchment with an MAR of 150 million m^3/annum and no major dams. In comparison, the Matlabas/Mokolo sub-area, as defined in the NWRS, has a surface water yield of 35 million m^3/a from a catchment with an MAR of 382 million m^3/annum and the largest dam in the WMA. To resolve this anomaly, the Lephalala Key Area was analysed in detail as part of this ISP using a reconnaissance level simulation model (Mallory, 2003) and the surface water yield found to be in the order of only 15 million m^3/annum, most of which is derived from the farm dams in the upper reaches of the catchment. The ecological Reserve, given in the WMA report as zero, was also re-assessed as part of this study and found to be in the order of 3 million m^3/a. This is the value used as the most accurate for all water balance estimates in this ISP.

The available water resources in the catchment are summarized in **Table 4.9**.

Table 4.9: Water availability in the Lephalala Key Area (at 1:50 year assurance) in the year 2003

Resource category	Available (million m^3/annum)
Gross surface water resource	15
Subtract:	
- Ecological Reserve	3
- Invasive alien plants	0
Net surface water resource	12
Groundwater	12
Return flows	0
Total local yield	**24**
Transfer In	0
Grand Total	**24**

4.7.3 Water requirements

By far the largest water use in the Lephalala Key Area is for irrigation. The NWRS gives an irrigation requirement of 39 million m^3/a which seems very high for a catchment such as the Lephalala with limited surface water resources. The registered water use, however, is for an even greater amount (52 million m^3/a), but a spacial analysis of the registered water use suggests that 13 million m^3/a of this is probably sourced from the main stem of the Limpopo and has now been included in the Limpopo Main Stem Key Area. The only other significant water use is the rural water use and it is assumed that this is sourced from groundwater. Communities in the catchment are located in the lower reaches and they rely mainly on the groundwater resource.

The water requirements of the Lephalala Key Area are summarised in **Table 4.10**.

Table 4.10: Water requirements in the Lephalala Key Area (at 1:50 year assurance) in the year 2003

User sector	Water requirement/ Impact on yield (million m^3/a)
Irrigation	33
Urban	0
Rural	3
Industrial	0
Mining	0
Power Generation	0
Afforestation	0
Total local requirements	**36**
Transfer out	0
Grand total	**36**

4.7.4 Reconciliation of requirements and availability

A reconciliation of the available water resource and requirements is shown in **Table 4.11**.

Table 4.11: Reconciliation of the water requirement and the water resource in the Lephalala Key Area in the year 2003 (all units are million m^3/a)

Available Water	Local yield	24
	Transfer In	0
	Total	24
Water requirements	Local requirements	36
	Transfers out	0
	Total	36
Balance		**-12**

The catchment appears to be stressed but this probably relates to opportunistic irrigation in the lower reaches of the catchment. Many complaints have been received from irrigators regarding the shortage of water in this catchment which is an indication that this Key Area is indeed stressed.

An unusual feature of this catchment is that the middle reaches of the Lephalala River have a high conservation status while normally it is the upper reaches of a river which enjoy a higher ecological status. The irrigation development in the upper reaches is creating a problem for the Reserve requirements of the middle reaches, which cannot be met under the current levels of development. This is a problem which needs to be addressed.

Although there are potential dam sites on the Lephalala River, which is under-developed, due to the high conservation status of the this area, it is unlikely that major dams would ever be constructed on the main-stem of the Lepalala River. There is potential for additional water usage from groundwater.

4.7.5 Water Quality

The water quality of the Lephalala Key Area is generally good. However, there are a rapidly growing number of hotels and game lodges in the upper catchment and the effluent from these establishments could become a problem if not treated properly, especially during winter when natural dilution is at a minimum. There is also a risk that the use of fertilizers for irrigation will lead to deterioration in the water quality over time.

4.7.6 Future scenarios

There is little scope for large-scale expansion or development in the Lephalala Key Area due to the shortage of surface water. The upper reaches of the catchment will probably continue to develop as this area is becoming increasingly popular as a tourist destination. However, the game farms can source their water requirements from groundwater and the implications on surface water relate mostly to quality concerns. A survey of the sewage treatment facilities in the Limpopo indicated that private treatment, such as at game farms, was generally adequate so these concerns have no foundation. Nevertheless, the situation should be monitored. Discharge from all sewage works operated by DWAF and local municipalities also need to be monitored more stringently.

4.7.7 Summary, key issues and broad strategy

The Lephalala Key Area has limited water resources but surprisingly high water requirements, dominated by the irrigation sector with its water requirement estimated at 39 million m^3/a. Irrigation takes place mainly in the higher rainfall upper reaches of the Key Area where there are a large number of farm dams, while lower in the catchment irrigators make use of water from alluvial aquifers. Nevertheless, the catchment appears to be stressed and no new licences should be issued from surface water for irrigation purposes. Additional water for domestic purposes should be sourced from groundwater.

The middle reaches of the Lephalala Key Area are near-pristine and of high conservation value. Development should be limited in the Lephalala Key Area to maintain this important conservation area.

4.8 THE MOGALAKWENA CATCHMENT

4.8.1 Introduction

The Mogalakwena Key Area follows the same pattern of the other Key Areas, with moderate rainfall in the upper mountainous reaches of the catchment, declining to the north which is arid. The main urban centres are Modimolle, Mookgopong and Mokopane. There are only two significant dams in the Key Area, the Doorndraai Dam situated in the upper reaches, which supplies water to Mookgopong and to irrigators downstream of the dam, and the Glen Alpine Dam, situated much lower in the catchment. From a hydrological point of view there is scope for additional dams in this Key Area but there is a lack of suitable dam sites due to the very flat terrain.

This Key Area is becoming increasingly important economically as platinum mines are expanding in the area and there is still vast untapped mining potential. It is crucial therefore that the water supply in this Key Area is secured and well managed to support these mining developments.

The irrigation sector is currently the largest water user in this Key Area.

4.8.2 Water availability

The water resource of the Mogalakwena Key Area is summarised in **Table 4.12.**

Table 4.12: Water availability in the Mogalakwena Key Area (at 1:50 Year assurance) in the year 2003

Resource category	Available (million m^3/a)
Gross surface water resource	60
Subtract:	
- Ecological Reserve	5
- Invasive alien plants	5
Net surface water resource	50
Groundwater	55
Return flows	7
Total local yield	**112**
Transfer In	3
Grand Total	**115**

With the exception of groundwater, the water resource summary given in Table 4.12 was sourced from the NWRS. The large discrepancy in the groundwater resource (the NWRS estimates the groundwater resource at 15 million m^3/a) is due to new data which recently became available through the registration process. The registered groundwater use in the Mogalakwena Key Area is 49 million m^3/a (see Appendix D), most of which is for irrigation purposes. Allowing for schedule 1 rural use, which is assumed to be supplied from groundwater (and is not a registered use), the total groundwater resource is estimated at 55 million m^3/a.

Transfers into the Key Area are from the Crocodile West WMA. Water is transferred from the Apies/Pienaars system to Modimolle.

According to the DWAF WMA report (DWAF, 2003b) invasive alien plants in the upper reaches of the catchment have a significant impact on the available yield in this Key Area.

The breakdown of the registered water use is given in **Appendix D**.

4.8.3 Water requirements

The water requirements in the Mogalakwena Key Area are given in **Table 4.13**.
The water requirements are considerably higher than given in the NWRS. This is due to the increased estimate in the irrigation requirements derived from the registered water use.

The urban requirements are mostly those of the towns of Modimolle, Mookgopong and Mokopane. Modimolle receives its water via a transfer scheme from the Roodeplaat Dam while Mookgepong receives its water from the Doorndraai Dam, which also supplies Mokopane.

Table 4.13: Major water users/requirements in the Mogalakwena catchment in the year 2003

User sector	Water requirement/ Impact on yield (million m^3/annum)
Irrigation	90
Urban	9
Rural	9
Mining/Industrial	6
Afforestation	0
Total local requirements	**114**
Transfer out	0
Total local requirements	**114**

4.8.4 Reconciliation of requirements and availability

A reconciliation of the available water resource and the water requirements is given in **Table 4.14.**

Table 4.14: Reconciliation of the water requirement and the water resource in the Mogalakwena Key Area in the year 2003 (all units are million m^3/a)

Available Water	Local yield	112
	Transfer In	3
	Total	115
Water requirements	Local requirements	114
	Transfers out	0
	Total	114
Balance		**1**

The Mogalakwena Key Area is currently approximately in balance. The implementation of the Reserve is unlikely to change this situation significantly due to the small impact of the Reserve on the surface water resources.

The only potential for additional water resources within the Key Area is from groundwater.

4.8.5 Water Quality

There are no reported serious water quality problems in the Mogalakwena Key Area. However, there is a risk that surface water quality in the catchment could be affected by diffuse pollution from densely populated informal settlements and mines.

Groundwater pollution is also a threat due to minewater decant, the high concentration of pit latrines in certain areas, and the naturally occurring fluorides emanating from the underling granite in many areas.

There is a need to determine and verify the extent and sources of both surface and groundwater pollution in the catchment.

4.8.6 Future scenarios

The water requirements of the Mogalakwena Key Area are expected to grow due to:

- An influx of people into the urban centres
- Growth in the mining sector
- The supply of basic water requirements to the scattered rural settlements
- Water required to redress the imbalances of the past

There are plans, far advanced, to transfer some of the treated effluent derived from Polokwane to Mokopane to supply the mines in the area.

4.8.7 Summary, key issues and broad strategy

The Mogalakwena Key Area is a catchment with limited surface water resources and large groundwater resources which have already been extensively exploited by the irrigation sector. The water use in the Key Area is dominated by irrigation with an estimated requirement of 99 million m^3/a.

This Key Area is rapidly gaining strategic importance in the provincial and National economy due to the rapid expansion of mines in the area and the water supply to these mines must be secured as a matter of priority. Mines with limited water requirements should be able to source their water from groundwater while larger

mines may require transfers in from the Olifants WMA since there is little scope for further development of the local surface water resources.

New allocations for rural domestic use should be sourced from groundwater.

Various options to secure a sustainable water supply to the mines in the Mogalakwena Key Area and ensure a sustainable water supply to Mokopane are currently being investigated by DWAF's Options Analysis Directorate . These include a new transfer from the Flag Boshilo Dam in the Olifants WMA which is currently being raised. New allocations to the irrigation sector are possible from groundwater but this would need to be studied in more detail since there is a risk of over-exploiting the groundwater resources in this Key Area.

4.9 THE SAND KEY AREA

4.9.1 Introduction

The Sand Key Area is by far the driest of all the Key Areas in the WMA, with a unit runoff of only 1 mm/a (see **Table 2.1**). The surface water resource of the Sand Key Area is therefore very limited. There is no scope for the construction of dams. The bulk of the water requirements in this Key Area are met from the ample groundwater resource. The Key Area also relies heavily on transfers from other WMAs, which are used to meet the urban and industrial demands of Polokwane, Sheshego and Makhado. There is also a small transfer from the Limpopo River to the Venetia Mine. The other significant towns in the area, Musina and Dendron. Musina abstract their water from sand aquifers in the Limpopo River while Dendron relies on groundwater.

There are huge irrigation requirements in the Sand Key Area which rely almost exclusively on groundwater.

Mining is also an important economic driver in this Key Area with the large silicon mine near Polokwane and the Venetia Diamond Mine situated near Musina. There is also a platinum smelter near Polokwane which services all the platinum mines in the area.

4.9.2 Water availability

The water resource of the Sand Key Area is shown in **Table 4.15** from which it is clear that the catchment is largely dependent on groundwater.

There are signficant transfers into the Key Area from the Letaba/ Levuvhu WMA to meet the urban requirements of Polokwane and Makhado. In addition to this there is a small transfer in from the Olifants WMA to Polokwane. A summary of these transfers is provided in Table 2.5.

Table 4.15: Water availability in the Sand Key Area (at a 1:50 year assurance) in the year 2003

Resource category	Available (million m^3/annum)
Gross surface water resource	11
Subtract:	
- Ecological Reserve	1
- Invasive alien plants	0
Net surface water resource	10
Ground water	95
Return flows	10
Total local yield	**105**
Transfer In	15
Grand Total	**120**

4.9.3 Water Use

The estimated water requirements in the Sand Key Area are given in **Table 4.16**. Irrigation is by far the largest water requirement in this Key Area.

Table 4.16: Water requirements in the Sand Key Area (at a 1:50 year assurance) in the year 2003

User sector	Water requirement/ Impact on yield (million m^3/a)
Irrigation	185
Urban	24
Rural	9
Industrial/Mining	4
Afforestation	0
Total local requirements	**222**
Transfer out	0
Total local requirements	**222**

4.9.4 Reconciliation of water requirements and availability

A reconciliation of the available water resource and the water requirements is given in **Table 4.17.**

Table 4.17: Reconciliation of the water requirement and the water resource in the Sand Key Area (all units are million m^3/a) in the year 2003

Available Water	Local yield	105
	Transfer In	15
	Total	120
Water requirements	Local requirements	222
	Transfers out	0
	Total	222
Balance		**(102)**

The above analysis indicates a large deficit in the Sand Key Area while the NWRS indicates that this catchment is in balance. The reason for this difference is the large registered irrigation requirement (185 million m^3/a) which cannot be sustained from either the very limited surface water resource or the more substantial groundwater resource. Verification of this use is required as a matter of urgency to resolve this.

It is important to note that the above water balance assumes that the groundwater resource indicated in **Table 4.17** is sustainable, while in Chapter 3 it is argued that this may not be the case and that the groundwater resources may already have been over-exploited.

4.9.5 Water Quality

Groundwater quality in the Vivo and Dendron areas is a problem due to over-exploitation and uncontrolled use of fertilizers resulting in high concentrations of nitrates. Other than this there are no major water quality problems in the Sand Key Area.

4.9.6 Future scenarios

De Beers are prospecting for diamands throughout the Limpopo WMA. The outcome of this is unpredicatable, but if new diamond deposits are found, for example, at Venetia, then ad-hoc solutions to the water supply to these mines will have to be formulated since it is not possible to plan for this in advance.

The more certain increases in the water requirements of the Sand Key Area are due to:

- Potential mining development by Kumba Resources near the confluence of the Sand and Diep Rivers
- Growing urban water requirements
- Providing basic water services to rural communities
- Planned industrial and other mining developments.

Since there is no potential for additional water use in this Key Area, all additional water requirements will have to be sourced from transfers in from other Key Areas.

4.9.7 Summary, key issues and broad strategy

The Sand River Key Area is a dry catchment with a very limited surface water resource. However, it has exceptional groundwater reserves which have been fully and possibly over-exploited. The water requirements are large compared to the rest of the WMA, and again irrigation is the largest water user, with a requirement of

187 million m^3/a. Urban requirements, estimated at 24 million m^3/a, are mostly sourced from transfers in from other WMAs (see **Table 2.5)**.

The catchment is in deficit due to the over-development of irrigators relying on the very sparse surface water resource. Also there is a very real concern that the groundwater resources could have been over-exploited but further studies are required to confirm this. In the interim, no new licences from any local source should be issued except for domestic use. Plans are far advanced to increase transfers into this Key Area from the Olifants WMA to meet increasing urban and mining requirements.

In the long term, if it can be shown that the groundwater resource has been over-exploited, compulsory licencing may be required in order to reduce abstractions from groundwater to sustainable levels.

4.10 THE NZHELELE KEY AREA

4.10.1 Introduction

The Nzhelele Key Area consists of the small catchment of the Nzhelele River, which rises on the northern slopes of the Soutpansberg mountains and flows north to the Limpopo River. More than half of this Key Area's runoff of 89 million m^3/a is derived from quaternary catchment A80A where the rainfall is over 1 000 mm/a.

Water use in this Key Area is dominated by irrigation which is supplied by the Mutshedzi Dam, farm dams, run-of-river in the upper reaches of the catchment, and the Nzhelele Dam (the second largest dam in the WMA) in the lower reaches of the catchment. Much of this irrigation is managed by emerging farmers. There is also a significant amount of afforestation in the high rainfall regions on the slopes of the Soutpansberg mountains which reduces the runoff by an estimated 2 million m^3/a and available yield by 1 million m^3/a.

There is a small industrial area, referred to as the Makhado Centre, located in the upper reaches of the catchment, where industries such as a vegetable processing factory, bakery and furniture factory are located. This industrial centre obtains water from the Mutshedzi Dam Regional Water Supply Scheme. Siloam Hospital, located in the upper Nzhelele valley, obtains water from the Nzhelele Regional Water Supply Scheme.

4.10.2 Water availability

The available resources in the WMA are summarized in **Table 4.18**. The surface water resources of this catchment are derived mostly from the Nzhelele Dam, while the small Mutshedzi Dam, farm dams and run-of-river also contribute significantly to the yield. There is extensive use of groundwater but still potential for further use.

Table 4.18: Water availability in the Nzhelele Key Area (at 1:50 year assurance) in the year 2003

Resource category	Available (million m^3/a)
Gross surface water resource	26*
Subtract:	
- Ecological Reserve	2
- Invasive alien plants	1
Net surface water resource	23
Ground water	11
Return flows	2
Total local yield	**36**
Transfer In	0
Grand Total	**36**

*Source: Nzhelele Basin Study (DWAF, 1993).

4.10.3 Water use/requirements

Irrigation is by far the largest water user in the Nzhelele Key Area. The latest estimates of irrigation water use, sourced from the WARMS, indicates that there is considerably more irrigation than previously thought. The allocated area is 4 800 ha (DWAF, 2003), but according to this same report only 3 160 ha of this was being irrigated at the time of the study. The large registered irrigation requirement was probably based on the allocated area, and all irrigators which have an allocation probably registered their entitled use as opposed to their actual use.

Table 4.19: Water requirements in the Nzhelele Key Area (at a 1:50 year assurance) in the year 2003

User sector	Water requirement/ Impact on yield (million m^3/a)
Irrigation	36
Urban	0
Rural	4
Industrial	0
Afforestation	1
Total local requirements	**41**
Transfer out	0
Grand Total	**41**

4.10.4 Reconciliation of water requirements and availability

A reconciliation of the water requirements and the water resource of the Nzhelele Key Area is given in **Table 4.20.**

Table 4.20: Reconciliation of the water requirement and the water resource in the Nzhelele Key Area in the year 2003 (all units are million m^3/a)

Available Water	Local yield	36
	Transfer In	0
	Total	36
Water requirements	Local requirements	41
	Transfers out	0
	Total	41
Balance		**(5)**

The Key Area appears to be stressed and this confirms the findings of the Nzhelele Basin Study, in which it is stated that the full quota can be supplied to irrigators only 60% of the time. Implementation of the Reserve will exacerbate this situation.

4.10.5 Water Quality

There are no serious water quality problems in this Key Area.

4.10.6 Future scenarios

The water supply to the rural sector will increase as service delivery to RDP standards are implemented in this Key Area. This has already been taken into account in the reconciliation shown in **Table 4.20** which assumed a water requirement of 25l/person/day. No other increases in water use are expected due to the limited surface water resources.

There is potential to develop the surface resources of the Nzhelele catchment further and potential dams sites were identified as part of the Nzhelele Basin Study (DWAF, 1993). The preferred option for making more water available is water conservation and demand management. There are apparently large losses from the canals which distribute water from the Nzhelele Dam to irrigators and these losses must be addressed before considering the construction of new dams.

4.10.7 Summary, key issues and broad strategy

The Nzhelele Key Area is a small catchment dominated by irrigation, with an allocated area of 4 800ha, but not all of this is currently in use due to insufficient water resources. Uncharacteristically for the Limpopo WMA, there is a small area of afforestation, estimated at 31 km^2, but this has only a small impact on the water resource of the Key Area. The only other significant water use in the area is domestic use by the rural sector.

The second largest dam in the WMA, the Nzhelele Dam, is situated in this Key Area and most of the surface water of the Key Area is derived from this dam. Groundwater is also used extensively in the Nzhelele Key Area.

The catchment is clearly stressed and this is due to over-allocation and/or over-development of the irrigation sector. This is the current situation before implementation of the ecological Reserve. In order to successfully implement the Reserve, it will probably be necessary to carry out compulsory licensing, but there is no urgency for this. No new allocations to the irrigation sector are possible at present, while additional allocations for domestic use will have to be sourced from groundwater.

4.11 THE NWANEDI KEY AREA

4.11.1 Introduction

The Nwanedi Key Area is the smallest in the Limpopo WMA and consists of only quaternary catchment A80H and A80J. Almost all the runoff is from the A80H catchment which is situated in the Soutpansberg mountains where the rainfall is relatively high. Without any major dams in the catchment, the surface water resource is limited, derived mostly from the small Nwanedzi and Luphephe Dams, as well as some run-of-river yield. As with the rest of the Limpopo WMA, there are also ample groundwater resources in this Key Area, although the water use from groundwater is very limited.

There is a substantial amount of irrigation in this Key Area, much of which is managed by emerging farmers but the extent of which is not accurately known.

4.11.2 Water availability

The availability of water resources in the Nwanedi catchment are limited by its small size and the lack of water resource development. The groundwater resource is probably under-utilised.

Table 4.21: Water availability in the Nwanedi Key Area (at 1:50 year assurance) in the year 2003

Resource category	Available (million m^3/annum)
Gross surface water resource	8
Subtract:	
- Ecological Reserve	1
- Invasive alien plants	0
Net surface water resource	7
Ground water	2
Return flows	1
Total local yield	**10**
Transfer In	0
Grand Total	**10**

4.11.3 Water requirements

The water requirements of the Nwanedi Key Area are summarised in **Table 4.22.**

The large irrigation requirement is based on the registered water use, and given the stressed nature of the Key Area (See **Table 4.24)**, it seems unlikely that the use which has been registered actually occurs in practice.

Table 4.22: Water requirements in the Nwanedi Key Area (at a 1:50 year assurance) in the year 2003

User sector	Water requirement/ Impact on yield (million m^3/annum)
Irrigation	15
Urban	0
Rural	1
Industrial	0
Afforestation	0
Total local requirements	**16**
Transfer out	0
Grand Total	**16**

4.11.4 Reconciliation of water requirements and availability

A reconciliation of the water requirements and available water resources is shown in **Table 4.24**. This indicates a large deficit relative to the size of the catchment.

Table 4.23: Reconciliation of the water requirement and the water resource in the Nwanedi catchments (all units are million m^3/annum) in the year 2003

Available Water	Local yield	10
	Transfer In	0
	Total	10
Water requirements	Local requirements	16
	Transfers out	0
	Total	16
Balance		**(6)**

4.11.5 Water Quality

There is no reported water quality problem in this catchment.

4.11.6 Future scenarios

Other than increased water supply to the rural sector due to increased standards of water supply, no further increases in water use are expected in this Key Area due to the limited surface water resources.

There is some potential for additioanal groundwater use in this Key Area. Additional surface water could also be made available by raising the Mutshedzi Dam.

4.11.7 Summary, key issues and broad strategy

The Nwanedi Key Area is a small catchment in the north-eastern corner of the WMA, characterised by large areas (estimated to be in the order of 20 km^2) under irrigation. The water resource of the Key Area is limited to that provided by a few small dams and run-of-river, and the catchment is in deficit. This is due to over-allocation or over-development by the irrigation sector.

The broad strategy for this catchment is basically the same as that for the Nzhelele Key Area, in that compulsory licencing may be required to deal with the over-development by irrigators and to implement the Reserve. In the interim, no new licences should be issued for irrigation and any additional water requirements for domestic use will have to be sourced from groundwater.

4.12 THE LIMPOPO MAIN STEM

4.12.1 Introduction

The Water Resources Situation Assessment Report (DWAF, 2001b) and the NWRS both dealt with the Limpopo WMA as if it were independent of the Limpopo River, while the reality is that there are substantial but poorly quantified flows in the Limpopo River which are used, mostly by irrigators, in the Limpopo WMA. The surface flow in the Limpopo River is very erratic, especially with the substantial development in the Crocodile (West) catchment (one of the main tributaries of the Limpopo River) which utilises much of the low flow which contribute to the Limpopo River main stem under natural conditions. It may therefore be asked how such an erratic flow which could otherwise produce a sustainable yield to support irrigators riparian to the Limpopo River. The answer to two-fold. Firstly, a large number of weirs and some off-channel dams have been constructed on the Limpopo River and these store flood waters for use by irrigators. Secondly, the Limpopo River forms a large alluvial aquifer from which substantial, but as yet unquantified, quantities of water can be abstracted.

This ISP attempts to quantify the water use from the main stem of the Limpopo River. It has not however been possible to quantify the water resources (surface and groundwater) which can be drawn from the Limpopo River. This would require a major study which is far beyond the scope of this ISP. The assumption is therefore made that development along the Limpopo River has expanded to the limit of sustainability and that the water resource availability is balanced by the water use.

4.12.2 Water availability

The water resource of the Limpopo Main Stem is summarised in **Table 4.25**.

Table 4.24: Water availability in the Limpopo Main Stem (at 1:50 year assurance) in the year 2003

Resource category	Available/impact (million m^3/annum)
Gross surface water resource	29
Subtract:	
- Ecological Reserve	0
- Invasive alien plants	0
Net surface water resource	29
Ground water	50
Return flows	0
Total local yield	**79**
Transfer In	0
Grand Total	**79**

The water availability in the Limpopo River was derived from a spatial analysis of the registered water use in the Limpopo WMA. Any water use near the Limpopo River (~ 2 km) was assumed to be utilising the resources of the Limpopo River, whether this was from surface flow or from the alluvial aquifer (see **Figure 4.2**). Assuming then that water use balances the available resource, the resource can be determined as given in **Table 4.25.**

The yield from surface flow is made possible by the large number of weirs on the main stem of the Limpopo as well as pumping to off-channel dams during flood flows. The largest of these off-channel dams is the Schroder Dam.

Note that no allowance is made for the ecological Reserve in the main stem of the Limpopo River. This is because of the highly ephemeral nature of the river.

4.12.3 Water requirements

The estimated water abstractions from the main stem of the Limpopo are shown in **Table 4.26.** This requirement, sourced from WARMS, has been divided between direct surface water abstraction (31 million m^3/annum) and groundwater abstraction (49 million m^3/annum), again based on the WAMRS data.

The large irrigation requirement is based on the registered water use. The majority of this use (74%) is located at Wiepe in the A70L quaternary catchment and is dependent of groundwater. This irrigation can be seen on the land-use map (see **Figure 2.4**).

The shared use of the Limpopo Basin, ie including Botswana, Zimbabwe and Mozambique will need to be considered when managing for the Reserve and for other downstream users.

Table 4.25: Water requirements met from the Limpopo Main Stem (at a 1:50 year assurance) in the year 2003

User sector	Water requirement/ Impact on yield (million m^3/annum)
Irrigation	78
Urban	1
Rural	0
Industrial	0
Afforestation	0
Total local requirements	**79**
Transfer out	0
Grand Total	**79**

4.12.4 Reconciliation of water requirements and availability

As stated in section 4.12.1, it has been assumed that the Main Stem of the Limpopo is currently in balance. This is difficult to ascertain with any certainty, however, without a detailed analysis which would need to include the complex interaction of surface and groundwater along the alluvial aquifer formed by the Limpopo River. A model of this basin has been set up and configured (Department of Civil

Engineering, University of Stellenbosch, 1999) and will be used in the proposed Limpopo Basin Study.

There is no potential for any additional water use from the Limpopo River. For many years there has been pressure on DWAF by irrigators along the Limpopo to construct a dam, but due to the very flat terrain, there are no feasible dam sites (MacDonald Shand Consortium, 1991) and DWAF will therefore not support the construction of a dam on the Limpopo River.

4.12.5 Water Quality

The surface water quality of the Limpopo River can become a problem during periods of low or zero flow. Pools form in the river which provide refuge for hippos, crocodiles and fish and the water quality in these pools becomes very poor. The poor quality in the Limpopo associated with periods of low flow is a natural occurrence but one that has been exacerbated by human development upstream of the Limpopo River.

The water abstracted from the alluvial aquifer is generally good but the underlying geology consists of marine deposits and there is a real danger that if the alluvial aquifer is over-exploited then the quality of this water may deteriorate. The quantity and quality of water abstracted from the Limpopo alluvial aquifer therefore needs to be monitored to ensure that the quality of the water does not deteriorate.

4.12.6 Future scenarios

If left unregulated, it is conceivable that irrigation use would increase until the Limpopo alluvial aqufier is over-exploited. Some sources indicate that this has already happpened. It is uncertain whether or not there is scope for additional abstractions from the Limpopo River alluvial aquifer, but DWAF should take a precautionary and not allow any additional use from this source.

4.12.7 Summary, key issues and broad strategy

The hydrology, and more importantly, the available yield of the main stem of the Limpopo is poorly understood. Within the borders of the Limpopo WMA there are large abstractions from the Limpopo River, estimated to be in the order of 80 million m^3/a, more than half of which is abstracted from the alluvial aquifer. These abstractions are used almost exclusively for irrigation, although other users include the town of Musina and the Venetia diamond mine.

Additional abstractions from the Limpopo River should not be permitted for two reasons. Firstly, increased abstractions could result in contamination/salination of this resource from the under-lying marine deposits. Secondly, the Limpopo is an international river and increased abstractions cannot be considered without first consulting the co-basin states. Increased supplies to meet domestic requirements should be sourced from groundwater further than 2 km away from the Limpopo River.

A study is requires in order to understand the water resources of the Limpopo River better. This will require a thorough understanding of the groundwater/surface water interaction.

4.13 SUMMARY

A summary of the water requirements, water resource and a reconciliation between the two for the whole WMA is given in **Table 4.27.**

This reconciliation differs considerably from that of the NWRS in the detail, although the overall perspective, that of the Limpopo WMA being a WMA which is in deficit, is the same. The deficits in the WMA are primarily because of opportunistic irrigation in the Sand and Lephalala Key Areas and over-allocated irrigation in the Nzhelele and Nwanedi Key Areas.

The water requirements and groundwater resources of the WMA, as documented in this ISP, are much higher than those given in the NWRS (see **Table 4.27)**. The reason for this is that new information became available on the groundwater use through the registration process as well as the GRIP project (DWAF, 2004a).

Table 4.26: Reconciliation of water requirements and available water in the Limpopo WMA for the year 2003 (million m^3/a) as per this ISP

Sector/ Key Area	Available water			Water requirements/allocations			Balance
	Local yield	Transfers In	Total	Local requirements	Transfers out	Total	
Matlabas	4	0	4	6	0	6	(2)
Mokolo	83	0	83	83	0	83	0
Lephalala	24	0	24	36	0	36	(12)
Mogalakwena	112	3	115	114	0	114	1
Sand	105	15	120	222	0	222	(101)
Nzhelele	36	0	36	41	0	41	(5)
Nwanedi	10	0	10	16	0	16	(6)
Main stem Limpopo	79	0	79	79	0	79	0
Total	**453**	**18**	**471**	**595**	**0**	**595**	**(123)**

The other major difference between this ISP and the NWRS is that the main stem of the Limpopo River has been considered as a separate entity with its own resource and requirements. While the water balance given for the Limpopo River main stem is very much a first order estimate, it does at least separate out the large irrigation abstractions made from the Limpopo River from the major tributaries which make up the Limpopo WMA. This is important since these abstractions are utilising the resource of the Limpopo River itself, which also receives inflow from the Crocodile River, Botswana and Zimbabwe. The actual resource available from the Limpopo River would be difficult to determine since the surface flow is very erratic but serve to fill the alluvial aquifer associated with the Limpopo River. Abstractions are mostly from this aquifer and not from the surface flow as such. Since the sustainable yield of this aquifer has not been determined, it has been assumed in this ISP that the Limpopo River main stem is in balance.

Table 4.27: Reconciliation of water requirements and available water in the Limpopo WMA for the year 2003 (million m^3/a), as given in the NWRS

Sub-area	Available water			Water requirements/allocations			Balance
	Local yield	Transfers In	Total	Local requirements	Transfers out	Total	
Matlabs/Mokolo	46	0	46	63	0	63	(17)
Lephalala	42	0	42	42	0	42	0
Mogalakwena	72	3	75	79	0	79	(4)
Sand	91	15	106	106	0	106	0
Nzhelele/Nwanedi	30	0	30	32	0	32	(2)
Total	**281**	**18**	**299**	**322**	**0**	**322**	**(23)**

5. KEY ISSUES AND MANAGEMENT STRATEGIES

The NWRS lists a number of key issues and strategies for the Limpopo WMA. These are summarised below in italics and comment is made on these issues, given the more thorough evaluation made as part of this ISP.

5.1 GENERAL

Water resources in the Limpopo WMA, although on the verge of stress, are broadly in balance with the requirements for water. Serious deficits may result in some of the catchments when the Reserve is implemented. Detailed assessment of the Reserve with respect to these catchments, together with careful planning for the implementation thereof, is therefore required as a priority. Compulsory licensing will probably soon be required in some catchments.

With limited undeveloped resource potential remaining, the primary focus in the water management area should be directed towards the more efficient, beneficial and equitable use of the water resources currently available. New surface resource developments and inter-catchment transfers of water would most likely only be affordable for high value uses. Water to supply current deficits (including the ecological component of the Reserve), as well as for rural development, poverty relief and to redress inequities, will therefore mostly have to be obtained from existing users. In some instances, such as for rural domestic supplies and community gardens, the development of groundwater may be the most advantageous option.

Comment

New information that became available during the development of this ISP has resulted in important new conclusions being drawn with regard to groundwater in the Limpopo WMA. These are, firstly, that there is considerably more groundwater use in the WMA than previously thought. Secondly, that groundwater use in the Sand Key Area appears to already be over-exploited. This could result in serious long-term consequences and the situation urgently needs to be investigated in order to understand the situation better and develop appropriate management actions. Nevertheless, groundwater remains a crucial water resource in the WMA given the lack of surface water resources. There is potential for additional groundwater use in most of the WMA; everywhere except in the Sand Key and Nwanedzi Key Areas.

Most of the rivers in the Limpopo WMA are ephemeral, including the Limpopo River itself, and the Reserve requirements of such rivers is not well understood. A lot more research into this aspect is required before the Reserve can be determined, let alone implemented in this WMA. The exception to this is the Mokolo and Nzhelele Key Area where the Reserve can be implemented to an extent through imporoved operation of the large dams (Mokolo and Nzhele) in these Key Areas. This will however require a re-allocation from these dams and/or compulsory licensing in the whole catchment.

5.2 MATLABAS/MOKOLO SUB-AREA

Little change in the requirements for water is foreseen in this sub-area. However, implementation of the ecological Reserve could cause serious imbalances, which should be approached as described above.

Comment

A more detailed analysis carried out as part of this ISP indicates that the Matlabas/Mokolo sub-area as a whole is approximately in balance, even after

making provision for the ecologcial Reserve. Implementation of the Reserve should therefore be possible in the Mokolo, at least in principle, although strict control measures would need to be put in place to prevent irrigators abstracting the river flow earmarked for the ecology.

5.3 LEPHALALA SUB-AREA

Water requirements in this sub-area are expected to remain close to the current levels. Recognising the important wilderness areas in the catchment, it may be set as an objective for the Lephalala River to be managed in a close to natural state, at least upstream of the conservation area.

Comment: Due to the significant irrigation requirements and the large number of farm dams in the upper Lephalala Key Area, the Key Area is already far from in a natural state. A better understanding of the irrigation requirements is required in this Key Area since current use appears to be unsustainable.

5.4 MOGALAKWENA SUB-AREA

Water for the expected mining developments in the Mokopane-Mogoto area could, at least initially, be supplied with the effluent return flows from Mokopane and Polokwane as well as through re-allocation from other areas. Water conservation and demand management will also be required for urban areas. Should larger quantities be required, these will probably have to be sourced through additional transfers from the Olifants River (and may require construction of the proposed Rooipoort Dam on the Olifants River).

Additional water for Modimolle and Mookgopong could probably be obtained from the Donkerpoort Dam.

Comment: A dam on the Steelpoort River (a tributary of the Olifant River) referred to as the De Hoop Dam has been selected as the preferred option to augment the water supply to the Mogolakwena sub-area. As small dam at Rooipoort is still a possibility, however.

5.5 SAND SUB-AREA

Growth at Polokwane should first be supplied through water demand management, whilst transfers from the Olifants River may also be increased up to the capacity of the existing pipeline. Additional transfers will require that new infrastructure be constructed, which may include construction of Rooipoort Dam.

Provision for growth at Makhado should first be made through water demand management, after which it is expected that water will have to be transferred from the Luvuvhu and Letaba water management area (from Albasini Dam or Nandoni Dam). The possibility also exists of reducing afforestation in the vicinity of Makhado in order to increase recharge and utilisation of groundwater.

Comment: There is limited scope for Polokwane to transfer additional water from the Letaba catchment because their allocation from this catchment is 18,5 million m^3/a (12,0 from Ebenezer Dam and a further 6,5 million m^3/a from the Dap Naude Dam) while they are currently only utilising 10 million m^3/a. Polokwane could utilise this allocation fully before developing new resources in the Olifants WMA. However, the Ebeneezer Dam is over-allocated and the allocation to Polokwane is therefore likely to be reduced during a re-allocation process. Should this be the case, Polokwane will need to source their additional water from the Olifants WMA.

An allocation has been made from the newly completed Nandoni Dam to Mahhado and the design of a scheme to deliver this allocation is far advanced.

The reference to reducing afforestation in the vicinity of Makhado in the NWRS is spurious since there is a negligible amount of forestry in the area. In principle though, new concepts such as reducing afforestation to improve groundwater recharge would need to be investigated in detail before implemented. The water requirements of Makhado are not beyond the range which could be supplied from groundwater. However, given the possible over-utilisation of groundwater in the Sand Key Area, this would also need to be carefully evaluated.

5.6 NZHELELE/NWANEDZI SUB-AREA

No significant growth in the requirements for water is foreseen in the Nzhelele/Nwanedzi sub-area. Apart from the standard interventions already mentioned above, the option also exists of raising the Mutshedzi Dam in order to make more water available.

Comment: This Nzhelele and Nwanedi Key Areas are more severely stressed than indicated in the NWRS and implementation of the ecological Reserve may require compulsory licensing.

6. WATER CONSERVATION AND WATER DEMAND MANAGEMENT

The Directorate of Water Conservation and Water Demand Management is in the process of finalising a national strategy for WC/WDM. At the same time municipalities with the financial assistance of the Regional Office and National directorate of WC/WDM should undertake situation assessment studies that would lead to the development of a WC/WDM strategy in the Limpopo WMA. For more detailed information on the WC/DM situation in the Limpopo WMA and recommended strategies, refer to **Part B2, Strategies G5.1 and G5.2.**

7. COOPERATIVE GOVERNANCE

Successful implementation of the IWRM process requires co-operative governance. There should be effective communication and co-operation amongst all the municipalities and government departments involved in the process. (See **Part B2, Strategy G6).**

Municipalities are required to develop Integrated Development Plans (IDPs) and Water Services Development Plans (WSDP's). The implementation of WC/WDM requires the co-operation of users and other stakeholders. Data collection is a joint task involving the Department of Agriculture, Environmental Affairs and Tourism, South African Weather Bureau Services, Department of Health etc. This can only be implemented successfully if all the parties involved buy-in to the process.

8. WATERWORKS MANAGEMENT

In the Limpopo WMA there are few large dams, the details of which are given in Chapter 2. The management of these dams focuses on three main strategies.

- System management
- Infrastructure development, and

- Recreation on dams and rivers

The ***System Management Strategy*** focuses on system operations and management of the releases (i.e. releases during dry and wet periods including when there are restrictions). The reader is referred to **strategy G7.1** in **Part B2** for more details. The **Infrastructure Development Strategy (Strategy G7.2)** focuses on any plans for future development of infrastructure in the catchment. However, in the Limpopo WMA the opportunities for further infrastructure development are very limited.

9. MONITORING AND INFORMATION SYSTEMS

The backbone of any planning exercise and the successful management of a water supply system is the availability of accurate data collection, management, storage and dissemination in the Limpopo WMA. For more details on the current monitoring situation in the WMA refer to **Strategy G8** in **Part B2.**

10. REDRESSING INEQUITIES

The Limpopo Province is one of the poorest provinces in South Africa. Poverty eradication involves quite a number of activities. In the context of the ISP, much attention is on the responsibilities related to DWAF. These responsibilities as stated in DWAF's corporate vision (refer to **Chapter 1, section 1.2)** can be interpreted as follows:

- To ensure that all South Africans enjoy the benefits of a clean and adequate water and hygenic sanitation services
- To ensure that the country's valuable asset (i.e. water) is utilized efficiently and economically. Uses may vary from industrial production, mining and large scale commercial farming, to allowing the poor to live successfully off the land through subsistence farming and food gardening and other productive economic uses at household scale such as brick making.

The reader is referred to **Strategy G19** in **Part B2,** for more details on the poverty situation in the Limpopo WMA and proposed strategies on how to address the eradication of poverty through the allocation and use of water.

11. SUPPORT TO LOCAL AUTHORITIES

Local Authorities in the Limpopo WMA are facing the challenge of delivering basic water services to the widely distributed rural population. For these services to be reliable, sustainable water sources must be identified. The Department of Water Affairs and Forestry has been providing funds to assist the municipalities in identifying reliable sources. This process was undertaken through the Water Services Development Plans. A number of gaps have been identified through these WSDPs and the department is making more funds available to review and update this WSDPs and also to capacitate Local Municipalities in preparation for the full-scale implementation of the WSDPs. This strategy presents the situation with regard to LAs and how DWAF should continue provide technical assistance to municipalities.

12. IMPLEMENTATION

Once the final ISP report has been approved, DWAF will be faced with a challenge of making the proposed strategies real. To implement it successfully, the Department will need a champion for each WMA to focus on the identified and prioritised strategies. For more details on actions required, refer to **Strategy 11 in Part B2.**

13 CONCLUSION

The ISP for the Limpopo WMA has provided perspectives on how DWAF wants to manage the scarce water resources in the WMA. These perspectives are based on:

- The overall water resources (surface and groundwater) situation within the WMA
- The availability of water for use and estimated water requirements
- Current activities which pose risks of pollution to the water resources
- The need to protect the resource and the surrounding environment
- Current monitoring and information within the WMA
- Current institutional support and public involvement

Various management strategies are proposed to: -

- Maximise the available resource and minimise the current deficit
- Protect both surface and groundwater resources
- Protect the environment
- Ensure that the local authorities within the WMA are provided with guidance for sustainable and appropriate water sources
- Ensure water is utilised for poverty eradication
- Improve on the current monitoring situation
- Involve all the stakeholders (Co-operative governance) in the management of the catchments

This ISP is a living document that will be updated and improved in accordance with the latest available information and inputs from various stakeholders.

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PART B1: CATCHMENT SPECIFIC STRATEGIES

Matlabas /Mokolo catchments Strategy

1.1: Reconciliation of water requirements and available water resourcesStrategy
1.2: Water quality

Lephalala catchment Strategy

2.1: Reconciliation of water requirements and available water resourcesStrategy
2.2: Water quality

Mogalakwena catchment Strategy

3.1: Reconciliation of water requirements and available water resourcesStrategy
3.3: Water quality

Sand catchment Strategy

4.1: Reconciliation of water requirements and available water resources Strategy
4.2: Water quality

Nzhelele/Nwanedi catchment Strategy

5.1: Reconciliation of water requirements and available water resources Strategy
5.2: Water quality

PART B1: GENERAL STRATEGIES APPLICABLE TO THE WHOLE WMA

Strategy G1: Water Balance and Reconciliation
- G1.1: Resource availability – surface waster
- G1.2: Resource availability – groundwater
- G1.3: Water requirements
- G1.4: Water reconciliation
- G1.5: Transfers and reservation of waster

Strategy G2: International Obligations
Strategy G3: Water Quality
Strategy G4: Water Use Management
Strategy G5: Water Conservation and Demand Management
Strategy G6: Co-operative Governance
Strategy G7: Waterworks Management
Strategy G8: Monitoring and Information
Strategy G9: Re-dressing Inequities
Strategy G10: Support to Local Authorities
Strategy G11: Implementation of the ISP