REPORT No. PWMA 18/000/00/0304

DEPARTMENT: WATER AFFAIRS AND FORESTRY

Directorate: Water Resource Planning

BREEDE WATER MANAGEMENT AREA

INTERNAL STRATEGIC PERSPECTIVE

VERSION 1
OCTOBER 2004

COMPILED BY:

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JAKOET & ASSOCIATES

DEPARTMENT OF
WATER AFFAIRS
& FORESTRY

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INTERNAL STRATEGIC PERSPECTIVE

APPROVAL

Title	**:**	**Breede Water Management Area: Internal Strategic Perspective**
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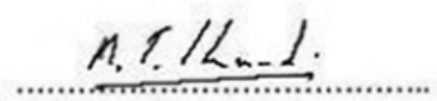
STUDY TEAM: Approved for Ninham Shand

G ENGLISH



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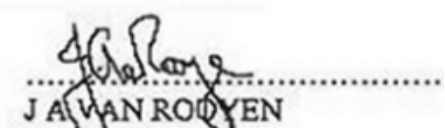

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REFERENCE

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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This report will be updated on a regular basis until it is eventually superceded by the Catchment Management Strategy. Water users and other stakeholders in the Breede River 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:
  - Intranet: http://dwaf-www.pwv.gov.za/documents/
  - Internet: http://www.dwaf.gov.za/documents/
- On CD which can be obtained from DWAF Map Office at:
  157 Schoeman Street, Pretoria (Emanzini Building)
  +27 12 336 7813
  mailto:apm@dwaf.gov.za

  or from the Version Controller (see box overleaf)

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

- Breede WMA Internal Strategic Perspective (*This Report*)
  (Report No: P WMA 18/000/00/0304)
- The National Water Resource Strategy, First Edition, 2004
- The Breede WMA - Overview of Water Resources Availability and Utilisation
  (Report No: P WMA 18/000/00/0203)
- The Breede WMA – Water Resources Situation Assessment
  (Report No: P WMA 18/000/00/0101)

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This report is a living document and will be updated on a regular basis. If the version of this report is older than 12 months, please check whether a later version is not available.

This can be done on the DWAF website: http://www.dwaf.gov.za/documents/

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VERSION CONTROL

BREEDE WMA
INTERNAL STRATEGIC PERSPECTIVE

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

BREEDE WMA

INTERNAL STRATEGIC PERSPECTIVE

EXECUTIVE SUMMARY

1. INTRODUCTION

The Breede Water Management Area (WMA) is situated in the south-west corner of South Africa. It derives its name from the largest river within its boundaries, namely the Breede River. The WMA is bounded by the Indian Ocean to the south, the Olifants/Doorn WMA in the north-west, the Berg WMA in the west and the Gouritz WMA in the east. It falls entirely within the Western Cape Province.

2. WATER LEGISLATION AND MANAGEMENT

The **National Water Act** of 1998 (NWA) is the principal legal instrument relating to water resource management in South Africa. It is now being incrementally implemented. The NWA introduces far-reaching concepts such as the **National Water Resource Strategy** (NWRS), the First Edition of which will be published in the first quarter of 2004. This NWRS is being progressively developed to set 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 delegation of water resource management from central government to catchment level, as provided for in the NWA, will be achieved by establishing a Catchment Management Agency (CMA) for each WMA and each CMA will progressively develop a Catchment Management Strategy (CMS), within the general framework set by the NWRS. Until such time as the CMA is established and is able to manage the water resources within the WMA according to its CMS, the Regional Offices (ROs) of the Department of Water Affairs and Forestry (DWAF) will continue to manage water resources according to the Internal Strategic Perspective (ISP).

3. INTERNAL STRATEGIC PERSPECTIVES

This document presents DWAF's Internal Strategic Perspective (ISP) or view on how it intends managing the water resources within the Breede WMA during the period leading up to the establishment of a CMA and the development of a CMS by the CMA. The ISP will inter alia provide a consistent basis for the Western Cape Regional Office to process requests for new water use licences.

After internal approval, the Department will obtain comment on the ISP from local authorities, Water User Associations (WUAs), other water related organisations and the public. This will take place through the RO's established liaison structures (forums) and through normal contact with water users in the execution of its duties. This ISP document will be updated periodically

until the CMA for the Breede WMA is fully functional and has prepared a CMS. All updates to the document will be authorised by the RO, and the task of managing version control will be the function of the Catchment Manager for the Breede WMA.

The ISP has been compiled by referring to policy documentation, legislation, regional planning, departmental guidelines and relevant water related studies, and is also based on interviews and communications with DWAF's regional managers, as well as staff in relevant Head Office directorates.

The yield balances quoted in this report are based on the findings of the Breede River Basin Study (Ref 8) and on the Breede WMA Report (Ref 9), for those areas lying outside of the Breede River catchments. The Breede WMA Report was compiled as part of the NWRS process.

The ISP does not assume to address all possible issues. This is a living document and further improvements will be made and strategies developed as new issues arise.

4. INTEGRATED WATER RESOURCE MANAGEMENT

As part of the implementation of Integrated Water Resource Management (IWRM), in line with the requirements of the NWA, DWAF is following a process that will include:

- development of the ISPs;
- verification of existing lawful use;
- determination of water availability at acceptable confidence levels; and
- determination of Ecological Reserves at high confidence levels.

An iterative and interactive process will also follow where public participation will play a role in determining water resource and water use reconciliation options. This will be handled by DWAF until the CMA can take over.

The following aspects of water resource management will be encompassed within the broad process of IWRM:

- caring for the environment and where possible, enhancing ecological integrity;
- keeping society at the forefront of all decision making;
- affording the correct level of attention to addressing water quality issues in relation to both surface and groundwater;
- managing groundwater as an integral part of the total water resource;
- taking cognisance of the recreational and social use of dams and rivers; and
- forging ways to improve co-operative governance with other authorities towards more effective water resource management.

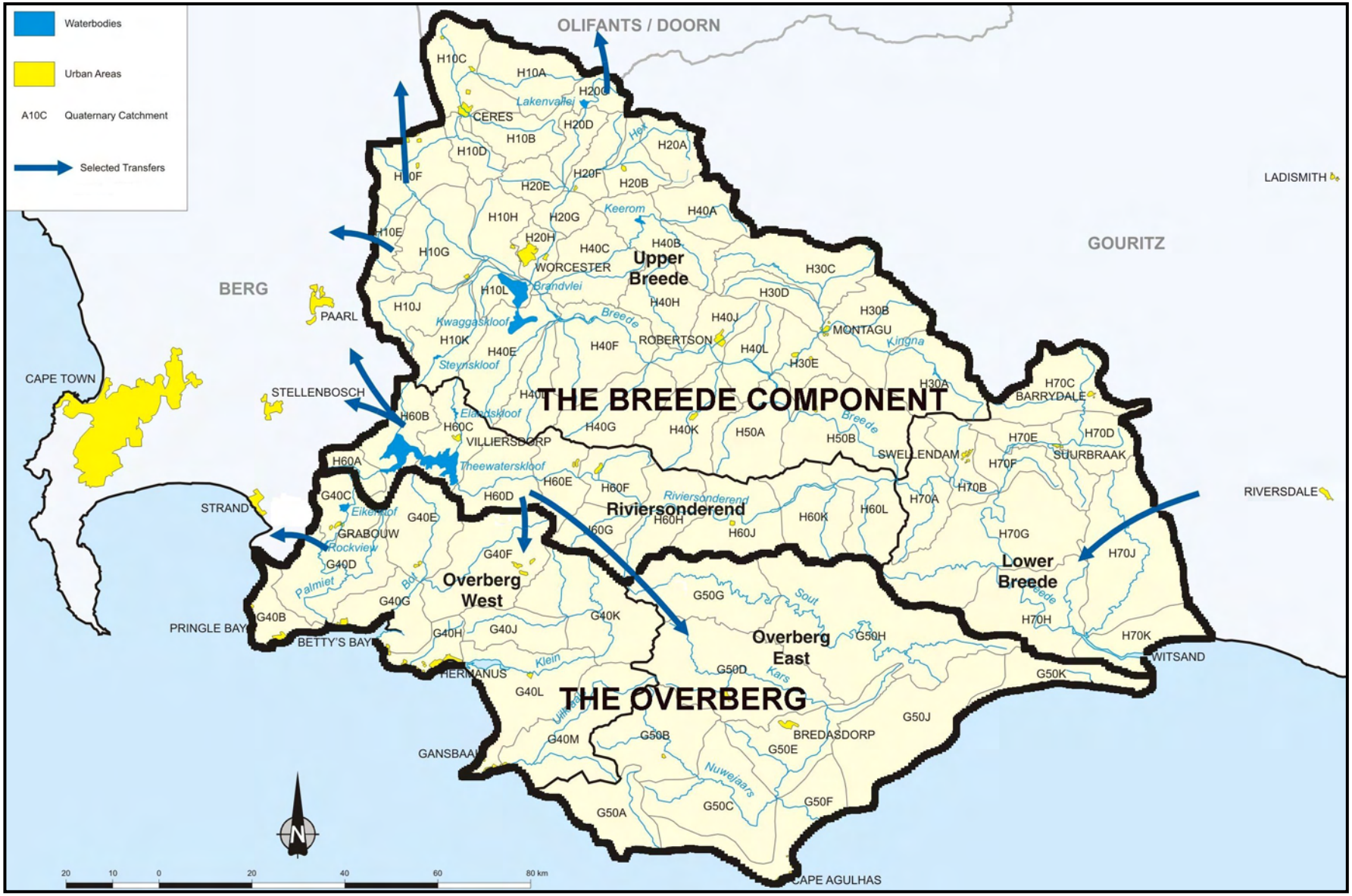

Figure E1: The two components of the Breede WMA and their sub-areas

5. SUB-AREAS OF THE BREEDE WMA USED IN THE NWRS

For the purposes of reviewing the available yield, the Breede WMA was divided into two components, namely the Breede Component and the Overberg (see Figure E1). Each component was further sub-divided into smaller sub-areas, three in the Breede and two in the Overberg. These five sub-areas within the WMA correspond with the so-called areas of interest used in the NWRS.

To facilitate the identification of issues and concerns, the Breede component was further sub-divided into eight sub-areas, and the Overberg into six. This is discussed in Chapter 6 of this report.

6. TOPOGRAPHY, RAINFALL AND LAND-USE

The topography of the Breede WMA varies considerably from east to west, with consequential impact on the climate of the region. Rainfall is highest in the mountainous regions in the south-west where the mean annual precipitation is as high as 3 000 mm per annum, whilst the central and north-eastern areas receive as little as 250 mm per annum. There is intensive irrigation in the Breede and Riviersonderend River valleys (Breede component of the WMA) as well as in the extreme west of the Western Overberg, notably in the Palmiet River catchment.

7. ECONOMIC ACTIVITY

Irrigated agriculture, wheat cultivation and associated activities such as processing and packaging are the primary economic activities in the Breede WMA. The contribution of this WMA to the national Gross Domestic Product (GDP) is less than 1%, and is among the lowest in the country. There is a 19% unemployment rate which is significantly better than the national average of 29%.

8. POPULATION

Of the total population of 382 400, estimated in 1995 (Ref 9), 66% reside in urban and peri-urban areas and 34% in rural areas. No significant population increase is anticipated, although there will be a small increase in the coastal towns and a continuation of seasonal influx, notably during summer holiday periods.

9. CONSERVATION FEATURES

The Breede River estuary and the estuaries of the Overberg Rivers are of ecological importance. In 1986 the Heuningnes estuary was proclaimed a RAMSAR site. The Papenkuils wetland has been impacted on by activities within its catchment, notably the diversion of water upstream of it for irrigation purposes.

10. WATER RESOURCE MANAGEMENT PERSPECTIVE OF THE BREEDE RIVER COMPONENT

The Breede River component (see Figure E1) corresponds with the scope of the BRBS, on which much of the information used in this ISP has been based. There are three sub-areas used to describe the water availability, water requirements and yield balance, namely :

- The Upper Breede sub-area
- The Lower Breede sub-area
- The Riviersonderend sub-area

10.1 Regional Water Supply Schemes in the Breede River Catchments

A major inter-basin transfer takes place between the Breede and Berg WMAs via the Riviersonderend-Berg-Eerste River Government Water Scheme, which also supplies water for irrigators in the Riviersonderend sub-area and to the Overberg Water Board schemes in the Overberg. Of the total scheme yield of 234 million m^3/a (1 in 50 year assurance of supply), an average annual net transfer of 161 million m^3/a takes place into the Berg WMA. Via this scheme, a further 6,5 million m^3/a is transferred, namely 4 million m^3/a to the Overberg and 2,5 million m^3/a to the Lower Breede sub-area. The largest beneficiary in the Berg WMA is the City of Cape Town (CCT). Irrigators in the Berg and Eerste River catchments also have an allocation out of this scheme. Four other small transfer schemes out of the Breede River component total approximately 12 million m^3/a, of which 2,5 million m^3/a is into the Olifants/Doorn WMA via the Inverdoon Canal. The remaining 9,5 million m^3/a is transferred into the Berg WMA via the Artois Canal (4 million m^3/a), the "Gawie-se-Water" Scheme (5 million m^3/a), and about 0,5 million m^3/a to Franschhoek.

10.2 Urban Water Supply Schemes in the Breede River Component

Urban water requirements constitute approximately 5% of the total water requirement in the Breede River component of the WMA. This is primarily supplied out of schemes owned and operated by local authorities. Water conservation and demand management offers potential towards meeting future urban requirements, as well as the development of small supplementary groundwater schemes.

10.3 Irrigation Supply in the Breede River Component

95% of the total water requirement is for irrigation. Based on checks undertaken in the Hex River catchment, it appears that registered irrigation information (WARMS) is reasonably accurate. Results in the Hex River catchment were within 3% of independent assessments undertaken as part of the BRBS, adding confidence to estimates of actual water use by irrigation.

10.4 Waterworks

Stettynskloof Dam (Worcester) is the only dam of significant size that is owned by a local authority, and for which the primary purpose is urban water supply. Of the dams supplying water for irrigation, Greater Brandvlei Dam (firm yield of 155 million m^3/a) is the largest, and has spare storage capacity of 133 million m^3. This offers potential for increasing the yield via pumping out of the Breede River. Other large dams supplying irrigation include :

- Lakenvallei and Roode Elsberg Dams of the Sanddrift Government Water Scheme (firm yield of 9 million m^3/a)
- Keerom Dam (firm yield of 3,8 million m^3/a)
- Elandskloof Dam (firm yield of 12 million m^3/a)
- Buffeljags Dam (firm yield of 11 million m^3/a)

Farm dams collectively provide about 83 million m^3 of storage.

10.5 Water Availability for Year 2000

The water availability estimate for the Breede River component, at a 98% assurance of supply is shown in Table E1.

Table E1: Water Availability in the Breede River Component (million m^3/a, Year 2000)

Resource Category	Upper Breede	Riviersonderend	Lower Breede	Total
Gross Surface Water Resource Yield	428	262	59	**749**
Less Impact on Yield of:				
Preliminary Ecological Reserve	16	0	0	**16**
Invasive Alien Plants	25	13	7	**45**
River Losses	5	0	0	**5**
Net Surface Water Resource	**382**	**249**	**52**	**683**
Plus Groundwater	94	5	4	**103**
Plus Return Flows	85	10	7	**102**
Total Local Yield	**561**	**264**	**63**	**888**
Transfers In	0	0	14	**1**
TOTAL	**561**	**264**	**77**	**889**

Uncertainties affecting the water availability estimate include :

- riverine and estuarine Reserve determinations are preliminary;
- rain gauging in the high rainfall regions is not adequate and impacts on the reliability of hydrology.

The impact of climate change on future estimates of water availability will need to be taken into account.

10.6 Water Requirements for Year 2000

The estimates of current water requirements for the Breede River component of this WMA are shown in Table E2.

Table E2: Water Requirements in the Breede River Component (million m^3/a, Year 2000)

Category	Upper Breede	Riviersonderend	Lower Breede	Total
Irrigation	495	91	72	**658**
Urban	23	2	1	**26**
Rural	4	2	1	**7**
Impact of Afforestation on Yield	0	1	0	**1**
Total Requirements	**522**	**96**	**74**	**692**
Transfers Out	22 (1)	168 (2)	0	**177** (3)
TOTAL	**544**	**264**	**74**	**869**

1) Made up as follows: **4** million m^3/a IBT to Berg WMA via Artois Canal, plus **5** million m^3/a IBT from "Gawie-se-water" to Berg WMA, plus **2,5** million m^3/a IBT to Olifants/Doorn WMA (via the Inverdoorn Canal), plus **10** million m^3/a surplus water from freshening releases.

2) Made up as follows: **161** million m^3/a from Theewaterskloof to Berg WMA, plus **0,6** million m^3/a to Franschhoek (Berg WMA), representing the net transfer from the Breede River component to the Berg WMA after accounting for the Wolwekloof and Banhoek Diversions in the Berg WMA, into the Breede WMA during winter months. In addition, transfers of **4** million m^3/a to Overberg, plus **2,5** million m^3/a to Lower Breede also take place.

3) Made up as follows: **161** million m^3/a IBT from Theewaterskloof to Berg WMA, plus **4** million m^3/a IBT to Berg WMA via Artois Canal, plus **5** million m^3/a IBT from "Gawie-se-water" to Berg WMA, plus **0,6** million m^3/a IBT to Franschhoek, plus **2,5** million m^3/a IBT to Olifants/Doorn WMA (Inverdoorn Canal), plus **4** million m^3/a to Overberg region.

In terms of estimates of current water requirements, the main concern is that water use outside of controlled irrigation areas is less certain than water use within them. It is estimated that approximately 25% of the total current irrigation activity lies outside of government controlled schemes and Water User Associations (WUAs).

Future uncertainties in estimating water requirements include :

- the impact of climate change
- the impact of changes in land-use
- the impact of water conservation and demand management

10.7 Reconciling Current Water Requirements and Availability

The current yield balance within the Breede River component is estimated to be a surplus of 20 million m^3/a, as shown in Table E3.

Table E3: Reconciliation of Water Requirements and Availability in the Breede River Component (million m^3/a, Year 2000)

Description		ISP SUB-AREAS			Total
		Upper Breede	Riviersonderend	Lower Breede	
Available Water	Local Yield	561	264	63	**888**
	Transfers In	0	0	14	**1**
	Total	**561**	**264**	**77**	**889**
Water Requirements	Local Requirements	522	96	74	**692**
	Transfers Out	22	168	0	**177**
	Total	**544**	**264**	**74**	**869**
Balance		**17**	**0**	**3**	**20**

The 20 million m^3/a surplus lies in Koekedouw Dam (3 million m^3/a), Stettynskloof Dam (14 million m^3/a) and Buffeljags Dam (3 million m^3/a). The former two dams are not owned by the Department. However, the Department will endeavour to influence the owners into making any long-term surpluses available for use by resource poor farmers.

10.8 Water to Resource Poor Farmers

There have not been many examples of historically disadvantaged people emerging from their current situation on the basis of agricultural water use. Information on the actual water use by the established resource poor farmers (2 200 ha) is not readily available. The same is true for the 29 projects currently being implemented on an additional 1 900 ha.

The Department favours a joint venture approach in the establishment of resource poor farmers, so as to benefit from the skills and technical support from existing commercial farmers.

10.9 Future Water Requirements

It is estimated that after allowing for a 30% saving through water demand management, the urban water requirement will increase by only 17 million m^3/a by 2030. The BRBS has identified that it is economically viable to expand irrigation up to an additional water requirement of 140 million m^3/a. On the other hand, the future water requirements in the Berg WMA could increase by about 260 million m^3/a by 2025. Consequently, there will be competition for any future yield developed in the Breede River catchments. Some sharing of the Breede resources is recommended.

10.10 Reconciliation Interventions

Over and above the development of new water resources, there are other important interventions that must be considered, namely :

(a) ***Verification of Existing Lawful Use***

Some water could potentially be returned to the system once this process has been concluded.

(b) ***Water Conservation and Demand Management***

Savings of between 30 and 40% are achievable in the urban sector. In the agricultural sector, on-farm irrigation techniques are generally efficient in this region. The main opportunities to save water lie in the maintenance and upgrading of water conveyance and distribution systems as well as improved management of releases from dams (notably Greater Brandvlei Dam).

(c) ***Trading of Existing Water Use Authorisations***

Trading of existing authorisations is a way of shifting water towards more beneficial use or higher paying use, without increasing total volume demand.

(d) ***Clearing of Invasive Alien Plants***

Although total removal of the current 46 000 ha of invasive alien plants is not realistic, very important gains can be made through clearing. Priority areas include the upper reaches of the Riviersonderend and Upper Breede sub-areas. The use of bio-control presents a cost-effective and sustainable form of control.

10.11 Development of Groundwater Yield Potential

Further abstraction out of the alluvial aquifers should be cautiously considered due to the direct interaction with surface water flow. There is a great deal of groundwater which only has weak links to surface water and can be abstracted without significantly impacting on surface water yields.

Currently, approximately 103 million m^3/a is abstracted from groundwater sources, much of which is from the alluvial aquifers. The Table Mountain Group Aquifer holds significant potential and is being investigated by the CCT as an option to augment their existing sources of supply. Within the Ceres catchment (Upper Breede sub-area), groundwater abstraction currently exceeds what is considered to be sustainable abstraction. Groundwater is also extensively used in the Hex River catchment. The BRBS has estimated that there is in excess of 300 million m^3/a of additional groundwater that could theoretically be abstracted on an environmentally sustainable basis. Notwithstanding that practical constraints in developing the resource would significantly reduce this potential, a resulting additional yield potential in the order of 100 million m^3/a is considered to be a reasonably conservative estimate.

10.12 Development of Surface Water Yield Potential

The BRBS concluded that through the development of approximately 400 million m^3 of additional storage, it would be economically viable to develop between 90 and 140 million m^3/a of additional surface water yield. The range is dependant on the ecological water requirements associated with the particular ecological classes for the rivers and the estuary. It is important to note that to achieve the upper limit of 140 million m^3/a, the recommended classes (with the exception of the Riviersonderend River) would be in place, but all invasive alien plants would need to be removed. Until the ecological classes for the rivers and the estuary have been decided upon, the water resources will be managed according to the current classes (i.e. the status quo). Furthermore, these potential yields assume that the use of groundwater potential within, or in close proximity to river channels is considered as surface water use.

10.13 Potential New Schemes

(a) ***Developing Yield for In-catchment Use***

The Augmentation of Greater Brandvlei Dam, through the utilisation of its spare storage capacity is considered the optimum large scheme for in-basin development. Over and above the existing installed pumping capacity (5 m^3/s) from the Breede River (Papenkuils Pump Station) into the dam, additional pumping capacity (if installed) of 15 m^3/s could yield an additional 33 million m^3/a. The Unit Reference Value (URV) for this scheme is estimated at R0,15/m^3. URVs are used for a comparative assessment of the financial costs of scheme options. The lower the URV, the more affordable the scheme.

The second most favourable option for in-catchment development appears to be a 10 m raising of Buffeljags Dam which could double its current yield (from 11 to 22 million m^3/a). The URV for this scheme is estimated at R0,75/m^3.

(b) ***Developing Yield for Water Transfer***

The two preferred options identified in the BRBS are the Michell's Pass Diversion and the Upper Molenaars Diversion.

The Michell's Pass Diversion involves the construction of a 10 m high weir on the Dwars River in the Upper Breede sub-area, and the diversion of water from it via a canal into the catchment of the Klein Berg River, from where the water would flow into Voëlvlei Dam. A potential yield of 53 million m^3/a has been estimated and this could either be utilised by the CCT or users in the rapidly developing West Coast region, or some combination of both. The URV for this scheme is estimated at R0,11/m^3. The impact of this scheme on the current and potential yield of Greater Brandvlei Dam will need to be investigated during the Western Cape Reconciliation Strategy Study, to be undertaken by the Department in 2005.

The potential Upper Molenaars River Diversion has been estimated to yield about 27 million m^3/a. It would involve pumping water from a diversion site on the river to the

existing pipeline leading through the Huguenot Tunnel. From there the water would either gravitate to the existing Wemmershoek Dam or, alternatively, to the Berg River Dam (currently under construction). For the Wemmershoek option, a URV of R0,82/m^3 has been estimated. The impact of this scheme on the existing diversions into Greater Brandvlei Dam will be investigated during the Western Cape Reconciliation Strategy Study.

A third option involving the transfer of water from Greater Brandvlei Dam by pumping to Theewaterskloof Dam was considered less favourable than the Michell's Pass and Upper Molenaars River Diversions. The financial cost (URV of R1,14/m^3) and environmental concerns (water quality) are limitations in terms of this option.

10.14 Allocating Future Developed Yield

Water resource managers face important challenges with respect to the allocation of potential yield that might be developed in the Breede River component of this WMA. There will be significant competition for water, both from in-catchment irrigation potential and from urban growth in the Berg WMA (notably the CCT and the West Coast). How much might become available will be influenced ultimately by the ecological water requirements, which in turn will depend on the river classifications.

In the interim, planning will be based on the assumption that the Upper Molenaars and Michell's Pass Diversion schemes appear to be most suitable for water transfer. Similarly, the Greater Brandvlei Augmentation Scheme and the raising of Buffeljags Dam appear suitable for in-catchment irrigation expansion.

10.15 Water Quality

The natural geology (shales) and agricultural practices contribute to the salinity problem in the Breede River, which impacts on water quality for irrigation. Salinity levels are currently managed as far downstream as the Zanddrift weir, through freshening releases of about 22 million m^3/a out of Brandvlei Dam. The BRBS recommends that the current practice be maintained but that modelling of other options should be undertaken. New irrigation development should be appropriately sited to best avoid exacerbating the salinity problem.

11. WATER RESOURCE MANAGEMENT PERSPECTIVE OF THE OVERBERG

For the purpose of describing the water availability, water requirements and yield balance within the Overberg, the figures published in the NWRS are used. These are considered the most reliable to date. The two sub-areas (see Figure E1) correspond with the so-called areas of interest used to describe the Overberg in the NWRS.

11.1 Regional Water Supply Schemes in the Overberg

An inter-basin transfer takes place out of the Palmiet River (Overberg West) into the Upper Steenbras Dam (Berg WMA), via the Palmiet Pumped Storage Scheme. The average annual volume transferred is 22,5 million m^3/a and this is utilised by the CCT.

The Overberg Water Board operates the Ruensveld West and Ruensveld East Schemes, which abstract water from the Riviersonderend River. The water is treated and distributed to rural users and for stockwatering. Collectively, the transfers from the two Ruensveld Schemes total about 4 million m^3/a.

11.2 Urban Water Supply Schemes in the Overberg

With the exception of some domestic water supplied by the Ruensveld Schemes, local sources (surface and groundwater) meet the urban water requirements in the Overberg. The only dam in the Overberg primarily supplying water to urban users is the De Bos Dam, owned and operated by the Overstrand Municipality (Hermanus).

11.3 Irrigation Supply in the Overberg

Of the 11 400 ha of irrigated land in the Overberg, 11 300 ha lies in the Overberg West sub-area, and much of that is concentrated in the Palmiet River catchment. This is irrigated out of dams on the Palmiet River, of which Eikenhof Dam with a capacity of 29 million m^3 is the largest.

11.4 Water Availability for Year 2000

The water availability estimate for the Overberg at a 98% assurance of supply is shown in Table E4.

Table E4: Water Availability in the Overberg (million m^3/a, Year 2000)

Resource Category	Overberg West	Overberg East	Total
Gross Surface Water Resource	121	3	**124**
Less Impact on Yield of			
Preliminary Ecological Reserve	2	0	**2**
Invasive Alien Plants	31	2	**33**
River Losses	0	0	**0**
Net Surface Water Resource	**88**	**1**	**89**
Groundwater	3	1	**4**
Return Flows	8	0	**8**
Total Local Yield	**99**	**2**	**101**
Transfers In	2	2	**4**
TOTAL	**101**	**4**	**105**

The main uncertainty associated with the estimate of current availability is the fact that Reserve estimates remain preliminary at this stage.

11.5 Water Requirements for Year 2000

The estimates of current water requirements are shown in Table E5.

Table E5: Water Requirements in the Overberg (million m^3/a, Year 2000)

Category	Overberg West	Overberg East	Total
Irrigation	64	0	64
Urban	8	2	10
Rural	2	2	4
Impact of Afforestation on yield	5	0	5
Total Requirements	**79**	**4**	**83**
Transfers Out	23	0	23
TOTAL	**102**	**4**	**106**

Uncertainties in estimating future water requirements are the same as those described in Section 10.6 of this executive summary.

11.6 Reconciling Current Water Requirements and Availability

The Overberg West has a shortfall of 1 million m^3/a and the Overberg East is in balance, resulting in an overall shortfall of 1 million m^3/a for the Overberg as a whole.

11.7 Reconciliation Interventions

The potential reconciliation interventions within the Overberg are :

- Water conservation and demand management, including water re-use
- Exploiting groundwater resources
- Clearing of invasive alien plants

11.8 Development of New Surface Water Supply Schemes

In terms of in-catchment development, abstraction of surplus winter water into off-channel storage facilities is an option that can be considered in certain rivers within the Overberg.

The Palmiet River offers further potential for the development of additional yield (about 25 million m^3/a), subject to the Reserve requirement of the Palmiet River and estuary. This could potentially be used to augment the Western Cape Water Supply System.

11.9 Water Quality

With the exception of the Palmiet River and the headwaters of certain rivers of the Overberg West, naturally occurring salinity is prevalent throughout the Overberg. No specific interventions are necessary as irrigation expansion of any significance is unlikely, outside of the Palmiet catchment.

12. REVISED INPUTS TO THE NWRS

Chapter 5 presents the water requirements, water availability and yield balance inputs that are required for the NWRS. No new information is introduced and the purpose of Chapter 5 is to facilitate easy updating of the NWRS, by presenting the information in the same format as that used in the NWRS.

13. THE TEN STRATEGIC WATER RESOURCE MANAGEMENT REQUIREMENTS OF THIS ISP

The strategies contained in this document were developed to give effect to the NWA and the NWRS.

The ten broad strategic groups cover all currently identified water management activities of the DWAF RO and the requirements of the NWA and the NWRS. These are:

(i) Yield balance and reconciliation strategies address the need relating to the existing uncertainties and information gaps in the availability of surface water and groundwater, the water requirements and the possible reconciliation interventions (WC/DM, removal of invasive alien plants, water trading, for example), and the potential for the development of the groundwater resource in the Breede WMA. Four strategies were developed, namely:

- ⇨ Water Availability
- ⇨ Water Requirements
- ⇨ Reconciliation of Water Supply and Demand
- ⇨ Groundwater Utilisation

(ii) Water resource protection strategies address the need to achieve the protection of water resources to ensure their continuing availability for human use by leaving enough water of appropriate quality in rivers and streams to maintain their ecological functioning. This will be achieved by classification of freshwater bodies and determination of their human and ecological Reserves, setting resource quality objectives for freshwater bodies, addressing solid waste management, pollution control, sanitation and salinity. The following three strategies were developed:

- ⇨ Reserve and Resource Quality Objectives
- ⇨ Estuaries and Wetlands
- ⇨ Water Quality Management

(iii) Water use management strategies address the objectives of equity of access to water, and sustainable and efficient use thereof. This will be achieved through conditions of water use imposed through authorisations. These will include general authorisations (GAs) to manage water use, verification of the legality of existing water use, processing and issuing of new water use authorisations, possible re-allocation of water and changing land use. Six water use management strategies have been developed, namely:

- ⇨ General Authorisations
- ⇨ Verification of Existing Lawful Use
- ⇨ Allocation and Licensing
- ⇨ Compulsory Licensing
- ⇨ Changing Land-use : Forestry
- ⇨ Changing Land-use : Clearing of Invasive Alien Plants

(iv) Water conservation and demand management strategies are required as a prerequisite before considering augmentation of water supply by developing physical infrastructure. Attention needs to be devoted to managing the demand for water, encouraging the efficient and effective use thereof, minimising loss or waste of water and creating a water conservation and demand management culture within all water management and water services institutions, and among water users. These strategies will address urban and agricultural conservation measures and water demand management. The following two strategies have been developed:

- ⇨ Water Services : Water Conservation and Demand Management
- ⇨ Agricultural Water Conservation and Demand Management

(v) Integration and co-operative governance strategies address the establishment and nurturing of co-operative relationships with other South African Government Departments, local authorities and water service providers for co-operative data collection, information sharing, sharing of visions and plans, capacity building and support and co-operative making of joint decisions. This strategy further aims to alleviate poverty by addressing the inequities of the past relating to water, *inter alia* relating to resource poor farmers and by support rendered to water related land reform initiatives. Two strategies were developed, namely:

- ⇨ Support to Resource Poor Farmers
- ⇨ Co-operative Governance

(vi) Institutional development and support strategies address the fundamental transformation of water resources management and governance, to appropriate and representative regional and local institutions. One strategy has been developed, namely :

- ⇨ Supply to Local Authorities

(vii) The **Social** strategy addresses the importance of DWAF highlighting the social aspects of its agenda. These are already very clear in the quest for equity, in support for resource poor farmers, in the water supply and sanitation programme, and in the poverty alleviation drive, but it is nevertheless very important that DWAF never loses sight of its social responsibilities.

(viii) Waterworks development and management strategies address the challenges associated with the contribution from private dams towards meeting the Reserve. The recreational opportunities on State owned dams are also addressed. Two strategies were developed, namely:

- ⇨ Management of Reserve Releases from Private Dams
- ⇨ Recreation on Dams and Rivers

(ix) Monitoring and information management strategies address the monitoring of, collection of and data capturing of water resource related information from surface freshwater bodies and groundwater. Resulting information will enable the introduction of water billing and will ensure compliance with water authorisation conditions and the control of all water users. Issues relating to information systems and information access and requirements are also addressed. The following two strategies were developed:

- ⇨ Abstraction Control Monitoring
- ⇨ Monitoring Networks and Data Capture

(x) Implementation strategies address the need for a consolidated approach within DWAF to the implementation and ongoing management of the ISP process. This will formalise the implementation, so that delegated responsibilities and a programme of implementation can be drawn up according to priorities set in the ISP. The ISP is a developing process and the document will be reviewed on a regular basis. Strategies will be amended, updated or added so as to achieve the management objectives for the Breede WMA. One strategy was developed, namely:

- ⇨ ISP Implementation

Under each of these main strategy groups, the specific strategies particular to the Breede WMA have been identified and developed. 24 strategies have been developed. As additional strategies are identified through the implementation process (including feedback from stakeholders), this document will be updated by the Department.

For each strategy, the following aspects are addressed:

- ***Management objectives*** in terms of the envisaged solutions for the Strategy;
- ***Situation Assessment*** stating the relevant issues, problems, uncertainties and gaps in information;
- ***Strategic Approach*** as to a correct management procedure or solution to a problem in terms of the DWAF's management perspective for the ISP-area;
- ***Management Actions*** required to implement the strategy and the responsible organisations or persons;
- ***Responsibility and Priority***. The responsible implementing authority and the priority for implementation in terms of the ISP rating system (1 – 5, where 1 is of highest priority).

BREEDE WMA

INTERNAL STRATEGIC PERSPECTIVE

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LIST OF ABBREVIATIONS

ASR	Aquifer Storage Recovery
BRBS	Breede River Basin Study
BWP	Berg Water Project
CCAW	Co-ordinating Committee for Agricultural Water
CCT	City of Cape Town
CMA	Catchment Management Agency
CMS	Catchment Management Strategy
CNCB	Cape Nature Conservation Board
DEADP	Department of Environmental Affairs and Development Planning
DEAT	Department of Environmental Affairs and Tourism
DECAS	Department of Environment Affairs, Culture and Sport
DWAF	Department of Water Affairs and Forestry
EWR	Ecological Water Requirements
GAs	General Authorisations
GDP	Gross Domestic Project
IDP	Integrated Development Plan
ISP	Internal Strategic Perspective
IWRM	Integrated Water Resource Management
ℓ/c/d	litres per capita per day
m^3/a	cubic metres per annum
m^3/s	cubic metres per second
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
mg/ℓ	milligrams per litre
NWA	National Water Act
NWRS	National Water Resource Strategy
RO	Regional Office (DWAF, Western Cape Regional Office)
SFRA LAAC	Streamflow Reduction Activities Licence Assessment Advisory Committee
SUP	Sustainable Utilisable Potential
TINWA	Team for Implementation of the National Water Act
TMG	Table Mountain Group
WCDM	West Coast District Municipality
WC/DM	Water Conservation and Demand Management
WCSA	Western Cape System Analysis
WCWSS	Western Cape Water Supply System
WfW	Working for Water
WMA	Water Management Area
WRPM	Water Resources Planning Model
WRSA	Water Resources Situation Assessment
WSA	Water Service Authorities
WSAM	Water Situation Assessment Model
WSDP	Water Services Development Plan
WSP	Water Service Provider
WTW	Water Treatment Works
WUA	Water User Association
WWTW	Wastewater Treatment Works
x 10^6 m^3/a	million cubic metres per annum

GLOSSARY OF TERMS

AQUIFER	A saturated permeable geologic unit that can transmit significant (economically useful) quantities of water under ordinary hydraulic gradients. (Specific geologic materials are not innately defined as aquifers and aquitards, but within the context of the stratigraphic sequence in the subsurface area of interest.)
ASSURANCE OF SUPPLY	The reliability at which a specified quantity of water can be provided, usually expressed either as a percentage or as a risk. For example "98% reliability" means that, over a long period of time, the specified quantity of water can be supplied for 98% of the time, and less for the remaining 2%. Alternatively, this situation may be described as a "1 in 50 year risk of failure" meaning that, on average, the specified quantity of water will fail to be provided in 1 year in 50 years, or 2% of time.
BASIN	The area of land that is drained by a large river, or river system.
BIOTA	A collective term for all the organisms (plants, animals, fungi, bacteria) in an ecosystem.
CATCHMENT	The area of land drained by a river. The term can be applied to a stream, a tributary of a larger river or a whole river system.
COMMERCIAL FARMING	Large scale farming, the products of which are normally sold for profit.
COMMERCIAL FORESTS	Forests that are cultivated for the commercial production of wood or paper products.
CONDENSATION	The process whereby water is changed from a gas (water vapour) into a liquid.
CONFINED AQUIFER	An aquifer that is physically located between two aquitards. The water level in a well tapping a confined aquifer usually rises above the level of the aquifer.
CONTAMINANT	Any physical, chemical, biological, or radiological substance or matter in the water.
DEFICIT	Describes the situation where the availability of water at a particular assurance of supply is less than the unrestricted water requirement.
DISCHARGE AREA	The area or zone where groundwater emerges from below the surface. The outflow maybe into a stream, lake, spring, wetland, etc.

ECOLOGICAL IMPORTANCE	A measure of the extent to which a particular species, population or process contributes towards the healthy functioning of an ecosystem. Important aspects include habitat diversity, biodiversity, the presence of unique, rare or endangered biota or landscapes, connectivity, sensitivity and resilience. The functioning of the ecosystem refers to natural processes.
ENVIRONMENTALLY SENSITIVE AREA	A fragile ecosystem which will be maintained only by conscious attempts to protect it.
FORMAL IRRIGATION SCHEME	The term applies to a scheme where water for irrigation purposes is stored in a dam controlled by DWAF or an Irrigation Board and supplied in pre-determined quotas to irrigators registered under the scheme.
GREY WATER	Any water that has been used in the home, such as water from the bath, shower, washing machine, and bathroom sink, but not from toilets and the kitchen sink, is referred to as "grey water". Grey water can be used for other applications around the home, such as garden irrigation.
GROUNDWATER	Water in the sub-surface, which is beneath the water table, and thus present within the saturated zone. In contrast, to water present in the unsaturated or vadose zone which is referred to as soil moisture.
HYDRAULIC GRADIENT	The difference in hydraulic head between two measuring points within a porous medium, divided by the distance between the two points.
HYDRAULIC HEAD	The fluid potential for flow through porous media largely comprised of pressure head and elevation head. This satisfies the definition of potential in that it is a physical quantity capable of measurement (such as with manometers, piezometers, or wells tapping the porous medium), where flow always occurs from regions of higher values to regions of lower values.
INTERBASIN TRANSFER	Water transferred from one WMA to another.
MEAN ANNUAL RUNOFF	Frequently abbreviated to MAR, this is the long-term mean annual flow calculated for a specified period of time, at a particular point along a river and for a particular catchment and catchment development condition. In this report, the MARs are based on the 70-year period October 1920 to September 1990 inclusive.
NON-POINT SOURCE OF POLLUTION	Contaminates found in water from a source that cannot be specifically defined. For example contamination resulting from municipal runoff or agricultural infiltration.
OPPORTUNISTIC IRRIGATION	Irrigation from run of river flow, farm dams, or compensation flows released from major dams. As storage is not provided to compensate for reduced water availability in dry years, areas irrigated generally have to be reduced in dry years.

PERMEABILITY	The portion of the proportionality constant of hydraulic conductivity, which is a function of porous medium alone. Permeability is an intrinsic property, which is a function of mean grain diameter, grain size distribution, sphericity and roundness of grains and the nature of grain packing.
POINT SOURCE OF POLLUTION	Contaminants found in water that can be readily identified from a specific source such as a leaking underground storage tank.
POLLUTION	Any substance, natural or synthetic, that degrades water quality to such a degree that water is not suitable for a particular use.
POTABLE WATER	Water, which is free from impurities that may cause disease or harmful physiological effects, such that the water is safe for human consumption.
QUATERNARY CATCHMENT	The basic unit of catchment area used in the WR90 series of reports published by the Water Research Commission and also in this report. The primary drainage regions are divided into secondary, tertiary and quaternary catchments. The quaternary catchments have been created to have similar mean annual runoffs: the greater the runoff volume the smaller the catchment area and vice versa. The quaternary catchments are numbered alpha-numerically in downstream order. A quaternary catchment number, for example R30D, may be interpreted as follows: the letter R denotes Primary Drainage Region R, the number 3 denotes secondary catchment 3 of Primary Drainage Region R, the number 0 shows that the secondary catchment has not, in this case, been sub-divided into tertiary catchments, and the letter D shows that the quaternary catchment is the fourth in sequence downstream from the head of secondary catchment R30.
RECHARGE AREAS	Areas of land that allow groundwater to be replenished through infiltration or seepage from precipitation or surface runoff.
RESERVOIR	The lake formed behind a dam wall. In this report the colloquial term dam is generally used for reservoir.
RESOURCE QUALITY	The quality of all the aspects of a water resource including: (a) the quantity, pattern, timing, water level and assurance of instream flow; (b) the water quality, including the physical, chemical and biological characteristics of the water; (c) the character and condition of the instream and riparian habitat; and (d) the characteristics, condition and distribution of the aquatic biota.
RESOURCE QUALITY OBJECTIVES	Quantitative and verifiable statements about water quantity, water quality, habitat integrity and biotic integrity that specify the requirements (goals) needed to ensure a particular level of resource protection.

RIVER SYSTEM	A network of rivers ranging from streams to major rivers and, in some cases, including rivers draining naturally separate basins that have been inter-connected by man-made transfer schemes.
SALINITY	The concentration of dissolved salts in water. The most desirable drinking water contains 500 ppm or less of dissolved minerals.
SATURATED ZONE	The subsurface zone below the water table where pores within the geologic matrix are filled with water and fluid pressure is greater than atmospheric.
SUB-CATCHMENT	A sub-division of a catchment.
SURFACE WATER	Bodies of water, snow, or ice on the surface of the earth (such as lakes, streams, ponds, wetlands, etc.).
10^6 m^3/a	1 million cubic metres of water in one year.
TRANSPIRATION	The process by which plants give off water vapour into the atmosphere.
TURBIDITY	A measure of water cloudiness caused by the amount of suspended matter in the water
UNCONFINED AQUIFER	(a.k.a. water table aquifer) - An aquifer in which the water table forms the upper boundary. The water level in a well tapping an unconfined aquifer will rise only to the level of the water table within the aquifer.
UNSATURATED ZONE	(See vadose zone)
WATER IMPORTS	Water imported to one drainage basin or secondary sub-catchment from another.
WATER TABLE	The surface on which the fluid pressure in the pores of a subsurface porous medium is exactly atmospheric.
WATER TRANSFERS	Water transferred from one drainage basin or secondary sub-catchment to another. Transfers in are synonymous with water imports.
YIELD	The maximum quantity of water obtainable on a sustainable basis from a dam in any hydrological year in a sequence of years and under specified conditions of catchment development and dam operation.

PART 1 – INTRODUCTION AND OVERVIEW

CHAPTER 1: BACKGROUND TO THE INTERNAL STRATEGIC PERSPECTIVE

1.1 LOCATION OF THE BREEDE WMA

Figure 1.1 shows the location of the Breede WMA, which falls within the Western Cape Province.

Figure 1.1: Location of the Breede WMA

1.2 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, 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. 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 Resources 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.

1.2.1 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).

1.2.2 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).

1.2.3 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 (ISPs)

1.3.1 The Objectives of the ISP Process

The objective of the ISP will be 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 ISP

The ISP for the Breede WMA was developed in five stages as follows:

i) Determining the current status of water resource management and relevant water resource management issues and concerns in the Breede WMA. This was achieved through interviews with individual members of DWAF's RO in Bellville and by collating information from the NWRS, WMA reports, Water Resource Situation Assessment (WRSA) reports and other catchment study reports. The following topics were discussed with Regional Office staff and their issues and concerns documented:

- Water Situation
- Resource Protection
- Water Use
- Water Reconciliation
- Water Infrastructure
- Monitoring and Information

- Water Management Institutions
- Co-operative Governance
- Planning Responsibilities.

A starter document of the identified issues and concerns was produced as a discussion document for the first workshop.

ii) The first workshop was held with attendees from the Regional Office, the Integrated Water Resource Planning (IWRP) Chief Directorate of the Department as well as the consulting team. The workshop focussed on the lists of general issues in the WMA as well as area-specific issues. The issues were clarified and refined during the workshop. Strategies were discussed and developed to address the issues.

iii) The third stage involved the preparation of the second workshop document to be used for refining strategies to address the various issues and concerns, during the second workshop.

iv) The fourth stage was the second workshop. During this workshop the overall management of the water resources in the catchment was discussed along with the ISP management strategies and the relevant issues and concerns. The priorities and responsibilities for carrying out the strategies were identified. First workshop attendees were again involved, as were representatives of several DWAF Head Office directorates.

v) The fifth stage was the finalisation of the ISP document.

As can be deduced from the above this Breede ISP was prepared internally within the Department, and captures the Department's perspectives. Once approved by DWAF Management, it is intended that the Regional Office will make the ISP available to Water User Associations (WUAs), Water Service Providers (WSPs), Water Service Authorities (WSAs) and other forums for discussion and comment. These comments will be considered and worked into later versions of the ISP. By adopting this procedure this ISP becomes a working document, which will be progressively updated and revised by DWAF. Public participation forms part of the CMS process, for which the ISP serves as a foundation (see Paragraph 1.6).

The ISP does not formulate all the details pertaining to every strategy but provides a suggested framework for each strategy around which the details will be developed by the responsible authority. Where relevant and readily available, certain details have been included in the strategies. The responsible authority for the further development of each strategy is indicated. This is predominantly the Regional Office, which remains responsible for involving the relevant DWAF directorates.

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 liasing 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 Breede WMA. The current incumbent is Mr J Roberts, 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 information contained in the NWRS is the best information and knowledge available at the time. The information in Chapter 2 and Appendix D of the NWRS 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 superceded 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 emerged in some cases. The reason is that the level of study is more detailed and intense for the ISP. This included very close scrutiny of the numbers used in the NWRS, and in some cases a reworking of base data and some re-modelling. In this WMA the Breede River Basin Study (Ref.8) has provided water resource information considered to be the most reliable to date for the Breede River catchment. Extensive use has been made of the information contained therein, in this ISP. Where the ISPs contain yield balance data which differs from the NWRS, these discrepancies are carefully explained. 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 as the ISP reports will be published on the Internet and in hardcopy, and will be presented and discussed at WMA forums. Comments received will be considered and worked into subsequent versions of the ISP on a regular (yearly) 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 us in poverty eradication and removal of inequity.

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.

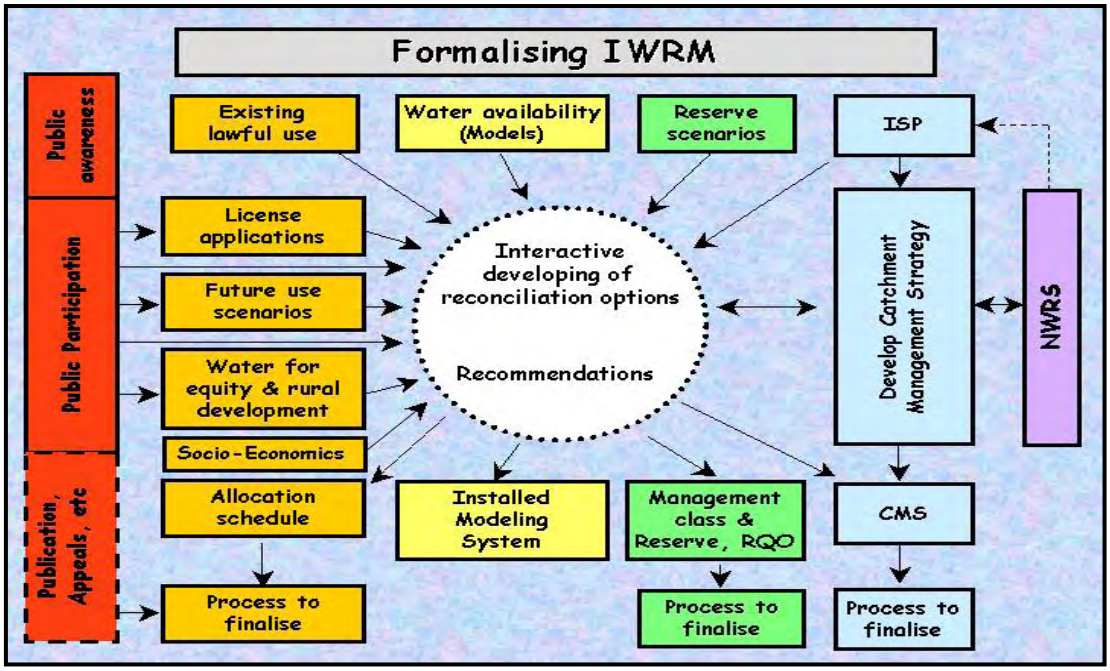


Figure 1.2: Diagram showing DWAF Integrated Water Resources Management approach

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.

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 water use licences that could be issued, 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 users 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 out 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 on 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 Strategies 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 utilisation 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 for employment and 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, 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 farmer 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 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 importance of releasing better quality water from Brandvlei Dam for freshening the saline water in the lower reaches of the Breede River, and of the addition of freshening releases from Vaal Barrage to bring water back to an acceptable quality has, inter alia, long been standard practice. 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 wastewater or industrial effluent, but are no less pernicious.

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 license users to take water, and again to discharge it, recognising 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.

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 wastewater discharges. Of these, industrial waste and wastewater discharges are the easiest to license and control, but this does not mean that this is problem-free. The Department has found that the situation with regard to wastewater 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.

Groundwater quality requires equal attention, and more so as we recognise the importance of groundwater in supplementing our meagre resources, and providing water to remote communities. Although our groundwater resources are for the most part to be found at relatively deep levels (50-100m 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 increase of nitrates, primarily a consequence of human habitation and sanitation. Pit latrines are on the one hand 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 of strategy within this ISP – considered primarily within the Water Quality Strategy and also under Groundwater. 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 cross-cutting 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. 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 particularly to the Water Quality Strategy in Chapter 8.

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 the Southern and South Eastern WMAs and especially where the Table Mountain Group Aquifer (TMG) predominates, the interaction is thought to be strong, with groundwater supplying a significant portion of baseflow. In these circumstances groundwater 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 licences 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. The TMG which underlies parts of the Breede WMA is being specifically researched for its utilisation potential. See also the Groundwater Utilisation Strategy in Chapter 7.

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 (the Berg, Breede, Dusi and Fish River canoe marathons being prime examples). 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.

In this ISP refer to the Recreational Use of Dams and Rivers Strategy in Chapter 14.

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 Agency. 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.

CHAPTER 2: INTRODUCTION TO THE BREEDE WMA

2.1 INTRODUCTION

The Breede WMA is bounded by the Indian Ocean to the south, the Berg WMA in the west, the Olifants/Doorn WMA in the north-west and the Gouritz WMA in the east. It falls entirely within the Western Cape Province.

From a water resource management perspective, the Breede WMA can be sub-divided into two specific regions, as shown on Figure 2.1.1, namely:

- The Breede River component
- The Overberg component

This Chapter serves as an introduction to the Breede WMA and briefly describes the over-arching characteristics of the WMA. Thereafter the water resource management perspective for each of the two main regions and their respective sub-areas and catchments, is further addressed in detail in:

- Chapter 3: The Breede River component
- Chapter 4: The Overberg

There are a number of large water supply schemes in the Breede WMA. Locally, most of the water is used for irrigation. There are however a number of interbasin transfer (IBT) schemes from the Breede WMA into the Berg WMA, of which the following two are the most significant:

- Riviersonderend-Berg-Eerste River Government Water Scheme (RSE Scheme)
- The Palmiet Pumped Storage Scheme

These schemes feed into the Western Cape Water Supply System (WCWSS). The urban sector in the Berg WMA is dependent on both, whilst certain irrigators along the Berg and Eerste Rivers are dependent on the RSE Scheme. There is one small transfer out of the Breede WMA into the Olifants/Doorn WMA. The schemes are further described in some detail in Chapters 3 and 4.

2.1.1 Topography, Rainfall and Land-use

The topography of the Breede WMA is characterised by mountain ranges in the north and west, the wide Breede River valley, and the rolling hills of the Overberg. The Breede valley is flanked by the Franschhoek and Du Toit's Mountains in the west, the Hex River Mountains to the north and the Langeberg Mountains in the east. The higher peaks reach an altitude of 1500m-2000m.

Figure 2.1.1: The two Sub Regions within the Breede WMA

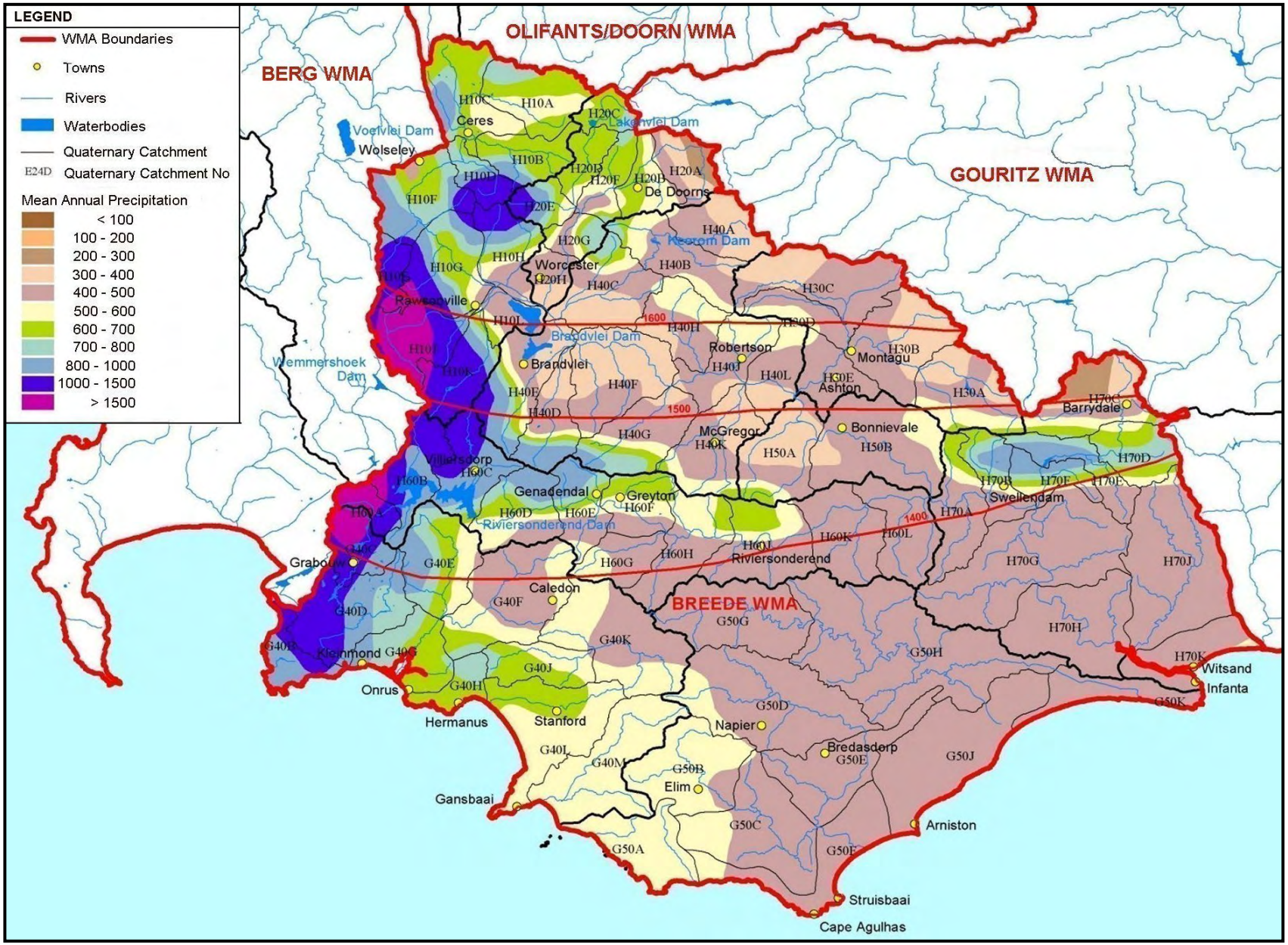


Figure 2.1.2: Rainfall in the Breede WMA

The mean annual temperature varies between 17ºC in the east to 15ºC along the south-west coast, with an average of 17ºC for the whole WMA. Maximum temperatures are experienced in January (average daily max = 37ºC) and minimum temperatures usually occur in July (average daily min = 0ºC). Frost occurs throughout the WMA in winter, typically between mid-May and late August.

Most of the rain falls between the months of May and August over most of the WMA. An all year round rainfall pattern prevails in the far south-east. Occasional snowfalls occur on the mountains in the south-west and north-west of the WMA during most winters. The orographical influence of the high mountain ranges introduces a large spatial variability in the mean annual precipitation (MAP). Refer to Figure 2.1.2. In the high mountainous regions in the south-west, the maximum MAP exceeds 3 000mm, but rainfall is as low 250mm in the central and north-eastern Breede River valley and other interior valleys. The average potential mean annual evaporation (measured by S-Pan) ranges from 1200 mm in the south to 1700 mm in the north of the WMA.

Land-use is characterised by large expanses of dry land cultivation in the southern Overberg areas (Figure 2.1.1), where wheat is the predominant crop type. Intensive irrigation takes place along the Breede and Riviersonderend Rivers, in their tributary valleys, and in the Palmiet River catchment. Irrigated crop types include orchard crops, vineyards for wine and table grapes, citrus, as well as some cash crops and lucerne. Afforestation is confined to the high rainfall mountainous areas, almost entirely in the Palmiet River and Upper Riviersonderend River catchments.

2.1.2 Economic Activity

The following information is based on the recent DWAF report: Breede Water Management Area: Overview of Water Resources, Availability and Utilisation Report (Ref.9) of September 2003.

Less than 1% of the national Gross Domestic Product (GDP) originates from the Breede WMA, which is amongst the lowest of all WMAs in the country. In 1997, the main drivers of the local economy in the Breede WMA in terms of the Gross Geographic Product (GGP) were:

- Agriculture 32%
- Trade 19%
- Manufacturing 12%
- Finance 10%
- Government 10%

Geographically, most of the economic production is from the areas where irrigation is practised and where processing and packaging plants are located. The agricultural sector in the WMA is fairly diversified, providing for a relatively stable economic base. Production of fruit and wine is of specific importance, while substantial wheat production comes from the Overberg grain belt. Since there is a strong domestic and international demand for agricultural products from this region, it is expected that the agricultural sector will remain important. Some products have met with temporary declines in the market and many farmers are diversifying their activities, aimed at higher value niche markets.

Trading activities are concentrated on wholesale wine, fruit and wheat, local retail services, and on tourism. The manufacturing sector is also strongly linked to the region's agricultural activities. The majority of manufacturing activities are in the food and beverage sub-sectors. A few manufacturing concerns which operate in other products are also located in the WMA.

Financial services are closely linked to other economic activities in the region, and the sector is also supported by a relatively strong property market. The government sector is supported by a variety of provincial, regional and local public institutions.

Of the work force of 155 000 people in the WMA in 1994, 62% were active in the formal economy and 19% were unemployed. These figures are significantly better than the national unemployment average of 29%. Of those formally employed, 43% were active in the agricultural sector, 22% were involved in the government sector and 13% in manufacturing.

Agriculture is the only sector in which the economy of the Breede WMA is highly competitive in the South African context. This can largely be attributed to the Mediterranean climate of the region which is different to most other parts of the country, and the large domestic and international demand for products from this region. Subject to price fluctuations, the exchange rate and trade agreements, this sector is likely to remain in a favourable position and has potential for growth. However at a regional level, the scope for further irrigation development is directly related to the availability of water in this WMA.

Growth is also expected in tourism and the development of coastal properties, which are likely to be stimulated by the proximity of Cape Town. No minerals or precious metals have been found to support the establishment of mining operations in the WMA, other than a limestone mine near Robertson.

2.1.3 Population

The total population of the Breede WMA was estimated at 382 400 in 1995 (ref: Breede WMA Report). The population of the urban and peri-urban areas was 254 200 (66%), with the remaining 34% in the rural areas. In 1995 approximately 60% of the total population lived in the Upper Breede sub-area (refer to Figure 3.1 of Chapter 3), also the area of highest economic activity.

Some increase in population as well as migration from the rural to the urban sector is expected to take place for a period, after which a levelling off or even a slight decline could be experienced. Coastal developments, particularly along the Overberg West coast will result in a further small increase in the urban population in that region, with seasonal peaks during the summer holiday periods. The population in the eastern parts of the WMA may show some decline due to the lack of strong economic stimulus in that area.

2.1.4 Conservation Features

The Breede River itself, and most of the coastal rivers of the central Overberg, contain sensitive aquatic ecosystems and support ecologically important wetlands and estuaries. An important example is the Papenkuils Wetland in the Upper Breede. This wetland contains a variety of wetland and terrestrial flora that are worthy of conservation and are not conserved elsewhere. The Papenkuils is particularly vulnerable due to reduced water availability and retention, as a consequence of local disturbances and activities within the catchments upstream. These activities include the re-direction of water into Greater Brandvlei Dam from the influent rivers feeding the wetland.

All the estuaries in the Breede WMA are of ecological importance. The Estuaries and Wetlands Strategy (8.2) identifies the need to confirm their relative importance. In view of the impacts already taking place in the Papenkuils Wetland, this is already considered to be a very modified system. On the other hand some of the estuaries within the Breede WMA are considered to be conservation worthy systems of extreme importance. The Breede River estuary is one of the most valuable in the country but also the most threatened in terms of upstream development (UCT, 2003). Furthermore the Heuningnes estuary at De Mond (declared a RAMSAR site 1986) is under stress, particularly due to the negative impacts on the hydrological flow regime as a result of invasive alien plants.

Other important protected natural areas include the Kogelberg and Agulhas Biosphere Reserves, mountain catchments, and other natural heritage sites also occurring within the Breede WMA.

CHAPTER 3: THE BREEDE RIVER COMPONENT OF THE BREEDE WMA: OVERVIEW FROM A WATER RESOURCE MANAGEMENT PERSPECTIVE

3.1 INTRODUCTION

To address the water resource management perspective within the Breede WMA, the WMA has been split into two sub-regions, namely:

- the Breede River component (see Figure 3.1)
- the Overberg component (see Figure 4.1)

This Chapter describes the water resource management perspective within the Breede River component. This encompasses the catchments of the Breede River and its tributaries of which the Riviersonderend River is the largest. Chapter 4 describes the Overberg component of the Breede WMA.

The existing water resource infrastructure is documented, after which a detailed assessment of the current and future water resource (availability), water requirements and yield balance are presented. Water quality, which plays an equally important role in the use and management of the water resource, is then addressed.

Much of the information on the Breede River component has been sourced from the following reports:

- *The Breede River Basin Study – Main Report (Ref.8)*
- *Breede WMA : Overview of Water Resources Availability and Utilisation (Ref.9)*
- *National Water Resource Strategy, First Edition (Ref.10)*

The extent of the Breede River component corresponds to the study area of the recently completed Breede River Basin Study (BRBS). That study presents the latest available assessment of water resources in the Breede River component and the information contained therein is used extensively is this chapter. The catchment areas of the Breede River and its tributaries drain the northern region of the WMA and are clearly distinguishable from the remainder of the Breede WMA to the south (the Overberg catchments).

In the NWRS, the Breede River component of the Breede WMA has been further sub-divided into three sub-areas. This sub-division has been retained in the ISP for the purpose of describing the availability, requirements and yield balance within the region. The three sub-areas as shown in Figure 3.1 are:

- The ***Upper Breede*** sub-area, consisting of 5 secondary catchments (H10-H50). This area extends from the source of the Breede River in the Skurweberg Mountains (to the north of Ceres) down to the confluence of the Breede and Riviersonderend Rivers.

- The ***Riviersonderend*** sub-area, consisting of secondary catchment H60, which extends from the source of the Riviersonderend River in the Franschhoek Mountains, upstream of Theewaterskloof Dam, to the confluence with the Breede River.
- The ***Lower Breede*** sub-area, downstream of the confluence with the Riviersonderend River, consisting of secondary catchment H70 which includes the Buffeljags River tributary.

The Breede River and its largest tributary, the Riviersonderend River, are the two main rivers in the Breede River component, draining an area of 12 600 km^2. The Breede River itself is 322 km long, rising in the Skurweberg Mountains near Ceres (H10C) and draining to the estuary mouth between Infanta and Witsand.

In its upper reach, the Breede River flows southward and is joined by a number of tributaries, namely the Wit River (H10E), the Molenaars River (H10J) and the Holsloot River (H10K). The Hex River drains the H20 catchment and joins the Breede River near Greater Brandvlei Dam (H20H).

In the middle reach, the Breede River is joined by the Kingna River (H30A to D) and extends from below Greater Brandvlei Dam to its confluence with the Riviersonderend River (H50E). The Riviersonderend River itself rises upstream of Theewaterskloof Dam (H60C), in the Hottentots Holland (H60A) and Franschhoek Mountains (H60B). Downstream of the dam, a number of small tributaries join the Riviersonderend before it reaches its confluence with the Breede River.

In the lower reach, the main tributary joining the Breede River is the Buffeljags River, which rises in the Langeberg Mountains (H70C to E) and is regulated by the Buffeljags Dam.

Figure 3.1: The Breede River Component of the Breede WMA *(ref: The Breede WMA Report)*

3.2 REGIONAL WATER SUPPLY SCHEMES IN THE BREEDE RIVER COMPONENT OF THE BREEDE WMA

3.2.1 The Riviersonderend-Berg-Eerste River Government Water Scheme

The Theewaterskloof Dam has a capacity of 434 million m^3 and is the source reservoir for the Riviersonderend-Berg-Eerste River Government Water Scheme. This is an IBT scheme supplying water for urban use to the Greater Cape Town area (including Stellenbosch), and water for agricultural use in the Eerste River and Berg River catchments. The dam stores runoff from its own catchment as well as water diverted into it during the winter months from the Berg WMA by means of a system of diversion weirs and tunnels. During summer a significant proportion of the total yield of the dam is transferred back to the Berg WMA via the same tunnel system. The scheme has a 1 in 50 year yield of 234 million m^3/a (BRBS, 2003). This is inclusive of the yields of the Banhoek and Wolwekloof tributary diversions on the Upper Berg River, and of the local yield of Kleinplaas Dam on the Eerste River in the Berg WMA.

Some 60 % of the yield has been allocated for irrigation in the Berg and Eerste River catchments, the lower Riviersonderend catchment, and for supply to the Overberg Rural Water Supply Scheme in the adjacent Overberg. The balance is allocated to the Cape Town Metropolitan Area and there is no surplus yield available from the system. On average a net transfer of about 161 million m^3/a into the Berg WMA takes place via this scheme. The only way in which the supply to the Berg WMA from this scheme could be increased, would be to supplement inflows to Theewaterskloof Dam from Greater Brandvlei Dam, via a transfer scheme which would have to be constructed between the two dams.

3.2.2 Minor Transfer Schemes

Four small schemes transfer water out of the Breede WMA. These are:

- the *Inverdoorn Canal* in which 2,5 million m^3/a of water for irrigation is diverted by means of weirs on the Spek and Valschgat Rivers (H20C) into the Inverdoorn Canal which carries it into the catchment of the Doring River (E22C) in the Olifants/Doorn WMA.

- the *Artois Canal* which transfers an estimated 4 million m^3/a of water from the Breede River (H10F) to the Klein Berg River catchment (G10E) in the Berg WMA for irrigation use by the Dwars River WUA. The town of Wolseley also has an allocation from the scheme.

- The *"Gawie se Water" Scheme*, which diverts 5 million m^3/a of water for irrigation from the Upper Wit River catchment (H10E) in the Breede WMA to the Kromme River catchment (G10D) in the Berg WMA.

- The *Du Toits River to Franschhoek* transfer (H10J) supplies approximately 0,6 million m^3/a from the Breede River catchment to the town of Franschhoek in the Upper Berg.

A small transfer of approximately 0,7 million m^3/a into the Breede WMA (Lower Breede sub-area) takes place from the Duiwenhoks River catchment in the adjacent Gouritz WMA. Approximately 145 farms within the Breede WMA, and the town of Witsand, are supplied from this transfer.

3.3 LOCAL URBAN WATER SUPPLY SCHEMES IN THE BREEDE RIVER COMPONENT

Small local supply schemes meet almost all of the urban water requirements in the Breede River component. There are a few exceptions, namely the town of Witsand (supplied out of the Gouritz WMA), and the towns of Riviersonderend and Greyton (both supplied from Theewaterskloof Dam). The current urban (26 million m^3/a) and rural (7 million m^3/a) water requirements constitute collectively less than 5% of the total local water requirement.

Augmentation of current urban supply schemes may be required in the future, depending on growth in requirements. However, all local authorities must first undertake and implement more efficient water use and water re-use from their existing resources, before consideration will be given to the development of new schemes.

Where the provision of supplementary urban water supply is unavoidable, groundwater should be seriously considered. Towns such as Witsand could also augment supplies through the desalination of water from the lower Breede River-estuary interface zone. The details of current and future supply schemes to towns within the Breede River component are addressed under the Supply to Local Authorities Strategy (12.1).

Over and above Theewaterskloof Dam, the other large dam supplying urban water users is Stettynskloof Dam (owned by the Breede Valley Municipality). This has a capacity of 15,5 million m^3, and supplies water to the town of Worcester. Through agreement with the Breede Valley Municipality, irrigators of the Holsloot WUA are also supplied from the dam. The annual volume supplied to the irrigators and the assurance of that supply is dependent on the storage in Stettynskloof Dam.

3.4 IRRIGATION SUPPLY IN THE BREEDE RIVER COMPONENT

Irrigation is by far the largest user of water in the Breede River component. Excluding transfers, it accounts for approximately 95% of the total local water use for this region of the WMA.

In 1998 there were sixty-six irrigation boards in the Breede River component. Of these, sixty-two were in the Upper Breede sub-area (H10 – H50), three in the Riviersonderend sub-area (H60) and one in the Lower Breede (H70) sub-area. The most recent available estimate of irrigated land-use is 99 100 ha (BRBS, 2003). It is estimated that approximately 25% of the total irrigated land lies outside the authority of irrigation boards or water user associations. It is important to note that in the hydrocensus carried out by the Department in the Hex River catchment (H20), the registered irrigation area (4 500 ha) compared to within 3% of that determined independently in the BRBS (using aerial photography). This adds confidence to the total areas and actual water use estimates determined in the BRBS, and adopted in this ISP as the best information available. DWAF will

be verifying all water use in all quaternary catchments and determining its lawfulness. Refer to Verification of Existing Lawful Use Strategy (9.2).

The larger dams in the Breede WMA primarily supplying irrigators include:

- *The Ceres (Koekedouw) Dam* with a capacity of 22,5 million m^3. The BRBS reports a yield of 17 million m^3/a at an 85% assurance of supply. This supplies water to the Koekedouw Water User Association (WUA) for irrigation, and also supplies the town of Ceres.

- *Greater Brandvlei Dam*, an off-channel storage dam, filled to a capacity of 342 million m^3 by a canal from diversions out of the Smalblaar and Holsloot Rivers (tributaries of the Breede River). The dam has a firm yield of 155 million m^3/a (Ref 8). Unused spare storage capacity in the dam of 133 million m^3 could be utilised through increased pumping capacity (additional 15m^3/s to total 20 m^3/s) out of the Breede River. Although previously seldom operated, the existing 5m^3/s pumping facility was fully utilised for the first time in 2003, which was a particularly dry year. Where possible, farmers avoid this option due to the pumping costs associated with utilising it, but there is enough winter water available out of the Breede River should this seem necessary.

- *The Lakenvallei* and *Roode Elsberg Dams* in the Hex River catchment have a combined capacity of 18 million m^3 and a firm yield of 9 million m^3/a (Ref 8). They provide primary storage for the Hexvallei WUA (Sanddrift Government Water Scheme). The dams supply irrigators in the Hex River Valley and urban water users in the town of De Doorns. Water is transferred by means of a tunnel through the Hex River mountain range that separates the dams from the valley, and is distributed via a network of pipelines within the valley itself.

- *Keerom Dam* on the Nuy River has a capacity of 10,4 million m^3 and a firm yield of 3,8 million m^3/a (Ref 5) and is owned by the Nuy WUA.

- *Elandskloof Dam* on the Elands River has a capacity of 11,4 million m^3 and a firm yield of 12 million m^3/a (Ref 5). It supplies irrigators and the town of Villiersdorp.

- *Buffeljags Dam* on the Buffeljags River has a capacity of 5,2 million m^3 and a firm yield of 11 million m^3/a (Ref 8), and supplies water for irrigation to the Buffeljags WUA.

In addition to these larger dams there are a number of smaller farm dams in the Upper Breede (particularly upstream of Ceres), the Lower Breede and the Riviersonderend sub-areas, with combined capacities of 59 million m^3, 4 million m^3 and 20 million m^3, respectively.

3.5 WATER AVAILABILITY IN THE BREEDE RIVER COMPONENT

The BRBS represents the latest available assessment of water resource availability in the Breede River component. The BRBS figures are used in this first version of the Breede ISP, and form the basis for strategic recommendations with regard to use, planning, and management. A

comparison with those figures appearing in the First Edition of the NWRS is presented in Chapter 5, where the more significant differences are briefly explained, and the recommended changes are motivated.

The natural Mean Annual Runoff (MAR) and the preliminary ecological component of the Reserve are shown in Table 3.5.1.

Table 3.5.1: Mean Annual Runoff and Preliminary Ecological Water Requirements (million m^3/a)

Resource Category	Upper Breede	Riviersonderend	Lower Breede	Total
Natural MAR (1)	1092	439	272	**1803**
Preliminary Ecological Water Requirement (1) & (2)	612	170	193	**975 (3)**
Impact of Preliminary Ecological Water Requirement on Yield (Incremental) (2)	16	0	0	**16**

1) Quantities are incremental.
2) Based on the current ecological classes.
3) The preliminary Ecological Water Requirements determined in the BRBS indicates that the estuary requirement is 954 million m^3/a (53% of the natural MAR). However, in certain months, the riverine requirement is higher. That study recommends that the higher of the two requirements be allowed for, namely 975 million m^3/a.

Table 3.5.2: Water Availability in the Breede River Component (million m^3/a, Year 2000)

Resource Category	Upper Breede	Riviersonderend	Lower Breede	Total
Gross Surface Water Resource Yield	428	262	59	**749**
Less Impact on Yield of:				
Preliminary Ecological Water Requirement	16	0	0	**16**
Invasive Alien Plants	25	13	7	**45**
River Losses	5	0	0	**5**
Net Surface Water Resource	**382**	**249**	**52**	**683**
Plus Groundwater	94	5	4	**103**
Plus Return Flows	85	10	7	**102**
Total Local Yield	**561**	**264**	**63**	**888**
Transfers In (1)	0	0(3)	14(2)	**1**
TOTAL	**561**	**264**	**77**	**889**

1) Transfers into and out of sub-areas may include transfers between sub-areas as well as transfers between WMAs. Addition of the transfers per sub-area therefore does not necessarily correspond to the total transfers into and out of the WMA.
2) Made up as follows: **10** million m^3/a from the Upper Breede sub-area, approximately **3** million m^3/a from the Riviersonderend sub-area and about **1** million m^3/a inter-basin transfer from the Gouritz WMA.
3) Winter transfers at the Wolwekloof and Banhoek diversions into the Riviersonderend-Berg-Eerste River tunnel in the Berg WMA, are balanced by transfers via the tunnel back to the Berg WMA, in the summer months.

As shown in Table 3.5.2, the gross surface water resource in the Breede River component is estimated to be 749 million m^3/a, of which approximately 60% is provided from the major dams and 40% from minor dams and run-of-river. After allowing for the impact of the preliminary Ecological Water Requirements, the impact of invasive alien plants and river losses, the available surface water is 683 million m^3/a (at 1 in 50 year assurance of supply).

The greatest use of groundwater takes place in the Upper Breede and particularly upstream of Ceres, in the vicinity of Rawsonville, and in the Hex River valley. In the Hex River valley, surface and groundwater use are of similar magnitude (approximately 20 million m^3/a each). The present day groundwater yield from the Upper Breede sub-area is 94 million m^3/a of the total of 103 million m^3/a for the Breede River component.

Irrigation return flows in the Upper Breede also contribute substantially to the yield. However, downstream of Worcester these return flows contain high salt concentrations necessitating the need for freshening releases to improve water quality in the lower reaches (see Section 3.12). After allowing for return flows of 102 million m^3/a, the total local yield is estimated to be 888 million m^3/a. A net transfer of 1 million m^3/a takes place into the Breede River component, from the Gouritz WMA, bringing the total water availability to 889 million m^3/a.

3.5.1 Uncertainties Affecting Water Availability Estimates

In estimating water availability, the following uncertainties have been identified:

Preliminary Ecological Water Requirements:
The BRBS undertook a detailed investigation into preliminary Ecological Water Requirements for the Breede River and the Breede River estuary. The conclusion arising from that study was that the Breede River has one of the higher estuary requirements (53% of the natural MAR) of the large rivers in the country. This may be due to the fact that few other estuary Reserve assessments have been done in the Western Cape, and knowledge in estimating actual Ecological Water Requirements of large estuarine systems in the Western Cape is still limited.

It is important to note that despite the high preliminary Ecological Water Requirement of 975 million m^3/a, the resulting low impact of 16 million m^3/a on the yield of the present system is due to the fact that:

i The current Ecological Water Requirements for the Lower Breede River (Class "C") and its estuary (Class "B") are almost entirely met through present day flow conditions. Meeting the few seasonal shortfalls accounts for the relatively small impact on the present day yield (provided by the existing infrastructure) of 16 million m^3/a.

ii An assumption was made to keep the Riviersonderend River, at least for the interim, as a Class "E" (its present ecological status). The motivation for this decision is as follows: The current ecological class of the Riviersonderend River is a Class "E".

Were the river to be rehabilitated to a Class "D" (the scientific recommendation of the BRBS), the resulting impact on yield would be 85 million m^3/a, with much of that having to be provided through releases out of Theewaterskloof Dam. The yield from the dam is already fully allocated and compulsory licensing would be required to resolve the over-allocation. The CCT and irrigators dependent on water from the dam would then need to curtail use (cutting back on farming and other economic activity) or develop other sources to offset this impact.

In terms of (ii) above, if the Riviersonderend River were to be rehabilitated to a Class "D" River, the financial and social costs would be very high. In order to make a decision as to which ecological class is to be adopted, it will be required to develop Reserve implementation scenarios and to engage in a well-informed public participation process. However, the Reserve and Resource Quality Objectives Strategy (8.1) recommends that, in the interim, the status quo be maintained as the management class. Water resource management of the Riviersonderend River, in terms of this ISP, will therefore be based on the current class, until a more informed decision possibly suggests otherwise. Based on this interim approach, there would therefore be no further impact on the present day yield of the Riviersonderend catchment.

Hydrology

The number of and distribution of rainfall records is of some concern, particularly in the uppermost (high rainfall) regions of the Breede River catchments, where much of the runoff is generated. Improvements to the rain gauging at higher altitudes is important for understanding the recharge to the TMG aquifers, and the proper separation of baseflow contributions from shallow and deep TMG sources. DWAF's RO is arranging for additional rain gauges to be sited at higher elevations and the additional data will be utilised to improve the accuracy of future hydrological modelling calibrations.

Climate Change

It is predicted that ongoing global warming will bring about a decrease in rainfall over the Western Cape region. This could cause substantial reductions in streamflow with associated impacts on the surface and groundwater yields. Studies to date suggest a possible 10% reduction in streamflow in the Western Cape, by 2015. This means that the current estimates of available water may need to be revised downwards as a direct result of global warming. As discussed in the Water Availability Strategy (7.1), this must be taken into account when assessing future estimates of water availability.

3.6 WATER REQUIREMENTS IN THE BREEDE RIVER COMPONENT

Water requirements determined in the BRBS are considered the best synthesis of available knowledge and are used in this Section. These form the basis for the strategic recommendations in this ISP. A comparison with the figures appearing in the First Edition of the NWRS is presented in Chapter 5, where the more significant differences are briefly explained, and the recommended changes are motivated.

Table 3.6.1: Water Requirements in the Breede River Component (million m^3/a, Year 2000)

Category	Upper Breede	Riviersonderend	Lower Breede	Total
Irrigation	495	91	72	**658**
Urban [(1)]	23	2	1	**26**
Rural	4	2	1	**7**
Impact of Afforestation on Yield	0	1	0	**1**
Total Requirements	**522**	**96**	**74**	**692**
Transfers Out [(2)]	22[(3)]	168[(4)]	0	**177[(5)]**
TOTAL	**544**	**264**	**74**	**869**

1) Includes component of Reserve for basic human needs at 25 l/c/d.
2) Transfers into and out of sub-areas may include transfers between sub-areas as well as transfers between WMAs. Addition of the transfers per sub-area therefore does not necessarily correspond to the total transfers into and out of the WMA.
3) Made up as follows: **4** million m^3/a IBT to Berg WMA via Artois Canal, plus **5** million m^3/a IBT from "Gawie-se-water" to Berg WMA, plus **2,5** million m^3/a IBT to Olifants/Doorn WMA (via the Inverdoorn Canal), plus **10** million m^3/a surplus water from freshening releases.
4) Made up as follows: **161** million m^3/a from Theewaterskloof to Berg WMA, plus **0,6** million m^3/a to Franschhoek (Berg WMA), representing the net transfer from the Breede River component to the Berg WMA after accounting for the Wolwekloof and Banhoek Diversions in the Berg WMA, into the Breede WMA during winter months. In addition, transfers of **4** million m^3/a to Overberg, plus **2,5** million m^3/a to Lower Breede also take place.
5) Made up as follows: **161** million m^3/a IBT from Theewaterskloof to Berg WMA, plus **4** million m^3/a IBT to Berg WMA via Artois Canal, plus **5** million m^3/a IBT from "Gawie-se-water" to Berg WMA, plus **0,6** million m^3/a IBT to Franschhoek, plus **2,5** million m^3/a IBT to Olifants/Doorn WMA (Inverdoorn Canal), plus **4** million m^3/a to Overberg region.

The 22 million m^3/a freshening releases from Greater Brandvlei Dam are taken into account in the Irrigation Water Requirement in Table 3.6.1. The opportunistic use of approximately 10 million m^3/a of this, downstream of the lowest salinity management point on the Breede River, is reflected as a transfer into the Lower Breede sub-area (see Table 3.5.2).

At an equivalent 1 in 50 year assurance of supply, the estimated 99 100 ha (BRBS) of irrigated land utilises approximately 95% of the total local water requirement in the Breede River component. 75% of the total irrigation water requirement is from within the Upper Breede sub-area.

The CCT and irrigators along the Berg and Eerste Rivers are partially reliant on water supplied from the Breede River component. Section 3.2 describes these transfers in some detail. The main transfer takes place from the Riviersonderend sub-area, out of Theewaterskloof Dam. This varies annually depending on the operation of the Western Cape Water Supply System (WCWSS), averaging at the moment 161 million m^3/a.

3.6.1 Uncertainties Affecting Water Requirement Estimates

In estimating water requirements, the following uncertainties have been identified:

Climate Change

In addition to predicted decline in rainfall, increased temperatures in the Western Cape would further result in increased evaporation and an increase in irrigation requirements. Although this has no impact on current water requirement estimates, the impact of climate change must be taken into consideration when developing planning scenarios for future water requirements (refer to Water Requirements Strategy – 7.2).

Current Irrigation Water Use

The irrigation water requirement supplied from outside of controlled irrigation areas (government schemes and WUAs) is estimated to be in the order of 25% of the total irrigation requirement in the Breede River component. These sources include run of river, farm dams and boreholes. Herein lies some degree of uncertainty. However the hydrocensus undertaken by the Department in the Hex River Valley has shown that registered water use figures (WARMS) in that area compare favourably with the actual water requirement estimates undertaken for the BRBS. By extrapolation it is reasonable to assume that the BRBS requirement values for the whole Breede River component of the Breede WMA are reasonably accurate. The registration process will be followed up with a verification of the extent of the lawfulness of that use which has been registered. This is further addressed under the Verification of Existing Lawful Use Strategy (9.2).

Changes in Land-use

The decommissioning of commercial forestry will result in small areas of state owned land becoming available for alternative land-uses in the Breede River component. There is currently only 1500 ha of forestry in the catchment with an estimated impact on yield of only 1,5 million m^3/a, much of which is in the Riviersonderend sub-area. Clearing will increase runoff and the yield of the system. Future land-use such as the establishment of emerging forestry growers or emerging farmers may introduce new demands. Refer to the Changing Land-Use: Forestry Strategy (9.5).

The priority areas for clearing invasive plants are identified in the Clearing of Invasive Alien Plants Strategy (9.6) and briefly described under the Reconciliation Interventions in Section 3.9.

The Impact of Implementing WC/DM

In this ISP, estimates of future urban water requirements are based on the assumption that a 30% saving will be achieved through the implementation of WC/DM by local authorities. Little progress has been made to date and appropriate monitoring will be necessary to determine actual success in achieving this. The WSDPs provide the platform for the Department to encourage and assist local authorities in the implementation of WC/DM.

In the agricultural sector significant savings could be achieved through the upgrading and programmed maintenance of distribution infrastructure (pipelines and canals), although this

would be capital intensive. A reduction in saline return flows would also reduce the need for freshening releases from Brandvlei Dam, and thus increase water availability. Currently, freshening releases of about 22 million m^3/a are made out of Greater Brandvlei Dam. Future water resource planning will need to continually incorporate the progress made in this regard. To date, the introduction of more efficient irrigation systems (drip, microjet) represents the only significant steps towards implementing WC/DM in the agricultural sector.

Savings could be made through :

- interception of saline return flows to reduce salinity levels and required freshening volumes.
- improved (more efficient) management of irrigation and freshening releases.
- repair to ageing conveyance systems.

WC/DM is further discussed under Section 3.9 (Reconciliation Interventions) and in the WC/DM Strategies, 10.1 and 10.2.

3.7 RECONCILIATION OF WATER REQUIREMENTS AND AVAILABILITY IN THE BREEDE RIVER COMPONENT

Table 3.7.1 provides a reconciliation of the current water requirements with the available resource for the Year 2000. The reconciliation figures presented in Table 3.7.1 are based on the recommended availability and requirement figures described previously.

Table 3.7.1: Reconciliation of Water Requirements and Availability in the Breede River Component (million m^3/a, Year 2000)

Description		ISP SUB-AREAS			Total
		Upper Breede	Riviersonderend	Lower Breede	
Available Water	Local Yield	561	264	63	**888**
	Transfers In	0	0	14 (1)	**1 (1)**
	Total	**561**	**264**	**77**	**889**
Water Requirements	Local Requirements	522	96	74	**692**
	Transfers Out	22	168 (2)	0	**177(3)**
	Total	**544**	**264**	**74**	**869**
Balance		**17**	**0**	**3**	**20**

1) Transfers into the Lower Breede sub-area include transfers between sub-areas as well as the IBT from the Gouritz WMA. The net transfer into the Breede River component being the IBT from the Gouritz WMA (0,7 million m^3/a).

2) Made up as follows: **161** million m^3/a from Theewaterskloof to Berg WMA, plus **0,6** million m^3/a to Franschhoek (Berg WMA), representing the net transfer from the Breede River component to the Berg WMA after accounting for the Wolwekloof and Banhoek Diversions in the Berg WMA, into the Breede WMA during winter months. In addition, transfers of **4** million m^3/a to Overberg, plus **2,5** million m^3/a to Lower Breede also take place.

3) Made up as follows: **161** million m^3/a IBT from Theewaterskloof to Berg WMA, plus **4** million m^3/a IBT to Berg WMA via Artois Canal, plus **5** million m^3/a IBT from "Gawie-se-water" to Berg WMA, plus **0,6** million m^3/a IBT to Franschhoek, plus **2,5** million m^3/a IBT to Olifants/Doorn WMA (Inverdoorn Canal), plus **4** million m^3/a to Overberg region.

The Reserve and Resource Quality Objectives Strategy (8.1) recommends that until otherwise concluded (through more detailed analysis and public participation), the Lower Breede River and the estuary should be managed according to their current ecological classes. This is in line with the recommendations of the BRBS. The one exception to the BRBS recommendation is that this strategy recommends that the Riviersonderend River be retained at its current Class "E", whereas the scientific recommendation in the BRBS is that it be upgraded to a Class "D". Were it to be upgraded to Class "D", the 85 million m^3/a impact on the yield of Theewaterskloof Dam would have severe social and economic impacts on many irrigators and on the City of Cape Town [see also 3.5.1 (ii)].

Taking these strategic recommendations into account, the current surplus water available in the Breede River component is 20 million m^3/a, as shown in Table 3.7.1. This is primarily available from currently unexercised allocations in the Upper and Lower Breede sub-areas out of the following dams:

Upper Breede sub-area (17 million m^3/a)

- 3 million m^3/a unused out of Koekedouw Dam which serves both irrigators and the town of Ceres (H10C)
- 14 million m^3/a unused out of Stettynskloof and Fairy Glen Dams serving Worcester (H10K)

Lower Breede sub-area (3 million m^3/a)

- 3 million m^3/a unused out of Buffeljags Dam (H70E) which otherwise serves local irrigators

3.7.1 Allocating the Current Available Surplus

It will be shown in Section 3.8 that future urban water requirements in the Breede River component are estimated to increase by 17 million m^3/a by 2030. Noting that the currently available "surplus", which whilst not yet in use, has in fact been allocated, the following recommendations are made in terms of planning for the future disposition of this 20 million m^3/a:

- the 3 million m^3/a surplus available out of Koekedouw Dam, in the Upper Breede sub-area should be utilised towards meeting future urban needs of Ceres, as well as for meeting the Reserve requirements of the Koekedouw River, downstream of the dam.
- the 14 million m^3/a shown as being available out of the Stettynskloof and Fairy Glen Dams (one system), should be set aside for the anticipated growth in the urban water requirements of Worcester. Both dams are owned by the Breede Valley Municipality. Under agreement between the town and the Holsloot WUA, some of this surplus is utilised for irrigation, as Worcester does not yet have the need for it. The WMA is entitled to store water in the dam, if surplus capacity is available. Weekly monitoring of inflow (m^3/s) determines how much the WUA is entitled to store. Estimates of annual volumetric use by the WUA from this source were not determined in the BRBS. This estimate should be undertaken to evaluate the actual available surplus in the dam, whilst

this agreement is in place. Worcester must first reassess its anticipated growth in urban water requirements. Any likely surplus should then be allocated towards addressing inequity through the further establishment of resource poor farmers in the area. The vehicle for this is the Co-ordinating Committee for Agricultural Water (CCAW), formerly known as the Irrigation Action Committee (IAC).

- Worcester also receives water out of the Lower Hex River via a diversion at Sesbek. This is used for irrigating sportsfields at Worcester and could potentially be traded with irrigators in the Hex River Valley, to improve the assurance of supply in that area. The annual volume received by Worcester from this diversion should be established as it is currently not monitored.
- the surplus of 3 million m^3/a available in the Lower Breede sub-area out of Buffeljags Dam, should be allocated to the establishment of resource poor farmers.

DWAF will be in a position to influence the allocation of the available surplus through the Water Service Development Plans (WSDPs) of the relevant local authorities. It is strongly suggested that any long-term surpluses be made available for use by resource poor farmers.

3.7.2 Water to Resource Poor Farmers

In the Breede River component, there are meaningful opportunities to address poverty through agricultural water use and related activities. There is some measure of own production in and around villages and townships. However, there have not been many examples of historically disadvantaged people emerging from their current situation into dramatically or even incrementally improved livelihoods based on agricultural water use or related business opportunities. Institutions in a position to facilitate the availability of land, water, and the many services related to the agricultural sector, need to work together to plan and support new farmer development. In the Western Cape, the planning and implementation of irrigation developments is co-ordinated through the CCAW. This is further addressed in the Support to Resource Poor Farmers Strategy (11.1).

In terms of land acquisition, a large number of resource poor farmer developments in the Breede River catchments have been registered with the Department of Land Affairs. Of these developments, 15 projects had been approved by March 2002, benefiting in excess of 1000 participants on some 2 200 hectares. The BRBS highlighted that access to information is not readily available on how much of this land is irrigated and whether or not that which is irrigated is from existing allocations.

A further 29 projects benefiting 1 700 participants on 1 900 hectares are in the process of implementation. Information as to the extent of access to water on these projects is also not readily available.

The establishment of resource poor farmers from current sources of supply is limited to the areas in which some surplus water is available. To optimise access to the currently available surplus

(in a short time frame), financial, technical and training support to resource poor farmers would need to be provided by the government, with the CCAW as facilitating agent.

An alternative option would be to create opportunities for the establishment of resource poor farmers by encouraging the formation of joint venture partnerships between emerging farmers and existing commercial farmers where new irrigation developments are undertaken. This could be achieved through the implementation of a licensing strategy that would favour the issuing of new licences for irrigation water use to such joint partnerships. The benefit of this option would be that new entrants would receive technical and operational skills support from established farmers, already familiar with the challenges of commercial farming in the Breede WMA, and this approach is favoured by the Department.

Information must be obtained by DWAF from which the progress of land reform and the current and future access to water can be documented and regularly updated. This should clearly outline:

i Where the land is situated? (Some information is available).
ii How much is currently under irrigation?
iii Whether this relies on existing (allocated water) or new water needs?
iv Whether this involves a JV arrangement and if so with whom?
v Where future demands for land (and water) are expected?

3.8 FUTURE WATER REQUIREMENTS

3.8.1 Potential In-catchment Urban Requirements

The BRBS has identified that without implementing WC/DM, the current urban water requirement of 26 million m^3/a is expected to increase to 61 million m^3/a by 2030.

Effective water demand management measures are not being implemented in the urban sector, and significant water savings can still be achieved. According to national estimates provided in the draft WC/DM Strategy for the Water Services Sector, potential savings of up to 40% of existing consumption can be realised in urban areas through the implementation of water demand management measures. In line with the BRBS, the Water Services: WC/DM Strategy (10.1) of this ISP, sets the objective of achieving at least a 30% saving in water use by the urban sector. This will limit the urban water requirement to 43 million m^3/a by 2030, a net increase of 17 million m^3/a, much of which will be in the larger urban centres, such as Worcester, where there is currently sufficient surplus available towards meeting these requirements.

3.8.2 Potential In-catchment Irrigation Expansion

Based on commercial lending rates (i.e. without government subsidy), it has been determined in the BRBS that viable irrigation expansion up to an additional water requirement of 140 million m^3/a could take place in the Breede River component, should it be possible to make this additional water available. This assessment took into account the cost of the land

development, the cost associated with the development of the water resource to supply that requirement, and was based on a conservative view of foreign exchange rates (i.e. a strong Rand). It is important to note that the 140 million m^3/a potential irrigation water requirement was determined independently from the potential additional yield scenarios, one of which (Scenario3) happens to be of the same numerical value (see Section 3.10).

3.8.3 Potential Water Transfers out of the Breede River Component

Despite the anticipated completion of the Berg Water Project in 2007 (additional 81 million m^3/a yield to the Western Cape Water Supply System (WCWSS)) the Western Cape System will again be in deficit soon after 2010, even with the implementation of effective WC/DM measures. Options for further potential yield development in the Berg WMA are few, and these carry high financial and environmental costs.

In the DWAF ISP for the Berg WMA, it was identified that future water requirements of the WCWSS would increase from 405 million m^3/a (2000) to 668 million m^3/a by 2025. This equates to an increase of 263 million m^3/a. Furthermore irrigation expansion in the Berg WMA will come to a complete halt, as all allocations from Government Water Schemes will soon be fully utilised. Both the agricultural and urban sectors will therefore be under pressure for resources. This suggests that affordable options for augmenting the WCWSS from the Breede River component would be an attractive option for urban users in the Berg WMA, particularly the City of Cape Town (CCT). It will be shown (see Section 3.10) that all the potential yield that could be developed in the Breede River component could be fully utilised just in meeting future water requirements in the Berg WMA, without any further allocations to in-catchment agriculture being made in the Breede WMA. However, in terms of cost-effective scheme development, not all of the potential scheme locations in the Breede WMA would be suited to supplying the Berg WMA, and some sharing of the Breede's resources is in any event recommended.

3.9 RECONCILIATION INTERVENTIONS

It has been illustrated that potential water requirements, both in-catchment and for the WCWSS out of the Breede River component, are significant. To meet these potential requirements it will be necessary to develop additional yield in the Breede River. However there are a number of other important reconciliation interventions that must be also be considered, and these are discussed below. The development of potential (additional) yield is discussed in Section 3.10.

3.9.1 Verification of Existing Lawful Use

As noted previously, registered water use by irrigators in the Breede River component of this WMA, is expected to be reasonably accurate. Nevertheless, the verification process must be concluded and this may bring about small volumes of water that can be returned to the system.

3.9.2 Water Conservation and Demand Management (WC/DM)

Urban Sector

Virtually no existing WC/DM measures are being applied in the urban sector (BRBS). Savings of between 30 and 40% are achievable and local authorities such as the CCT (in the Berg WMA) and the Overstrand Municipality (Overberg sub-area) serve as examples for others to follow. DWAF can achieve a great deal by promoting the principles of WC/DM and lending technical support to those local authorities that are most in need. WC/DM is an intervention that the Department not only encourages but also sees as a prerequisite before the licensing of any new schemes for local authorities. Realistic WC/DM targets need to be identified in the WSDPs of local authorities and progress needs to be closely monitored to establish its implementation success. This is further addressed under the WC/DM: Water Services Strategy (10.1).

Based on the urban water requirement (only 5% of the total local water requirement), the use of treated effluent from wastewater treatment works (WWTWs) forms a relatively small component of potential available water. Nevertheless there is potential for the re-use of water in the larger urban centres, either directly or via an exchange with irrigation. Worcester's treated effluent, for example, is indirectly re-used. It is discharged into the Breede River, becoming available for abstraction further downstream. Water re-use is further addressed under the Water Services WC/DM Strategy (10.1).

Agricultural Sector

Irrigation in the Breede River component constitutes 95% of the in-catchment water requirement making this the most important sector on which to focus savings. The BRBS refers to an earlier study undertaken by the Water Research Commission (1986-1988). That study found that in a typical irrigation district within the Robertson area, less than 50% of the water diverted into Greater Brandvlei Dam actually reaches the farm boundaries. Whilst this Study may be 15 years old, there is still significant scope to improve water use efficiency within the agricultural sector.

There are a number of opportunities to implement WC/DM, such as:

- upgrading the irrigation conveyance and distribution systems to reduce losses;
- improved scheduling at irrigation schemes;
- the improved timing of releases, through for example, the introduction of short-term demand projections by farmers;
- improved monitoring of abstraction within irrigation schemes;
- over-irrigation to leach out salts (typically on new farms) can be reduced by appropriately siting new irrigation developments on less saline soils (licence conditions);
- improved techniques to manage salinity (interceptor drains for example) and reduce the quantities of freshening releases required.

Efficient irrigation systems (drip and microjet) are used by most irrigators in the Breede River component. WC/DM in the agricultural sector is further addressed under the Agricultural

WC/DM Strategy (10.2). Implementation of WC/DM remains more cost-effective than the development of new schemes and needs to be entrenched at all user levels through technical support, public awareness and education.

3.9.3 Trading of Water

Trading of existing authorisations is a way of shifting water towards more beneficial or higher paying use, without increasing total volume demand. Typically, urban demands can be met by sourcing water from agricultural users.

3.9.4 Clearing of Invasive Alien Plants

An estimated 46 000 ha of the land area in the Breede River catchments has been invaded by alien plant species. The actual area invaded is much larger but this is expressed as an equivalent area of 100% invasion density. When compared to the cost of constructing new water supply schemes, the elimination of invasive alien plants often represents an economical means of unlocking water resources. The BRBS has estimated that through the removal of all invasive alien plants in the Breede River component an additional system yield of some 45 million m^3/a could become available in the following sub-areas:

- Upper Breede: 25 million m^3/a
- Riviersonderend: 13 million m^3/a
- Lower Breede: 7 million m^3/a

If the growth of invasive alien plants were to continue unchecked, the invaded areas could triple in size by 2020, and cover about 250 000 ha by 2040, with disastrous impacts on available water resources. Although the ideal of total removal is not realistic, very important gains can be made through the clearing programme. The Changing Land-Use – Clearing of Invasive Alien Plants Strategy (9.6), presents a suggested priority for clearing. The main recommendations of that strategy are that existing clearing programmes in the Riviersonderend (particularly in the catchment area of Theewaterskloof Dam) and Upper Breede sub-areas should be continued, and preferably intensified. Early attention should also be given to clearing efforts in the catchments with lighter infestations, particularly the Cogmanskloof, Ceres and Middle Breede areas, before these areas become densely invaded. Bio-control has proven to be a cost-effective measure against many species and should be introduced wherever possible. This presents the most certain, cost-effective and sustainable form of control. The progress and benefits of clearing invasive alien plants will need to be monitored and water resource availability assessments adjusted accordingly.

3.9.5 Development of Groundwater Potential

It is possible that some of the potential yield that could be developed in the Breede River catchments could be developed from groundwater sources in the Upper Breede sub-area, as an

alternative to surface water development (described in Section 3.9.6). The approach, however, is toward the development of surface water yield, with groundwater providing yet more yield.

The potential of the surface water resource depends not only on good catchment management (notably clearing of invasive alien plants) but also on groundwater abstraction. Groundwater abstracted from river beds, close to streams, and from shallow alluvial aquifers will have a very direct influence on surface water yields, and should be seen as equivalent to surface water use. Despite this caveat there is a great deal of groundwater which has only very weak links to surface water and which can be abstracted without significantly impacting on surface water yields. Development and use of this water would for the most part be very localised, i.e. with use close to source. Some of the surface water yield potential could therefore be harvested as "groundwater" but the preferred approach is to limit further groundwater abstraction from the zone of direct interaction and to focus on harvesting groundwater where this is most likely to yield additional water. This allows surface and groundwater to be viewed as additive, with groundwater significantly increasing the development potential in the Breede River component of the WMA.

The current estimate of actual groundwater use in the Breede River catchments is 103 million m^3/a, much of which is abstracted out of the alluvial aquifers, and the Bokkeveld and Karoo fractured rock aquifers. The Table Mountain Group (TMG) aquifers of the Upper Breede sub-area are a potential source of supply, both for in-catchment use and for supply to the Berg WMA. The supply of water to the CCT out of the TMG from within the Breede River catchments has been identified as one of the viable reconciliation interventions for the Berg WMA, and is being investigated by the CCT. Although there is potential to develop the groundwater resource in the Breede River catchments, the H10A-C group of quaternaries in the Ceres catchment is an exception. The BRBS has shown that in terms of aquifer recharge and contribution to surface water base flow, the current groundwater use in that area exceeds the estimates of sustainable supply volumes from the groundwater resource.

Within the Hex River catchment (H20) the current registered groundwater abstraction is 20 million m^3/a. In terms of contribution to baseflow and recharge, the BRBS concludes that there is still some potential for sustainable groundwater abstraction in the Hex River catchment. However, the extent of current abstraction is impacting on the availability of surface water to other users in that catchment. As a result of the impact on other users, further groundwater abstraction in the Hex River catchment should be cautiously considered. The further development of surface water resources, such as the proposed Osplaas Dam, is being investigated by the WUAs to supplement existing sources in the Hex River Valley.

The sustainable abstraction potential of groundwater between the base of Michell's Pass (H10D) to the Greater Brandvlei Dam is estimated at approximately 94 million m^3/a of which about 32 million m^3/a is the current registered use. 80 million m^3/a of the potential is from within the TMG. Approximately 11 million m^3/a is from the fractured rock aquifers of the Bokkeveld and Karoo groups and the remaining 3 million m^3/a, from within the alluvium. Similarly, in the area between Worcester and the Nuy Valley, the potential for sustainable abstraction is estimated at 15 million m^3/a and current use only at 2,5 million m^3/a.

The CCT is currently undertaking a feasibility study into the potential for augmenting the City's water supplies out of the TMG Aquifer. There is a complex interaction in terms of the recharge dynamics of the alluvial aquifers, from the TMG and from summer baseflow in the rivers, which in turn is also largely provided from the TMG. The recharge dynamics of the alluvial aquifers vary significantly from one site to the next and as such, site specific monitoring is important in order to support any new applications for abstraction authorisations, particularly out of the alluvium. It is clear that abstraction from the alluvium affects surface water baseflow and must to this extent be regarded as equivalent to surface water use.

Essentially, the use of groundwater from more distant, disconnected sources draws on invisible storage which recharges over time when there is surplus water within the system (just as a dam would fill), and this can be seen as "available water". The BRBS has estimated that after allowing for the contribution of groundwater to the Reserve, the potential groundwater availability in the Breede River component of this WMA is estimated at > 300 million m^3/a. Table 7.4.1 of the Groundwater Utilisation Strategy (7.4) sets out the potential within each of eleven groundwater resource units and indicates the aquifer type. Full utilisation of this potential will not be realised due to the following practical constraints :

- It becomes financially less viable to abstract groundwater from depths in excess of 100 m due to the associated infrastructure, drilling and pumping requirements.
- Access to remote and inaccessible areas is often not possible due to the rugged terrain within the Breede River catchment.
- In order to abstract large volumes of groundwater, wellfields consisting of many individual boreholes are required and this has associated cost implications.
- The availability of groundwater may not be congruent with irrigable land or other potential uses. The financial cost of pipelines and pump stations to convey the water from its source to the users may be too high for the purpose of irrigation.

3.9.6 Development of Surface Water Yield Potential

The development of the potential additional yield in the Breede River component was investigated during the BRBS. The existing Breede River system was configured in the Water Resources Yield Model, and the yields associated with three potential ecological classification scenarios were investigated. The added yield potential for each scenario was based on an assessment of between 100 and 800 million m^3 of storage in the Breede River component. The assessment concluded that the development of up to 400 million m^3 of additional storage could be cost effectively developed. Ultimately, decisions on the selection of ecological classes for the rivers and the estuary will involve further study and public participation.

The three scenarios investigated during the BRBS and the resulting potential yields associated with each are shown in Table 3.9.1 and graphically in Figure 3.9.1.

Table 3.9.1: River Classification Scenarios Investigated in the BRBS

Site	The Current Class	Recommended Classes[(1)] and Existing IAPs	Reduced Classes and Existing IAPs	Recommended Classes [(1)] and Complete IAP Removal
	(Status Quo)	(Scenario 1)	(Scenario 2)	(Scenario 3)
1. Upper Breede River (H10F)	D/E	D	D	D
2. Molenaars River (H10J)	B	B	B	B
3. Middle Breede River (H40F)	C/D	C/D	C/D	C/D
4. Lower Breede River (H70G)	C	B/C	B/C	B/C
5. Riviersonderend River (H60F)	E	(E)[(2)]	E	(E) [2]
6. Breede River Estuary	B	B	C	B
Resulting Yield Potential within the Breede River component (million m^3/a) for additional storage of 400 million m^3.		**90** million m^3/a	**115** million m^3/a	**140** million m^3/a

(1) "Recommended Classes" are those scientific recommendations of the BRBS.
(2) The exception in this scenario being that the Riviersonderend River is retained at its current Class "E", although the recommendation from a scientific perspective was that it should be rehabilitated to a Class "D".

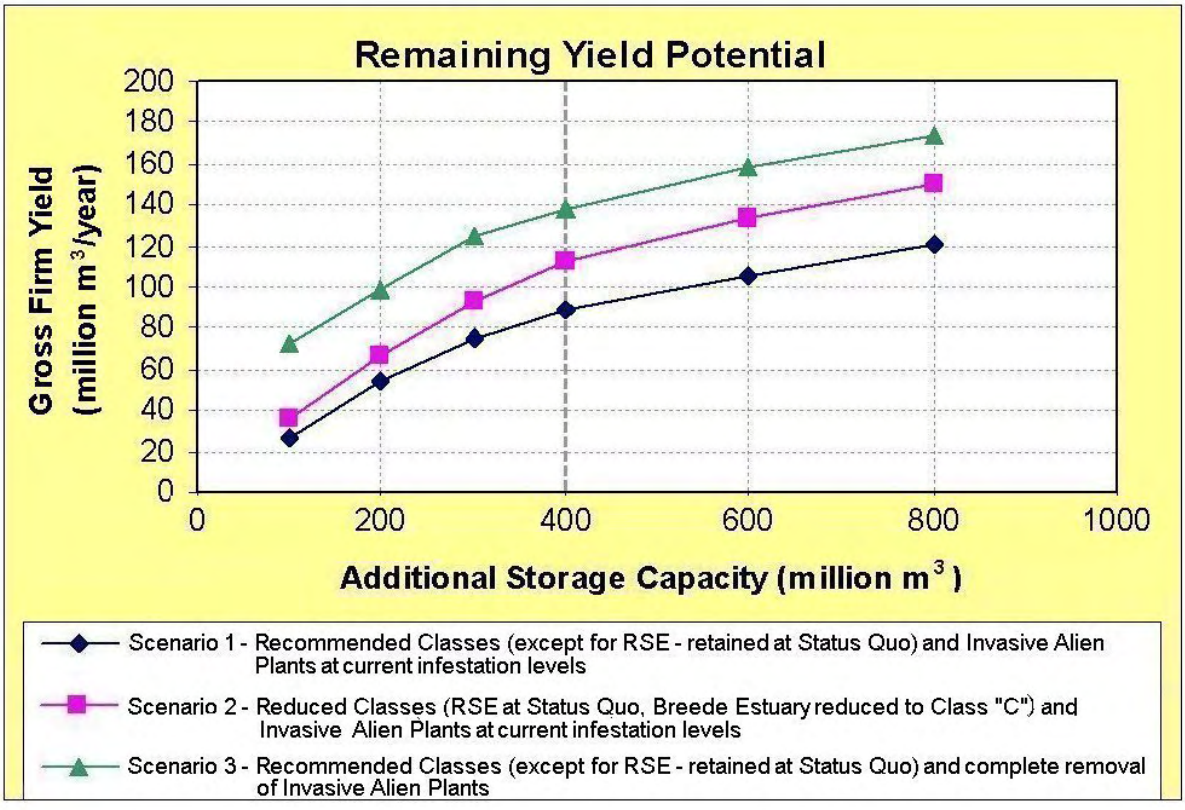


Figure 3.9.1: The impacts of two ecological class scenarios and one invasive alien plant removal scenario on potential yield

An explanation of the three scenarios investigated in the BRBS follows.

Scenario 1 – Recommended Ecological Classes

As shown in Table 3.9.1, the scientific recommendations are such that the current classes (status quo) would be improved in the upper reaches of the Breede River, in the Riviersonderend River and in the Lower Breede River. The scientific recommendation in terms of the Molenaars River, Middle Breede and the Breede River estuary is that they be maintained at their current levels. The result of this scenario using scientific recommended classes would be that the potential yield that could be achieved would be in the order of 90 million m^3/a, through the use of additional storage of 400 million m^3. Of the 400 million m^3, 133 million m^3 is already available in Greater Brandvlei Dam, but at present the dam can not be filled to its full capacity. To achieve this yield however, the Riviersonderend River would need to be retained at its current Class "E" and not upgraded to a Class "D". Furthermore, the extent of invasive alien plant infestation is assumed to be maintained at current levels.

Scenario 2 - Reduced Ecological Classes

Under this scenario, the most significant changes from the recommended classes are the Riviersonderend (retained at current Class "E") and the Breede River Estuary (reduced to a Class "C"). This scenario also assumes that the invasive alien plant infestation is maintained at current levels. The potential yield from additional storage of 400 million m^3 is approximately 115 million m^3/a.

Scenario 3 - Recommended Ecological Classes and Removal of Invasive Alien Plants

This scenario is the same as Scenario 1, with the exception that it assumes the complete removal of all invasive alien plants in the Breede River component of the WMA. The infestation has a current impact on yield of about 45 million m^3/a. Although complete removal is considered unlikely, this scenario is nevertheless of relevance, as it defines an upper limit of the yield potential, taking the scientific recommendations of the BRBS (with the exception only of the Riviersonderend River) into account.

The BRBS considered many possible individual schemes from which to develop potential yield in the catchment. These schemes were all assessed on an individual basis. The impact on the yield potential of an existing or proposed downstream scheme, from the development of one or more upstream schemes was not investigated. The BRBS should be referred to for detail on all of the options considered. Only those options ranked in that study as most preferable will be described in this ISP, and briefly at that. The assessment undertaken in the BRBS was essentially conducted for two development options, namely:

- In-catchment development of irrigation
- Water for transfers to the Berg WMA

Whilst it has been shown that either option could exclusively make full use of the yield potential within the Breede River component, the discussion that follows is based on the point of departure that:

- ⇨ the development of yield for increasing the transfers into the Berg WMA will be considered;
- ⇨ some combination of water for transfer and in-catchment development will be the most probable implementation scenario.

The application of two possible Reserve scenarios and one invasive alien plant removal scenario described in this ISP each show different yield development potential (90, 115 and 140 million m^3/a). In Sections 3.10.1 and 3.10.2 recommendations are made in terms of which schemes appear more favourable for in-catchment development, and which for water transfer into the Berg WMA. Within each Reserve scenario described above, the relative impacts of schemes on one another will need to be investigated. This would be part of the Western Cape Reconciliation Study, to be undertaken by the Department towards the end of 2004.

The potential yields associated with each of the three scenarios are based on the assumption that the use of groundwater potential from areas within or close to river channels, is considered as equivalent to the use of surface water. Potential groundwater abstraction out of the TMG from sites at which there is not a direct interaction with surface water flow is not included. The CCT is currently investigating this potential as part of its feasibility study into the TMG, as a potential source to augment Cape Town's water supply. Further abstraction from the TMG is therefore not considered a Breede WMA resource for purposes of this ISP.

3.10 POTENTIAL NEW SCHEMES

3.10.1 Developing Yield for In-catchment Use

Of the larger regional development options considered in the BRBS, a process of multi-criteria decision analysis clearly identified the following two options as the preferred options for in-basin irrigation development:

- Augmentation of Greater Brandvlei Dam
- Raising Buffeljags Dam

Augmentation of Greater Brandvlei Dam

From an in-catchment perspective, taking advantage of the existing spare capacity in Greater Brandvlei Dam (133 million m^3) is the optimum development option for irrigation expansion in the Breede River component. Within this option many possible permutations were considered in terms of where to divert or abstract the water for storing in the dam, how to convey it into the dam, and what the environmental impacts and financial costs would be.

The conveyance and pumping capacity is already in place to deliver 5m^3/s from the existing Papenkuils pump station on the Breede River. Further development of the pumping capacity of this scheme would be the most favourable for in-catchment irrigation development. The current abstraction capacity of 5m^3/s equates to a yield of 11 million m^3/a out of Greater Brandvlei Dam. Prior to 2003, this was seldom utilised to its full capacity. However, during 2003 and 2004 this

pumping scheme was fully utilised. As such, the yield delivered at the 5 m^3/s pumping rate should not be considered as available surplus as this is included in the existing yield.

By increasing the pumping capacity by 15m^3/s to 20 m^3/s (for which the existing pump station makes provision to house additional pumps) to pump surplus winter water from the Breede River into Greater Brandvlei Dam, the yield of the dam could be increased by an additional 33 million m^3/a (over and above the 11 million m^3/a from current 5 m^3/s installed pumping capacity). This would allow for new in-catchment development without affecting the use or assurance of existing users. This is after allowance for the recommended ecological water requirements of the Breede River and its estuary, as determined in the BRBS. A further benefit of this option is that a balancing weir would not be necessary and the risk of inundating the Papenkuils wetland would be avoided. Together with the installation of additional pumps, minor modifications to the existing pumping sump would enable more efficient pumping.

Unit Reference Values (URVs) are used for a comparative assessment of the financial costs of scheme options. The lower the URV, the more affordable the scheme. The Papenkuils Pumpstation Scheme (increasing the capacity by 15m^3/s) is estimated to have a capital cost of approximately R38 million and a URV of R0,15/m^3. This cost excludes costs that will have to be incurred to distribute additional water from Brandvlei Dam.

It should be noted that diversions from Michell's Pass into Greater Brandvlei Dam via a 40km canal or pipeline were also considered. This did not prove to be a cost-effective option for in-basin development with the URV for the canal option at R1,04/m^3, and R2,45/m^3 for the pipeline. Options for increasing diversions from the Molenaars River were investigated, but were also considered to be less attractive than the Papenkuils Scheme.

The location of the Greater Brandvlei Augmentation Scheme (Papenkuils Pumpstation) for in-catchment development is shown on Figure 3.10.1.

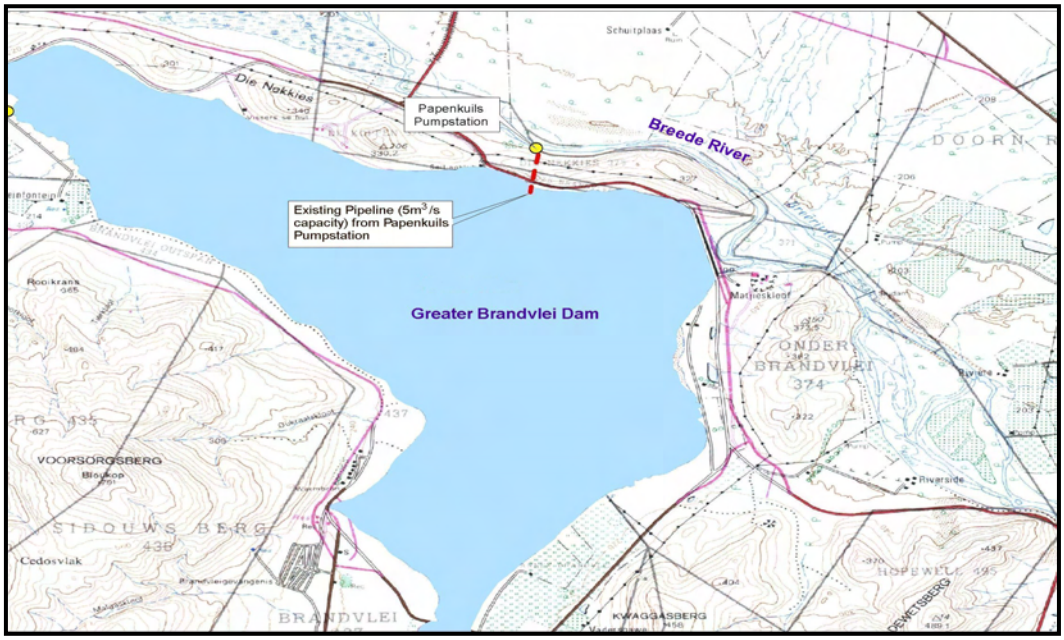


Figure 3.10.1: The Potential Brandvlei Augmentation Scheme

Upstream scheme development such as the potential Michell's Pass and Molenaars Diversion transfer schemes (described in Section 3.10.2) would have some impact on the present day yield of Brandvlei Dam and on the potential yield of the Brandvlei Augmentation Scheme. The extent of these impacts will be assessed in the Western Cape Reconciliation Strategy, and various pumping options at Papenkuils will be investigated to offset the impacts of potential upstream schemes.

Raising Buffeljags Dam

The second most favourable development option for in-catchment supplies appears to be the raising of the existing Buffeljags Dam by 10m, doubling its current yield from 11 to 22 million m^3/a (after allowing for ecological flow releases to the Lower Breede and the Estuary). The water, which is of good quality, could be used to expand irrigation downstream, offering potential to establish resource poor farmers in the area. The capital cost to implement this scheme is estimated to be approximately R80 million, with a URV of R0,75/m^3. The possible scheme layout is shown on Figure 3.10.2.

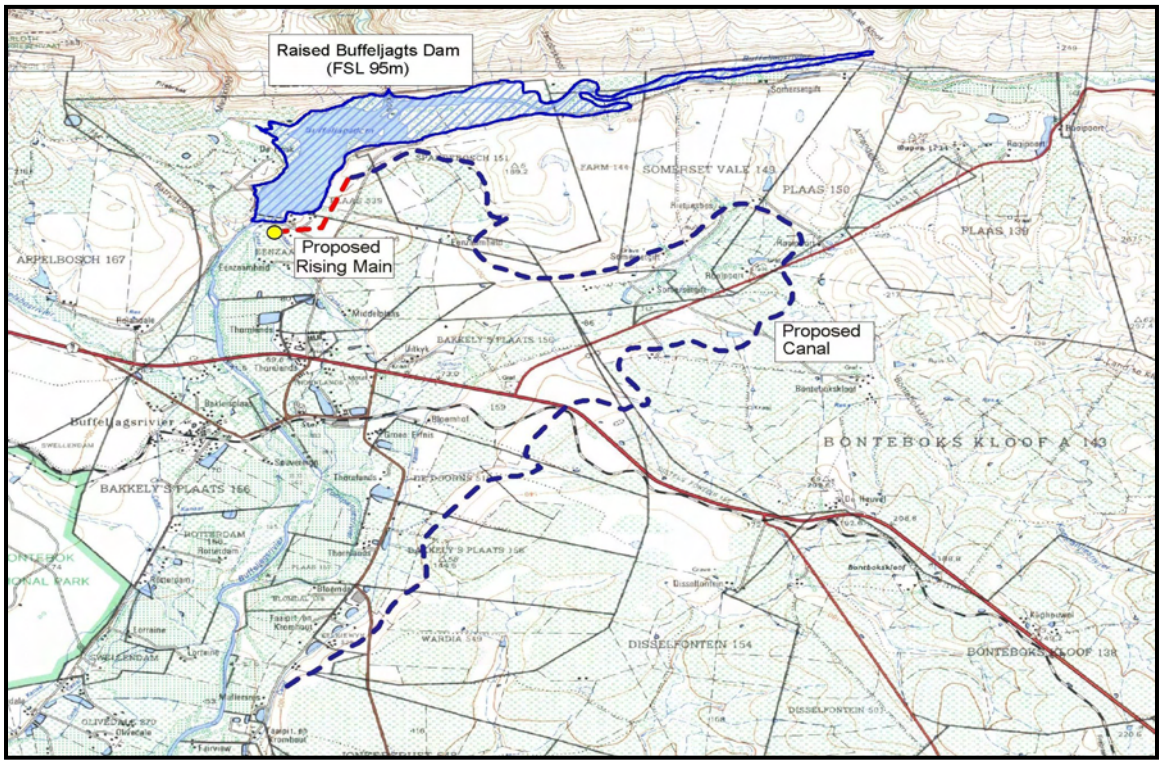


Figure 3.10.2: The Potential Raising of Buffeljags Dam

The Greater Brandvlei Augmentation Scheme and the raising of Buffeljags Dam are not mutually exclusive and there is sufficient water to implement both options. There are also numerous smaller potential schemes with individual yields of less than 5 million m^3/a. It is conceivable that some of these schemes could be developed in conjunction with scaled-down versions of the Greater Brandvlei Augmentation Scheme and the raising of Buffeljags Dam.

3.10.2 Developing Yield for Transfer

Three large schemes were identified in the BRBS for the potential additional transfer of water into the Berg WMA. These are:

1) Augmenting Theewaterskloof Dam out of Greater Brandvlei Dam
2) The Michell's Pass Diversion
3) The Upper Molenaars Diversion

Theewaterskloof Dam and the tunnel system supplying water to the WCWSS already draws on the maximum available yield from the Upper Riviersonderend catchment. To increase the yield of Theewaterskloof Dam, it would be necessary to transfer water from Greater Brandvlei Dam. Pumping out of the Breede River by means of an enlarged pumping capacity would take place into Greater Brandvlei Dam, from where the water would be transferred to Theewaterskloof Dam by a system of pump stations, pipelines and canals. The potential yield of this scheme for transfer is expected to be similar to that for in-catchment development (see Section 3.10.1). To verify this it would be necessary to integrate the Breede System models with that of the Western Cape System, so as to determine the marginal yield benefit to the Western Cape System. A URV of R1,14/m^3 was determined for this option.

Concern has however been raised from a water quality perspective in terms of introducing more turbid water from Greater Brandvlei Dam into Theewaterskloof Dam. This scheme would also preclude the usage of additional water pumped into Greater Brandvlei Dam for in-catchment development. Consequently the two preferred options for water transfer were identified as:

- The Michell's Pass Diversion
- The Upper Molenaars Diversion

<u>The Michell's Pass Diversion</u>

A 10m high weir on the Dwars River (Upper Breede) would divert winter water only, via a 9km canal across the catchment divide and into a tributary of the Klein Berg River. From the Klein Berg River, the existing diversion weir and canal would divert the water into Voëlvlei Dam. Alternatively, the water could continue to the Berg River, for diversion and use in the West Coast area. The possible scheme layout is shown on Figure 3.10.3.

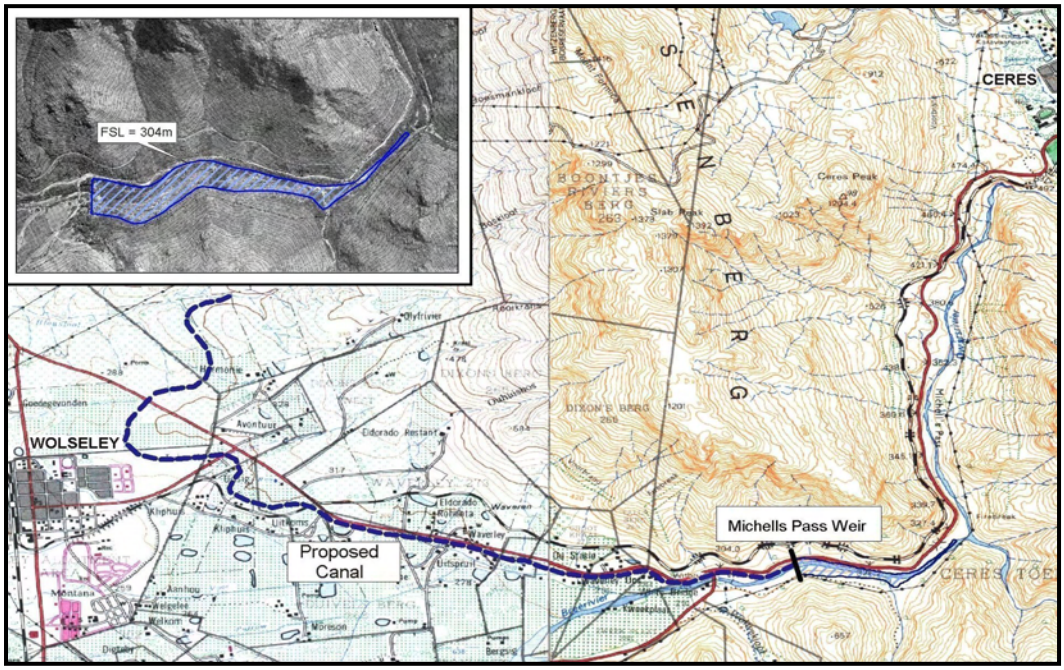


Figure 3.10.3: The Potential Michell's Pass Diversion Transfer Scheme

The capital cost of the Michell's Pass Scheme (2003) to the first point of delivery (Voëlvlei Dam) is R56 million. This equates to a URV of R0,11/m^3. The substantial potential yield arising from the scheme (53 million m^3/a) will probably require that a second pipeline to Cape Town be constructed from Voëlvlei Dam, involving additional costs which would substantially increase the URV. The Michell's Pass Scheme remains a favourable option to augment the WCWSS and supply to Cape Town. Although a URV has not been calculated to alternatively convey this water to the West Coast, this also looks very promising. It is possible that both the CCT and the West Coast could be supplied through a sharing of the resource.

The impact of the Michell's Pass Diversion on the potential yield of the Greater Brandvlei Augmentation Scheme did not form part of the scope of the BRBS, although some preliminary assessments of the impacts were undertaken for the West Coast Study. That study found that, for example, a 1 m^3/s diversion at Michell's Pass would have an impact on the yield of Greater Brandvlei Dam of about 6 million m^3/a. In order to recover this yield, the rate of abstraction at the Papenkuils Pump Station would need to be increased from 5 m^3/s to 6,4 m^3/s. The impacts of a range of abstraction rates at the potential Michell's Pass Diversion, on the yield of Greater Brandvlei Dam, will be investigated during the Western Cape Reconciliation Strategy Study. Furthermore, the yields quoted above may not translate into equivalent yield benefits to the Western Cape System, as the critical drought period in the Breede WMA may not coincide exactly with the critical drought period in the Berg WMA. This will need to be investigated as part of the Western Cape Reconciliation Strategy Study.

The Upper Molenaars River Diversion

During the construction of the Huguenot Tunnel, provision was made for the transfer of water from the Upper Molenaars River via a pipeline installed along the length of the tunnel. From a pump station located downstream of the confluence of the Molenaars and Elands Rivers, winter

water would be pumped to the east portal. From there it would gravitate via the existing pipeline through the tunnel, and then via a new pipeline from the west portal to Wemmershoek Dam. As an alternative, a similar option would be possible for gravitating the water to the Berg River Dam. The capital cost of the scheme would be approximately R213 million, providing 27 million m^3/a of additional yield at a URV of R0,82/m^3 (for delivery to Wemmershoek Dam). The CCT is currently investigating the additional costs associated with linking their existing bulk water infrastructure to the Berg Water Project, currently being developed. The investigation will take account of the possibility of integrating the Upper Molenaars Diversion Scheme layout shown on Figure 3.10.4.

The Molenaars Scheme would have some impact on the existing diversions into Brandvlei Dam and on the potential additional yield of the dam. The impact was not determined during the BRBS and will be investigated during the Western Cape Reconciliation Strategy Study.

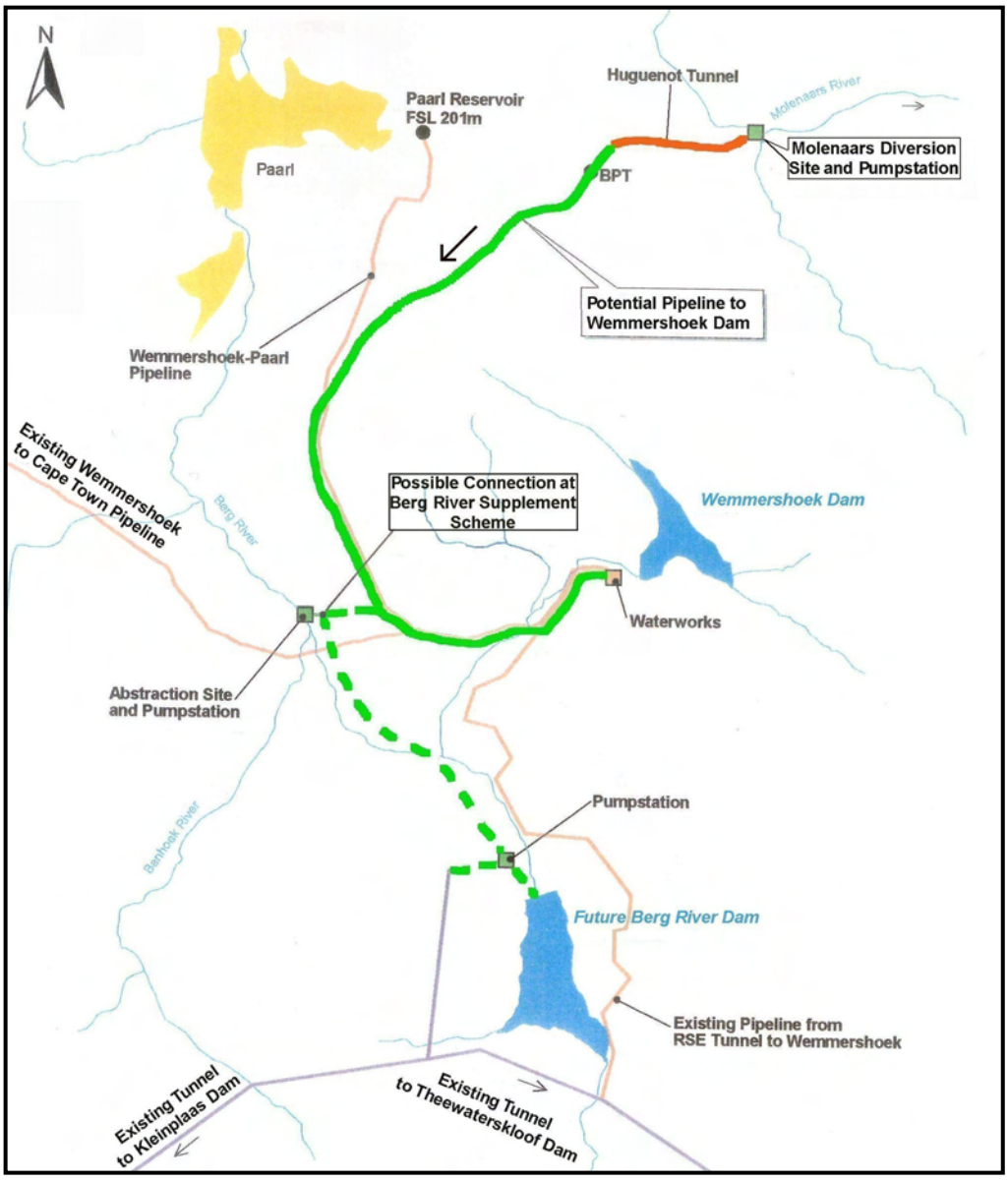


Figure 3.10.4: The Potential Upper Molenaars Diversion Transfer Scheme

3.11 ALLOCATING FUTURE DEVELOPED YIELD

Table 3.11.1 summarises the suggested scheme developments and allocations, based on the best available information. These should be viewed as interim options on which to base water resource planning until the Western Cape Reconciliation Strategy Study provides more informed strategic direction. It does not suggest that all of these schemes will necessarily be developed. As better information becomes available, these interim options will be updated, improved and revised.

Table 3.11.1: Potential Yield Development Options

Potential Yield Development	Comments	Potential Schemes - Max Yields (million m^3/a)
Scenario 1 (90 million m^3/a)	Scenario 1 assumes the recommended ecological classes with the Riviersonderend retained at its current Class "E".	*In-catchment Development* ⇨ Greater Brandvlei Augmentation (33) ⇨ Raise Buffeljags Dam (11) ⇨ Smaller schemes (16) *Transfer Schemes (1)* ⇨ Michell's Pass Diversion (53) ⇨ Molenaars Diversion (27)
Scenario 2 (115 million m^3/a)	Scenario 2 assumes a reduced ecological class for the Breede River Estuary from that recommended in the BRBS. The Riviersonderend is also retained at its current Class "E".	
Scenario 3 (140 million m^3/a)	Scenario 3 assumes a contribution to the 140 million m^3/a, of 45 million m^3/a from clearing of all invasive alien plants. The Riviersonderend is also retained at its current Class "E".	

(1) The yields of the potential transfer schemes do not take account of the mitigating measures, such as the Greater Brandvlei Augmentation Scheme, which may be required to restore the existing yield of Brandvlei Dam.

With the exception of the Buffeljags Scheme and possibly some smaller regional schemes, the other potential schemes may be mutually exclusive. The relative impacts on the yields of one another, will be investigated in the Western Cape Reconciliation Strategy Study. Furthermore, the yield development options in the Breede WMA will have to be aligned with the Berg WMA development strategies.

It should be noted that the direct effects of invasive alien plants on the potential schemes themselves would be small, as most of the schemes would divert water during the winter months when evapotranspiration by invasive alien plants is very small. On the other hand invasive alien plants will reduce summer runoff into existing dams, and remove water from the rivers. This will result in less water being available for abstraction from on-channel dams and from rivers (including the Breede River). The impact on the yields of potential schemes through the clearing of invasive alien plants will form part of the Western Cape Reconciliation Strategy Study.

In terms of developing future yield potential, one of the most important challenges facing water resource managers in the Western Cape is how to allocate future yield, developed within the region, between competing users. Irrigation expansion in the Breede River component remains

an important part of the economic growth potential, not only within the catchment but also within the Western Cape region as a whole.

In the Berg WMA, industrial and urban expansion will introduce increasing demands for water. In this regard, options for augmenting the WCWSS from within the Berg WMA are becoming scarce and ever more expensive to develop. Whilst more affordable options from within the Breede WMA have been identified, there will be significant competition for any future available water by the following three sectors:

- Urban and industrial users within the Breede River component
- Urban users within the Berg WMA (most notably the CCT)
- Irrigators within Breede River component.

The potential yields for each of the three Ecological Water Requirement scenarios could be fully utilised in the Breede River component for irrigation development alone. These same yields could equally well be fully utilised by urban water users in the Berg WMA. The key question arises as to which Ecological Water Requirement scenario will ultimately be adopted, how the potential yield should best be allocated, and which schemes might best be developed to supply such allocation. The answer cannot be prescribed at this stage and will become more apparent after the findings of the Western Cape Reconciliation Strategy study, currently being implemented by the Department, become available.

However, on the basis of information available through studies completed to date, the Department must make the best possible decisions and utilise the available information to allocate water in the short-term until the Reconciliation Strategy Study is completed. As such, a strategic approach is proposed to guide the Department in this regard. This will be revisited in subsequent ISPs using the output of the Reconciliation Strategy Study, and refined as more informed decision-making becomes possible. As a point of departure, the allocation of water from the potential yield that could be developed in the Breede River component, should be based on the following strategies:

i The provision of 17 million m^3/a for meeting the estimated increase in urban water requirements (2030) within the Breede River component will receive first priority. This will to some extent be met through the current surpluses in the Koekedouw (Ceres), Stettynskloof and Fairy Glen Dams (Worcester). It will be supplemented by groundwater schemes and/or small urban allocations which would need to be traded out of irrigation schemes unless the verification process finds some additional water. The town of De Doorns would be served out of Osplaas Dam and Robertson out of Greater Brandvlei Dam, for example.

ii The option to provide water to the WCWSS out of the Breede River catchment should not be unnecessarily compromised. In this regard the Michell's Pass (53 million m^3/a potential) and Molenaars Diversion (27 million m^3/a potential) schemes appear to be the most suitable options.

iii Irrigation expansion within the Breede River component could possibly be supported through the Brandvlei Augmentation Scheme and the possible raising of Buffeljags

Dam, or a combination of smaller schemes with suitably down-scaled versions of the two larger ones. Firstly however, the impact of the potential transfer schemes on the current and potential yield of Greater Brandvlei Dam must be investigated. A high priority will be to ensure a fair allocation of any water becoming available for in-catchment development towards improved equity, such as the establishment of resource poor farmers and job creation.

Future studies will need to take the effects of climate change into account. In the Western Cape, there is the prospect of a reduction in mean annual runoff of 10% by 2015 (as a result of global warming). The impact of this is likely to be increased drought duration, with reduced assurances of supply from schemes.

The selection of which schemes to implement and at what scale, depends on which Reserve scenario is ultimately implemented. The scheme combinations and their relative impacts on one another will be assessed for a number of Reserve scenarios in the Reconciliation Strategy Study. At present no firm decision can be made. However, it is reasonable to consider those schemes in Table 3.11.1 to be the most likely prospects for development. The potential provision of some water for transfer to the Berg WMA will not be excluded from whichever Reserve scenario may ultimately prevail.

In terms of future allocation to irrigation expansion, first priority will be towards achieving economic upliftment of those persons previously disadvantaged. DWAF recognises that much of the current water resource is in the hands of historically advantaged (white) farmers and would like to see this imbalance redressed. To this end water that is available at the present time will be allocated to resource poor farmers.

The development of additional resources will be dependent on significant use being made of that water to redress inequity. Much will depend on who funds the resource development but the opportunity must first go to the previously disadvantaged sector. The Department encourages the sharing of the water resource. Joint ventures are viewed favourably because they allow the established agricultural sector to support disadvantaged farmers with technical and management skills (and perhaps financial backing), and all parties stand to gain from the available water. The CCAW should be informed of opportunities so as to identify potential emerging farmer groups in areas where water may become available in the future.

3.11.1 Reconciliation in 2025

It should be noted that in this ISP no reconciliation of potential water requirements and availability is provided for the Breede River catchments on account of the uncertainties about the combined potential yields of the various schemes that may be required, and the potential future allocations between the WCWSS and the Breede WMA. These uncertainties should be resolved by the future Western Cape Reconciliation Strategy Study.

3.12 WATER QUALITY

3.12.1 Salinity

Surface water quality in the Breede River component is primarily affected by salinity, resulting from the diffuse return flows from irrigated farmland and from leaching of the naturally saline geology. This is most prevalent in the middle and lower reaches of the Breede River, with salinity levels progressively increasing in a downstream direction.

From the geological perspective the water generated in the sandstone areas (typically the Table Mountain Group ranges) is of a high quality with a low dissolved salt content. The quality deteriorates in the main river channel due to the impact of more saline water arising from the lowlands, where the shales and mudstones are predominant. This is further aggravated during the dry summer months when dilution is less effective and irrigation return flows predominate (as described below), with qualities resulting in adverse impacts on downstream irrigators.

Agricultural practices aggravate the extent of the salinity problem, through the wash-off of fertilisers and through the leaching of natural salts. Irrigation causes the release of natural salts much faster than would be the case under normal conditions. Of particular influence is the intentional leaching of natural salts where new lands are cleared and soils purposefully leached to prepare those lands for irrigation. This is most apparent where new land is cleared on the higher lying ground. Under these conditions the leaching of soils creates flow paths through existing lands, further exacerbating the leaching effect.

Whilst the ecology and riverine health has adapted to high levels of salinity over geological time, the current increase in levels through irrigation practices is the primary concern in terms of water quality for irrigation out of the Breede River, and in terms of the ecology of the river and estuary.

3.12.2 Managing Salinity in the Breede River Component

Salinity levels in the middle and lower reaches of the Breede River are currently managed through freshening releases (approximately 22 million m^3/a) out of Greater Brandvlei Dam. Salinity is managed as far downstream as the Zanddrift Canal off-take, just upstream of the Cogmanskloof River confluence (H30E / H40L). Although salinity levels are currently still within the target limits at the off-take, this will change should irrigation development continue. Farmers below the Zanddrift Water User Association canal off-take are already receiving water that does not comply with the prescribed limits.

Some distance downstream of the canal off-take, a degree of naturally occurring freshening takes place where the Riviersonderend and Buffeljags River tributaries enter the Breede River. This is because the water arising from those tributaries is of better quality than the water in the middle Breede River itself. To date no freshening releases into the Riviersonderend River from Theewaterskloof Dam have been considered necessary.

The Water Quality Strategy (8.3) makes recommendations regarding possible remedial measures such as the use of interceptor drains to limit the saline return flows entering the river. The demarcation of saline soils and the issuing of water use licences with conditions as to where new lands can be established, is another option. By reducing the salinity levels in the river through appropriate management, the volumes of freshening releases could potentially be reduced and the availability of water to meet other important needs improved.

Other more extreme (and costly) alternatives include the construction of high-level canal systems (totalling up to 580km), to convey water directly from Greater Brandvlei Dam to irrigators along the Breede River in the Brandvlei Government Water Scheme. Water released from the dam would not be affected by saline return flows and the river channel would no longer serve to convey water to downstream irrigators from the Government Scheme. This option would have the impact that the Breede River would become even more exposed to the effects of saline return flows, and possibly place farmers downstream of the Government Water Scheme in an even worse position than at present. Canal conveyance losses could also be significant. Other options investigated include the construction of a drainage canal to convey the saline return flows downstream, or the construction of holding dams for the later release of saline water during periods of high flow.

The BRBS concluded that salinity modelling of the more favourable options should be undertaken, taking into account the technical feasibility, environmental impacts, Reserve requirements and financial costs. In the interim, the current management of salinity through freshening releases should be continued. As previously mentioned, of practical importance is the appropriate siting of any new irrigation developments so as to best avoid exacerbating the salinity problem. This may be difficult given the need to provide water for resource poor farmers in areas where water can be made available. However, the risks of salinisation must be a critical component of all irrigation development planning.

3.12.3 Other Water Quality Concerns

In the Breede River component, point source pollution such as the discharge of inadequately treated wastewater effluent from WWTWs, and irrigation with untreated winery and other industrial effluent are further concerns. Most municipal WWTWs and larger industries are in general making the necessary effort to become compliant with the conditions of their water use authorisations. However, the cumulative effect of many smaller operators irrigating with effluent which does not meet the GA requirement, remains a concern. Whilst the practice of water re-use must be encouraged, the minimum water quality standards set through licences and GAs must be maintained. Compliance monitoring must be put in place through co-operative governance between DWAF, local authorities, and WUAs.

Diffuse pollution from poorly serviced informal settlements and the use of soak-aways on the banks of the Lower Breede River are also of concern. These concerns, and steps to remedy them, are addressed in the Water Quality Strategy (8.3).

CHAPTER 4: THE OVERBERG COMPONENT OF THE BREEDE WMA: OVERVIEW FROM A WATER RESOURCE MANAGEMENT PERSPECTIVE

4.1 INTRODUCTION

In Chapter 3, extensive reference was made to the findings of the Breede River Basin Study (BRBS), which provides a concise overview of the water resources in that area. The BRBS was even more recent than the Breede WMA Report (see next paragraph). The remainder of the Breede WMA (the Overberg) did not form part of the BRBS.

In terms of assessing water availability and requirements for the Overberg region, the figures published in Appendix D19 of the NWRS are considered the most reliable to date. These are derived from the Breede WMA Report: Overview of Water Resources Availability and Utilisation (Ref.9), hereafter referred to as the Breede WMA Report. The WMA report is one of nineteen WMA reports issued in 2003 as part of the process leading up to the publication of the first version of the NWRS, and contains additional detailed information that could not all be taken up in the NWRS itself.

In addition to the NWRS and the Breede WMA report, information on the Overberg catchments has also been sourced from the following reports:

- *Eastern Overberg Coastal Zone Water Supply* (Ref.1)
- *Western Overberg Coastal Zone Water Supply* (Ref.4)
- *Breede WMA Water Resource Situation Assessment* (Ref.5)
- *Overstrand Water Resource Investigation* (Ref.6)

The Overberg region is divided into two sub-areas in the NWRS. This division has been retained in the ISP for the purpose of describing the availability, requirements and yield balance within the Overberg. The two sub-areas shown on Figure 4.1 are:

- The ***Overberg West*** sub-area; includes the coastal catchments extending from the Palmiet River in the west to the Uilkraals River in the east. This area has been defined as secondary catchment G40.
- The ***Overberg East*** sub-area; includes the catchments of the Sout, Kars and Nuwejaars Rivers in one secondary catchment, namely G50.

In the extreme west, the Palmiet River, rises in the Hottentots Holland Mountains (G40C), flows through the fertile and intensely irrigated Elgin basin (G40C and D), the pristine Kogelberg State Forest area (G40D) and into the sea via the Palmiet estuary.

The Bot River initially flows through well developed agricultural land (G40E). The land surrounding the eastern reaches (G40F) has not been developed on account of the geology and the low surface water runoff. The river flows into the Bot River Lagoon (G40G).

The Onrus River (G40H) supports some irrigation and supplies water to the Greater Hermanus area out of De Bos Dam. The river consists of just one quaternary catchment and enters the sea via the Onrus Lagoon.

Rising in the rolling hills of the Ruensveld (G40J and K) to the north of the coastal mountain range is Klein River. It flows into a valley that cuts through the mountain range and enters the Kleinriviers Vlei to the east of Hermanus (G40L).

The Uilkraals River (G40M), recently dammed by Kraaibosch Dam, consists of one quaternary catchment only.

The Nuwejaars River catchment (G50B and C) has very low runoff. The river joins the relatively saline Kars River (G50D and E) and enters the sea as the Heuningnesvlei River between Struisbaai and Arniston (G50F).

The Sout River drains the eastern Ruensveld (G50G and H) into the De Hoopvlei (De Hoop Nature Reserve). This is an "endoeric" river (it has no outlet to the sea) and as its name suggests is highly saline (geological causes).

Figure 4.1: The Overberg Component of the Breede WMA *(ref: The Breede WMA Report)*

4.2 REGIONAL WATER SUPPLY SCHEMES IN THE OVERBERG

4.2.1 The Palmiet River Government Water Scheme

The Palmiet River Government Water Scheme transfers water from the Palmiet River in the Breede WMA (G40D) to the Berg WMA for use by the CCT. The scheme is a dual purpose water transfer and hydro-electric pumped storage scheme.

The hydro-electric components comprise the Kogelberg Dam on the Palmiet River, the power station and waterways, and the upper reservoir, known as Rockview Dam. The two dams each have a capacity of 17 million m^3. During periods of the week when there is a low demand for electricity, and when there is sufficient water in the Palmiet River (over and above the ecological water requirements), river water may be pumped from Kogelberg Dam to Rockview Dam for transfer into the Upper Steenbras Dam in the Berg WMA. From there water is released through the Steenbras Hydro-electric Power Station to a pipeline conveying it to the Faure Water Treatment Plant and to CCT consumers. Although the average quantity currently transferred is 22,5 million m^3/a, there are possibilities for a further scheme to increase the yield, should the need arise. The size of any additional scheme will depend on the ecological Reserve requirement of the Palmiet River and its estuary.

4.2.2 The Overberg Rural Water Supply Schemes

The Overberg catchments are served by two rural water supply schemes, operated by the Overberg Water Board. These schemes provide water for domestic use to about 60% of the rural population in the Overberg as well as drinking water for livestock. The schemes also supplement the supply to the towns of Caledon (G40F), Waenhuiskrans (Arniston-G50J) and Bredasdorp (G50E). Settlements at Protem and Klipdale are also dependent on the schemes. These schemes are:

- the *Ruensveld East Rural Water Supply Scheme* abstracts water from the Riviersonderend River by means of a pumpstation situated midway between the towns of Riviersonderend and Swellendam. This water is treated close to the abstraction point. The main feeder pipeline extends in a southerly direction to Bredasdorp, and further on to near Waenhuiskrans (Arniston). With branch pipelines, the scheme covers an area of some 1 750 km^2. It supplies about 65% of the rural population in its supply area, as well as providing drinking water for livestock. The scheme has a capacity of 0,85 million m^3/a, with demand and supply approximating 0,73 million m^3/a in 1995. In addition to the towns of Bredasdorp and Arniston, the settlements of Protem and Klipdale also receive water from this scheme.

- the *Ruensveld West Rural Water Supply Scheme* abstracts water from the Riviersonderend River approximately two kilometres downstream of Theewaterskloof Dam. The water is treated adjacent to the abstraction point. From there a gravity main supplies treated water to the town of Caledon (supplementing the town's groundwater source) and to farms between Caledon and Riviersonderend. Water is also piped from another reservoir near Caledon in a south-westerly direction to farms in the vicinity of Napier. All along the gravity main,

branch lines radiate to the boundaries of the scheme to supply individual farms. In addition to the town of Caledon, water is provided for domestic use, livestock, and to 370 farms. The capacity of the scheme is approximately 2,4 million m^3/a, with about 30% of the requirement being for livestock. In 1995 the scheme supplied approximately 1,7 million m^3/a.

4.3 LOCAL URBAN WATER SUPPLY SCHEMES IN THE OVERBERG

With the exception of some domestic water supplied through the Ruensveld East and Ruensveld West schemes, local surface and groundwater supply schemes meet all the urban requirements in the Overberg region. The urban and rural domestic water requirements constitute 12% and 5% respectively of the total current water requirements in the Overberg. With the exception of peak-season shortages (predominantly due to limited infrastructure capacity), there is sufficient water available to meet the current requirements of the urban sector. However the town of Grabouw is rapidly expanding.

Augmentation of existing urban supply schemes may be required in the future, particularly in Grabouw and in the coastal towns, where demand is still growing. All local authorities must undertake and implement more efficient water use (WC/DM, water re-use, lei-water exchange, etc) so as to make best possible use of their existing resources, before consideration is given to the development of new schemes.

Groundwater should be seriously considered for any supplementary urban water supply schemes. Desalination is another option for coastal towns. The details of current and future supply schemes to towns within the Overberg are addressed under the Supply to Local Authorities Strategy (12.1).

The only dam in the Overberg primarily supplying water to urban users in the region is the De Bos Dam. This is owned by the Overstrand Municipality, has a capacity of 6,3 million m^3 and supplies domestic water to the Greater Hermanus area. Compensation releases of approximately 0,5 million m^3/a take place to supply irrigators downstream of the dam.

Dams primarily supplying irrigation but from which some urban water requirements are supplied are described in Section 4.4.

4.4 IRRIGATION SUPPLY IN THE OVERBERG

In the Overberg, irrigation water requirements account for 77% (64 million m^3/a) of the total in-catchment water requirement. There are only two irrigation boards in the Overberg and neither has been transformed into WUA. These are the Groenland Irrigation Board in the Palmiet River catchment (G40B-D) and the Houtveld Irrigation Board in the Bot River catchment (G40E-G). Of the 11 400 ha of irrigated land in the Overberg, 11 300ha lies within the Overberg West sub-area (ref: Breede WMA Report) and 7 600 ha of that within the intensively irrigated Palmiet River catchment alone (ref: Breede WMA Water Resource Situation Assessment Report).

The larger dams in the Overberg primarily supplying irrigators include:

- *Nuweberg Dam* on the Palmiet River is owned by the Nuweberg Dam Syndicate. The dam has a capacity of 3,9 million m^3 and supplies irrigators in the syndicate.
- *Eikenhof Dam* on the Palmiet River, the spillway of which was raised in 1998 to provide a capacity of 29 million m^3. The dam is owned by the Groenland Irrigation Board and primarily supplies water for irrigation. The town of Grabouw receives approximately 0,5 million m^3/a from this dam.
- *Appelthwaite Dam*, also on the Palmiet River is owned by Elgin Orchards. It has a capacity of 3,5 million m^3 and supplies irrigation requirements only.
- *Arieskraal Dam* on the Palmiet River is owned by Arieskraal Farm. The dam supplies water for irrigation and has a capacity of 4,4 million m^3/a.
- *Grootvlei Dam* on the Palmiet River has capacity of 1,6 million m^3 and is owned by Elgin Orchards.
- *Kraaibosch Dam* on the Uilkraals River supplies water for irrigation and the town of Gansbaai.

4.5 WATER AVAILABILITY IN THE OVERBERG

The natural Mean Annual Runoff (MAR) and the preliminary ecological component of the Reserve are shown in Table 4.5.1. It is important to note that the preliminary ecological water requirements (EWRs) are based on desktop level estimates and do not take the estuarine requirements into account.

Table 4.5.1: Mean Annual Runoff and Preliminary Ecological Water Requirements (million m^3/a)

Resource Category	Overberg West	Overberg East	Total
Natural MAR (1)	480	110	**590**
Preliminary Ecological Water Requirement (1)	94	13	**107**
Impact of the Preliminary Ecological Water Requirement on Yield (Incremental)	2	0	**2**

1) Quantities are incremental.

Table 4.5.2: Water Availability in the Overberg (million m^3/a, Year 2000)

Resource Category	Overberg West	Overberg East	Total
Gross Surface Water Resource	121	3	**124**
Less Impact on Yield of			
Preliminary Ecological Reserve	2	0	**2**
Invasive Alien Plants	31	2	**33**
River Losses	0	0	**0**
Net Surface Water Resource	**88**	**1**	**89**
Groundwater	3	1	**4**
Return Flows	8	0	**8**
Total Local Yield	**99**	**2**	**101**
Transfers In	2(1)	2(1)	**4**
TOTAL	**101**	**4**	**105**

1) Transfers in from Riviersonderend River in the Breede River component via the Ruensveld Schemes.

The gross surface water resource in the Overberg is estimated to be 124 million m^3/a, of which 98% (121 million m^3/a) lies in the Overberg West sub-area. In the Palmiet catchment alone, the 1 in 50 year yield from the five larger dams (46 million m^3/a) and forty-seven other registered smaller dams (19 million m^3/a) is approximately 65 million m^3/a.

Groundwater partially supplies a number of towns on the Overberg West catchments, and in the remainder of the Overberg it is mainly utilised for rural, domestic and stockwatering supply. Return flows mainly arise from the catchments of the Palmiet and Bot Rivers in the Overberg West sub-area.

After allowing for the impact of the preliminary Ecological Water Requirements, and the impact of invasive alien plants, the resulting available surface water in the Overberg is approximately 89 million m^3/a (1 in 50 year assurance of supply).

4.5.1 Uncertainties Affecting Water Availability Estimates

In estimating water availability, the main uncertainty with regard to the availability of water is the Ecological Water Requirement associated with the Reserve. The preliminary estimates totalled for the rivers are shown in Tables 4.5.1 and 4.5.2. These are based on desktop estimates. A desktop methodology has not yet been developed to estimate estuarine Reserve requirements, so this remains an important information gap. Invasive alien plant clearing is one option through which water can be made available towards meeting Reserve requirements in the Overberg catchments, with the very large impact of invasive alien plants offering a potential large release with successful clearing.

4.6 WATER REQUIREMENTS IN THE OVERBERG

Table 4.6.1: Water Requirements in the Overberg (million m^3/a, Year 2000)

Category	Overberg West	Overberg East	Total
Irrigation	64	0	64
Urban (1)	8	2	10
Rural	2	2	4
Impact of Afforestation on yield	5	0	5
Total Requirements	**79**	**4**	**83**
Transfers Out	23(2)	0	23
TOTAL	**102**	**4**	**106**

1) Includes component of Reserve for basic human needs at 25 ℓ/c/d.
2) Comprising the average annual transfer of 22,5 million m^3/a to the Berg WMA via the Palmiet Pumped Storage Scheme.

At an equivalent 1 in 50 year assurance of supply, the estimated 11 400 ha of irrigated land utilises approximately 77% of the total local water requirement in the Overberg. The irrigation requirement is essentially all within the Overberg West – less than 0,5 million m^3/a irrigation requirement (approximately 100 ha) lies within the Overberg East.

The impact on yield of forestry in the western Overberg is 5 million m^3/a from approximately 4500 ha of which 3300 ha lie within the Palmiet catchment. Much of this forestry is scheduled for clearing.

No changes are proposed to the water requirement estimates. These are based on the latest available estimates as published in the First Edition of the NWRS.

4.6.1 Uncertainties Affecting Water Requirement Estimates

In estimating water requirements in the Overberg, the following uncertainties have been identified:

Unexercised Irrigation Allocations

The irrigation water requirement estimates are based on actual allocations and not on actual current water use. The RO has provided the following estimates of the extent of allocated but unexercised allocations in the Overberg West sub-area:

- In the Palmiet catchment (G40B-D)
  - 5% summer allocations out of Eikenhof Dam
  - 20% winter allocations out of Eikenhof Dam

In the Uilkraals River catchment (G40M) a 40% increase in summer allocations out of Kraaibosch Dam, through the progressive implementation of agricultural development is anticipated.

Climate Change

As discussed in Chapter 3 increasing temperatures are likely to cause an increase in irrigation water requirements, and this should be allowed for when developing future water requirement scenarios.

Changes in Land-use

The decommissioning of commercial forestry will result in areas of State owned land becoming available for alternative land-use purposes in the Overberg West sub-area. This will be the case primarily in the Palmiet and adjacent Bot River catchments. Once cleared, existing areas of SAFCOL plantations have been earmarked for the establishment of resource poor farmers. The initial impact of any clearing is likely to be less water use, with some increased runoff. Future land-use such as irrigated agriculture may introduce new demands. Access to water where resource poor farmers may potentially be established on this land will be necessary. Soil suitability is an important criteria informing decisions as to where irrigated agriculture would be best developed. Refer also to the Changing Land-Use: Forestry Strategy (9.5).

The priority areas for clearing of invasive plants in the Overberg should be linked to the need to protect the estuaries. The highest priority lies within the Overberg East and in particular within the catchments of the Kars River (G50D) and Nuwejaars River (G50B-C). Here clearing could generate increased freshening flows into the Heuningnes Estuary, which is of particularly high ecological importance. Bio-control has proven particularly effective against *Acacia longifolia*, a common invader species in coastal lowlands, typical of the Overberg. As such there is opportunity to effectively implement bio-control in this region. The impact of invasive alien plants in the Overberg is extreme. 25% of the gross surface water resource in the western Overberg and 66% of the gross surface water resource in the eastern Overberg is lost to invasive alien plants.

The clearing of Invasive Alien Plants Strategy (9.6) discusses this in more detail.

The Impact of Implementing WC/DM

Estimates of future urban and irrigation water requirements in the Overberg do not make allowance for water savings that will be achieved through WC/DM. Future water resource planning will need to take this into account. Urban and Agricultural WC/DM are addressed under the Water Conservation and Demand Strategies in Section 10.

4.7 RECONCILIATION OF REQUIREMENTS AND AVAILABILITY IN THE OVERBERG

Table 4.7.1 provides a reconciliation of the water requirement with the available resource for the Year 2000.

Table 4.7.1: Reconciliation of Water Requirements and Availability in the Overberg (million m^3/a, Year 2000)

Description		ISP SUB-AREAS		Total
		Overberg West	Overberg East	
Available Water	Local Yield	99	2	101
	Transfers In	2	2	4
	Total	**101**	**4**	**105**
Water Requirements	Local Requirements	79	4	83
	Transfers Out	23	0	23
	Total	**102**	**4**	**106**
Balance		**-1**	**0**	**-1**

The Overberg is essentially in balance with water availability and water requirements of equal magnitude.

4.7.1 Water to Resource Poor Farmers

Based on information available from the RO, the establishment of resource poor farmers in the Overberg is centred around small groups in Caledon and Bredasdorp only. Crops cultivated by these farmers include wheat, canola, and vegetables and are primarily dryland. The extent of formally irrigated land is assumed to be very small. Based on the Year 2000 yield balance, there is no surplus yield available from existing resources for further irrigation expansion of any kind. Where new applications to develop either groundwater or storage are forthcoming, those applications supporting resource poor farmer development will be given preference.

Opportunity will present itself for establishing resource poor farmers in the Palmiet catchment on land that is to be cleared of existing forestry plantations (SAFCOL), utilising the water that becomes available by the clearing of the plantations and invasive alien plants. Not all of the land will be available or suitable for establishing irrigated agriculture. Re-establishing indigenous vegetation will occur on large tracks of land, and these should be located in those areas least suitable for irrigated commercial farming. Soil potential and access to water will need to be investigated, and viable areas for irrigated agriculture identified. Joint venture partnerships with existing commercial farmers, provides an option for establishing and supporting resource poor farmers. Through joint venture arrangements, skills transfer and technical support from existing commercial farmers is at hand. Alternatively State funded programs are another option via the CCAW.

In the higher rainfall regions of the Western Overberg (Palmiet and Bot River catchments), a potentially very viable opportunity for resource poor farmers is the farming of indigenous plants, which can be grown under natural conditions in these wet catchments.

4.8 FUTURE WATER REQUIREMENT SCENARIOS

Estimates of future water requirements in the Overberg are based on the Year 2025 scenarios used for input to the NWRS.

4.8.1 The Year 2025 Base Scenario

Within the spectrum of population and economic growth scenarios, a ***base scenario*** was selected for estimating the most likely future water requirements in the Overberg. This is built on the high scenario of population growth and more equitable distribution of wealth leading in time to higher average levels of water services.

For the base scenario the increase in projected water requirements for the Overberg is small, comprising a small increase in urban water requirements only, with a slight decrease in rural water requirements. This equates to an overall increase in the water requirement of less than 4% (3 million m^3/a). When reconciling water requirements with availability for this scenario, the Overberg would have a shortfall of 2 million m^3/a (see Table 4.8.1).

4.8.2 The Year 2025 High Scenario

A possible ***high scenario*** of future water requirements, is also given, based on the assumption of high population growth and high standard of services (socio-economic development); together with a strong increase in the economic requirements for water, where the public and business use of water would increase in direct proportion to the gross domestic product. It assumes no general increase in irrigation requirements from those in 2000 and no adjustments have been made to reflect the impacts of increased water use efficiency.

For the high scenario the projected water requirements for the Overberg for 2025 of 125 million m^3/a would result in a shortfall of 15 million m^3/a (see Table 4.8.1), when reconciled with water availability.

Table 4.8.1: Reconciliation of Water Requirements and Availability for the 2025 Scenarios (million m^3/a)

Description		2025 BASE SCENARIO			2025 HIGH SCENARIO		
		Overberg West	Overberg East	Total	Overberg West	Overberg East	Total
Available Water	Local Yield	100	3	**103**	103	3	106
	Transfers In	2	2	**4**	2	2	4
	Total	**102**	**5**	**107**	**105**	**5**	**110**
Water Requirements	Local Requirements	83	3	**86**	95	7	102
	Transfers Out	23	0	**23**	23	0	23
	Total	**106**	**3**	**109**	**118**	**7**	**125**
Balance		**-4**	**2**	**-2**	**-13**	**-2**	**-15**

4.9 RECONCILIATION INTERVENTIONS

4.9.1 Water Re-use

The current urban water requirement (10 million m^3/a) represents only 12% of the total local water requirement in the Overberg (83 million m^3/a). Nevertheless, the use of treated effluent from WWTWs offers potential for re-use, particularly in the larger towns. Exchange with nearby irrigation users is one option, as is the irrigation of local sports fields and parks. Water re-use is further addressed under the Water Services WC/DM Strategy (10.1).

4.9.2 Water Conservation and Demand Management (WC/DM)

Urban Sector

The opportunity to use water more efficiently in the urban sector offers local authorities a cost effective means of taking full advantage of their available water resources. In contrast to the situation in the adjacent Breede River component, certain local authorities in the Overberg have already made significant strides in this direction. Hermanus (Overstrand Municipality) for example, has received international acclaim for its successful implementation of a WC/DM strategy. Water use was reduced by 20% in one year. Ongoing efforts at Caledon to use water more efficiently are also recognised. Following suit have been the towns of Bredasdorp, Arniston (Waenhuiskraans), Kleinmond and Betty's Bay, all of which have a strategy in place for WC/DM. The effort made at these Overberg towns is recognised, encouraged and should serve as an example to other towns of what can be achieved.

DWAF can achieve a great deal by promoting the principles of WC/DM and lending technical support to those local authorities that are most in need. WC/DM is an intervention that the Department not only encourages but also sees as a prerequisite for the licensing of any new schemes by local authorities. Realistic WC/DM targets need to be identified in the WSDPs of

local authorities and progress needs to be closely monitored to establish its implementation success. According to national estimates provided in the draft WC/DM Strategy for the Water Services Sector, potential savings of as much as 40% can be realised in urban areas through the implementation of WC/DM measures.

Urban WC/DM is further addressed under the WC/DM: Water Services Strategy (10.1).

Agricultural Sector

In the absence of large conveyance systems (pipelines and canals) in the Overberg and limited irrigation development (outside of the Palmiet catchment), there is little opportunity to use water more efficiently in the irrigation sector. The most intensive irrigation takes place in the Palmiet River catchment where efficient irrigation systems are already in place.

4.9.3 Exploiting Groundwater Resources

The estimate of current developed groundwater yield (i.e. yield from boreholes currently in place), as quoted in the NWRS, is only about 4 million m^3/a for the entire Overberg. Yields from the TMG hold further potential for supply to the coastal towns such as Hermanus, and a recently installed borehole has provided good yield.

Regional groundwater studies undertaken in the Overberg indicate that groundwater is a cost effective option for development in the coastal and selected inland zones. In the Overberg East sub-area in particular, surface water schemes would be generally be more expensive to develop, due to the large distances over which water would need to be conveyed. Groundwater schemes would be more affordable although the quality could be problematic. In some parts of the Overberg, particularly where the Bokkeveld Shales occur, groundwater quality is poor (in some areas unfit for use). In the sandstone to the south, the groundwater quality is generally good.

Where the Bokkeveld shales overlay the TMG in the eastern Overberg, the feasibility of using TMG resources at depth needs to be explored. An alternative is to desalinate the saline groundwater abstracted out of shallower aquifers. The groundwater resource of the Potberg (TMG outcrop, 20 km west of Witsand) is underdeveloped and should be considered for potentially meeting seasonal shortages at Witsand and other coastal resorts in that area.

4.9.4 Clearing of Invasive Alien Plants

An estimated 172 000 ha of the Overberg catchment land area has been invaded by invasive alien plant species. This is most severe between Hermanus (G40H) and the Breede River mouth (H70K). Estimates in the NWRS indicate that the net impact on the 1 in 50 year yield in the Overberg is 33 million m^3/a. Of this some 31 million m^3/a lies within the Overberg West, despite the fact that more than 60% (109 000 ha) of the total infestation occurs in the Overberg East. This is due to the fact that the higher rainfall areas (notably occurring in the west) are far more significantly impacted than the drier regions. During a 1 in 50 year drought, the rivers in the drier regions will have virtually zero flow in them, regardless of whether there is riparian alien

infestation present or not. Consequently from a water resource perspective the highest priority for removing invasive alien plants lies in the Overberg West catchments. Clearing in the catchments of the Nuwejaars and Kars Rivers (Overberg East) could provide for increased freshening flows into the ecologically important Heuningnes Estuary at De Mond.

4.10 DEVELOPMENT OF NEW SURFACE WATER SUPPLY SCHEMES

4.10.1 Developing Yield for In-catchment Use

In view of the relatively small growth anticipated in future urban water requirements, WC/DM is the first step that must be implemented by local authorities. Outside of the Palmiet River catchment (Overberg West) there is little opportunity to further develop surface water yield for high assurance urban water use in the Overberg. Groundwater currently plays an important role in supplying urban water users and will continue to do so in the future.

It is not anticipated that there will be any significant expansion of irrigated agriculture as the available surface water resource is fully allocated. However in the Palmiet catchment there are unexercised allocations from Eikenhof Dam and Arieskraal Dam. Despite this some farmers have expressed intention to develop more cost effective storage on their farms as an alternative to the use of these dams. The RO has indicated that one farmer has a 4,5million m^3/a allocation from Eikenhof Dam that has yet to be exercised. Applications to develop cheaper storage as an alternative to the use of existing but unexercised allocations should not be authorised. Efficient use must first be made of existing available water.

Abstraction of surplus winter water to off-channel storage remains an option that can be considered from certain rivers in the Overberg. This could support limited irrigation expansion. The Klein River (Overberg West) and Nuwejaars River (Overberg East) are possibilities.

4.10.2 Further Development of Palmiet River Yield

The Palmiet River offers the only potential for any further significant development of the surface water resource in the Overberg. Currently 22,5 million m^3/a is transferred to the CCT and yield estimates suggest that based on current preliminary Ecological Water Requirements, a further 25 million m^3/a could potentially be developed in the Palmiet River by constructing a dam near the Upper Campanula Site. The extent of the potential will ultimately be defined by the Ecological Water Requirements for the riverine Reserve. It is of interest to note that the determining factor in terms of the Ecological Water Requirement is likely to be the requirement of the lower Palmiet River and not of the estuary. Although not undertaken to Reserve-type principles, estuary flow requirement work to date suggests that the estuary currently receives more than sufficient water to maintain it in its existing condition. This will need to be confirmed once the estuarine Reserve is determined.

4.10.3 Allocating Potential Yield From the Palmiet River

A decision will need to taken as to how potential yield developed in the Palmiet River catchment might be allocated (should it be developed).

The Allocation and Licensing Strategy (9.3) addresses some possible options which include:

- Augmenting the supply to the WCWSS (as suggested in 4.10.2);
- Provision of water to meet the growing needs of urban users in the Grabouw area;
- Supply to the coastal resort towns of the Overberg West;
- Irrigation supply to in-catchment development with high priority to resource poor farmers (potential to establish them on cleared forestry plantations);
- Some combination of the above.

4.11 WATER QUALITY

4.11.1 Salinity

The rolling hills of the Overberg consist of Bokkeveld shales and the geology has a strong effect on water quality. Whilst the water quality in most of the head waters of these rivers is good, it deteriorates when it reaches the river channels due to mixing with saline water draining from the shales occurring in the lower lying ground. In the Overberg East region there is insufficient water quality monitoring to assess the situation in any detail. The only monitoring station is at De Hoop Vlei, where salinity is high (>3400mg/*l*) and the water is classified as unacceptable for domestic or irrigation use. This can in all likelihood be attributed to naturally occurring high salinity in all the coastal rivers of the eastern Overberg. As a result poor water quality places constraints on crop selection, particularly in the east. The Monitoring Networks and Data Capture Strategy (15.2) addresses the monitoring requirements in the WMA.

The Water Quality Strategy (8.3) discusses the management of salinity in more detail, concluding that in the Overberg catchments no specific interventions be taken to address it. The riverine ecology has adapted to this situation over time. No further irrigation expansion of any significance is likely to take place, with the possible exception of some development in the Palmiet catchment, in which water quality is very good.

4.11.2 Managing Point Source Pollution

Through co-operative governance with local authorities, other pertinent water quality issues in the Overberg need to be addressed. The Water Quality Strategy (8.3) elaborates on these, the most important of which are briefly summarised as follows:

- Poorly managed and overloaded WWTWs pose a risk of discharging sub-standard effluent, particularly during peak season (Onrus being a typical example);
- Solid waste disposal sites (SWDSs) in some towns are poorly managed;
- Significant volumes of fruit waste are generated in the Grabouw area;

- Diffuse pollution from urban areas. At Grabouw, for example, the Klip River tributary of the Palmiet River receives spills from the raw sewage reticulation system servicing the RDP housing development, as well as from industrial point discharges.

CHAPTER 5: SUMMARY OF REVISED INPUTS TO THE NATIONAL WATER RESOURCE STRATEGY

In Chapter 3 (Breede River component of the Breede WMA), a number of changes were adopted for the Year 2000 water availability, water requirements and yield water balance figures, compared with those figures appearing in the First Edition of the NWRS. These changes arose primarily as a result of more updated information becoming available through the recently completed Breede River Basin Study (BRBS), which was also based on a Year 2000 level of development. The main differences between the recommended figures in this ISP and those of the First Edition of the NWRS are explained hereafter.

No changes were recommended to the Overberg component of the Breede WMA, and the water availability, water requirements and yield water balance figures remain unchanged from those appearing in the First Edition of the NWRS.

For convenience in updating the NWRS, Section 5.4 provides a summary of the water resource information for the whole Breede WMA, presented in the same format as that currently used in the NWRS.

5.1 PROPOSED CHANGES TO WATER AVAILABILITY ESTIMATES IN THE BREEDE RIVER COMPONENT OF THE BREEDE WMA

The main changes proposed to the water availability estimates in the First Edition of the NWRS are shown in Tables 5.1.2 and 5.1.3, and are briefly described below:

Surface Water Resource

The yield from major dams determined through the BRBS is 443 million m^3/a, a more detailed assessment and therefore more reliable than the 419 million m^3/a used in the NWRS. The BRBS further assumes that the available yield from farms dams and run-of-river is in balance with the irrigation requirement outside of the controlled irrigation schemes. Taking these changes into account equates to a total surface water resource of 749 million m^3/a, as opposed to the 684 million m^3/a of the NWRS.

Invasive Alien Plants

The impact on yield of invasive alien plants in the Breede River component was modelled using advanced simulation and modelling techniques during the BRBS. Although the condensed areas of infestation and the natural MARs compare reasonably well with those of the NWRS, the BRBS determined an overall impact of 45 million m^3/a as opposed to the desktop level estimate of 24 million m^3/a of the NWRS. The BRBS result is considered to be of greater confidence.

River Channel Losses

The 20 million m^3/a provided for losses in the Upper Breede by the NWRS is considered to be an overestimate. There is a strong interaction between the river channel and the alluvium. A mass balance was conducted during the Breede River Hydrosalinity Modelling project (Ninham Shand 1992). For the reach of river between Greater Brandvlei Dam and the Cogmanskloof confluence,

the lateral inflow into the river and the flow out of the river were found to be close to being in balance. A net loss from the Upper Breede sub-area of 5 million m^3/a is considered to be more reasonable.

Water Transfers

In terms of transfers, the major discrepancy between the NWRS and the BRBS is in the transfer of water into the Lower Breede sub-area from the Upper Breede sub-area. This has been estimated in the BRBS to be 14 million m^3/a and not 33 million m^3/a as per the NWRS. Table 5.1.1 shows the comparative figures out of each information source and is followed by an explanation.

Table 5.1.1: Transfers Into the Lower Breede Sub-area (million m^3/a, Year 2000)

Transfer In	ISP	NWRS
From Upper Breede	10	24
From Riviersonderend	3	8
From Gouritz WMA	1	1
TOTAL	**14**	**33**

The NWRS assumes that all of the freshening releases made out of Greater Brandvlei Dam become available in the Lower Breede sub-area. However this is not the case. The BRBS indicates an average annual freshening release of 22 million m^3/a, of which approximately 12 million m^3/a is abstracted opportunistically in the Upper Breede sub-area, downstream of the lowest salinity control point on the river. As such only the remaining 10 million m^3/a therefore becomes available in the Lower Breede sub-area.

The BRBS also estimates that the surplus water flowing from the Riviersonderend sub-area into the Lower Breede sub-area is only 3 million m^3/a and not as much as 8 million m^3/a. This volume represents inefficiencies in the releases from Theewaterskloof Dam during summer, and is considered to be relatively small. The Agricultural WC/DM Strategy (10.2) addresses the timing of releases from dams as a potential water saving.

Table 5.1.2: Mean Annual Runoff and Preliminary Ecological Water Requirements in the Breede River Component of the Breede WMA (million m^3/a)

Resource Category	Upper Breede		Riviersonderend		Lower Breede		Total	
	ISP	*NWRS*	ISP	*NWRS*	ISP	*NWRS*	ISP	*NWRS*
Natural MAR (1)	1092	*1212*	439	*460*	272	*210*	1803	*1882*
Preliminary Ecological Water Requirement (1)	612	*178*	170	*65*	193	*34*	975	*277*
Impact of Preliminary Ecological Water Requirement on Yield (Incremental)	16	*12*	0	*30*	0	*0*	16	*42*

1) Quantities given are incremental

Table 5.1.3: Water Availability in the Breede River Component of the Breede WMA (million m^3/a, Year 2000)

Resource Category	Upper Breede		Riviersonderend		Lower Breede		Total	
	ISP	*NWRS*	**ISP**	*NWRS*	**ISP**	*NWRS*	**ISP**	*NWRS*
Gross Surface Water Resource	428	*386*	262	*267*	59	*31*	749	*684*
Less Impact on Yield of:								
Preliminary Ecological Reserve	16	*12*	0	*30*	0	*0*	16	*42*
Invasive Alien Plants	25	*6*	13	*17*	7	*1*	45	*24*
River Losses	5	*20*	0	*0*	0	*0*	5	*20*
Net Surface Water Resource	**382**	***348***	**249**	***220***	**52**	***30***	**683**	***598***
Plus Groundwater	94	*97*	5	*4*	4	*4*	103	*105*
Plus Return Flows	85	*56*	10	*2*	7	*2*	102	*60*
Total Local Yield	**561**	***501***	**264**	***226***	**63**	***36***	**888**	***763***
Transfers In [(1)]	0	*0*	0	*0*	14[(2)]	*33*	1	*1*
TOTAL	**561**	***501***	**264**	***226***	**77**	***69***	**889**	***764***

1) Transfers into and out of sub-areas may include transfers between sub-areas as well as transfers between WMAs. Addition of the transfers per sub-area therefore does not necessarily correspond to the total transfers into and out of the WMA.
2) Made up as follows: **10** million m^3/a from the Upper Breede sub-area, approximately **3** million m^3/a from the Riviersonderend sub-area and about **1** million m^3/a inter-basin transfer from the Gouritz WMA.

5.2 PROPOSED CHANGES TO WATER REQUIREMENT ESTIMATES IN THE BREEDE RIVER COMPONENT OF THE BREEDE WMA

The main changes proposed to the water requirement estimates in the First Edition of the NWRS are shown in Table 5.2.1 and described below:

Irrigation Water Requirements

The BRBS investigated the extent of actual irrigation water use in the Breede River component, making use of aerial photography and reconciling this against actual water use figures available through the various government controlled schemes and WUAs. The requirement of 658 million m^3/a is at an equivalent 1 in 50 year assurance of supply. It is important to note that within the Breede River component there is very little allocated water that is not being used. Estimates from the RO suggest that less than 5% (summer abstraction) of allocated water on some government schemes may as yet not have been taken up.

Transfers Out of Upper Breede

Refer to Section 5.1, which describes the transfers into the Lower Breede sub-area out of the Upper Breede sub-area.

Table 5.2.1: Water Requirements in the Breede River Component of the Breede WMA (million m^3/a, Year 2000)

Resource Category	Upper Breede		Riviersonderend		Lower Breede		Total	
	ISP	*NWRS*	**ISP**	*NWRS*	**ISP**	*NWRS*	**ISP**	*NWRS*
Irrigation	495	*435*	91	*49*	72	*28*	658	*512*
Urban [(1)]	23	*26*	2	*1*	1	*2*	26	*29*
Rural	4	*4*	2	*2*	1	*1*	7	*7*
Impact on Yield of Afforestation	0	*0*	1	*1*	0	*0*	1	*1*
Total Requirements	**522**	***465***	**96**	***53***	**74**	***31***	**692**	***549***
Transfers Out [(2)]	22[(3)]	*35*	168[(4)]	*174*	0	*0*	177[(5)]	*177*
TOTAL	**544**	***500***	**264**	***227***	**74**	***31***	**869**	***726***

1) Includes component of Reserve for basic human needs at 25 l/c/d.
2) Transfers into and out of sub-areas may include transfers between sub-areas as well as transfers between WMAs. Addition of the transfers per sub-area therefore does not necessarily correspond to the total transfers into and out of the WMA.
3) Made up as follows: **4** million m^3/a IBT to Berg WMA via Artois Canal, plus **5** million m^3/a IBT from "Gawie-se-water" to Berg WMA, plus **2,5** million m^3/a IBT to Olifants/Doorn WMA (via the Inverdoorn Canal), plus **10** million m^3/a surplus water from freshening releases.
4) Made up as follows: **161** million m^3/a from Theewaterskloof to Berg WMA, plus **0,6** million m^3/a to Franschhoek (Berg WMA), plus **4** million m^3/a to Overberg, plus **2,5** million m^3/a to Lower Breede.
5) Made up as follows: **161** million m^3/a IBT from Theewaterskloof to Berg WMA, plus **4** million m^3/a IBT to Berg WMA via Artois Canal, plus **5** million m^3/a IBT from "Gawie-se-water" to Berg WMA, plus **0,6** million m^3/a IBT to Franschhoek, plus **2,5** million m^3/a IBT to Olifants/Doorn WMA (Inverdoorn Canal), plus **4** million m^3/a to Overberg region.

5.3 RECONCILIATION OF REQUIREMENTS AND AVAILABILITY IN THE BREEDE RIVER COMPONENT OF THE BREEDE WMA

A reconciliation of the proposed Year 2000 water availability and water requirement figures in the Breede River component of the Breede WMA, is given in Table 5.3.1.

Table 5.3.1: Reconciliation of Water Requirements and Availability in the Breede River Component of the Breede WMA (million m^3/a, Year 2000)

Description		Upper Breede		Riviersonderend		Lower Breede		Total	
		ISP	*NWRS*	**ISP**	*NWRS*	**ISP**	*NWRS*	**ISP**	*NWRS*
Available Water	Local Yield	561	*501*	264	*226*	63	*36*	**888**	***763***
	Transfers In	0	*0*	0	*0*	14 [(1)]	*33*	**1[(1)]**	***1***
	Total	**561**	***501***	**264**	***226***	**77**	***69***	**889**	***764***
Water Requirements	Local Requirements	522	*465*	96	*53*	74	*31*	**692**	***549***
	Transfers Out	22	*35*	168	*174*	0	*0*	**177**	***177***
	Total	**544**	***500***	**264**	***227***	**74**	***31***	**869**	***726***
Balance		**17**	***1***	**0**	***(1)***	**3**	***38***	**20**	***38***

1) Transfers into the Lower Breede sub-area include transfers between sub-areas as well as the IBT from the Gouritz WMA. The net transfer into the Breede River component being the IBT from the Gouritz WMA (0,7 million m^3/a).

This ISP concludes that the net effect of the proposed changes to the water availability and water requirement estimates is that the current surplus in the Breede River component of this WMA is 20 million m^3/a. This is considered more reliable than the NWRS estimate of 38 million m^3/a and the former will be adopted for interim strategic water resource planning purposes, updated and revised as more reliable information becomes available.

5.4 A SUMMARY OF THE WATER RESOURCE FIGURES FOR THE BREEDE WMA AS PER THE FORMAT USED IN THE NWRS

The following summary tables of the recommended revised inputs to the NWRS provide a quick reference for updating the NWRS tables for the Breede WMA as a whole. This information is drawn entirely from Chapters 3 and 4 of this ISP and no new information is presented here. Tables 5.4.1 to 5.4.4 are presented in the same format as those currently used in the NWRS, for convenience when updating the NWRS.

For completeness all water resource figures are shown, not only those requiring change.

Table 5.4.1: Natural Mean Annual Runoff and Ecological Reserve (million m^3/a)

Sub-area	Natural MAR (1)	Ecological Water Requirement (1)
Upper Breede	1092	612
Riviersonderend	439	170
Lower Breede	272	193
Overberg East	110	13
Overberg West	480	94
Total	**2393**	**1082**

1) Quantities given are incremental.

Table 5.4.2: Available Water in Year 2000 (million m^3/a)

Sub-area	Natural Resource		Useable Return Flow		Total local Yield (1)	Transfers In	Grand Total
	Surface water	Ground-water	Irrigation	Urban			
Upper Breede	382	94	74	11	**561**	0	**561**
Riviersonderend	249	5	9	1	**264**	0	**264**
Lower Breede	52	4	7	0	**63**	14	**77**
Overberg East	1	1	0	0	**2**	2	**4**
Overberg West	88	3	6	2	**99**	2	**101**
Total	**772**	**107**	**96**	**14**	**989**	**1**	**990**

1) After allowance for the impacts on yield of: ecological component of the Reserve, river losses, invasive alien vegetation, rain-fed agriculture (excluding forestry), and urban runoff.

Table 5.4.3: Year 2000 Water Requirements (million m^3/a)

Sub-area	Irrigation	Urban (1)	Rural (1)	Affore-station (2)	Total Local Requirements	Transfers Out	Grand Total
Upper Breede	495	23	4	0	**522**	22	**544**
Riviersonderend	91	2	2	1	**96**	168	**264**
Lower Breede	72	1	1	0	**74**	0	**74**
Overberg East	0	2	2	0	**4**	0	**4**
Overberg West	64	8	2	5	**79**	23	**102**
Total	**722**	**36**	**11**	**6**	**775**	**196** (3)	**971**

1) Includes component of Reserve for basic human need at 25l/c/d.
2) Quantities given refer to impact on yield only.
3) Transfers into and out of sub-areas may include transfers between sub-areas as well as transfers between WMAs. Addition of transfers per sub-area therefore does not necessarily correspond to the total transfers into and out of the WMA.

Table 5.4.4: Reconciliation of Requirements and Available Water for the Year 2000 (million m^3/a)

Sub-area	Available Water			Water Requirements			Balance (1)
	Local Yield	Transfers In (2)	Total	Local Require-ments	Transfers Out (2)	Total	
Upper Breede	561	0	561	522	**22**	544	**17**
Riviersonderend	264	0	264	96	**168**	264	**0**
Lower Breede	63	14	77	74	**0**	74	**3**
Overberg East	2	2	4	4	**0**	4	**0**
Overberg West	99	2	101	79	**23**	102	**(1)**
Total	**989**	**1**	**990**	**775**	**196**	**971**	**19**

1) Brackets around numbers indicate negative balance.
2) Transfers into and out of sub-areas may include transfers between sub-areas as well as transfers between WMAs. Addition of the transfers per sub-area therefore does not necessarily correspond to the total transfers into and out of the WMA.

No reconciliation is provided for the Year 2025 on account of the uncertainties about the yields of potential additional schemes, and the allocation of such yield between the Breede and Berg WMAs. These uncertainties should be clarified by the Western Cape Reconciliation Strategy Study.

CHAPTER 6: INTRODUCTION TO THE STRATEGIES

Strategies to address issues and concerns in the Breede WMA are presented in Chapters 7 to 16. Whilst the overview of water resources in this WMA has been at the regional scale, the Regional Office (RO) bases its day-to-day management of the WMA on smaller incremental management units, and strategies often need to take this into account.

In certain of the strategies that follow, reference is made to eight sub-areas within the Breede River component and six sub-areas within the Overberg. These smaller management units are shown on Figures 6.1 and 6.2.

Ten themes have been used in which to develop the strategies in Chapters 7 to 16 of this ISP. These are:

- Water Balance and Reconciliation (Chapter 7)
- Water Resource Protection (Chapter 8)
- Water Use Management (Chapter 9)
- Water Conservation and Demand Management (Chapter 10)
- Integration and Co-operative Governance (Chapter 11)
- Institutional Development and Support (Chapter 12)
- Social (Chapter 13)
- Waterworks Development and Support (Chapter 14)
- Monitoring and Information (Chapter 15)
- ISP Implementation (Chapter 16)

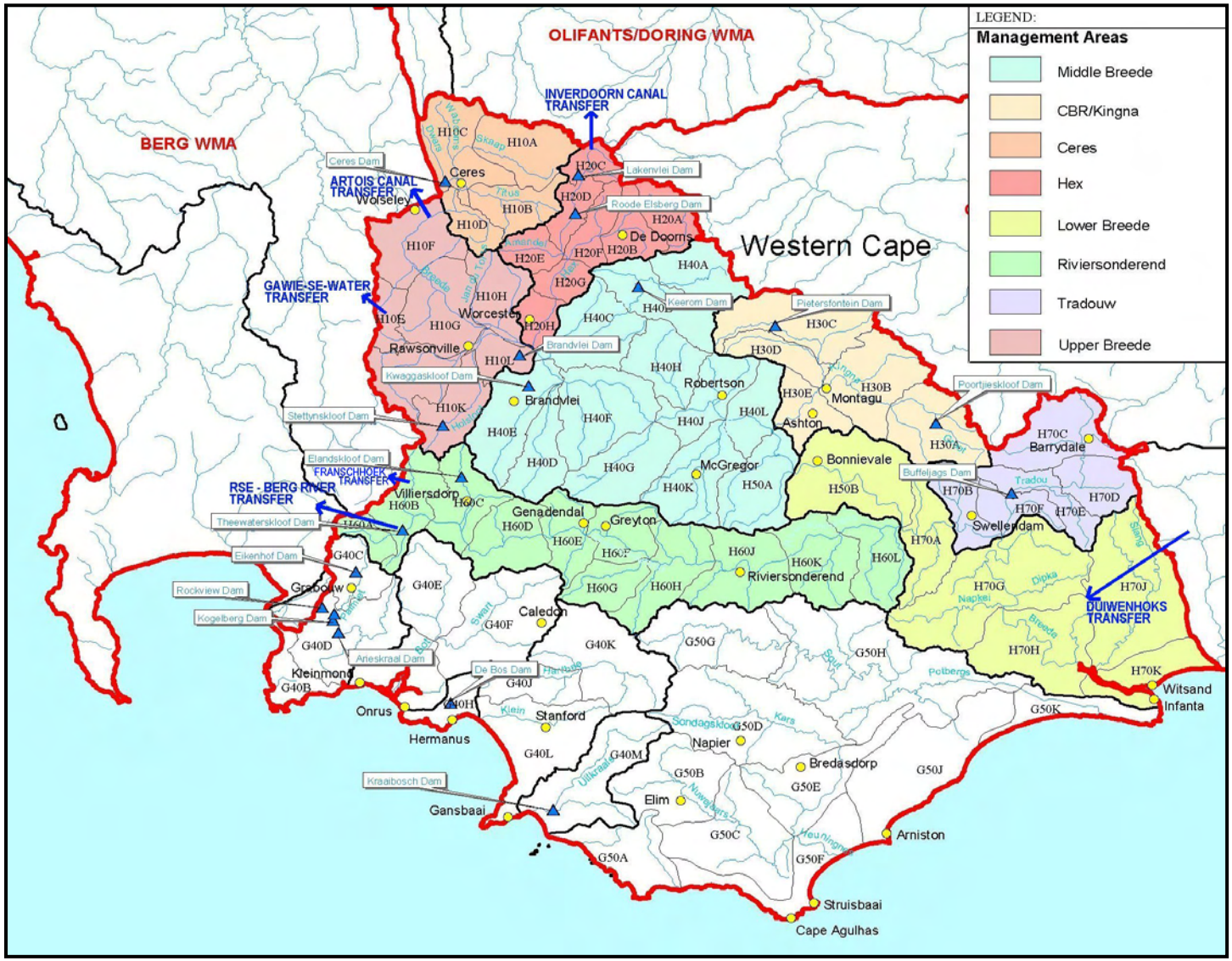


Figure 6.1: Water Resource Management Units within the Breede River Component

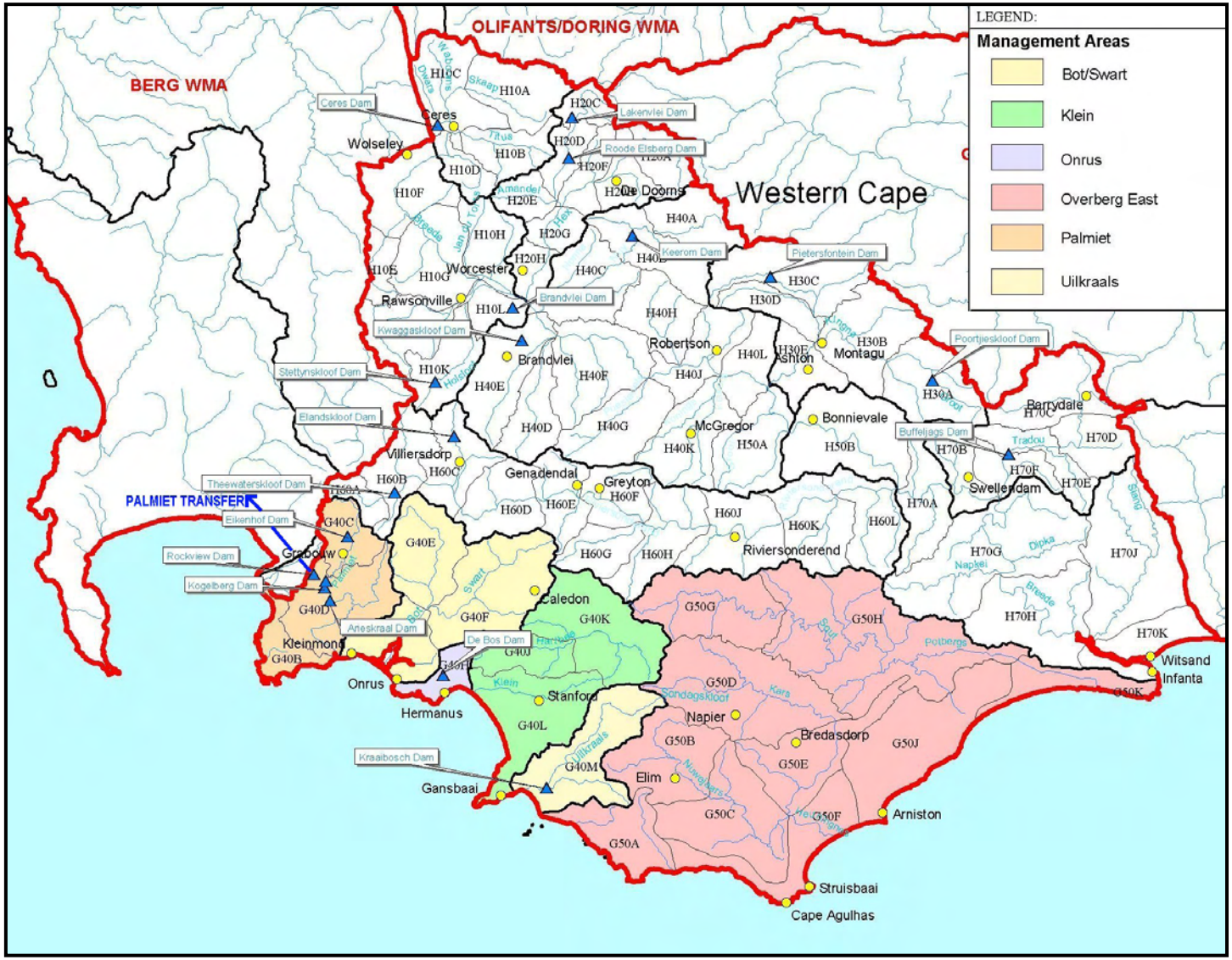


Figure 6.2: Water Resource Management Units within the Overberg Region

CHAPTER 7: WATER BALANCE AND RECONCILIATION STRATEGIES

Four strategies have been identified for development, namely:

7.1 Water Availability
7.2 Water Requirements
7.3 Reconciliation of Water Supply and Demand
7.4 Groundwater Utilisation

7.1 WATER AVAILABILITY STRATEGY

Management Objective

This strategy addresses the knowledge, assumptions and unknowns about the current and future availability of water in the WMA. This is an important component of determining reliable yield balance estimates on which to manage the WMA's water resource.

Situation Assessment

(a) Current Situation

In this first version of the ISP, estimates of water availability in the Breede River component of the WMA are based on the findings of the Breede River Basin Study (BRBS), which is the latest available source of information for that area. In the Overberg catchments, the NWRS figures, derived from DWAF's Breede WMA Report, represent the best available information. These two sub-regions are analysed independently in chapters 3 and 4, whilst availability for the whole WMA is presented here.

The extent to which the surface water resource can be exploited is affected by how much water has to remain in the aquatic ecosystems (the Reserve). A grand total of 990 million m^3/a is estimated to be available in the Breede WMA, after allowing for the 18 million m^3/a impact on yield of the preliminary Reserve (16 million m^3/a in the Breede River component and 2 million m^3/a in the Overberg). The impact of the Reserve is based on the current ecological classes of the rivers and the estuary. The impact on yield of invasive alien plants totalling 78 million m^3/a has also been allowed for (45 million m^3/a in the Breede River component and 33 million m^3/a in the Overberg).

(b) Future Yield Potential

Referring to Table 3.9.1, between 90 and 140 million m^3/a of surface water yield can be cost effectively developed in the Breede River component, depending on the Reserve scenario considered. The Michell's Pass Diversion (maximum yield of 53 million m^3/a) and Upper Molenaars Diversion (maximum yield of 27 million m^3/a) schemes appear to be the most suitable options for water transfer to the Berg WMA and especially the CCT. Greater Brandvlei Dam Augmentation (maximum yield of 33 million m^3/a) and raising Buffeljags Dam (11 million m^3/a) appear to be the most viable schemes for in-catchment development. In the Overberg it may be possible to develop an additional 25 million m^3/a in the Palmiet River, through constructing a dam at the Upper Campanula site.

The BRBS has shown a significantly higher impact of invasive alien plants (45 million m^3/a) on water availability in the Breede River component than previously estimated in the NWRS. Removal of invasive alien plants to "free-up" this 45 million m^3/a available would be required in order to realise the 140 million m^3/a potential of Reserve Scenario 3, shown in Table 3.9.1.

Decisions regarding the ecological classes are fundamental to meaningful determinations of water availability from surface resources. For example, if the Riviersonderend River were to be rehabilitated from its current Class "E" to the recommended Class "D", this would equate to an average annual impact on yield of 85 million m^3/a in the Riviersonderend sub-area. Much of this would need to be met out of releases from the already fully allocated yield in Theewaterskloof Dam, and this impact would have to be recovered elsewhere.

Groundwater use must take its rightful place as an increased future source of supply. Groundwater offers potential for increased utilisation throughout the WMA, with the exception of most of the Ceres sub-area, and a cautionary approach to be adopted in the Hex River catchment, where extensive groundwater use (20 million m^3/a) may impact on surface water supplies. Through the BRBS it was estimated that there is in excess of 300 million m^3/a of potentially available groundwater yield. Some of this (particularly if abstracted in close proximity to streams and rivers) would have a direct interaction with surface water flow and can be considered as the same resource. Access to remote drilling sites, borehole depths required to reach the resource, and the number of boreholes required to abstract large volumes of groundwater, all play a role in the feasibility of groundwater abstraction. Despite these challenges, groundwater offers a viable option for development. Should it be practical to develop 30% of this resource (considered reasonable by groundwater specialists), the resulting additional yield would exceed 100 million m^3/a within the Breede River component. Achieving the maximum out of groundwater will require

monitoring to improve estimates of utilisation potential, determination of groundwater Reserve requirements, understanding the interdependence between the surface and groundwater resource, and optimisation of opportunities for conjunctive water use.

There are other sources of water such as re-use (treated effluent use), return flows and desalination of poor quality surface and groundwater, about which adequate knowledge is essential in order to enable meaningful availability estimates to be made.

Rain gauge data (reliability, record length and spatial distribution) in the high rainfall mountainous areas poses a particular concern in terms of accurate hydrological modelling. Surface flow gauging is reasonable but will need to be improved as pressure on resources increases and ever tighter management is required.

It has been estimated that by 2015, the impact of global warming is likely to reduce streamflow in the Western Cape by 10%. This in turn will impact on the assurance of supply from water supply schemes.

Specific issues and concerns relating to the reliability of the hydrology have been identified:

- The rainfall gauging network is inadequate for accurate modelling purposes, particularly in the high rainfall regions from which much of the runoff in the Breede River catchments is generated.
- A number of long-term rain gauges have been closed.
- The interaction between surface water and groundwater is not well understood and is of particular importance in understanding the recharge of the alluvial aquifers from which much of the current groundwater abstraction in the Breede River component takes place.
- The impact of climate change on the surface and groundwater resource will need to be taken into account in the analysis of future yield determinations.
- A better understanding of the role of snowmelt in recharge would also improve resource analysis.
- In the Breede WMA land-use changes such as the removal of invasive alien plants and reduced commercial forestry will also impact on the availability of water. Refer to the Forestry Strategy (9.5) and the Removal of Invasive Alien Plants Strategy (9.6).

Strategic Approach

The methodology used to determine the impact of invasive alien plants in the Breede River component should be extended to cover all catchments of the WMA in which the removal of invasive alien plants is a priority.

The Department will continue to implement efforts to better understand the long-term effect of climate change on rainfall and on hydrology. Additional rain gauging stations in targeted high rainfall areas will be established to enable data collection in support of more reliable rainfall:runoff catchment modelling. Also the dynamics of aquifer recharge and the associated impacts of climate change need to be considered in future water resource planning.

The future availability of additional water from the Breede River component will be based on the assumptions that:

- The recommendations of targeted areas for invasive alien plant removal (Strategy 9.6) will be implemented.
- Until decisions on the ecological classes of the rivers are finalised, the Reserve and Resource Quality Objectives Strategy (8.1) recommends that the water resources be managed according to their current classes (status quo).

Management Actions

The following actions are required:

- ⇨ Address the diminishing rainfall gauging network to avoid loss of valuable input data for reliable rainfall:runoff modelling. The Region should continue to indicate needs and propose improvements to the network, along with an implementation plan.
- ⇨ Establish additional rain stations in the high rainfall areas of the Breede River component and the Palmiet River catchment.

- ⇨ Identify required improvements to flow gauging throughout the WMA. List and implement these on an ongoing basis.
- ⇨ Update the hydrology at regular intervals, bringing added knowledge of the impacts of climate change and snowmelt.
- ⇨ Research the interaction between surface water and groundwater, with particular emphasis on the dynamics between the TMG and the alluvial aquifers.
- ⇨ Implement the methodology used in the BRBS for re-determining the impact on yield of invasive alien plants in the rest of the WMA.
- ⇨ Until otherwise determined, manage the water resources according to their current ecological classes.

Responsibility and Priority

The implementation of the **Water Availability Strategy** is the responsibility of the RO, in consultation with the Directorate: NWRP. It is of **Priority 2** (high) due to its relevance to the water resource planning for the Western Cape as a whole.

7.2 WATER REQUIREMENTS STRATEGY

Management Objective

This strategy addresses the knowledge of, and uncertainties about assumptions relating to the current and future water requirements in the Breede WMA. The objective is to improve on our knowledge and understanding of the requirements which in turn will improve on the reliability of the yield balance.

Situation Assessment

In this first version of the ISP, estimates of current water requirements for the Breede River component are based on the findings of the BRBS, which is the latest available source of information for that area. In the Overberg catchments, the NWRS figures represent the best available information.

The current total water requirement from within the Breede WMA is estimated at 971 million m^3/a, of which 196 million m^3/a is transferred out of the WMA. Of the total in-catchment water requirement (775 million m^3/a), 93% is for local irrigation, most of which is within the Breede River component. Extensive irrigation also takes place in the Overberg West (64 million m^3/a), most of which is in the Palmiet River catchment.

From checks done in the Hex sub-area, registered irrigation requirements (WARMS) compared well with the actual water requirements determined independently in the BRBS. There is therefore a degree of confidence in the registered water use within government controlled schemes and WUAs. It is important to note that the water requirements presented in Chapter 3 (the Breede River component) are based on estimates of actual water use (BRBS). In contrast, the water requirements in the Overberg (from the NWRS) are based on allocations, some of which may not have as yet been exercised. The Western Cape Regional Office (DWAF) has indicated that there does not appear to be much water "tied-up" in unexercised allocations in the Breede WMA. There are a few exceptions. These are 4,5 million m^3/a allocated to (and paid for), but unused by irrigators in the Groenland Irrigation Board, out of the privately owned Eikenhof Dam (Palmiet River), and 14 million m^3/a surplus in the Stettynskloof and Fairy Glen Dams at Worcester (Breede Valley Municipality).

Limited growth in water requirements is anticipated in the Overberg and local supply schemes will suffice in meeting these. In the Breede River component, the potential future water requirements could well exceed the potential surface water availability of between 90 and 140 million m^3/a (depending on the Reserve scenario). All this water could be used for in-catchment development alone. The same is true in terms of the future requirements by the CCT. However, not all potential yield developed in the Breede River component would be accessible for transfer purposes. A logical sharing of this future potential is recommended.

DWAF is in the process of commissioning a Reconciliation Strategy Study for the Western Cape. This will consider the possibility of transfer of more water from the Breede WMA. Once this study has been undertaken, more detailed feasibility studies will be commissioned to evaluate comparisons between potential sources of supply in the Berg WMA and those in other areas such as the Breede WMA. Only then will final decisions be possible.

Ever increasing temperatures (global warming) will have an impact on water requirements in the Western Cape and should be taken into account when developing hydrological system models, to assess the impacts of future water requirement scenarios.

Strategic Approach

Best use will be made of the latest water requirement information as this becomes available. This has been undertaken in this ISP by drawing on the key findings of the BRBS. In so doing the required input to the NWRS, as tabled in Chapter 5 of this ISP will be continually improved and used in supporting management decisions in this WMA. The approach is to continually improve knowledge of requirements and to make use of this improved information. Allowance must be made for climate change and the impact thereof on water requirements.

Registration of water use has been captured on DWAF's Water Authorisation and Registration Management System (WARMS) and the sources identified from which these requirements must be supplied. The only way that the requirement can then change is through issuing of a licence(s) and that will also be known information. Allocations for future irrigation requirements are therefore in the hands of the licensing authority (now DWAF). Issuing

irrigation licences is a re-active process and the rate of requests can also be estimated and planned for. Urban future use on the other hand will depend on demographics and economics and must be estimated and monitored for forward planning.

The BRBS provides an improved assessment of water requirements in the Breede River component of this WMA. Through the ISP these must be taken into account in the development of a detailed strategy for improving the reliability of the current and future water requirements in the Breede WMA, as part of the Western Cape Reconciliation Strategy Study to be undertaken by the Department.

Management Actions

The following general actions are required:

- ⇨ Update the requirements at regular intervals using best available information.
- ⇨ Make allowance for increased water requirements as a direct result of climate change.
- ⇨ Keep a watchful eye on water use trends through monitoring and ensure that all observations are brought to the attention of the resource planners.
- ⇨ Improve the sophistication of input data for future requirement estimates by incorporating elements such as population, standard of living (as reflected in individual water use), economic activity, etc.

Responsibility and Priority

The implementation of the Reliability of the Water Requirements Strategy is the responsibility of the RO, in consultation with the Directorate: NWRP. It is of **Priority 2** (high) due to its relevance to the water resource planning for the Western Cape as a whole.

7.3 RECONCILIATION OF WATER SUPPLY AND DEMAND STRATEGY

Management Objective

To match the water requirements in the Breede WMA with adequate supply in such a way that growth is not unreasonably constrained nor the environment and long-term future of the WMA in any way compromised. From the broader regional perspective any proposed future expansion of commercial irrigation in the Breede WMA should be weighed up against the potential transfer of more water from the Breede WMA to urban users in the Berg WMA.

Situation Assessment

There is currently a small surplus of 20 million m^3/a is available in the Breede River component and a 1 million m^3/a shortfall in the Overberg. It must be remembered that these yield balance estimates are based on the current ecological classes and corresponding preliminary Reserve estimates. Of the surplus in the Breede River component, 3 million m^3/a is available in Koekedouw Dam (Ceres), 14 million m^3/a in the Stettynskloof and Fairy Glen Dams (Worcester) and 3 million m^3/a in Buffeljags Dam. The Allocation and Licensing Strategy (9.3) makes recommendations on the allocation of this available surplus.

Reconciliation interventions to be implemented within the Breede WMA are listed below. The relevant strategies within this ISP are also referred to by number in parenthesis:

- Water re-use (10.1),
- WC/DM - leakage control, abstraction control (monitoring), urban and industrial savings, conveyance losses in the irrigation sector (10.1 and 10.2),
- Step-wise water pricing to reduce water demand (10.1 and 10.2),
- The increased utilisation of groundwater - notably from the alluvial and TMG Aquifers (7.4),
- Licensing (9.3) and the Verification of Existing Lawful Use (9.2) which includes the prosecution of any unlawful users and return of this water to the common pool,
- Water Trading (9.3),
- Removal of invasive alien plants (9.6),
- Water quality management - improved salinity management and reduced freshening releases (8.3),
- Compulsory licensing - a drastic measure to reduce existing allocations, the need for which will ultimately be determined by the Reserve requirement and perhaps to a lesser extent the provision of water to the resource poor (9.4). At this stage compulsory licensing has a low priority in this WMA.
- The construction of new water resource infrastructure and development of schemes.

Strategic Approach

To support decisions on allocating water in the next 10 years, the options presented in Table 3.11.1 will be investigated. The needs of the CCT and the need for continuing development in the Breede WMA (particularly the requirements of equity through supply to resource poor farmers) will be considered. Development opportunities are suggested to provide water towards both of these needs.

With the Overberg being in balance and a surplus in the Breede River component, the current situation is such that there is not much reconciliation to be done at all. However the future development within the Breede WMA and the Western Cape as a whole, will introduce new challenges in terms of sharing the Breede WMAs water between in-catchment development and urban water use in the Berg WMA.

Taking the needs of the Berg WMA into account and the fact that further irrigation development in the Breede WMA is economically viable, the various augmentation options must be considered for phased implementation with immediate effect. Options must be evaluated sooner rather than later due the time frames of such studies which can take five years or more to complete. Groundwater must take its rightful place and conjunctive use of surface and groundwater investigated in parallel with surface water resources.

The immediate focus should lie with the implementation of WC/DM (see Strategies 10.1 & 10.2), ongoing clearing of invasive alien plants (Strategy 9.6), water pricing, and water trading (Strategy 9.3). The Reconciliation Strategy Study for the Western Cape Water Supply System (WCWSS) to be undertaken in 2004/2005 should thereafter be updated on a regular basis as research and information inputs become available.

Within the Breede River component, the following scheme options and interventions form the basis of the suggested options for this WMA (refer to Allocation and Licensing Strategy - 9.3);

(a) Potential Transfer Schemes (80 million m^3/a)

- Michell's Pass diversion (maximum yield of 53 million m^3/a)
- Upper Molenaars diversion (maximum yield of 27 million m^3/a)

(b) In-catchment Development (60 million m^3/a)

- Brandvlei augmentation (maximum yield of 33 million m^3/a)
- Raise Buffeljags Dam (11 million m^3/a)
- Smaller schemes (16 million m^3/a)

The Reconciliation Strategy Study will provide more informed direction regarding possible combinations of schemes, their impacts on one another and at what scale they could be implemented. This will be considered for a range of possible Reserve implementation scenarios.

Within the Overberg it is estimated that a further 25 million m^3/a could be developed out of the Palmiet River via a new dam at the Upper Campanula site, whilst still meeting preliminary Ecological Water Requirements. Storage could be provided (for the option of transfer) through raising the Lower Steenbras Dam (Berg WMA).

It is not expected that all of these options will and must be developed during the next 10 years. The key principle is that the resource will be shared between transfers to the Berg WMA and in-catchment development. The proposed schemes are presented as the most immediately appropriate opportunities for investigation. Significant additional volumes of groundwater could also be developed, particularly from within the deeper TMG source.

Management Actions

The following actions are required:

- ⇨ Undertake the WCWSS Reconciliation Strategy with a well-structured participation process,
- ⇨ Update the WCWSS Reconciliation Strategy at approximately 2 yearly intervals as new information becomes available from studies and from monitoring,
- ⇨ Develop a policy on the re-use of treated wastewater,
- ⇨ Formulate scenarios for reconciling future supplies and demands,
- ⇨ Carry on with implementation of effective WC/DM measures,
- ⇨ Prioritise studies required to reduce uncertainties (as listed in this ISP), as well as to improve cost estimates and yield figures for specific development options,
- ⇨ Review the impact of invasive alien plants in the Overberg catchments (with priority to the western Overberg) in line with the methodology adopted for the Breede River component during the BRBS.
- ⇨ The further development of the Brandvlei Augmentation Scheme must be discussed with the CCAW and determined when it will be required, who will benefit from it and who will finance it.

Responsibility and Priority

The development and implementation of a **Reconciliation of Water Supply and Demand Strategy** is the responsibility of the Directorate: NWRP together with the Regional Office (RO) and the Directorate Options Analysis. This is of **Priority 2** - High. Immediate implementation is necessary to enable future schemes to be timeously planned with confidence.

7.4 GROUNDWATER UTILISATION STRATEGY

Management Objective

The objective of this strategy is to promote the conjunctive development of groundwater and surface water resources in an Integrated Water Resources Management (IWRM) framework within the Breede WMA. This requires considerable additional reliance on groundwater supplies. The strategy also addresses the uncertainties, assumptions and critical gaps in the hydrogeological database. Central to this objective is the development of a better understanding of groundwater - surface water interaction, which by its nature defines part of the groundwater Reserve.

A further objective is the need to develop operating rules for groundwater abstraction that meet legal requirements, and which are regularly adjusted as suggested by monitoring.

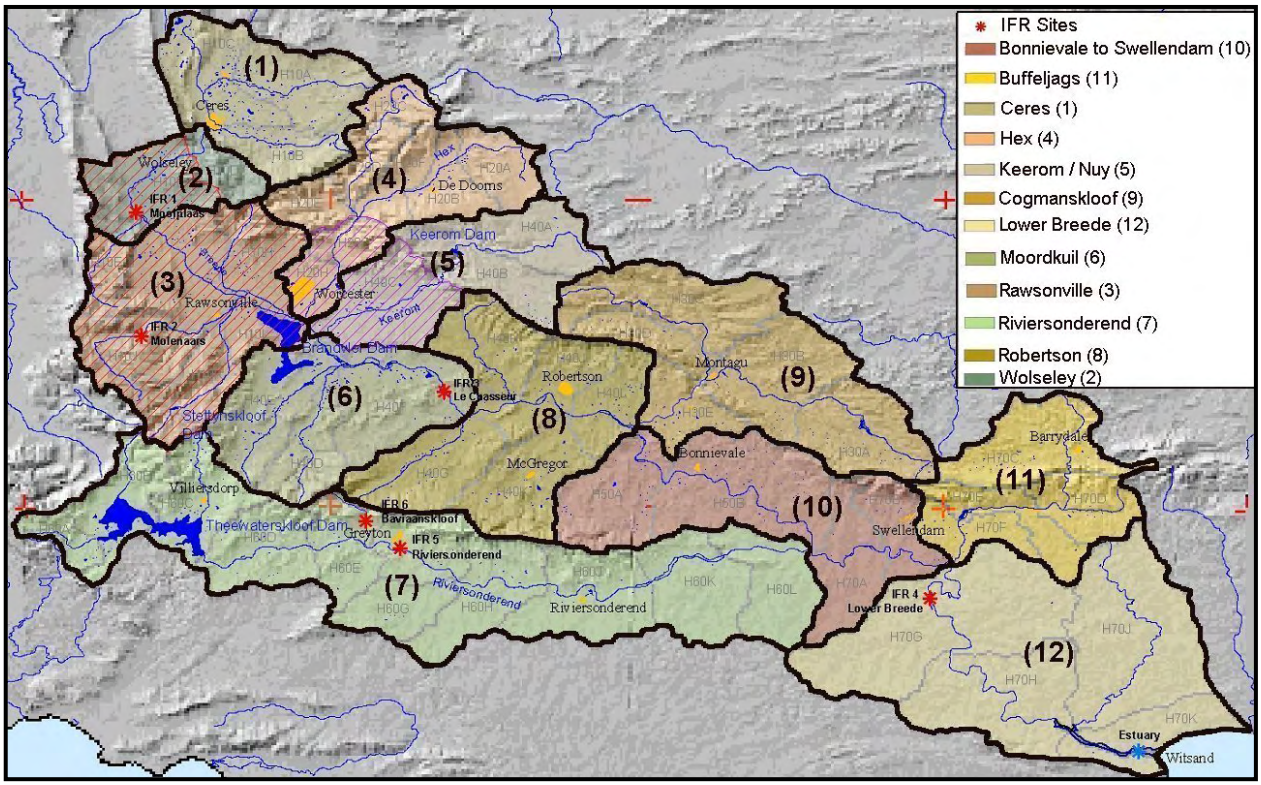
Situation Assessment

Current groundwater use in the Breede WMA is estimated to be 107 million m^3/a of which 103 million m^3/a takes place in the Breede River catchments, most of which supplies irrigation from farmers' boreholes. About 4 million m^3/a is used in the Overberg catchments for domestic and stock-watering purposes. The BRBS estimates that after allowing for groundwater contribution to baseflow, and taking recharge potential into account, there remains a theoretical sustainable abstraction potential in excess of 300 million m^3/a. This is over and above current groundwater use. Table 7.4.1 provides a breakdown of current groundwater use and the remaining theoretical potential within twelve sub-areas in the Breede River catchments. The geographical extent of these sub-area is shown on Figure 7.4.1.

Table 7.4.1: Current Groundwater Use and Potential (million m^3/a)

Area	Quaternary Catchments	Registered Groundwater Use	Remaining Sustainable Potential	Aquifer
Ceres	H10A-C	18	0	TMG and Bokkeveld
Wolseley	H10D, F	7	5	Aluvium and Malmesbury
Rawsonville	H10E, H-L	25	61	Aluvium and Malmesbury
Hex	H20A-H	20	25	TMG and Bokkeveld
Keerom/Nuy	H40A-C	3	23	TMG, Bokkeveld and Malmesbury
Moordkuil	H40D-F	7	3	TMG and Bokkeveld
Robertson	H40G-L	4	29	Bokkeveld and Malmesbury
Cogmanskloof	H30A-E	14	18	TMG and Bokkeveld
Bonnievale to Swellendam	H50A-B, H70A-B	1	2	TMG and Bokkeveld
Buffeljags	H70C-F	2	5	TMG and Bokkeveld
Riviersonderend	H60A-L	2	121	TMG and Bokkeveld
Lower Breede	H70G-J	0	25	Bokkeveld
TOTAL		**103**	**317**	

(Ref : BRBS, Groundwater Reserve Determination Report)



(Ref : BRBS, Groundwater Reserve Determination Report)

Figure 7.4.1: Sub-areas for which Groundwater Potential was assessed in the BRBS

Referring to Table 7.4.1, there are three main sources of groundwater in the Breede River catchments, namely :

(i) The alluvial sources, with very strong and direct surface water interaction.
(ii) The fractured rock aquifers (Bokkeveld and Malmesbury) with a lesser spatial interaction.
(iii) The Table Mountain Group Aquifers, some of which are deep and confined.

Abstraction out of the alluvial aquifers is considered to be equivalent to surface water use. There is a complex recharge dynamic within the alluvium involving recharge out of the TMG Aquifer and from surface water. As such, site specific monitoring of the impacts of abstraction out of the alluvium must form an important component of any further development of that resource.

The CCT is currently investigating sites in the catchment of Theewaterskloof Dam (Riviersonderend) for possible augmentation of the City's water supply. The TMG Aquifer in the Riviersonderend area holds significant potential for development.

It is important to refer to the constraints associated with groundwater abstraction from deep aquifers, like the TMG. These are described in Section 3.9.5, of Chapter 3.

Specific concerns in terms of groundwater utilisation include:

(i) over allocation of groundwater in the H10A-C quaternaries of the Ceres catchment;
(ii) the salinisation of underlying aquifers that discharge into the Breede River (possible impact of irrigation return flows);
(iii) the impact of untreated agricultural effluent (discharged or used for irrigation) on the alluvial aquifer and on the rivers. The interaction between the alluvium and the rivers in the Middle Breede catchment may be resulting in cross contamination;
(iv) saline intrusion of primary coastal aquifers (sea water intrusion due to poor management/over-abstraction);
(v) limited groundwater Reserve determinations have been undertaken - notably none in the Overberg;
(vi) limited groundwater monitoring;

(vii) there is limited understanding of the interaction between surface water and groundwater;
(viii) the only documentation related to baseflow contribution in this WMA is found in the Groundwater Resources of the Republic of South Africa maps and in the BRBS;
(ix) potential wasted groundwater arising from artesian boreholes as a result of these not being capped;
(x) monitoring of groundwater levels is based on individual borehole monitoring, whilst more advanced and available technology (radar for example) has not yet been investigated, for possible implementation.

Strategic Approach

Groundwater is an exceptional resource and extremely important in the Breede WMA. It must therefore be given very high management priority and appropriate matching resources.

It must be recognised that surface water sources have become quite limited in the Breede WMA, and much of that which is developed, is for transfer out of this WMA. Surface water can also only be used within the geographical reach of the schemes. Groundwater on the other hand has a wide extent of potential utilisation. If properly managed, and carefully used, it can have a small impact on surface water baseflow and on other users.

The approach in this WMA is therefore to :

(i) manage the alluvium water as if it were surface water;
(ii) promote the use of groundwater as an available resource which can be developed by towns, businesses and farms, always conditional on an assessment of the possible impact on surface water and other users.
(iii) consider the TMG as potential for some in-catchment use but also as a source for possible water transfer to the Berg WMA.

It will be up to local authorities and landowners to develop groundwater resources for use in the Breede WMA (excluding the TMG). Licences would be issued to those individuals or institutions developing the resource. Whilst attention and preference should be given to equity, given that groundwater is largely place-bound, water cannot be reserved for this purpose.

Sustainability is central to the use of groundwater and users will be required to monitor boreholes and manage abstractions within set parameters. Where severe impacts are detected and other sources or users are clearly being affected, DWAF should retain the prerogative to revise the conditions of use as permitted in the licence.

The Department will initiate further studies on an ongoing basis to refine the estimates of aquifer recharge, sustainable abstraction volumes, and to assess groundwater quality. This will contribute to a quantitative approach to groundwater allocation, management of the groundwater Reserve, and selection of appropriate conjunctive water resource management scenarios. This should be undertaken at a scale of 1:50 000 mapping and must take into account utilisation of aquifer storage, groundwater quality, seasonal and annual climate and usage patterns, and the existing surface water yield and potential for development of additional yield.

It is critically important that the Department expand the monitoring network for groundwater resource assessment and evaluation, thus integrating both surface and groundwater, and ecological monitoring in the NWA context. Advancements in available monitoring technology need to be considered. It is necessary to document what parameters are monitored at each site, how often the site is monitored, and that the monitoring results be interpreted and used to improve groundwater management. Refer also to the Monitoring Networks and Data Capture Strategy (15.2).

Independent groundwater monitoring initiatives such as that undertaken by WUAs in the Hex River valley are to be supported and encouraged by the RO and present a valuable opportunity to expand the local scale understanding of the flow regimes of the aquifers.

The Department cannot postpone applications received for new groundwater abstraction on the basis that it needs to first better understand the groundwater resource. In areas where the resource is currently understood to be stressed (Ceres sub-area) licences will not be issued. However, in other areas the decision must ultimately be based on how much protection is required, both in terms of surface water base flow and the impacts on other users. The suggested approach (refer to Allocation and Licensing Strategy – 9.3) is that best use be made of available expert knowledge

and the findings of the BRBS, to map groundwater protection zones. This mapping can then be used to guide decisions on new groundwater abstraction licence applications.

National and Regional Management Actions

The following management actions are required at regional and national level:

Groundwater Management and Regulation Actions

- ⇨ Design and implement an appropriate database and information management system to promote the interpretation of data, revision of regulatory criteria and guidelines for management of different aquifers.
- ⇨ Undertake training of DWAF hydrogeological staff in order to instil confidence in abilities and use of tools in licence application evaluation.
- ⇨ Evaluate the cumulative impact of generally authorised groundwater use on regional groundwater tables and groundwater Reserve flows and revise GAs regularly, as may be required (refer also to the General Authorisation Strategy - 9.1).
- ⇨ Artesian boreholes must be capped to reduce wasteful discharge unless they are specifically required for providing continuous flow.
- ⇨ The mapping of availability and of groundwater use should be undertaken and regularly updated as better information becomes available.

Groundwater Reserve Actions

- ⇨ Evaluate the worth of developing a transient model for Reserve determination that takes into account preceding and predicted climate patterns as well as the aquifer storage. This will promote the management of surface and groundwater as an integrated resource.

Groundwater Monitoring Actions

- ⇨ Design and implement a monitoring network with immediate effect that is based on current best understanding of surface and groundwater interactions with a plan and purpose to upgrade, expand as data, insight and information become available.
- ⇨ Local and/or regional changes in the piezometric gradient will be determined through monitoring. Regional monitoring of confined artesian basins is essential and urgent.
- ⇨ Integrate the surface, groundwater and ecosystem monitoring such that ongoing interpretation upgrades the network design, surface water and groundwater interaction understanding and facilitates responsible and informed decision-making.
- ⇨ Design and implement an Aquifer Protection and Recharge Protection Strategy.
- ⇨ Integrate the Water Quality Monitoring data into the groundwater database. This is in order to protect groundwater resources and to implement any RQO measures.
- ⇨ Expand the groundwater quality monitoring network to ensure that water quality and potential contamination from diffuse and point sources can be monitored at the appropriate intervals and to ensure that monitoring data of a physical and a chemical nature is interpreted and used in water resource management decisions;
- ⇨ Explore the use of radar technology to measure regional changes in groundwater level, rather than remaining reliant on borehole data. The Breede WMA is an ideal area in which to carry out a pilot study of this kind due to the current extensive use of groundwater and the potential for future abstraction.

Impact on Ecosystems Actions:

- ⇨ From the data obtained from the above actions, evaluate the following:
  - o the impact of groundwater abstraction and climatic patterns on headwaters and discharge sites at specific river reaches of perennial rivers;
  - o the relationships between, recharge and discharge/abstraction from different aquifers and runoff using past and predicted climate patterns. Use at least monthly and in stressed areas daily data and continuous flow records in selected catchments;
  - o the impact of current abstraction practice on the Groundwater Reserve levels using the past and future monitoring data collected by DWAF.

Breede WMA Specific Management Actions

The following management actions specific to the Breede WMA are required:

- ⇨ Establish Preliminary Groundwater Reserves in the Overberg catchments and the Comprehensive Groundwater Reserve in selected catchments of the Breede River, where groundwater use is extensive (Ceres, Hex and Upper Breede for example).
- ⇨ Verify actual groundwater use in the Breede WMA and document the source (for example, alluvial, Bokkeveld, TMG, etc.).
- ⇨ Investigate options with the WUAs in the Ceres catchment to curtail groundwater abstraction to within sustainable levels.
- ⇨ Cautiously consider licence applications for further groundwater abstraction in the Hex River catchment.
- ⇨ Monitor primary coastal aquifers and stop over-abstraction so as to reduce the risk of saline intrusion.
- ⇨ Develop a clear set of principles for the utilisation of groundwater in the Breede WMA and the issuing of licences.
- ⇨ Implement the groundwater management actions recommended in the General Authorisation Strategy (9.1), of this ISP.

Responsibility and Priority

The implementation of the **Groundwater Utilisation Strategy** is the responsibility of the RO in co-operation with the Directorate : NWRP and Directorate : Options Analysis. It is of **Priority 3** (medium) and studies are to be implemented on an ongoing basis to determine viable options for long-tern application.

CHAPTER 8: WATER RESOURCE PROTECTION STRATEGIES

Three strategies have been identified for development, namely:

8.1 Reserve and Resource Quality Objectives
8.2 Estuaries and Wetlands
8.3 Water Quality Management

8.1 RESERVE AND RESOURCE QUALITY OBJECTIVES STRATEGY

Management Objective

The objective of this strategy is to address how (i) implementation of the Reserve in the WMA will affect the availability of water to other users, (ii) how the authorisation of licence applications will impact on the Reserve, and (iii) the uncertainties relating to the current procedures for Reserve determination.

Situation Assessment

Before a licence is issued a Reserve must be determined and the impact of the licensed use considered. In the absence of a river classification system (currently being developed), a preliminary Reserve based on a preliminary classification is determined. The process of undertaking many individual Reserve determinations can be time consuming and resource intensive.

Any one of the three methods (desktop, intermediate or comprehensive) can be used and the selection of which method is determined by the level of risk that can be accepted in terms of the results and also by the available data required as input to each method.

A) Surface Water

During the BRBS intermediate level Reserve determinations were undertaken at a total of six sites along the Breede River, Riviersonderend River and their tributaries. An intermediate level determination was also undertaken for the Breede River estuary. These determinations provide site-specific recommendations of the ecological river classes. Table 3.9.1 of Chapter 3 presents the three scenarios investigated during the BRBS and the potential yield development associated with each.

In terms of water availability and regional water resource planning, the most significant decision regarding river classification in the Breede WMA centres around the Riviersonderend River. The resulting shortfall that would occur (85 million m^3/a) were the river to be improved from its current Class "E" to a recommended Class "D" would result in the need for drastic measures to be taken to provide for this at very high social and financial costs. These include the development of new schemes by the CCT to offset the impact on the already fully allocated yield out of the Riviersonderend (Theewaterskloof Dam), and compulsory licensing.

It is important to note that if the recommended Class "D" in the Riviersonderend River were not implemented, the recommended Ecological Water Requirements for the Lower Breede River and its estuary, could still be met from within the Breede River itself. Under this status quo scenario, compulsory licensing in the Breede River component becomes a low priority.

The potential future yield development in the Breede River component, for each of the three scenarios considered is:

Scenario 1 : Recommended classes, with current levels of invasive alien plant infestation
The exception being the Riviersonderend River which is assumed to be retained at its current Class "E" (potential yield = 90 million m^3/a)

Scenario 2 : Reduced classes with current levels of invasive alien plant infestation
(potential yield = 115 million m^3/a)

Scenario 3 : Recommended classes, with removal of all invasive alien plant infestation
The exception being the Riviersonderend River which is assumed to be retained at its current Class "E" (potential yield = 140million m^3/a)

Within the Overberg, the classifications adopted in the NWRS vary between the numerous coastal rivers. Current preliminary river classifications vary between "C" and "D" in the Overberg West sub-area and between "B" and "D" in the Overberg East sub-area. From the preliminary Reserve determinations, the impact on yield reported in the NWRS is 2 million m^3/a for the Overberg West and zero for the Overberg East. Subsequent to these determinations, an updated approach for desktop determinations has become available. If this updated approach is implemented in the Overberg catchments, the Reserve is likely to increase and the available yield in those catchments (and the

WMA as a whole) may correspondingly further reduce. This is likely to be further exacerbated once a desktop method is implemented to undertake estuarine Reserve determinations in the estuaries of the Overberg, which are currently not accounted for.

In addition to the Preliminary Reserves undertaken to date, the Ecological Water Requirement developed for surface flow in the Palmiet River could be developed into a Reserve. However, the work done to date on the estuary has not been according to Reserve principles and can therefore not readily be upgraded to an Estuarine Reserve requirement. However, current knowledge pertaining to the Palmiet estuary suggests that it receives abundant flow and is unlikely to have an impact on the yield of the Palmiet River. The Ecological Water Requirement of the lower Palmiet River is likely to be the controlling factor.

B) Groundwater

In the BRBS intermediate level groundwater reserve determinations were undertaken in two areas, namely:

- between Wolseley and Greater Brandvlei Dam
- Between Worcester and the Nuy valley

In a separate study, an intermediate level determination had been undertaken for the Hex River catchment (H20). Reserve determinations in twelve areas covering the remainder of the Breede River component were undertaken at desktop (rapid) level. The detailed results can be reviewed in the BRBS and are not repeated here. The overall conclusion is that whilst there remains significant opportunity for groundwater development in most of the Breede River component, registered groundwater use in the Ceres sub-area is already in excess of what is considered sustainable. Groundwater use in the Hex River catchment is extensive (20 million m^3/a) and there is significant competition for water by farmers.

In the upper and middle reaches of the Breede River, the interaction between the alluvium and the river, and the respective contribution to baseflow and recharge is not well understood.

Strategic Approach

The long-term implementation of river classification and the consequential impact on the potential to develop water resources requires further investigation and debate. In the interim, current ecological classes should be maintained for the purpose of managing the resource.

The construction of new schemes aimed solely at providing for the Reserve is not a viable approach considering the high value of water to the Western Cape region. The way forward is to continually evaluate the Reserve and its impact on yield development. This opportunity will present itself when undertaking feasibility studies into development options, identified through the Reconciliation Strategy Study.

Where ad-hoc Reserve determinations are required, these will have to be based on best available information, using the rapid or intermediate approach until such time as data has been accumulated to support more comprehensive methods.

Management Actions

The following actions are required:

⇨ In the short-term, manage the water resources in the Breede WMA at their current ecological classes (i.e. the status quo).

⇨ Complete the Western Cape Reconciliation Strategy Study and undertake the recommended feasibility studies arising from it. This process will ultimately be the driver in reaching decisions on changes to the ecological classes.

⇨ The following further actions will support the two broad strategic actions mentioned above.

- As a lower order of priority to the Breede River component, focus on the estuaries of the Overberg catchments, making use of the desktop method currently being adapted for undertaking preliminary estuarine Reserve determinations.

- Reserve determinations require additional resources and these must be assigned. In making the case for these resources it may be necessary to determine the extent of need, delays, cost of delays and what functions the Regions would be able to perform instead of head office staff, etc.
- Review the RDM policy to take into consideration the concept of localised "sacrificial" and "conservation-worthy" sub-systems. An example in this WMA being Riviersonderend River.
- Investigate the financial and social implications of restoring the Riviersonderend River to a Class "D" taking into account the need to meet the future water requirements of the Western Cape region as a whole.
- Public participation will be required to debate the impacts of various Reserve implementation scenarios against the benefits to the region of further development.
- Implement a river classification matrix for all rivers in this WMA to facilitate rapid decision making in terms of the level of Reserve determination required for rivers of varying ecological importance. The classification will also have a bearing on the minimum discharge standards required for each specific class of river.

Responsibility and Priority

The implementation of the **Reserve and Resource Quality Objectives Strategy** is the responsibility of RO in conjunction with the Directorate: RDM. This is of **Priority 1** (very high) in the Breede River component to enable confident future water resource planning for the Western Cape.

8.2 ESTUARIES AND WETLANDS STRATEGY

Management Objective

The objective of this strategy is to ensure that the estuaries and wetland of the Breede WMA receive sufficient freshwater to maintain their ecological health and function. At the moment there is insufficient data to be sure of Reserve requirements and this strategy aims to see this gap being filled. Estuaries also need to be prioritised in terms of importance as regards preservation.

Situation Assessment

The estuaries of the Overberg include the Palmiet (G40D), Buffalo (G40D), Bot (G40G), Onrus (G40H), Klein (G40L) and the estuary of the Heuningnesvlei (G50F). Invasive alien plants severely impact on the flow regime of both the Heuningnesvlei and therefore its estuary at De Mond, declared a RAMSAR site in 1986. Invasive alien plants also impact on the Zoetendalsvlei (G50C) and its associated wetland. These estuaries and wetlands have not been studied to the same level of detail as the Breede River estuary and no Reserve determinations have been undertaken on them. However some estuary water requirement work has been undertaken on the Palmiet River estuary, the Bot River estuary, the Klein River estuary and the Uilkraals River estuary. Based on in-stream-flow requirement studies undertaken to date, the Palmiet estuary currently receives more than sufficient water of good quality. Future potential development of yield in that catchment will take the needs of the estuary into account.

In the Breede River component, the Breede River estuary is still in a relatively good condition and remains sensitive to changes in water quality and reduced flows. It is important from a floral, piscifaunal (fish) and avifaunal (bird) perspective and very highly rated in terms of the risk to it from impacts of upstream catchment development.

The Papenkuils Wetland has become vulnerable as a result of upstream agricultural activities including the diversion of Papenkuils Wetland inflow into Greater Brandvlei Dam. The problems include both reduced water availability and retention. This wetland contains a variety of wetland and terrestrial flora that are worthy of conservation and are not conserved elsewhere in the WMA. As discussed in the Reserve and Resource Quality Objective Strategy (8.1), intermediate level Reserve determinations were carried out for the Papenkuils Wetland during the BRBS. The results, although not very reliable due to insufficient data, are the best available. The results indicate that the present ecological status category of the wetland is a "declining C", contrasting with its ecological importance rating of "B/C". This implies that steps must be taken to rehabilitate the functioning of the wetland. In particular, the interaction between the surface and groundwater resource is an important dynamic of the Papenkuils Wetland and will need to be further investigated.

The rivers of the Overberg catchments are all relatively short reach rivers. This means that any impact upstream is likely to affect their estuaries. The Onrus River estuary for example is regularly polluted as a result of sewage spills occurring in the peak season, due to a reticulation system incapable of accommodating peak loads. Estuaries are not only reliant on base flow but also require flood peaks to scour them and maintain their dynamics, something that cannot easily be supported where in-channel storage dams were developed, again especially a problem on short-reach rivers.

Diffuse pollution from surface water runoff finds its way into the coastal lakes at Kleinmond, which are connected to the Bot River Lagoon. Prior to the influx of holidaymakers, the local authority breaks the naturally occurring bund between coastal lakes and the Bot River estuary, and accumulated pollution from the coastal lakes is flushed into the estuary. Key stakeholders (Overstrand Municipality, WCNCB and the RO) have been involved in drafting a System Management Plan to address the problem.

There is as yet no rapid / desktop method available for carrying out first-estimate Reserve determinations for estuaries and wetlands. Consequently, it is not possible to assess licence applications on these rivers with any degree of confidence in terms of the potential impacts that they may have on the estuary or wetland.

Strategic Approach

The Estuarine Reserve requirement and its impact on the assessment of potential yield is of particular concern when evaluating yield water balance and reconciliation estimates. The strategic approach by the Department will be to develop and implement a modified desktop method for Estuarine Reserve determinations, to provide at least a first estimate. Loopholes in data will then be identified and appropriate monitoring implemented to gather the necessary data. Once sufficient data is available, more comprehensive estimates will be undertaken.

The priority of each of the wetlands and estuaries in terms of defining their ecological condition and the level of Reserve determination required for each, should be determined through a workshop type environment making best use of expert knowledge and available reports.

Where applications are considered for the development of catchment storage, and where this is on short reach rivers feeding estuaries, the recommended option will be the use of off-channel storage. This will allow for conditional abstraction such that low flows and flood peaks can be maintained for inflow to estuaries.

Within social and economic constraints, DWAF will seek best possible strategies to optimise water for maintaining the wetlands and estuaries.

Management Actions

The following actions are required:

- ⇨ Implement the Management Actions of the Reserve and Resource Quality Objectives Strategy.
- ⇨ The rapid / desktop level method for the determination of Estuarine Reserve requirements needs to be finalised, taking into account methods used on five provisional Estuarine Reserve estimates which have been done in other parts of the country.
- ⇨ Initiate workshops and invite specialist debate to determine an order of priority and a Reserve determination level for each estuary and wetland in this WMA. As a starting point consider the Heuningnes, Onrus and Bot estuaries as a provisional order of priority, also taking into account the work already done on the Breede estuary.
- ⇨ Implement further studies to understand the optimum flow requirements of the Papenkuils wetland and investigate the diversion of Breede River main channel flow into the wetland, to meet those requirements.
- ⇨ The Management Plan for the Bot River lagoon developed co-operatively between key stakeholders should be finalised and implemented. Refer also to Co-operative Governance Strategy (11.2).

Responsibility and Priority

The implementation of the **Estuaries and Wetlands Strategy** is the responsibility of the RO in consultation with the RDM office. It is of **Priority 2** (high).

8.3 WATER QUALITY MANAGEMENT

Management Objective

Water quality needs to be appropriately managed to ensure that there is water of acceptable quality available to meet the needs of the environment and of all users in the Breede WMA. Salinity concentration and nutrient content must be reduced to the most practically manageable levels. This strategy aims to address the problems associated with water quality in the Breede WMA and to recommend steps that can be taken to improve the quality where problems currently exist.

Situation Assessment

In terms of water quality, the predominant problem throughout much of the Breede WMA is one of salinity. The Bokkeveld shales introduce naturally occurring salinity to the Middle and Lower Breede River. Water quality is generally good in the uppermost reaches of the Breede River tributaries, but becomes increasingly more saline in a downstream direction. All the rivers of the Overberg region are exposed to salinity as a result of the geology, with the exception of the Palmiet River sub-area, in which the water quality is good. Where irrigation is intensive, return flows aggravate the salinity problem through the leaching of salts into the rivers. Nitrogen and phosphorous loading from washoff of fertilisers is also of some concern. Point source pollution also has an impact on water quality, but to a far lesser extent than salinity in the Breede WMA.

Salinity

The Middle and Lower Breede River carries the brunt of salinisation, receiving naturally saline water and irrigation return flows. The water quality eventually becomes unsuitable for agricultural use due to increasing salinity, in a downstream direction. The current management approach is to introduce freshening releases (approximately 22 million m^3/a) from Greater Brandvlei Dam. These releases serve to manage salinity levels as far downstream as the Zanddrift canal off-take near Bonnievale.

Increased freshening releases could further reduce salinity but this is a water intensive solution. A more radical proposal is to convey all water to users via an independent canal or pipeline, rather than via the river channel itself, although this would be capital intensive and would ultimately consign the lower reaches of the river to the role of a salt drain.

Some natural freshening takes place downstream of the Riviersonderend River confluence and again downstream of the Buffeljags River confluence as a result of better quality water arising from those two catchments. The salinity levels in the headwaters of the Riviersonderend River are low but increase marginally downstream due to agricultural practices. To date it has not been considered necessary to make freshening releases out of Theewaterskloof Dam into the Riviersonderend River.

Point Source and Non Point Source Pollution

Polluted runoff from inadequately serviced dense settlements and industrial point discharges poses a risk of pollution to the water resource. This is a problem with regard to the informal settlement at Grabouw and surrounding industries. Here pollution poses a threat to the water quality of the Klip River (a tributary of the Palmiet). The local authority (Theewaterskloof Municipality) is planning an additional 1500 RDP houses despite the fact that there are already insufficient services to cater for the existing population, and raw sewage spills from the reticulation network into the Klip River are not uncommon. This type of problem is however not widespread within the Breede WMA.

The problems associated with the management of diffuse pollution in the Bot River Lagoon are discussed in the Estuaries and Wetland Strategy (8.2) and a Management Plan is being drafted by the RO in consultation with all stakeholders.

Discharge of treated sewage effluent, management of solid waste and the activity of irrigating with inadequately treated industrial wastewater (typically winery effluent) are further water quality concerns. The Department has found that, within the Breede WMA, the situation with regard to sewage discharge is of concern in some the coastal towns where WWTW and reticulation system capacities are exceeded during peak season (notably Onrus and Kleinmond). Other WWTWs that are reaching their design capacity include Ashton and Gansbaai.

The use of soak-away facilities along the banks of, or in close proximity to the Breede River (lower reaches), is the current means of disposing of domestic sewage in that area. Seepage from these soak-aways finds its way into the river. Conservancy tanks would be the preferred alternative but the local authority does not, at the moment, have the necessary resources to service that type of facility.

The direct use of water from irrigation canals (for domestic purposes) by farm workers living in close proximity to the canals is of concern. This is worsened by the return of wastewater to the canals and the impact on other users further downstream.

Managing Solid Waste

Many towns operate their own small solid waste disposal sites, some of which are situated in close proximity to rivers. For example the McGregor SWDS lies adjacent to the Korings River. The site is no longer in use but has yet to be rehabilitated. Disposal of fruit waste at Ceres and Wolseley poses a threat to the local groundwater resource. The SWDS in Ceres is due to be closed. An alternative regional SWDS is proposed at Wolseley.

Strategic Approach

More than 90% of the total irrigation requirement in the Breede WMA lies within the Breede River basin, in which salinity in the middle and lower reaches is of concern. Although the Palmiet River catchment (Overberg West) is also extensively irrigated, the water quality is good. As such, the priority for salinity management currently lies in the Breede River component and should remain so.

For the purposes of improving crop quality and yield in the Middle Breede River, the possibility of lowering the target salinity limits at the Zanddrift canal off-take in certain months should be considered. Meaningful short-term salinity alleviation could be achieved through the construction of return flow interceptor drains and storage ponds. The accumulated saline water could then be released during periods of high flow to take advantage of the dilution effect, coupled perhaps with a less water intensive release strategy from Greater Brandvlei Dam. Given the levels of salinity, agricultural return flows into the Breede River are highly undesirable and should be minimised or eliminated.

A management action that can be immediately implemented, without having to undertake any construction of infrastructure, is to actively discourage the development of irrigation in areas producing highly saline return flows. This information is available within the Breede River component, based on the soils investigations carried out during the BRBS. These areas should be demarcated. DWAF and the future CMA should exert influence against further irrigation development in the demarcated areas. Measures could include the conditional approval of new water use licences; penalties for offences in terms of water use regulations or licensing conditions, and a pricing strategy that would allow for an increased price of water in demarcated areas.

Co-operative governance between the Department and local authorities must be focussed on the problems associated with the quality of effluent from all WWTWs, the management of solid waste and the provision of adequate services to informal settlements. In terms of improved future management of solid waste, the use of larger regional solid waste disposal sites should be encouraged and smaller sites closed and rehabilitated.

The failure to provide adequate household water to farm workers will not be tolerated and farm owners should be held accountable for his.

Management Actions

The following actions are required in terms of *Salinity Management:*

- ⇨ Demarcate areas with high salt generating potential in the Middle Breede and use these to screen new water use licence applications.
- ⇨ Strict rules for the application of fertilisers should be developed together with, and implemented by, the Department of Agriculture to reduce nitrogen and phosphorus loads in rivers.
- ⇨ Implement a feasibility level design and costing to evaluate the following potential salinity alleviation options that have already been investigated at reconnaissance level:

    (i) the potential of intercepting saline return flows for release during periods of high flow with improved dilution;
    (ii) the option of intercepting saline water in evaporation ponds with recovery and disposal of salt;
    (iii) the best possible sites for interceptor drains to capture saline return flow;
    (iv) the potential water saving through reduced freshening releases from Greater Brandvlei Dam in conjunction with the use of interceptor drains;

The following actions are required in terms of *Point Source and Non-Point Source Pollution Management:*

- ⇨ All dischargers are to be identified, licensed and registered, and once the waste discharge pricing strategy is in place, charged for discharging into rivers.
- ⇨ DWAF needs to assess the current total cumulative impact of current waste discharge.
- ⇨ Resource quality objectives for rivers must be defined and these objectives must not be exceeded.
- ⇨ The recently proposed GAs (containing more restrictive water quality requirements) for irrigation with treated effluent need to be implemented and compliance monitored through the WUAs.
- ⇨ Procedures to be developed and implemented by operators of WWTW for emergency control of spillages, power failure, mechanical breakdown.
- ⇨ DWAF is investigating whether methods can be invoked against non-compliant authorities, in cases where co-operative governance is unsuccessful.
- ⇨ Evaluate the existing pollution control mechanisms of wineries and industry and revise standards.
- ⇨ Farm owners must ensure that adequate services are provided to communities residing on their farms.
- ⇨ Implement the dense settlement strategy (DWAF/DANIDA), drawing on co-operative governance with local authorities, with particular focus on the informal settlements at the town of Grabouw.

Responsibility and Priority

The implementation of the **Water Quality Management Strategy** is the responsibility of the RO in conjunction the Water Resource Planning Systems and the Waste Discharge and Disposal Directorates. It is of **Priority 2** (High).

CHAPTER 9: WATER USE MANAGEMENT STRATEGIES

Six strategies have been identified for development, namely:

9.1 General Authorisations
9.2 Verification of Existing Lawful Use
9.3 Allocation and Licensing
9.4 Compulsory Licensing
9.5 Changing Land-Use: Forestry
9.6 Changing Land-Use: Clearing of Invasive Alien Plants

9.1 GENERAL AUTHORISATIONS STRATEGY

Management Objective

Appropriate General Authorisations (GAs) can simplify the management of the water resources of the Breede WMA. This strategy aims at putting such appropriate GAs in place, but also at ensuring regular review and amendment of existing GAs should circumstances change.

Situation Assessment

GAs have been introduced to allow conditional water use, without the need for a licence. Although no licence is necessary, the use under a GA must still be registered. GA protocols are available for surface and groundwater abstraction, storage, irrigation with treated effluent, effluent discharge, and solid waste disposal. The most recent GA protocol to be developed is for river channel modifications, such as the construction of culverts. Proposals have been made and are under review.

In the Breede WMA revised GAs have been recently proposed. The proposed GAs for surface water and groundwater abstraction are shown on Figures 9.1.1 and 9.1.2 respectively.

Surface Water GAs

The RO has proposed more restrictive GAs for surface water abstraction throughout the Breede WMA. The currently gazetted GAs and the proposed changes are as set out below:

- **Current** gazetted GA for surface water abstraction = 25 *l*/s:
    - for irrigation of up to 25ha of land at 6000 m^3/ha/a or;
    - for purposes other than irrigation, 100m^3/d (on any given day);
    - storage is limited to 50 000 m^3.
- **Proposed** GA for surface water abstraction = 15 *l*/s:
    - not exceeding 150 000 m^3/a;
    - storage is limited to 50 000 m^3.

Groundwater Abstraction GAs

The proposed GAs for groundwater abstraction are more restrictive than those currently gazetted. Of notable mention are the following quaternaries that had been generally authorised and are now proposed for exclusion:

- Ceres sub-area: H10C
- Tradouw sub-area: H70F

Current GAs for groundwater abstraction consist of four classes, namely 0, 60, 300 and 750 m^3/ha/a. The proposed GAs (see Figure 9.1.2) contain five classes of abstraction, namely 0, 45, 75, 150 and 400 m^3/ha/a and allow for up to 20m^3/d to be abstracted by small industrial users.

In those few quaternary catchments where relaxations have been proposed, the proposed increase in the permissible abstraction rate, is less than 100 m^3/ha/a.

To date the proposed GAs described above and shown on Figures 9.1.1 and 9.1.2 have yet to be approved.

Irrigation with Industrial Waste Water

Currently GAs for irrigating with industrial wastewater allow for up to 50 or 500 m^3/day (per user per property) to be used, depending on the water quality. Water quality criteria form part of that GA and where necessary, treatment is required to meet those criteria. However, users of up to 10 m^3/d (per user per property currently) need not register their use. In the Breede WMA the decision has been taken to stop any new irrigation using untreated wastewater. The large-scale irrigators are complying with this. However, small operators (such as small wineries) are more difficult to monitor and the potential cumulative impact on water quality is of concern. The most significant GA changes proposed are:

- Any person irrigating with any volumes of wastewater will have to register their use before commencement of irrigation, and water quality criteria in terms of treatment required, are now more restrictive;
- Upper limits of 50, 500 and 2000 m^3/d for irrigating with effluent, each with associated water quality criteria, have been proposed.

Through the proposed changes, better control and management of the extent of this activity will be possible, whilst encouraging the re-use of treated wastewater through the higher daily irrigation limit of up to 2000 m^3/d, subject to meeting specific water quality criteria.

Strategic Approach

GAs currently play an important role in easing the burden of licensing many small users of surface and groundwater in the Breede WMA, and can continue to do so. The limits and conditions of GAs need to be reviewed annually as has recently been done by the RO officials. Revisions must take the extent of new water use under GAs, and the anticipated increase in Reserve requirements into account. It is important that the effects of these GA changes are monitored to facilitate improved management decisions during subsequent reviews. The current proposals include greater restrictions on both surface water and groundwater abstraction.

Some relaxation in the limits for groundwater abstraction is possible. This is in line with the broad strategy of increased groundwater utilisation in much of the Breede WMA, with the exceptions of the Ceres catchment and limited further groundwater use in the Hex River catchment. GAs should not be issued at the scale of the WMA, or even at sub-area scale, and annual reviews must look to quaternary level detail. Local knowledge of the RO officials has been effectively applied in the proposed changes and this approach should be encouraged. The RO should be authorised to amend GAs directly.

If properly managed and monitored, the controlled activity of irrigating with treated wastewater can remain generally authorised and used to encourage increased water re-use.

Management Actions

The following actions are required:

- ⇨ Further changes to GAs for surface water abstraction could include an authorisation for seasonal abstraction only (during periods of high flow) into off-channel storage (the capacity of which is already limited under GA to 50 000 m^3).
- ⇨ Implement a programme of annual review of all GAs.
- ⇨ Implement the proposed GAs for river channel modification.
- ⇨ Implement a short term monitoring initiative/census to establish the actual extent and impact of all irrigation with, and all direct discharge of agricultural effluent under GA.
- ⇨ Develop a "code of practice" for handling and treating winery wastewater with specific conditions attached to the industry.
- ⇨ Seek authority to amend GAs at Regional level.

Responsibility and Priority

The implementation of the **General Authorisations Strategy** is the responsibility of the RO, in conjunction with the Directorate: Water Abstraction and Instream Use. It is of **Priority 2** (High).

Figure 9.1.1: Latest Proposed General Authorisations for Surface Water Abstraction

Figure 9.1.2: Latest Proposed General Authorisations for Groundwater Abstraction

9.2 VERIFICATION OF EXISTING LAWFUL USE

Management Objective

The objective of this strategy is to verify existing lawful water use, ensure correct registration on WARMS and ensure that unlawful use is discontinued. Verified existing lawful use will form the basis for payment of catchment management charges.

Situation Assessment

Verification of existing lawful use is an important step to ensure that the correct volumes are registered for payment of catchment management charges, the actual requirements are accurately known, and that any unlawful users discontinue use, thus returning this water to the system.

The processes involved take place in the following sequence:

i Registration – users must indicate how much water they use, and start paying for that use but this does not confer any rights of allocation. The registration process is complete in the Breede WMA;
ii Validation – DWAF checks the registered use to confirm that it is actual use, and may alter the volume registered if found otherwise;
iii Verification – DWAF checks and decides on the lawfulness of the actual use;
iv Lawful use is registered on WARMS;
v Users pay for that registered use, which now has the status of "allocated use".

It is a statutory obligation that all water users (excluding Schedule 1 users) register their use. Registration of both surface and groundwater users is required, and includes Stream Flow Reduction Activities and those users who utilise water under GA. In the Hex River sub-area, a hydrocensus carried out by the Department found registered water use to be within 3% of actual water use estimates made as part of the BRBS. This adds confidence to the initial indications that registered water use in the Breede WMA is a reasonable reflection of actual use. Registration, now complete in this WMA, does not, however, serve as a check on the lawfulness of the use.

Verification of existing lawful use serves the following functions:

- to reconcile registration, identify and correct errors,
- to take water out of the hands of unlawful users and return this to the system,
- to determine long-term water use,
- to ensure lawfulness of continued water use,
- forms an important input to compulsory licensing in catchments prioritised for that process.

Where unlawful users are identified, they will be required to stop using this water. This may put some volume of water back into the system, making it available for legitimate claims, including the meeting of the Reserve and redressing inequities. Unlawful water use is currently understood to be more probable in the following areas of the Breede WMA than in others:

⇨ In the Hex River catchment where there is intense demand for available water and the extent of water use from farmers' own sources, run of river and groundwater is not well quantified. Some of this may be unlawful use.
⇨ Outside of WUAs, use and lawfulness is not well established throughout the Middle Breede. On the tributaries, farmers abstract much of the summer flow and as much winter water as their infrastructure can accommodate.
⇨ There is substantial groundwater abstraction (unconfirmed estimates of up to 50 million m^3/a have been suggested) out of the alluvium in the Worcester/Rawsonville area of which only 25 million m^3/a is registered.
⇨ To the north of the Langeberg Mountains (Tradouw sub-area) there are illegal dams and illegal groundwater developments.

- ⇨ In the Bot\Swart and Lower Breede sub-areas, registration exceeds the extent of actual water use from the surface water resource.

The extent of unexercised but nevertheless 'lawful' allocations within the areas of jurisdiction of WUAs is not significant in this WMA.

Strategic Approach

Policing to target and identify unlawful water users is resource intensive and will require special staffing and budget. It is cost effective to ensure that lawful use is correctly quantified and paid for, and unlawful use is returned to the system.

Through the process of registration and verification, the Department is identifying unlawful water users, who will be held accountable for this. If the particular catchment is in deficit, then the use must stop. However, if there is a surplus after the Reserve and equity requirements have been met, then the user may apply for a licence.

A prioritisation strategy for identifying the most critical areas for verification must be developed. This should be focussed on those areas in which it is currently perceived that water use violations might be prevalent and where such use will most impact on the Reserve, and on the availability of water to other users reliant on the same resource. Cognisance must also be taken of the importance of the Riviersonderend and Palmiet River catchments in their provision of water for both in-catchment and water transfer purposes. The following order of priority should be used as an initial basis for implementing the verification process.

Proposed time frames and order of priority to complete the verification process (provided by the Region)

5 Years	*10 Years*	*15 Years*
1) Palmiet	6) Upper Breede	11) Klein
2) Hex	7) Middle Breede	12) Bot/Swart
3) Riviersonderend	8) Tradouw	13) Uilkraals
4) Onrus	9) Lower Breede	14) Overberg East
5) Ceres	10) CBR Kingna	

In order to give effect to the NWA, an example should be made of unlawful water users and tough decisions applied to them so as to return the component of unlawful water use to the system.

Where existing allocations have yet to be exercised, a strategic approach should be developed and implemented in which users may be (i) required to relinquish the allocation, or (ii) keep the allocation if they pay for it, or (iii) use the water within a specified time frame (say five years for example), or (iv) trade that water. They should not be entitled to hold onto it indefinitely.

Management Actions

The following actions are required:

- ⇨ Ensure that all users have registered their use. This is largely complete in the Breede WMA.
- ⇨ The RO should consult the guidelines developed by DWAF Gauteng RO in which a strategy has been drafted for implementing actions against unlawful users, and take appropriate action against them.
- ⇨ Set up a process to:
  - o verify existing use according to guidelines made available from the Directorate: Water Abstraction and Instream Use.
  - o determine lawfulness of use according to these guidelines.
  - o develop a strategy to act on unexercised allocations.
- ⇨ WUAs must ensure that their members are acting in compliance with the conditions of their water use authorisations.

Responsibility and Priority

The implementation of the **Verification of Existing Lawful Use Strategy** is the responsibility of the RO in conjunction with the Directorate Water Abstraction and Instream Use. It is of the highest priority (**Priority 1**).

9.3 ALLOCATION AND LICENSING STRATEGY

Management Objective

The objective is the implementation of a streamlined and improved strategy to assist the RO in reaching decisions on licence applications and when required, to attach appropriate conditions to licences.

Situation Assessment

(a) *The Current Situation*

The current available surplus in the Breede WMA is 19 million m^3/a. The incremental yield balances are shown on Figure 9.3.1. In the Upper Breede sub-area there is approximately 17 million m^3/a available out of:

- Koekedouw Dam: 3 million m^3/a
- Stettynskloof Dam: 14 million m^3/a

In Koekedouw Dam (owned by the Koekedouw WUA) the water is allocated to the WUA and the town of Ceres but the allocation has yet to be fully exercised. Similarly in Stettynskloof Dam (owned by the Breede Valley Municipality), the water is allocated to the town of Worcester but is not yet fully taken up. The urban water demands have yet to grow to a point where this water is required.

Figure 9.3.1: The Current Available Surplus in the Breede WMA

In the Lower Breede sub-area the 3 million m^3/a currently available is from surplus in Buffeljags Dam, near Swellendam.

In terms of making an assessment on the possible issuing of any new licences, the smaller management units (sub-areas) shown on Figures 6.1 and 6.2 of Chapter 6, are referred to.

Ceres Sub-Area

There is no further run-of-river yield available for abstraction in this sub-area. Surplus winter water that is available in H10D has been earmarked for the proposed Michell's Pass Diversion Scheme (water to the CCT) and is not available for further irrigation development. Approximately 3 million m^3/a of allocated but unexercised water is available in Koekedouw Dam. The high cost of water from that dam has been one of the reasons that a number of commercial farmers have been liquidated and the farms transferred to resource poor farmers.

Extensive use is already made of groundwater and the BRBS indicates that current registered groundwater use exceeds the sustainable annual abstraction potential within H10A-C. Further development of the groundwater resource in quaternaries H10A-C should not be considered.

Hex Sub-Area

The yield from the Sanddrift Irrigation Scheme is over-allocated, largely due to over optimistic estimates of yield from that scheme. As a result water is supplied at relatively low assurances of supply and there is intense competition for the available water. Conditions governing the release of compensation water from Roode Elsberg Dam have long been the source of disputes between water users in the Upper and Lower Hex River Valleys. The RO is currently evaluating a licence application for a possible dam at Osplaas (H20B) for both irrigation and for

provision of water to the town of De Doorns. The conditions attached to the Osplaas Dam licence require that a portion of the yield is allocated for the establishment of resource poor farmers in the area.

Farm dams throughout the Hex sub-area are filled in winter from excess flow and licences for additional winter abstraction under such conditions could be considered. Approximately 20 million m^3/a of surface water and 20 million m^3/a groundwater is used. The groundwater resource is already extensively developed and further licences should be cautiously considered until the Reserve has been finalised and approved. An intermediate level Reserve determination was completed in 2003.

Upper Breede and Middle Breede Sub Areas

There is a surplus of 14 million m^3/a in Stettynskloof Dam arising from allocations to the town of Worcester which have not been taken up. The dam was owned by the Worcester Municipality and now falls under the Breede Valley Municipality.

There is significant opportunity to utilise groundwater in the Upper Breede. However caution should be exercised when considering licences for further abstraction out of the alluvium, until the recharge dependency of the alluvium on summer base-flow (understood to be provided to a large extent by groundwater out of the TMG) is better understood. Site-specific conditions of every application for groundwater abstraction will need to be considered in addition to the status of the Reserve.

Lower Breede

The available surplus of 3 million m^3/a is that in the Buffeljags Dam, and offers the opportunity to establish resource poor farmers in the area. Issuing of new licences for surface water abstraction can be considered in this sub-area but should be restricted to abstraction of excess winter water into off-channel storage facilities. It is not anticipated that there will be a marked increase in the use of groundwater due the high salt content rendering the water unsuitable for irrigation.

Riviersonderend

There has been interest expressed by potential resource poor farmers for establishment at Riviersonderend and Genadendal. This sub-area is, however, currently in balance and as such, only abstraction of surplus winter water (to off-channel storage) and groundwater should be considered.

Water trading with existing irrigators and purchasing of lei-water from towns are options to consider in terms of developing resource poor farmers in the Riviersonderend sub-area. Some groups have already been established at Villiersdorp and water has been provided through trading with the Elandskloof and Vyeboom WUAs.

CBR Kingna Sub-Area

There is no scope for further development of irrigation from surface water outside of existing irrigation schemes.

Tradouw Sub-Area

There is very little further opportunity for issuing new licences to abstract surface water in the northern region (H70C-E). In the south (H70B & H70F) additional licences can be considered for the abstraction of surplus winter water only, to off-channel storage. No additional abstraction of surface water should be considered in summer. There is some potential for establishing resource poor farmers in the area through water supplied out of Buffeljags Dam, with significant opportunity becoming available if the dam is raised for further irrigation development.

The coastal catchments of the Overberg West and Overberg East

With the exception of Palmiet sub-area, the general approach regarding issuing new licences for surface water abstraction is that no new licences throughout the Overberg catchments should be considered for abstraction during summer. Most of these rivers support ecologically sensitive estuaries, for which there is not sufficient estuarine data available to support even a very preliminary desktop type Reserve assessment. Before issuing of additional licences can be considered, an estimate of the estuarine Reserve must at least be possible and that Reserve must be sustained. In the interim, the use of off-channel storage with abstraction of surplus winter water can be considered.

(b) The Future Situation

In the Overview chapters (3 and 4) and in the Water Availability Strategy (7.1) potential schemes were identified that could be developed within the Breede River component to realise potential yields of between 90 and 140 million m^3/a. In the Palmiet River catchment, 25 million m^3/a could potentially be developed. The licensing of agricultural water would depend on the sources of development funding, but would inevitably include a large equity component.

Strategic Approach

Based on the current available water resource, the following broad strategic approaches to the issuing of new licences are relevant in this WMA:

- The current surplus of 17 million m^3/a in the Koekedouw and Stettynskloof Dams should remain available for meeting the growing urban water requirements in Ceres and Worcester.
- The abstraction and off-channel storage of surplus winter water can be considered;
- Water quality permitting, the increased use of groundwater can be considered in much of the WMA.

Provided that developments are shown to be economically viable, support equity initiatives (resource poor farmers) and embrace the concepts of WC/DM, conditional licensing of water use should not be unnecessarily constrained. However the option of limiting the issuing of new licences to abstraction during periods of surplus flow and the use of off-channel storage will be necessary.

Supporting information on the impacts of groundwater abstraction on river flow is a prerequisite in support of applications for approval of new licences. Groundwater appears to offer great potential for abstraction particularly in the Upper Breede. The interaction between the groundwater and surface water resource (the groundwater Reserve) is not yet well understood. Whilst it is not necessary to delay processing of abstraction licences, the decision must be ultimately based on how much protection is required both in terms of surface water and for a particular aquifer. Before the comprehensive groundwater Reserve has been determined, the suggested approach is that best use be made of the BRBS and of available expert knowledge to map protection zones, from which guidance on decisions for new groundwater abstraction licences be sought.

Licences for water trades will be considered, particularly where the trades are within the same sector or from a low value to a high value sector, benefiting both society and economy. Trades within the same catchment are also more likely to be licensed.

Catchment specific approaches to licensing in each sub-area are offered under the situation assessment in this strategy.

The strategic approach in the medium term (next 10 years) towards allocating potential yield that could be developed in the Breede WMA is as follows:

- The potential allocation to the CCT of 80 million m^3/a from the potential Michell's Pass diversion (53 million m^3/a) and Upper Molenaars diversion (27 million m^3/a) is seen as the most effective and necessary use of this water and this opportunity should not be foreclosed. Realising this potential is dependant on the Reserve scenario ultimately implemented.

- Through the potential Brandvlei Augmentation Scheme (33 million m^3/a), possible raising of Buffeljags Dam (11 million m^3/a), and small scheme development (16 million m^3/a), 60 million m^3/a could become available for in-catchment use in the Breede River component. Realising this potential will depend on the Reserve scenario, the relative impacts of upstream diversions on the existing (and potential) yield of Brandvlei Dam, and the extent of invasive alien plant removal.

Reserve scenarios, scheme options and the impact of invasive plants on potential schemes will be investigated during the Reconciliation Strategy Study. In the interim, the aforementioned schemes should be considered as the most likely to warrant further investigation.

The Palmiet River has been identified as a possible option to further augment the WCWSS and/or for provision of water to the town of Grabouw and/or for supplying the coastal towns of the western Overberg. Further irrigation development is possible from unexercised allocations out of existing dams (Eikenhof and Arieskraal Dams, for example). Any irrigation expansion from new resources must include the establishment of resource poor farmers.

Management Actions

The following actions are required:

- ⇨ Consider applications for new licences in accordance with the recommendations in this situation assessment.
- ⇨ Until a comprehensive groundwater Reserve has been determined, implement workshop type discussions to make best use of current knowledge for mapping groundwater protection zones and developing guidelines for issuing new licences.
- ⇨ Inform the CCAW of the potential to augment the yield of Greater Brandvlei Dam and establish when the scheme would be required, who would benefit from it and who would pay for it.
- ⇨ Engage in co-operative governance with all relevant authorities so as to establish their future water requirements out of the available surplus from their own resources (notably Worcester and Ceres).
- ⇨ Through the CCAW, identify opportunities for future resource poor farmer development and the anticipated associated water requirements.

Responsibility and Priority

The implementation of the **Allocation and Licensing Strategy** is the responsibility of the RO in conjunction with the Directorate: Water Abstraction and Instream Use and the Directorate: Water Allocation. It is of **Priority 1** importance (highest).

9.4 COMPULSORY LICENSING STRATEGY

Management Objective

The objective of this strategy is to prioritise those areas within this WMA where the re-allocation of available water may become necessary through compulsory licensing.

Situation Assessment

The need for compulsory licensing is primarily to:

- address situations in which more water has been allocated to users than is actually available, with deficits, even during normal years if all users were to make full use of their allocations;
- address past inequitable distributions of water by redistributing water so that previously disadvantaged landholders and potential users are also able to receive a fair share;
- meet the needs of the Reserve (both ecological and basic human needs).

Based on the interim strategic approach that the water resources will be managed according to their current ecological classes, the Reserve requirements in the Riviersonderend will be met from present day flow conditions, with no impact on the yield of Theewaterskloof Dam. The priority for compulsory licensing is therefore considered to be low in this WMA. This could however change, depending on the Reserves that are ultimately set. A potential shortfall of up to 85 million m^3/a in the Riviersonderend sub-area alone has been identified if that river is to be rehabilitated to an ecological Class "D" from its current Class "E".

Over-abstraction by registered groundwater users in very localised areas (H10A-C quaternaries of the Ceres catchment for example) can be halted through compulsory licensing but it would be better if this could be resolved though negotiation, and the WUAs are encouraged to resolve this problem amongst their users.

Strategic Approach

The option of providing water from schemes in the Breede WMA to urban users in the Berg WMA must be kept open for the benefit of the regional economy in the Western Cape. The Riviersonderend and the Palmiet Rivers are currently important, and will remain important in this regard.

Given the historic inequities in water allocations within the Breede WMA, the 3 million m^3/a of available surplus in the Buffeljags Dam should be earmarked for the establishment of resource poor farmers. Worcester must assess its future urban water requirements. DWAF should encourage Worcester to support the establishment of resource poor farmers, though the provision of any surplus water from their current sources of supply. To allocate any current available surplus to further expansion of the existing commercial farming system would in all likelihood give rise to later enforced compulsory licensing for equity purposes, with current users having existing allocations reduced without any compensation.

Compulsory licensing, where this entails the curtailment of use of water by some in order to meet the needs of others (in the Breede these others would be the Reserve, and perhaps more water to equity) is not something to undertake lightly. All alternative sources of supply need first to be explored. In the Breede WMA the opportunities for increasing the availability of water include: Verification of existing lawful use (with a lower allocation perhaps resulting), the clearing of Invasive Alien Plants, and WC/DM. Reserve demands may also possibly be limited by adopting current ecological classes in certain rivers, where higher ecological classes have been recommended (notably the Riviersonderend River).

The situation of aquifer over-abstraction in the Ceres catchment should be addressed amongst the users within the WUA and compulsory licensing should be the last resort required to resolve this. This principle should be applied to other areas where local water stresses are encountered.

Management Actions

The following actions are required:

- ⇨ The Comprehensive Reserve determination (and associated public participation) will need to be completed before a decision on the need for implementing any compulsory licensing in this WMA can be taken.
- ⇨ Where there is over utilisation, WUAs must be encouraged to curtail use amongst their members.

Responsibility and Priority

The implementation of the **Compulsory Licensing Strategy** is the responsibility of the Directorate: Water Allocation and the Directorate: National Water Resource Planning. Nationally this is of highest priority (**Priority 1**). In the Breede WMA the implementation of compulsory licensing is currently considered to be **low**, subject to the Reserve ultimately selected for implementation.

9.5 CHANGING LAND-USE: FORESTRY

Management Objective

The primary objective of this strategy is to facilitate the processes required to address the decommissioning of commercial forestry operations in the Breede WMA.

Situation Assessment

Commercial forestry in the Breede WMA is largely confined to the upper reaches of the Riviersonderend and Overberg (Palmiet) sub-areas. Table 9.5.1 shows the estimated areas of forestry within the Breede WMA.

Table 9.5.1: Forestry in the Breede WMA

Sub-Area	Area (ha)	Reduction in runoff (million m^3/a)	Reduction in yield (million m^3/a)
Unit	**ha**	**million m^3/a**	**million m^3/a**
Upper Breede	831	0.9	0.2
Riviersonderend	746	1.4	1.1
Lower Breede	752	1.9	0.3
Overberg East	0	0.0	0.0
Overberg West	4 467	9.1	4.6
Total	**6 796**	**13.4**	**6.2**

The decommissioning of much of the commercial forestry industry will release water and this may allow for trading of existing authorisations currently held by the commercial forestry operators, of which SAFCOL holds the predominant market share. There may also be some new applications by other forestry operators for water use licences to develop new plantations.

SAFCOL is closing their Nuweberg, Grabouw, Lebanon and Grootvadersbos plantations. Of significance is the situation in the Overberg West, particularly in the Palmiet River catchment, where much of the current impact on yield (+4 million m^3/a) could eventually become available for alternative use.

Operators of licensed plantations may have some claim to water arising out of the closure of the plantations. On the other hand, where these plantations are on State owned land, the State may insist that the water be returned to it. If so it could be made available for other users, notably the Reserve, resource poor farmers or emerging growers.

The following issues/concerns have been identified:

- For each proposed change in land-use, a site-specific investigation is required, which is time-consuming. The core principle is that there should be no negative impact on other downstream users.
- Where SAFCOL (existing lawful user) is decommissioning its forestry operation and felling its plantations in the Western Cape, this forestry is on State Land and the proposed future use of this land is still uncertain.
- The State is also the sole shareholder in SAFCOL and could therefore presumably influence any attempt to trade water rights.
- Soil suitability has yet to be determined in the Palmiet sub-area where it is proposed that resource poor farmers will be established on some of the land currently under forestry plantations.

Strategic Approach

Applications for forestry will be treated as any other application for water use, recognising the fact that forestry water use cannot be curtailed as for other users. Forestry effectively takes what water is available at a 100% assurance. If there is water available for use then establishing emerging forestry growers and/or resource poor farmers will receive first priority.

Management Actions

The following actions are required:

- ⇨ A co-operative governance decision is required regarding the decommissioning of SAFCOL and the use of the State owned land (RO in conjunction with Department of Environmental Affairs and Development Planning, Department of Agriculture and local authorities).
- ⇨ Liaison with SAFCOL and the SFRA LAAC (Stream Flow Reduction Activities Licence Assessment Advisory Committee) to discuss whether there are any water use rights attached.
- ⇨ The availability of water resulting from changes between certain land-use types needs to be studied on an area-specific basis.
- ⇨ RO to develop plans and procedures for re-allocation of water which becomes available from changing land-use, taking assurances of supply into consideration.
- ⇨ Registration and licensing of all commercial afforestation to be completed.
- ⇨ The SFRA LAAC should be approached for input to this strategy.
- ⇨ Soil investigations will need to be undertaken where land is cleared, before planning the establishment of resource poor farmers.

Responsibility and Priority

The implementation of the **Changing Land-Use – Forestry** Strategy is the responsibility of the RO in conjunction with the Directorate: Water Abstraction and Instream Use. It is of low priority (**Priority 4**) in terms of the Breede River component but at a higher priority (Priority 2) for the western Overberg (particularly the Palmiet and Bot River sub-areas).

9.6 CHANGING LAND-USE: CLEARING OF INVASIVE ALIEN PLANTS

Management Objective

The goal is to optimise benefits to the water resource through the clearing of invasive alien plants. The first objective is to ensure that WfW and other initiatives responsible for the clearing of invasive alien plants are fully aware of the water resource management priorities. WfW must work closely with water resource managers in both planning and action.

Situation Assessment

Table 9.6.1 shows the estimated areas of invasive alien plants at an equivalent 100% density for the Breede WMA. The actual area invaded is actually much larger but this is expressed as an equivalent area of 100% invasion density.

Table 9.6.1: The Extent of Invasive Alien Plant Infestation in the Breede WMA

Sub-Area	Natural MAR	Condensed area	Reduction in runoff	Impact on yield (1 in 50 Yr)
Unit	**(million m^3/a)**	**ha**	**million m^3/a**	**million m^3/a**
Upper Breede	1092	26 000	34	25
Riviersonderend	432	13 500	17	13
Lower Breede	279	6 500	10	7
Overberg East	110	109 000	60	2
Overberg West	480	63 000	61	31
Total	**2393**	**218 000**	**182**	**78**

The Breede River component

The BRBS has indicated that the estimated 46 000 ha (equivalent condensed area) of invasive alien plant infestation has an impact on the yield of the Breede River component of 45 million m^3/a. Whilst in reality complete removal may be difficult to achieve there remains enormous benefit in containing the spread, both from a water resource and social (job creation) perspective. From a water resource perspective, it is required that this 45 million m^3/a be made available through clearing in the Breede River component if the full potential of the catchment to deliver an additional 140 million m^3/a of yield is to be realised (refer also to Scenario 3 in Table 3.11.1). Clearing of alien plants in the Riviersonderend sub-area has been underway for many years and clearing projects have also been initiated in the Ceres and Upper Breede sub-areas (H100 quaternaries) where there is extensive infestation.

In order to make best use of available funds and to maximise the impact of clearing, it is necessary to define those areas in which the most benefit will be achieved. The following order of priority is based purely on the cost of clearing and on the resulting benefit in terms of unlocking surface water runoff. This was determined in the BRBS. (Refer to Figures 6.1 and 6.2 to identify the management units/sub-areas).

High priority

The CBR Kingna, Ceres, and Middle Breede sub-areas.

Medium priority

The Hex sub-area, the catchments upstream of Theewaterskloof Dam (H60A-C) and the quaternaries H50A-B in the vicinity of Bonnievale.

Lower priority

The Riviersonderend sub-area (downstream of Theewaterskloof Dam), the Upper Breede sub-area and the three quaternary catchments (H70C-E) upstream of Buffeljags Dam in the Tradouw sub-area. Also the remaining catchments of the Tradouw sub-area and the Lower Breede sub-area.

This prioritisation should be reviewed to take into account the relative social and natural environmental benefits that would accrue in the sub-areas. Should the spread of invasive alien plants throughout the WMA be allowed to continue unabated, the impacts on the water resource catchments of the WMA will be disastrous. The severity of the problems that could arise as a result of a "no-interference" scenario is illustrated in the BRBS in which it is estimated that the present condensed invaded area of 46 000 ha could triple in size by 2020, and cover about 250 000 ha by 2040. Removal of invasive alien plants is therefore an important reconciliation intervention in the Breede WMA, and one that has long been identified as a very cost effective means of unlocking water and of protecting the water resource.

In the mountain catchments, pines and hakea species generally occur, while acacias and eucalyptus predominate in riparian zones. Developed land is generally uninvaded, although riparian zones on farms are often a major problem.

The Overberg Catchments

Within the Overberg catchments, an estimated 33 million m^3/a of run of river yield (1 in 50 year) is lost to invasive alien plants (NWRS). Of this, the impact in the Overberg West is 31 million m^3/a and that in the drier Overberg East, 2 million m^3/a. The impacts have not been studied to the same level of detail as in the Breede River component. The estuaries and wetlands of the Overberg East catchments are particularly impacted by invasive plant infestation. The 1 in 50 year surface water yield is estimated at only 3 million m^3/a in the Overberg East of which 66% (2 million m^3/a) is lost to invasive alien plants. Clearing of invasive alien plants offers the potential to provide for the Reserve. The Kars and Nuwejaars Rivers in the Overberg East, feed the Heuningnes Estuary and clearing in those rivers could generate freshening flows.

Throughout the WMA, the aquatic environment would benefit substantially from low flows that are regained through the clearing of invasive alien plants, as would the potential yield available from those catchments. Besides the direct benefits that will be derived from continuing and intensifying the clearing efforts, other social and ecological benefits have considerable economic value. Commercial opportunities exist through which clearing operations on private land could be encouraged. These include the utilisation of cleared vegetation for pulp or charcoal production.

Strategic Approach

The Wetlands and Estuaries Strategy (8.2) makes recommendations on the ranking of the estuaries in terms of ecological importance. This same order of priority could be used as a starting point for prioritising clearing efforts in the Overberg catchments. Ultimately however, the priority must lie within the Breede River component, where water resource development for in-catchment requirements, establishment of resource poor farmers, augmenting supply to urban users in the Berg WMA and providing for the Reserve in the Breede River and its estuary are all important aspects from both a local and regional development perspective.

The clearing of invasive alien plants within the Breede River component should be programmed according to the order of priority listed in the situation assessment of this strategy. However it is also recommended that the existing clearing programmes in the Riviersonderend (notably those upstream of Theewaterskloof Dam) and Upper Breede catchments be continued, and preferably intensified, so as to not forgo the investment already made in those areas. Early attention should be given to clearing efforts in the catchments with lighter infestations, particularly the Cogmanskloof, Ceres and Middle Breede sub-areas, before these areas become densely invaded. Prevention is always better than cure, and very, very much cheaper.

Based on the potential benefits of clearing, particularly in terms of making water available within the Breede WMA, a vibrant invasive alien plant clearing programme must be maintained in this WMA. A situation approximating total eradication is required in the Breede River component. Bio-control is the most cost effective approach for most species and should be introduced wherever possible.

Management Actions

The following actions are required:

- ⇨ Improve estimates of the impact on yield of alien plant infestation outside of the Breede River component (Overberg, Palmiet) taking into account the methodology used in the BRBS.
- ⇨ Consider the provision of incentives to private landowners for clearing invasive alien plants. A major incentive would be to allow land-owners to use some or all of the water released through clearing practices on own land.
- ⇨ Ensure that catchment management charges are applied equitably and effectively towards invasive alien plant clearing, with the ultimate goal being the removal of all invasive alien plants.
- ⇨ WfW need to: (i) complete invasive alien plant mapping and interpretation from 2001 aerial photography, and (ii) reconcile the mapped information against actual field surveys to verify its accuracy.
- ⇨ Monitor the impacts of clearing of invasive alien plants – water yield, sedimentation and quality.
- ⇨ Prepare a clearing strategy in the Breede WMA from a water resource management perspective. This should include priority areas, a strategy of prevention by tackling less invaded areas and thus avoiding the densification of populations, together with support for bio-control initiatives.
- ⇨ Water resource priorities should be discussed with WfW and the implementation strategy aligned with these, and other needs.

Responsibility and Priority

The implementation of the **Changing Land-Use: Clearing of Invasive Alien Plants Strategy** is the responsibility of the RO in conjunction with the Directorate: Working for Water as well as the Directorate: Water Abstraction and Instream Use. In light of the potential of clearing as a cost effective reconciliation intervention, this strategy is of the highest priority - **Priority 1**.

CHAPTER 10: WATER CONSERVATION AND DEMAND MANAGEMENT STRATEGIES

Two strategies have been identified for development, namely:

10.1 Water Services: Water Conservation and Demand Management
10.2 Agricultural Water Conservation and Demand Management

10.1 WATER SERVICES: WATER CONSERVATION & DEMAND MANAGEMENT

Management Objective

The objective of this strategy is to entrench the concept of effective WC/DM by local authorities, most particularly in areas where water shortages are experienced and where new supply schemes may otherwise have to be developed.

Situation Assessment

With the exception of efforts to clear invasive alien plants, very few attempts have otherwise been made by some water management institutions to implement WC/DM in the Breede WMA. It appears that many local water services officials have very little understanding of the principles of WC/DM, and that its importance is still largely being ignored. There are some exceptions, of which the successes achieved at Hermanus are most notable, and serve as an example to other local authorities.

Of the 184 million m^3/a net transfer to the Berg WMA (161 million m^3/a via Theewaterskloof Dam and 22,5 million m^3/a via the Palmiet transfer) the urban water users within the Berg WMA (notably the CCT) are the largest beneficiaries. The city is already actively implementing WC/DM and these efforts should also serve as an example to all other local authorities.

Although the urban water requirement accounts for less than 5% of the total in the Breede WMA, more efficient water use by the urban sector can save a significant portion of this, with those savings immediately available. National estimates suggest that savings of as high as 40% of all urban use could be realised. Presently there is almost no data on how much water is lost in towns, both between the bulk supply and treatment works, and in the reticulation system to the users. Without monitoring systems in place to measure water loss, the performance and progress of local authorities in terms of WC/DM cannot be assessed.

In Grabouw, Bonnievale and De Doorns, the spectre of water shortages threatens. Although less imminent water shortages also threaten Robertson, Montagu, Villiersdorp, Barrydale, Riviersonderend and the Greater Hermanus area. Future potential water supply options to towns in this WMA are discussed in the Supply to Local Authorities Strategy (12.1). That strategy assumes that all effective WC/DM steps are taken before any new schemes will be considered.

Some of the larger towns do re-use some of their treated effluent for irrigating sports fields and golf courses. Other possibilities include local irrigation projects. Worcester's treated effluent is discharged into the Breede River, becoming available for uptake downstream.

Strategic Approach

The apparent lack of understanding of the importance of WC/DM by some local authorities requires a concerted effort from DWAF to promote the principles of WC/DM, illustrating the benefits that can achieved – with Hermanus and the CCT as examples. Savings of at least 30% in urban water use should be targeted.

Local authorities will be required to implement WC/DM before DWAF will permit the development of new local supply schemes. In line with the strategy to provide technical assistance to local authorities for managing their supply schemes, technical support will be provided by DWAF in facilitating the implementation of WC/DM, where appropriate and possible. Water 'recovered' through urban WC/DM should be used to meet the needs of that sector.

Management Actions

The following actions are required:

- ⇨ The WSDPs of local authorities should set WC/DM strategies and targets and should list those initiatives that are being implemented.
- ⇨ The RO must assess the WSDPs and ensure that WC/DM targets that are set by local authorities are both reasonable and achievable, and that they are implemented.
- ⇨ In towns in which there is still lei-water use, the use and efficiency of these systems should be established as this offers a potential water exchange option for municipal use.
- ⇨ Install bulk water meters on all urban supply schemes from which supplies are not currently measured.

- ⇨ Procedures should be instituted to reconcile bulk supply with end-use so as to quantify the extent of unaccounted for water in the reticulation system.
- ⇨ Towns of greatest need (e.g. Grabouw, Bonnievale, De Doorns) must be prioritised for implementing WC/DM.
- ⇨ Opportunities for increased use of treated effluent should be identified.
- ⇨ Develop a policy regarding the re-use of treated effluent taking into account the water quality requirements of different users and the requirements of the NWA.
- ⇨ Develop a programme to inform and train water services officials on the need for WC/DM.
- ⇨ Encourage local authorities to implement step-wise billing to encourage more efficient water use.
- ⇨ WC/DM by the CCT must continue and intensify where possible, thus reducing demand from water out of the Breede WMA.

Responsibility and Priority

The implementation of the Strategy for **Water Conservation and Demand Management: Water Services** is at National level (Directorate: Water Use Efficiency) with input from the RO. It is of high priority (**Priority 2**) and is to be implemented on an ongoing basis.

10.2 AGRICULTURAL WATER CONSERVATION & DEMAND MANAGEMENT

Management Objective

The objective of this strategy is to create a culture of water conservation through efficient conveyance systems, on-farm irrigation methods, salinity management and the promotion of conservation awareness amongst all users.

Situation Assessment

The BRBS concluded that there is significant potential for implementing WC/DM measures in the agricultural sector. The agricultural water requirement in the Breede WMA constitutes 93% of the current total in-catchment water requirement, and this sector therefore offers the greatest potential savings. Previous studies in the Robertson area suggest that less than 50% of the water diverted into Brandvlei Dam reaches the farm boundaries.

The most significant losses in this WMA are evaporation losses, conveyance losses, and freshening releases in the Breede River (to reduce salinity for users in the middle reaches). On-farm losses occur between the point of abstraction and the field edge. Actual irrigation technologies are, for the most part, modern and sophisticated and do not leave much room for improvement.

Timing of releases from storage dams, (notably Theewaterskloof and Greater Brandvlei) into the river channels and conveyance canals, for uptake by farmers is not as efficient as it could be as these are not based on short-term demand projections.

It is recognised that many farmers have installed efficient on-farm irrigation methods such as drip and microjet, but the overall impression is that with the exception of invasive alien plant removal, virtually no WC/DM measures are being applied to the conveyance systems (canals) themselves. Whilst little can be done to reduce evaporation losses, proper maintenance and upgrading of aging water distribution infrastructure serving the WUAs, can significantly reduce conveyance losses.

The pilot study that was planned by DWAF for the testing of its Agricultural WC/DM Implementation Guidelines had included the Breede River component as one of the study areas but unfortunately this did not materialise in this region.

Strategic Approach

The water available to virtually all the existing irrigation water supply schemes in the WMA is fully allocated, and agricultural water users must be encouraged to use water more efficiently. This water saved could either be used to expand existing operations (an incentive to farmers) or could be made available for emerging farmers, or simply returned to the system in the event of compulsory licensing.

Improved management of the releases from large dams should be investigated to determine the savings that may be achievable through the use of short-term demand projections, taking soil moisture and crop requirements into account. Release volumes could then be accordingly adjusted.

The recommendations of the Water Quality Strategy (8.3) in terms of potential water saving through alternative methods of salinity management (interceptor drains and reduced freshening releases for example) should be studied at feasibility level to determine the potential water savings and the financial costs of implementing such measures.

Management Actions

The following actions are required:

- ⇨ Through a workshop type forum, a set of benchmark values needs to be adopted for efficient water use on irrigated crops. All role players involved in irrigated agriculture within the Breede WMA should be included in the forum.
- ⇨ Consideration should be given to the concept of managing irrigation water supply schemes on the basis of compulsory weekly demand projections, based on reliable soil moisture content and crop water demand data.

- ⇨ Assess the condition of the distribution system and the losses (in the river and canals) so as to prioritise the implementation of improvements to the system.
- ⇨ Investigate the potential benefits of short-term demand projections and corresponding co-ordination of releases from Theewaterskloof and Greater Brandvlei Dams. Real-time monitoring requirements will need to be investigated (along the Breede and Riviersonderend Rivers as well as major irrigation canals) to support this type of release management approach.
- ⇨ DWAF's pilot study for the testing of its Agricultural WC/DM Implementation Guidelines should implemented in the Breede River catchment to develop a quantitative picture of the scope for WC/DM in the agricultural sector.
- ⇨ Consider the salinity interception management options described in the Water Quality Strategy (8.3) for reducing the volumes of water required for freshening the middle and lower reaches of the Breede River.

Responsibility and Priority

The implementation of the **Agricultural WC/DM Strategy** is a Regional responsibility, in consultation with the Directorate: Water Use Efficiency. It is of a high priority (**Priority 2)**.

CHAPTER 11: INTEGRATION AND CO-OPERATIVE GOVERNANCE STRATEGIES

Two strategies have been identified for development, namely:

11.1 Support to Resource Poor Farmers
11.2 Co-operative Governance

11.1 SUPPORT TO RESOURCE POOR FARMERS STRATEGY

Management Objective

The objective of this strategy is to provide a measure of equity in the allocation of water resources within the WMA and to prioritise the allocation of available surplus water to assist in the establishment of resource poor farmers. This can be achieved through the Co-ordinating Committee for Agricultural Water Use (CCAW) and the Water User Associations (WUAs).

Situation Assessment

A large number of resource poor farmer developments in the Breede River component have been registered with the Department of Land Affairs. Of these developments, 15 projects had been implemented by March 2002, benefiting in excess of 1000 participants on some 2 200 ha. A further 29 projects benefiting 1 700 participants on 1 900 ha are in the process of implementation. Whilst little detail is available, most of these projects are thought to be on existing farms and where irrigation is involved, would be using existing allocations of water. The extent of irrigation within these projects is uncertain but is likely to be negligible in comparison with the total current irrigation requirement of 722 million m^3/a in the Breede WMA.

As owner of the Stettynskloof and Fairy Glen Dams, the Breede Valley Municipality should be entitled to plan for meeting their future urban water requirements from the estimated 14 million m^3/a surplus available out of those dams. However, the municipality must be encouraged by DWAF to also identify opportunity to provide water towards the establishment of resource poor farmers.

Interest has been expressed by potential resource poor farmer groups in Ceres, the Hex Valley, the Buffeljags River catchment, Elim, Villiersdorp, Riviersonderend and Genadendal. The latter three all lie within the Riviersonderend sub-area in which there is no water available to allocate. However, there is a current surplus of 3 million m^3/a in the Buffeljags River catchment (out of Buffeljags Dam). The option of water trading provides an avenue through which water can be made available to the emerging farmers, in areas where there is currently no surplus.

Opportunity will also avail itself in the Palmiet and Bot River catchments, where forestry plantations are being cleared. This State owned land could be made available to establishing resource poor farmers. Soil suitability analysis and access to water will define the optimum areas in which to establish irrigated agriculture in these areas.

Strategic Approach

First and foremost, a workshop type forum should be conducted by DWAF to establish exactly where resource poor farmers have acquired land, how much of that is under irrigation, if the water provided to them is out of existing allocations, which of the projects are joint ventures and who the joint venture partners are.

Whilst the isolated development of unsupported new pockets of emerging farmers may be feasible in some WMAs, this is not considered a good route to take in the Breede WMA. The reason is primarily that new farmers will be required to compete in the production of high value export crops, against experienced and established commercial farmers. The development of new entrants into competitive commercial farming practices must be through committed and sustainable support mechanisms.

Joint venture partnerships with commercial farmers and/or support from the State, through the CCAW are both potential support mechanisms. DWAF will consider the licensing of water to a joint venture between established commercial interests and resource poor farmers in a favourable light. This could be for the allocation of water from newly established supplies (new dams) or even water re-allocated through compulsory licensing. The objective being to ensure the technology transfer required for sustainable, productive and competitive farming. Commercial farmers are aware that the balance in ownership of land and water must change. Joint ventures also offer existing enterprises with the one opportunity to grow their agricultural interests – the requirement being committed technology transfer.

More equitable water use for irrigation must be engendered in order to increase the current level of participation (currently very small) by the previously marginalized. This will not preclude further expansion by existing commercial farmers. It will however place a higher priority on allocating a fair amount of water to resource poor

farmers, after which some expansion of existing commercial irrigated agriculture in the Breede WMA can be considered.

The BRBS has identified that the potential exists to cost effectively develop up to an additional 140 million m^3/a of yield in the Breede River catchment. Ultimately, whatever Reserve scenario is implemented, it is likely that the development of potential yield in the Breede component of the WMA will have a significant component of irrigation expansion associated with it. A high priority will be placed on ensuring a fair share of any irrigation potential to resource poor farmers. As the first step, it must be accurately established exactly how much irrigated land is currently in the hands of resource poor farmers, what land is available, what the demand is, and where this demand is located.

Management Actions

The following actions are required:

- ⇨ Through the CCAW establish and document the current status in terms of how many hectares of irrigated land are currently held by resource poor farmers, what that water requirement is and how is the water being provided (i.e. through existing allocations or not).
- ⇨ Also, through the CCAW, assess the demand for equity water for agriculture (emerging farmers) and evaluate this against potentially availability. GIS plots of requirements, for overlays on the distribution of availability, would be a useful tool.
- ⇨ Where water is identified as being potentially available for allocation (Worcester and Buffeljags areas, for example) programmes through local government should be encouraged to inspire, inform and train new entrants into the irrigation sector. An implementing agent (perhaps a NGO) would be required to drive such a programme, to assist new farmers, and to facilitate access to available support.
- ⇨ Support for resource poor farmers must remain a continued focus of the CCAW, through co-operative governance between DWAF, the Department of Land Affairs, the Department of Agriculture, the Western Cape Nature Conservation Board (WCNCB) and Provincial government.
- ⇨ Ensure the inclusion and participation of resource poor farmers within the establishment of WUAs.
- ⇨ Implement soils analysis studies in the areas of the Palmiet and Bot River catchments where forestry plantations are being cleared, and establish the most viable areas for developing irrigated agriculture.
- ⇨ Investigate potential sources of water supply to prospective resource poor farmers in the Palmiet and Bot River catchments.
- ⇨ Link groundwater availability to the needs of resource poor farmers.

Responsibility and Priority

The implementation of the strategy for **Support to Resource Poor Farmers** is the responsibility of the RO in conjunction with the Directorate: Water Resource Finance and Pricing and the Directorate: Water Allocation. It is of **Priority 2** (High) to be implemented immediately and on an ongoing basis.

11.2 CO-OPERATIVE GOVERNANCE STRATEGY

Management Objective

The objective of co-operative governance is to ensure that all regulating authorities involved in the management of the WMA are fully aware of the impact which their functions, decisions, and planning have on the water resources of the WMA.

Situation Assessment

Effective water resource management involves many different role players. Local government, provincial government, water service authorities and water service institutions all play key roles in this. This Co-operative Governance Strategy is therefore an over-arching strategy that essentially involves all aspects of water resource management and integrates with every strategy in the ISP. This strategy serves to address the most pertinent issues and concerns relating to co-operative governance. To date a number of co-operative governance initiatives have been undertaken by the RO, and these are functioning well. These include:

- Memorandums of understanding between DWAF (RO), Department of Agriculture, Department of Environmental Affairs and Development Planning, and the Cape Nature Conservation Board in relation to land-use practices. An example being the need to control clearing of virgin soils for new irrigation development, in an attempt to reduce the salt concentrations washed from these lands into the rivers.
- The Co-ordinating Committee for Agricultural Water (CCAW) involves DWAF, the Department of Agriculture, Cape Nature Conservation Board, the Department of Land Affairs and the Provincial Government. The CCAW addresses, amongst other issues, the provision of water to resource poor farmers. Refer to the Support to Resource Poor Farmers Strategy (11.1).
- The Streamflow Reduction Activities Licence Assessment Advisory Committee (SFRA LAAC). This Committee makes decisions regarding the licence applications for stream flow reduction activities, at the moment limited to afforestation. Representation on the committee for a particular region may vary but for the Western Cape would typically include representation from Catchment Forums, DWAF, Land Affairs as well as the Provincial Departments of Environmental Affairs and Development Planning, Agriculture, Local Government and Housing, and various NGOs and other stakeholders. There is however not much call on the SFRA LAAC with respect to the Breede WMA.
- Sub-catchment stakeholder forums have been formed and extensive stakeholder consultation has taken place with a view to establishing a representative CMA.
- A plan to resurrect irrigation in the Koo Valley through a joint initiative between DWAF and Dept Agriculture. The provision of water is via deep drilling into the Nardouw aquifer. The Dept Agriculture has paid for the groundwater exploration, drilling and casing of boreholes. Once fully established, the farmers will have to pay for the distribution of the water themselves.

There remain a number of shortcomings relating to the need for other co-operative governance structures in order to achieve truly integrated water resource management. These are briefly outlined below.

Water Quality

Enforcing water quality standards set by DWAF for the discharge of treated effluent by other authorities remains a shortcoming. The use of larger regional solid waste disposal sites is desirable, rather than small sites operated by individual towns. Closure of some smaller sites has taken place but these have not all been rehabilitated. Although urban growth is not a widespread problem in the Breede WMA, the management of the rapidly expanding settlement at Grabouw is of concern (Refer to the Water Quality Strategy – 8.3)

The problems associated with the management of diffuse pollution in the Bot River Lagoon are discussed in the Estuaries and Wetland Strategy (8.2) and a Management Plan is being drafted by the RO in consultation with all stakeholders.

A Structure Development Plan for the Lower Breede River is being drafted between DWAF and Provincial Government. This will address amongst other issues, the pollution of the lower Breede River and estuary, from increasing residential development and recreational use of the river.

Water Conservation and Demand Management

Water losses from poorly maintained and ageing canal systems and inefficient irrigation practices by some farmers need to be addressed through a co-operative approach with the Dept Agriculture. This is further addressed in the Agricultural Water Conservation and Demand Management Strategy (10.2).

Resource Poor Farmers

The availability of land and good soil in the Breede River component would allow for large areas for establishment of resource poor farmers. Water availability is more limited. DWAF on the one hand must inform the CCAW of where surplus water is both currently and potentially available, and the CCAW on the other hand must determine the demand for water by emerging farmers in those areas.

Invasive Alien Plant Removal

A co-ordinated approach to the removal of invasive alien plants in the Breede WMA has yet to be implemented. Co-operation between WfW, Dept Agriculture and DWAF will be necessary in order to implement the Clearing of Invasive Alien Plants Strategy (9.6) with maximum efficiency.

Water Supply to Local Authorities

There is pressure in the Coastal catchments, for expansion and some increased water requirements can be expected. Future possible supply options are presented in the Supply to Local Authorities Strategy (12.1) and these must be aligned within the WSDPs and IDPs being prepared by local authorities, as well as this ISP.

Monitoring Information

The sharing of monitoring data between the Department and other water management authorities is to be encouraged. DWAF is playing a leading role in developing a monitoring strategy for the Western Cape, supported by all government partners engaged in monitoring. Refer to the Monitoring Networks and Data Capture Strategy (15.2).

Strategic Approach

The importance of co-operation across Government Departments is now recognised more clearly than ever at all levels. Water is absolutely central to this, given the pivotal role it plays in all development. DWAF is very aware of its role as a co-operative governance partner. The historical approach of "demand and we will deliver" has become one of "if you require, or are going to require water, we will explore options with you".

DWAF does not wish to exercise undue power through its control over the water resources. The approach is one of maximising the provision of information to and the understanding of all water users, and co-operation and negotiation to ensure wise management and an equitable sharing. This requires taking a very active role in all development and other co-operative governance, and in ensuring that water has a permanent position on the planning agenda of co-departments.

A major issue is the frequent lack of compliance by some local authorities, particularly in terms of discharges from WWTWs. Co-operative governance approaches are at present the only available tool, but DWAF has been forced to investigate whether other methods can be invoked against non-compliant authorities. This is being addressed at national level, but it would be best to find regional solutions. The first step in the right direction is to identify the poorly managed WWTWs and SWDSs and to propose and support ways of improving the situation. The preferred option in terms of improved management of solid waste is to make use of larger regional solid waste facilities.

The Provincial Liaison Committee (PLC) comprising the various Western Cape Government Departments should be used as the forum for addressing co-operative governance issues, and the CMAs should be ultimately represented on the PLC. In so doing many issues could be resolved at regional level without requiring National involvement.

The responsibilities and roles of co-operating institutions need to be clearly identified. For example in terms of developing resource poor farmers, DWAF's role and responsibility is to inform the Department of Agriculture, through the CCAW, as to where water is available for potential resource poor farmer development.

Management Actions

The following general actions are required at Regional level:

- ⇨ Compliance in the management of WWTW and discharge of effluent needs urgent attention. Policies must be developed to deal with disputes between local authorities and the RO in relation to effluent quality and management of WWTW. A process of resolution between government institutions is required at National level.
- ⇨ Identify opportunities for sharing both monitoring and the capture of water management information, and for the sharing of information with other authorities, to avoid duplication of effort.
- ⇨ Identify the relevant local authorities and develop strategies with them relating to pollution of rivers, taking into account the recommendations of the dense settlement strategy (DWAF/DANIDA).
- ⇨ DWAF and Provincial Government need to push for agreement on the Draft Structure Development Plan for the Lower Breede River.

Responsibility and Priority

The implementation of the **Strategy on Co-operative Governance** is at National level (Directorate: Institutional Oversight) with input from the RO. This is of **Priority 2** (High).

CHAPTER 12: INSTITUTIONAL DEVELOPMENT AND SUPPORT STRATEGIES

One strategy has been identified for development, namely:

12.1 Supply to Local Authorities

12.1 SUPPLY TO LOCAL AUTHORITIES STRATEGY

Management Objective

To ensure that the WSDPs, IDPs and all other planning processes are aligned with this ISP and with the realities of available water supply to Local Authorities and District Municipalities. The current sources of supply to all towns and the potential options for future supply need to be identified and strategies developed to ensure sustainable water provision.

Situation Assessment

As part of the Integrated Development Plans (IDPs), local authorities have been requested to prepare Water Services Development Plans (WSDPs). These are intended to highlight the current sources of supply and future anticipated sources of supply to these authorities for further distribution to users. Certain of the WSDPs have already been submitted. However, the detail and information provided varies and is often inadequate or incomplete. Future sources of supply to urban users, as best understood and recommended by DWAF, are suggested within this strategy (see Table 12.1.1).

In the Overberg catchments two rural water supply schemes (Ruensveld West and Ruensveld East) import water from the Riviersonderend River. Both are operated and maintained by the Overberg Water Board. Although these schemes are primarily for rural domestic water supply, the Ruensveld West Scheme also supplies water to the town of Caledon, Bredasdorp and Arniston. A third rural water supply scheme, the Duiwenhoks Scheme, imports water from the Duiwenhoks River Dam in the Gouritz WMA to supply farms in the Lower Breede sub-area. This scheme also supplies the town of Witsand with water. With the exception of the towns of Greyton and Riviersonderend (both supplied from Theewaterskloof Dam), the water requirements of all other towns in the Breede River component are supplied from local schemes operated by the local authorities. Use is made of both surface and groundwater.

Water shortages are imminent at the towns of Grabouw, Bonnievale and De Doorns. De Doorns will be granted an allocation out of the proposed Osplaas Dam should this be built. At Robertson, Montagu, Barrydale, Villiersdorp, Riviersonderend and the Greater Hermanus area, planning to meet future water requirements is also a high priority. Potential for groundwater abstraction out of the TMG has been confirmed at Hermanus.

The Water Services: Water Conservation and Demand Management Strategy (10.1) addresses the steps that must be taken to effectively implement WC/DM as a prerequisite to any further development of local supply schemes.

Strategic Approach

The responsibility for resolving local water supply problems lies with the local authorities. DWAF is nevertheless responsible for the overall management and allocation of the resource and will, before authorising any new allocation, take steps to ensure that the local authorities have access to the necessary information for decision-making, and that they have taken all possible steps to manage the existing allocation carefully.

With regard to the allocation of possible resources to be used in local supply schemes, DWAF will first focus on ensuring that adequate steps are taken by local authorities to implement the broad principles of WC/DM (water re-use, savings, leakage reduction, invasive alien plant removal, etc) and water trading. Thereafter groundwater will often be the preferred resource in this WMA, and DWAF will insist on proper groundwater investigations. Technical guidance will be provided by DWAF where possible and appropriate. More supportive technical assistance will be considered only where the towns do not have adequate resources themselves.

IDPs and WSDPs should include a review of supply options (as per Table 12.1.1), indications of growth rates, and plans for growth. Appropriate water supply and sanitation systems must be in place, taking into account the ability of the resource to handle waste discharge. DWAF will support the preparation of these documents through the provision of ideas, information, and technical expertise.

Management Actions

Local authorities will often need assistance and advice from DWAF in the planning of local schemes. The following actions are required in this regard:

- ⇨ Study available IDPs and WSDPs and check for alignment with the ISP in terms of water conservation and demand management, future supply, as well as projections of future requirements.
- ⇨ Liase with local authorities and District Municipalities to ensure that alignment is reached, with regard to both demand and supply, either through adjustments to the IDP / WSDPs or to the ISP.
- ⇨ Develop and provide local authorities with the principles against which DWAF will license water use.
- ⇨ Indicate to the local authorities the degree to which support could be provided by the Department.
- ⇨ Provide support as appropriate.
- ⇨ Develop and provide availability maps.

Responsibility and Priority

The implementation of the **Supply to Local Authorities Strategy** is the responsibility of the RO, providing guidance to local authorities and in consultation with the Directorate: National Water Resource Planning. It is of moderately high priority (**Priority 3**) to be implemented on an ongoing basis over the long term.

TABLE 12.1.1: CURRENT AND POTENTIAL SUPPLY OPTIONS TO URBAN USERS IN THE BREEDE WMA

LOCAL MUNICIPALITY	USER	CURRENT SOURCES OF SUPPLY	FUTURE POSSIBLE SOURCES OF SUPPLY
Witzenberg	Prince Alfred Hamlet.	Borehole and Wabooms River Diversion.	Adequate supply for the next 40 years.
	Ceres.	Koekedouw Dam.	Excess water is available but at high cost.
	Wolseley.	Tierhoek Stream.	Wolseley's unused allocation out of the Artois Canal.
Breede Valley	De Doorns.	Mountain stream, Sandrift Government Water Scheme.	50 000 m^3/a from proposed Osplaas Dam. Also boreholes.
	Rawsonville.	Smalblaar River.	Water trading and groundwater.
	Worcester.	Stettynskloof Dam, Fairy Glen Dam, and allocation out of the Hex River.	Some unused allocation out of Stettynskloof Dam currently utilised by the Holsloot Irrigation Board, under agreement with the Breede Valley Municipality - adequate for next 40 years.
Breede River / Winelands	Robertson.	Dassieshoek and Koos Kok Dams.	Water trading (adequate for 10 years). Potential to supply Robertson out of a potentially augmented Greater Brandvlei Dam.
	McGregor.	Houtbaais and Hoeks River.	Water trading and groundwater.
	Bonnievale.	Breede River via the Zanddrift Canal.	Water trading.
	Montagu.	Mountain streams, Breede River and borehole.	Cogmanskloof Scheme as well as possible groundwater out of the TMG. Also possible to link to Ashton through a pumping scheme.
	Ashton.	Breede River via the Cogmanskloof Scheme and private pumping scheme.	Cogmanskloof Scheme as well as possible groundwater out of the TMG.

TABLE 12.1.1 (cntd) CURRENT AND POTENTIAL SUPPLY OPTIONS TO URBAN USERS IN THE BREEDE WMA

LOCAL MUNICIPALITY	USER	CURRENT SOURCES OF SUPPLY	FUTURE POSSIBLE SOURCES OF SUPPLY
Theewaterskloof	Villiersdorp	Borehole and Elandskloof Dam. Winter water out of the Kommissiekraal River (tributary of the Elands River).	Water Conservation and Demand Management (WC/DM) and water trading.
	Genadendal	Mountain stream.	WC/DM. Existing sources can supply more if there is additional storage. Also groundwater.
	Greyton.	Mountain streams and Theewaterskloof Dam.	WC/DM. Trading with irrigators currently supplied out of Theewaterskloof Dam is also an option.
	Riviersonderend.	Mountain stream and Theewaterskloof Dam.	WC/DM. Trading with irrigators currently supplied out of Theewaterskloof Dam is also an option.
	Overberg Water.	Theewaterskloof Dam allocation.	Same as current + possible increased imports from Gouritz WMA (Duiwenhoks Scheme).
	Grabouw.	Eikenhof Dam and Wesselsgat Weir.	Palmiet River and TMG aquifer.
	Botriver.	Boreholes and springs and Railways Dam.	Groundwater.
	Caledon.	Ruensveld West Scheme (Overberg Water), out of the Riviersonderend River & boreholes.	Ruensveld Scheme and groundwater.
Langeberg.	Witsand.	Duiwenhoks Scheme (via Overberg Water Board)	Groundwater piped from Potberg. Desalination of Breede River Water. Possible excess winter water from Duiwenhoks River.
	Infanta.	Boreholes.	Groundwater (Potberg).
Swellendam	Barrydale.	Huis River/ Small Dam.	Groundwater development is an option as well as additional supply from the Huis River.
	Swellendam.	From a small stream (Klip River) into 3 small dams.	Has adequate supply. Peak demands could be met from groundwater.
	Suurbraak.	Buffeljags River and a spring.	Buffeljags River abstraction to off-channel storage.
	Buffeljags settlement.	Untreated water from Buffeljags Dam.	Buffeljags Dam.
	Rietkuil community.	Overberg Water.	Overberg Water.

TABLE 12.1.1 (cntd) CURRENT AND POTENTIAL SUPPLY OPTIONS TO URBAN USERS IN THE BREEDE WMA

LOCAL MUNICIPALITY	USER	CURRENT SOURCES OF SUPPLY	FUTURE POSSIBLE SOURCES OF SUPPLY
Overstrand	Pringle Bay, Rooi Els.	Buffels River Dam and springs.	Palmiet River and groundwater.
	Bettys Bay, Kleinmond.	Both from Palmiet River and also 3 boreholes for Kleinmond supply.	Palmiet River (adequate for 15+ years).
	Hermanus, Fisherhaven, Vermont, Onrus River, Sandbaai.	De Bos Dam.	TMG Aquifer, desalination and Klein River Dam.
	Gansbaai.	De Kelder springs, Franskraal Dam, boreholes and 2 million m^3/a from Kraaibosch Dam (Uilkraals sub-area).	Groundwater. Also possible artificial aquifer recharge using treated effluent.
	Stanford.	Groundwater.	Groundwater. Also possible artificial aquifer recharge using treated effluent.
	Tesselaarsdal Community.	Mountain stream, supplemented from boreholes and springs.	Groundwater.
	Pearly Beach.	Springs and Boreholes.	This needs to be addressed. Possible groundwater supply.
	Baardskeerdersbos.	Community Water and Sanitation Services (CWSS) Project 2004/5.	Tributary of Boesmans River and boreholes.
Cape Agulhas	Elim / Spanjaardskloof & Sandfontein.	Borehole and spring. Sandfontein supplied from CWSS project.	Additional boreholes and surplus winter water from Nuwejaars River.
	Bredasdorp.	Boreholes, Klein Sandrift Dam and Ruensveld East Scheme.	Ruensveld East Scheme via pipeline already installed. Also further development of local groundwater resource.
	Struisbaai, L' Agulhas & Suiderstrand.	Boreholes	Further development of groundwater.
	Arniston / Waenhuiskrans.	Bredasdorp Municipality and Ruensveld East Scheme. Groundwater used to meet peak demands but is of high salinity and treatment costs cannot be afforded by the local authority.	Supply from Bredasdorp and groundwater.
	Napier.	Borehole & mountain stream (Vlermuiskelderskloof).	Groundwater.
	Protem / Klipdale.	Ruensveld East Scheme (Overberg Water Board).	Ruensveld East Scheme (Overberg Water Board).

CHAPTER 13: SOCIAL STRATEGY

DWAF recognises that no decision regarding the use of water resources should be made without due consideration of the social, economic and ecological impacts of such decisions. Together with the technical and economic aspects this multi-faceted decision base has become more and more necessary as the resource becomes ever more scarce.

It is important that DWAF highlights the social aspects of its agenda. These are already very clear in the quest for equity, in the support for resource poor farmers, in the water supply and sanitation programme, and in the poverty eradication, but it is nevertheless very important that any decision by DWAF remains transparent and that the Department never loses sight of its social responsibilities. Extensive public participation has been mandated through the NWA for many DWAF activities and those strategies appearing in this ISP with a strong social and public participation component are:

- Groundwater Utilisation (7.4)
- Reserve and Resource Quality Objectives (8.1)
- Changing land-use – Clearing of Invasive Alien Plants (9.6)
- Water Conservation and Demand Management (10.1 and 10.2)
- Strategy for Supply to Local Authorities (12.1)
- ISP Implementation (16)

DWAF is required to include the public in much of its management and decision–making process and the ISP Implementation Strategy (No 16.1) is be aimed at putting this into effect for the ISP process.

CHAPTER 14: WATERWORKS DEVELOPMENT AND MANAGEMENT STRATEGIES

There are two strategies under this heading, namely:

14.1 Management of Reserve Releases from Private Dams
14.2 Recreation on Dams and Rivers

14.1 MANAGING RESERVE RELEASES FROM PRIVATE DAMS

Management Objective

To develop protocols for the releases of water from private dams as a contribution to the Reserve requirement of the river systems in which they occur.

Situation Assessment

Currently environmental releases from privately owned in-channel dams are specified only for three dams in the Breede WMA. These are the Eikenhof Dam on the Palmiet River, the Koekedouw Dam on the Koekedouw River at Ceres, and Kraaibosch Dam on the Uilkraals River. Whilst releases do take place from other private/municipal dams (De Bos Dam in the Onrus River catchment and Arieskraal Dam in the Palmiet catchment, for example) these are primarily for the benefit of other users downstream and not for the environment. The conditions attached to the authorisation for operating each of the three dams in question are unique to each of them and are briefly explained below:

Eikenhof Dam

The spillway of the Eikenhof Dam (Palmiet River) was raised and augmented in 1998, prior to the implementation of the NWA. Based on Ecological Water Requirement studies undertaken, the licence conditions for the raising were set, such that a release of 2 million m^3/a via a continual flow release into the Palmiet River be made.

Koekedouw Dam

The dam (in the Upper Breede) was reconstructed in 1998 and under the new licence, releases for Ecological Water Requirements were stipulated. Although the NWA had yet to be passed, the understanding of the requirements of the Reserve was already in place and the licence conditions were set with this in mind. The releases are based on fixed monthly percentages of modelled inflow for each month, and not on actual recorded inflow records. The licence has a condition for a 50% cutback in releases during drought periods, and this condition was implemented in September 2003 at the onset of the summer season.

Kraaibosch Dam

This dam, on the Uilkraals River, was approved prior to the implementation of the NWA. Releases for Ecological Water Requirements were stipulated, and licence conditions set with the Reserve in mind. During summer 100% of the inflow into the dam is released. Inflow is recorded at an upstream gauging station and the outlet releases adjusted to match. This is reset every second day. During winter, 60% of the inflow is stored and 40% released via a continual release process, based on the same inflow measuring process used in summer. The dam has a storage capacity of only 30% of the MAR and as a result fills relatively quickly in winter. When spilling starts, the outlet valves are simultaneously opened to assist in providing peak flows downstream in winter. The monitoring of flow releases is conducted by DWAF.

The Arieskraal Dam on the Palmiet River was authorised prior to the implementation of the NWA (1998) and a continual but small flow release is made from it, via a small diameter orifice plate. This release is to provide water to a downstream user who has a licence to abstract that water. The existing outlet infrastructure will not be able to make Reserve type releases. This presents a potential problem for implementing the Palmiet River Reserve. The only means of making environmental releases to the river downstream is by first filling Arieskraal Dam through releases made from the upstream Kogelberg Dam. Arieskraal is then allowed to fill and spill. Not only is this inefficient (particularly in summer) but means that with its current outlet infrastructure, Arieskraal Dam itself will be unable to contribute to the eventual Reserve requirement.

Strategic Approach

The importance of efficient water use is stressed throughout this ISP and solutions must be found to overcome the specific problem at Arieskraal Dam. More broadly, all large private dams should eventually be making a contribution towards the Reserve. The flow release conditions being implemented at Kraaibosch Dam for example, present a good illustration of what can be achieved, where the outlet infrastructure is in place to make such releases.

A Palmiet Catchment Management Plan has been developed by the RO and this management plan should be integrated with the strategies of this ISP.

Management Actions

The following actions are required:

- ⇨ Implement the Palmiet Catchment Management Plan.
- ⇨ The Reserve for the Palmiet River and estuary should be determined and the relative contribution from Arieskraal Dam to that Reserve be established.
- ⇨ Through negotiation with the owners, a solution to the problem at Arieskraal Dam must then be sought. A water efficient solution would be to replace the current orifice plate with a suitable outlet control structure at the dam.
- ⇨ Use the Kraaibosch Dam as an example to illustrate to stakeholders at other private dams how seriously the Department considers the importance of providing for the Reserve.
- ⇨ Encourage the Koekedouw Irrigation Board to establish a record of inflow into the dam so as to implement a responsive release management strategy, similar to that adopted at Kraaibosch Dam.

Responsibility and Priority

The implementation of the **Managing Reserve Releases from Private Dams Strategy** the responsibility of the RO in conjunction with the Directorate: RDM, the Directorate: Abstraction and Instream Use and the Directorate: National Water Resource Planning. This strategy is of highest priority (**Priority 1**).

14.2 RECREATION ON DAMS AND RIVERS

Management Objective

To identify and implement the zoning policy on existing dams and to manage recreational activities on the inland water bodies of the WMA.

Situation Assessment

The NWA defines recreation on rivers and dams as a water use. General Authorisations have been developed to establish the limits within which water resources may be used for recreational purposes. There is an existing policy in place for zoning of dams, concessions, and stakeholder involvement as far as recreational use is concerned.

Within the Breede WMA, the Greater Brandvlei Dam, Theewaterskloof Dam and the main stem Breede River itself are currently extensively used for recreational purposes. The Breede River in particular is of significant recreational importance in the WMA, one notable event being the Breede River Canoe Marathon held annually between Robertson and Swellendam.

The Greater Brandvlei Dam consists of the Brandvlei and Kwaggaskloof Dams. Motorised water sport is permitted on Kwaggaskloof Dam and yachting on Brandvlei. At Theewaterskloof Dam motorised water sport is permitted and yachting is very popular. Future planning in terms of zoning will need to take this into account, particularly in the case of the Greater Brandvlei and Kwaggaskloof Dams. These two dams share one water surface when they reach certain storage levels. This will be more frequent if the potential augmentation of Greater Brandvlei Dam comes to fruition, and the development of lakeside properties should be managed accordingly.

Strategic Approach

In the Breede WMA, DWAF sees its role as being to maximize recreational benefit from the use of state assets. At the same time this should not be at unreasonable cost to other water users. The RO must list and categorise all those dams and rivers that serve as 'recreational assets' in this WMA. The future management of these assets, and the likely negative impacts that current use might have, need to be evaluated. At the same time the very real social benefits of the recreational opportunities provided by dams and rivers need to be taken into account. No asset should be further restricted or closed to use without very close consideration of the social cost that this might carry, and such a decision should not be taken lightly. It is important that facilities should not be exclusive and bound to traditional users. DWAF must ensure that equity is achieved in making its resources available to all users.

Management Actions

The following actions are required:

- ⇨ Review and implement the existing recreational use policy in the Breede WMA.
- ⇨ Utilisation of the dams for recreational purposes should be promoted.
- ⇨ Strategies developed by the Sub-directorate: Environment and Recreation, on how these dams could best be utilised, should be implemented.

Responsibility and Priority

The implementation of the **Recreation on Dams and Rivers Strategy** the responsibility of the RO and is of a relatively low priority (**Priority 4**).

CHAPTER 15: MONITORING AND INFORMATION STRATEGIES

Two strategies have been identified for development, namely:

15.1 Abstraction Control Monitoring

15.2 Monitoring Networks and Data Capture

15.1 ABSTRACTION CONTROL MONITORING

Management Objective

To facilitate improved control and management of water abstractions, compliance with authorisations, and reliable information on actual water use.

Situation Assessment

It is probable that in certain areas of the WMA, some unlawful water use (such as exceedance of licensed volumes) is taking place, making the monitoring and control of abstraction a necessary activity. Within formal WUAs it is expected that the activities of members will be monitored by the WUAs themselves. The control of abstraction outside of formal WUAs presents a more formidable challenge, particularly in the Overberg catchments where farmers have historically not operated within the umbrella of irrigation boards.

Through the ISP process to date, indications are that possible areas of concern include the following:

- The extent of abstraction of groundwater within the Ceres sub-area exceeds the preliminary estimates of sustainable abstraction,
- Where artesian boreholes are found to occur, these are often not being appropriately capped (sealed) between periods of use. Under this type of non-continuous use, water is not being efficiently used,
- The extent of groundwater abstraction in the Hex sub-area and its impact on the available surface water resource,
- The current abstraction of groundwater out of the alluvium, in the area between quaternary catchment H10F and Greater Brandvlei Dam is estimated at 25 million m^3/a. The preliminary groundwater Reserve suggests a sustainable abstraction volume of 20 million m^3/a out of the alluvium in that area,
- The extent of summer abstraction of surface water from the Breede River and Riviersonderend River tributaries,
- Groundwater and surface water abstraction in the Tradouw sub-area, particularly to the north of the Langeberg mountains,
- The abstraction / storage of water by private irrigators in the Palmiet River,
- The RO does not currently have the resources available to monitor and police abstraction on behalf of the Reserve,
- In general, abstraction for irrigation purposes outside of irrigation schemes is difficult to control and would require continual policing to ensure compliance with licence conditions.

A protocol for abstraction of water from all water resources in the Breede WMA is currently being developed by the RO. Abstraction control by large private users from their own infrastructure will ultimately become the responsibility of the WUAs who will be responsible for monitoring the collective water use of all members.

Strategic Approach

Abstraction control and management is going to become ever more critical as water becomes scarcer and competition for the resource intensifies. This is a particular concern in the case of relatively uncontrolled shared water, such as aquifers accessed by many different users, and where dam releases are made for selective uptake by farmers further downstream. These are systems open to abuse.

Abstraction and monitoring must go hand in hand, and monitoring systems implemented to achieve the desired objective of stopping illegal and unpaid for water use. The Allocation and Licensing Strategy (9.3) provides recommendations on how new applications for abstraction licences should be managed within the Breede WMA. These recommendations must be taken into account when designing abstraction control monitoring networks.

Whilst it is understood that there is probably some over-abstraction by irrigators (the Ceres, Hex and Palmiet sub-areas for example), and this may be lawful use resulting in an effective over-allocation, this component of over-allocation should be resolved through the WUAs themselves. Any illegal use will be identified during the verification of existing lawful use process and the suggested actions of that strategy (9.2) applied.

Management Actions
The following actions are required:

- ⇨ Review and document the acceptability of current monitoring of use (what is currently monitored, how acceptable is it and what is required to meet the needs).
- ⇨ Groundwater abstraction licences should be written with a proviso statement under which special conditions such as borehole capping, control valves and monitoring come into effect if artesian water is encountered once the borehole is drilled.
- ⇨ The management of abstraction by irrigators must become part of the WUA responsibility and monitoring will have to be implemented by the WUAs to ensure that their members are compliant.
- ⇨ The monitoring of abstraction and storage of water from the Palmiet River must receive high priority as identified in the Verification of Existing Lawful Use Strategy (9.2).
- ⇨ Identify the extent of additional resources that would put the necessary monitoring in place to ensure that the requirements of the Reserve are not being impacted upon by illegal abstraction.
- ⇨ Develop capacity within the Breede CMA to undertake monitoring.

Responsibility and Priority
The implementation of the **Abstraction Control Monitoring Strategy** is the responsibility of the RO in conjunction with the Directorate: Water Abstraction and Instream Use. It is of **Priority 2** – High.

15.2 MONITORING NETWORKS AND DATA CAPTURE

Management Objective

The design and implementation of effective monitoring networks and repository databases to ensure adequate quantification of the balance between sustainable water use and protection for surface freshwater bodies and groundwater.

Situation Assessment

Some notable issues in the Breede WMA relate to inadequate groundwater monitoring, groundwater / surface water interaction, and a need to implement flow gauging into estuaries.

A. SURFACE WATER MONITORING

- Determining and implementing the Reserve is only one part of the picture. Monitoring to gather and evaluate baseline river data and assess the effectiveness of implementing the Reserve, is not yet in place.
- The Water Quality Management Strategy (8.3) identified the need for establishing and monitoring the extent of discharge and/or irrigation with inadequately treated or untreated agricultural effluent (particularly from small-scale polluters who are more difficult to monitor) and salinity.
- Flow gauging in the rivers of the Breede WMA is adequate from a hydrological perspective.
- Baseline monitoring (monitoring to establish current river health) of the wetlands and estuaries is inadequate throughout the WMA. An exception is the Bot River estuary (a managed system) in which baseline monitoring does take place.

B. GROUNDWATER MONITORING

- Groundwater abstraction licences cannot be issued without a preliminary groundwater Reserve determination and there is often insufficient monitoring data available to support a determination.
- The monitoring network can be expanded by attaching monitoring conditions to new licence applications. However, without first having that information to undertake a preliminary Reserve, the licence conditions cannot easily be set.
- Over-abstraction of groundwater takes place in the Ceres catchment and the actual extent of current abstraction out of the alluvium in the Upper and Middle sub-areas is not reliably known.

C. INTEGRATED WATER RESOURCE MONITORING

- The effects of snow melt on surface water flow and groundwater recharge is not well understood.
- The RO is developing a strategy/protocol on abstraction and allocation from all water resources in the Breede WMA.
- The raingauging network in the high rainfall areas of the Breede WMA is not adequate for accurate hydrological modelling of surface water runoff but expansion of the network is planned by the RO.
- Aquaculture taking place in Kraaibosch Dam (Uilkraals River) is being monitored by Gansbaai Municipality. This monitoring will serve as a baseline monitoring study to determine aquaculture impact on water quality of dams in general. This type of involvement by local authorities should be encouraged.

Strategic Approach

Surface Water Monitoring

Baseline monitoring in the Riviersonderend River is a high priority in order to gather information that will be required to support decisions on the Reserve for that river. Monitoring will bring an understanding of how the river system functions under present day flow conditions. Once the environmental requirements have been established and an understanding of the river system has been developed, then a detailed protocol for implementing the eventual Reserve can be put in place.

Groundwater Monitoring

The Groundwater Utilisation Strategy (7.4) lists the improvements required in terms of groundwater monitoring. In the interim, licence applications for groundwater abstraction do not need to be put on hold. Expert opinion coupled with the findings of the BRBS should be used to refine the recommendations of the Allocation and Licensing Strategy (9.3) as to where, and under what resource protection conditions licences for groundwater abstraction can be issued. Improvements to groundwater monitoring networks must be focussed on those areas which are most vulnerable and in which the use is most extensive. These include the Ceres, Hex and Upper Breede sub-areas, with particular emphasis on the alluvial aquifer and its interaction with surface flow and the TMG aquifer.

Water Quality

The extent of precautionary measures that need to be taken by polluters, and the effects of those measures, will need to be established through a census by the RO. The focus should first be on establishing the extent and impact of small-scale irrigation with inadequately treated effluent and to verify that the water quality requirements of the GAs for irrigating with wastewater, are being met.

Data Sharing

In the Western Cape a start has already been made by getting all the co-operative governance partners involved in monitoring, to coordinate a strategy, based on mutual needs and on achieving efficiencies by combining efforts in terms of both data collection and information management. DWAF has proved to be an obvious driver in this process and has been requested to maintain this role. More attention and resources are required if this is to keep its momentum. One of the core strategic approaches already adopted by the RO is that no data should have exclusive ownership and that the sharing of data should be maximised to the benefit of all. There are concerns regarding the possible misinterpretation of organisation-specific data by others, and there will inevitably be the need for some cost recovery in certain instances – however these broad principles are endorsed and need to be carried forward through this strategy. Monitoring by local authorities should be encouraged.

Management Actions

The following general actions are required:

- ⇨ As recommended in the Releases from Private Dams Strategy (14.1) a review of the current monitoring of releases from such dams should be undertaken.
- ⇨ In terms of the Reserve, a two-fold monitoring programme needs to be adopted to ensure that:
  - o the Reserve requirements are being complied with, and
  - o baseline data on river conditions is continually monitored so as to establish whether or not the ecological objectives of the setting the Reserve in the first place are being met (the Riviersonderend River is a priority for baseline monitoring).
- ⇨ Developing an understanding of the overall resource (of which snow melt is one component) is an important requirement for future water resource planning.
- ⇨ Further study is required to identify suitable monitoring criteria and sites so as to improve on the understanding of the surface water/groundwater interaction, particularly that of the alluvium (its core space volume, recharge, etc.). It is important to establish the potential of the alluvium for further development of yield in the Breede WMA.
- ⇨ The abstraction strategy/protocol being developed by the RO for the Breede WMA will be extended to also include the management of the alluvium.
- ⇨ Implement baseline monitoring to determine the ecological status of the estuaries and wetlands in the order of priority identified in the Estuaries and Wetlands Strategy (8.2). As a first step, the inflow to the estuaries should be monitored.
- ⇨ The RO must continue their investigation into establishing new raingauging stations in the mountain catchments of the Western Cape, establish new stations, and ensure that existing stations that are already in place, be maintained.
- ⇨ Develop and implement the Provisional Regional Monitoring strategy that has been drafted by the Western Cape RO.

Responsibility and Priority

The implementation and co-ordination of the **Monitoring Networks and Data Capture Strategy** must be driven at WMA level by the RO in consultation with the Directorate: Information Programmes and the Directorate: Hydrological Information. This of **Priority 2** – High.

CHAPTER 16: IMPLEMENTATION STRATEGIES

One strategy has been identified for development, namely:

16.1 ISP Implementation

16.1 ISP IMPLEMENTATION

Management Objective

To ensure that the approaches put forward by the Department through this ISP are adopted and implemented in the Breede WMA. This will require commitment, funding and capacity.

Situation Assessment

The ISP is an internal document developed by the Department of Water Affairs and Forestry. The ISP sets out the approaches which the Department is taking towards water management in the Breede WMA – and lists suggested actions towards achieving good management of the water resources.

The wider public has had no direct input into the writing of this ISP – yet it is recognised that the approaches suggested have a significant impact on the people of the Breede WMA. Whilst the approach to date in developing this ISP may seem non-participatory, it must be remembered that this is not a Catchment Management Strategy – but DWAF setting out how it sees the situation, and the steps which it views as most appropriate in dealing with that situation. Interactions with the public have been an important influence in developing the approaches adopted.

This ISP is not a closed document but is to be made available to the wider public for comment and input. This makes the ISP an inherently transparent document – opening out the thinking and planning of the Department. Although DWAF makes no commitment to adopt every comment made, these will be taken seriously and the ISP will be updated and improved as newer and better perspectives are formed. Once the CMA has been established it will be required to develop a CMS, and this will require full public participation. It is to be hoped that the ISP will be taken as useful baseline information and, indeed, that the approaches adopted here are found to be acceptable to, and adaptable by, the new dispensation.

Strategic Approach

ISPs for each WMA are guided by the NWRS – and decisions affecting national resource distribution and use, as presented in the NWRS, are binding on each ISP. This ISP does, however, make a number corrections and improvements which serve as knowledge updates to the NWRS, particularly as regards catchment water balances and the availability of water for purposes of allocation. The ISP is signed off by the Director NWRS and approved by the Department's Water Resources Functional Management Committee. It is also published on the Departmental website. It therefore has the status of an official document containing current best available knowledge with regard to water resource use and availability.

The ISP should be updated as and when new information becomes available and will serve as the primary source document for decision-making, within the framework provided by the NWRS.

The implementation of the ISP is an enormous task and will have to be tackled in a stepwise fashion. Much of what is in this document describes the day-to-day functions of the Department – but there are many new tasks, functions, and actions set out in response to DWAF's visions for the future.

It is recognised that it is quite impossible to immediately launch into, and achieve, all that is required by this ISP. Funds and capacity are real constraints. The approach is to take the ISP and to use it as instruction, guidance, and motivation in the development of yet clearer management and action plans. These must be built into Departmental Business Plans, and budgeted for as part of Departmental operating costs. This will necessarily be in a phased manner as dictated by available resources, but it is important that the ISP be used to leverage maximum funds, maximum capacity, and to bring optimum management to the WMA.

The position with regard to the 'Authority of Information Contained in the ISP' is further set out in Para. 1.3.4 of Chapter 1 of this ISP document.

Management Actions

The following actions are required:

- ⇨ Publish the ISP to be accessible for public input and comment (consider hard-copy and web-based options). Copies will be presented to key stakeholders on request. It is not the intention to have a major drive for public input, but merely to create opportunity for input.
- ⇨ Develop materials which help to take the ISP to Provincial, District and Local Government authorities. Also to support the Water Services Development Plan, organised agriculture, emerging farmers, and others. Materials should be useful in preparation of the Provincial Growth and Development Strategy and other regional and provincial planning activities.
- ⇨ There are many actions in the ISP which do require public involvement – and it is important that the thinking with regard to, for example, the use of groundwater, and the importance of WC/DM, is delivered forcefully to local authorities, other direct water users such as agriculture, and the wider public.
- ⇨ Collate and consider all comment in revising and improving the ISP.
- ⇨ The ISP should be open to continuous improvement, with updating on a regular basis.
- ⇨ All Regional Office water resource management staff, Working for Water, CCT and other major stakeholders should have access to, or copies of, the ISP.
- ⇨ Approaches set out in the ISP need to be accepted and adopted by both national and regional staff. Where there is resistance to ideas then this needs to be resolved in an open climate of debate and understanding. Modification of the ISP is not ruled out.
- ⇨ The practicalities of implementation demands must always be considered.
- ⇨ Most actions in this ISP have been assigned to the Region. It is critically important that the tasks outlined are prioritised, budgeted for, and built into regional and national business plans and budgets.

Responsibility and Priority

The RO is responsible for implementing this strategy. It is of the highest priority (**Priority 1**). The implementation is to be ongoing until the Breede CMA is established and the ISP is superseded by a CMS.

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APPENDICES

APPENDIX 1: QUATERNARY CATCHMENTS IN THE BREEDE WMA

Quaternaries	Rivers/River Reaches	Nearest Town
CERES (H10A-D)		
H10A	Skaap	Ceres
H10B	Titus	Ceres
H10C	Koekedouw	Ceres, Tulbagh
H10D	Witels	Ceres, Wolseley
HEX (H20A-H)		
H20A	Hex	De Doorns
H20B	Hex	De Doorns
H20C	Hex, Spek	De Doorns
H20D	Hex, Sanddriftskloof	De Doorns
H20E	Hex	De Doorns
H20F	Hex	De Doorns
H20G	Hex	Worcester
H20H	Breede, Hex	Worcester
UPPER BREEDE (H10F-L)		
H10E	Breede, Wit	Rawsonville
H10F	Breede, Romans	Wolseley
H10G	Breede, Slanghoek	Rawsonville
H10H	Breede, Smalblaar	Worcester
H10J	Breede, Molenaars	Rawsonville
H10K	Breede, Holsloot	Rawsonville
H10L	Breede	Rawsonville, Worcester
MIDDLE BREEDE (H40A-L ; H50A)		
H40A	Breede, Nuy	Montagu
H40B	Breede, Nuy	Montagu
H40C	Breede, Nuy	Worcester
H40D	Doring, Breede	Villiersdorp
H40E	Klip, Hoeks, Waboom, Breede	Worcester, Villiersdorp

APPENDIX 1 (cntd)

Quaternaries	Rivers/River Reaches	Nearest Town
MIDDLE BREEDE (H40A-L ; H50A), cntd		
H40F	Breede	Worcester
H40G	Poesjenels	Robertson
H40H	Noree, Vink	Robertson
H40J	Keisers, Willem Nels, Breede	Robertson
H40K	Keisers, Konings, Vink, Houtbaais	McGregor
H40L	Breede	Robertson
H50A	Breede	Bonnievale
LOWER BREEDE (H50B ; H70A,G,H,J,K)		
H50B	Breede	Bonnievale
H70A	Breede	Swellendam
H70G	Breede	Swellendam
H70H	Breede	Swellendam
H70J	Breede	Witsand
H70K	Breede	Witsand
RIVIERSONDEREND (H60A-L)		
H60A	Riviersonderend, Wildevyebooms	Grabouw
H60B	Riviersonderend	Grabouw / Villiersdorp
H60C	Riviersonderend, Elands	Villiersdorp
H60D	Elandskloof, Riviersonderend	Villiersdorp / Caledon
H60E	Riviersonderend	Greyton
H60F	Riviersonderend	Greyton
H60G	Riviersonderend	Caledon
H60H	Slang, Riviersonderend	Riviersonderend
H60J	Riviersonderend	Riviersonderend
H60K	Riviersonderend	Riviersonderend
H60L	Riviersonderend	Riviersonderend

APPENDIX 1 (cntd)

Quaternaries	Rivers/River Reaches	Nearest Town
CBR/KINGNA (H30A-E)		
H30A	Groot, Tradouw, Huis	Montagu
H30B	Kingna	Montagu
H30C	Pietersfontein, Vals	Montagu
H30D	Keisies, Vals	Montagu / Ashton
H30E	Cogmanskloof, Sarahs	Ashton
TRADOUW (H70B-F)		
H70B	Klip	Swellendam
H70C	Tradouw, Huis	Barrydale
H70D	Breede, Buffeljags	Swellendam
H70E	Heuningklip	Swellendam
H70F	Buffeljags	Swellendam
PALMIET (G40B,C,D)		
G40B	Buffels River	Betty's Bay
G40C	Palmiet, Kromme, Vet, Witklippieskloof	Grabouw
G40D	Palmiet, Krom, Huis	Grabouw
BOT/SWART (G40E-G)		
G40E	Botrivier	Villiersdorp / Grabouw
G40F	Swart	Bot River / Caledon
G40G	Afdaks, Huiswaterkloof	Hermanus
ONRUS (G40H)		
G40H	Onrus	Onrus / Hermanus
KLEIN (G40J-L)		
G40J	Klein, Hartbees	Caledon
G40K	Sondagskloof	Caledon
G40L	Klein	Stanford

APPENDIX 1 (cntd)

Quaternaries	Rivers/River Reaches	Nearest Town
UILKRAALS (G40M)		
G40M	Uilkraals	Stanford / Franskraal
OVERBERG EAST (G50A-K)		
G50A	Koks	Bredasdorp
G50B	Nuwejaars	Napier / Elim
G50C	Nuwejaars	Elim
G50D	Sondasgkloof, Kars	Napier / Bredasdorp
G50E	Kars	Bredasdorp
G50F	Kars, Heuningnes Vlei	Struisbaai
G50G	Salt	Caledon
G50H	Salt	Bredasdorp
G50J	Salt	Waenhuiskrans / Arniston
G50K	Salt	Infanta / Swellendam

APPENDIX 2: POTABLE WATER SUPPLY SCHEMES IN THE BREEDE WMA

Area	Quaternary	Scheme Name	Raw Water Source	Name of Town	Population Supplied in 1995	Water Requirements in 1995 (million m^3/a)
CERES	H10C	Prince Alfred Hamlet	Borehole, spring	Prince Alfred Hamlet	1850	0.4
	H10C	Ceres	Koekedouw	Ceres	21300	2.8
HEX	H20F	De Doorns	Mountain Stream, Sanddrift Government Water Scheme	De Doorns	6800	0.73
	H20H	Worcester	Stettynskloof Dam	Worcester	75700	11.8
UPPER BREEDE	H10F	Wolseley	River	Wolseley	5500	0.6
	H10L	Rawsonville	Smalblaar River	Rawsonville	1500	0.12
MIDDLE BREEDE	H40J	Robertson	Dassieshoek & Koos Kok Dams	Robertson	17200	1.98
	H40K	McGregor	Houtbaais and Hoeks Rivers	McGregor	1850	0.2
LOWER BREEDE	H50B	Bonnievale	Breede River	Bonnievale	5050	1
	H70D,E,H,J,K	Duiwenhoks	Duiwenhoks Dam	Duiwenhoks	3000	0.4
RIVIERSONDEREND	H60C	Villiersdorp	Borhole, Elandskloof Dam	Villiersdorp	3300	0.4
	H60E	Genadendal	Mountain Stream	Genadendal	3700	0.3
	H60F	Greyton	Mountain Stream	Greyton	650	0.1
	H60J	Riviersonderend	Mountain Stream & Riviersonderend	Riviersonderend	2650	0.32
	H60J,K,L H70A,G,H G50D,E,F,G,H,J	Ruensveld East	Riviersonderend, Theewaterskloof	Arniston/Waenhuiskrans	6000	0.8
	H60D,E,F,G,H,J G40F,K G50D,G	Ruensveld West	Riviersonderend, Theewaterskloof	Caledon	17000	1.7
CBR/KINGNA	H30B	Montagu	Mountain streams, Breede River	Montagu	8800	0.92
	H30E	Ashton	Breede River	Ashton	8450	1.4
TRADOUW	H70B	Swellendam	Klip River/small dam		10800	1
	H70C	Barrydale	Huis River	Barrydale	1700	0.22
	H70D	Suurbraak	Mountain Stream	Suurbraak	1600	0.13

APPENDIX 2 (cntd)

Area	Quaternary	Scheme Name	Raw Water Source	Name of Town	Population Supplied in 1995	Water Requirements in 1995 (million m^3/a)
PALMIET	G40B	Betty's Bay, Pringle Bay, & Rooi Els	Buffels River Dam	Betty's Bay, Pringle Bay, Rooi Els	220	?
	G40C	Grabouw	Eikenhof Dam	Grabouw	14300	0.5
	G40G	Kleinmond	Palmiet River	Kleinmond	4500	0.9
BOT	G40E	Botrivier	Boreholes (1 x6)	Botrivier	1950	0.18
ONRUS	G40H	Greater Hermanus	De Bos Dam	Hermanus, Fisherhaven, Vermont, Onrus River, Sandbaai	20700	
KLEIN	G40L	Gansbaai	Springs, Franskraal Dam	Gansbaai	5000	?
UILKRAALS	G40M	Kraaibosch	Kraaibosch dam	Gansbaai		
OVERBERG EAST	G50B	Elim	Borehole & spring	Elim	400	0.05
	G50D	Napier	Boreholes (1 x 3) & mountain stream	Napier	2450	0.25
	G50E	Bredasdorp	Boreholes (1 x 6), Klein Sanddrift Dam	Bredasdorp	11000	0.8
	G50F	L'Agulhas, Struisbaai, Suiderstrand	Boreholes (1 x 7)	L'Agulhas, Struisbaai, Suiderstrand	2700	0.33

APPENDIX 3: WASTEWATER TREATMENT WORKS IN THE BREEDE WMA

Quat	Responsible Authority / Owner	Name of Treatment Works	Permit No.	Date Issued	Expiry Date
H10C	Witzenberg Municipality	Ceres	213B	23/04/1987	
H10C		Ceres - Skoonvlei			
H10C		Prince Alfred Hamlet			
H10F		Wolseley	1030B	03/05/1983	
H70F	Overberg District Municipality	Buffeljagsrivier	1845B	18/05/1999	31/05/2004
G40M		Uilenkraalsmond			
H10L	Breede Valley Municipality	Rawsonville			
H20B		De Doorns	807B	05/07/1979	
H20H		Worcester	1571B	12/01/1993	
H30B	Breede River / Winelands Municipality	Montagu	1252B	21/10/1986	
H30E		Ashton	1056B	14/07/1983	
H40J		Robertson	1083B	04/08/1983	
H40K		McGregor			
H50B		Bonnievale	1686B	24/10/1996	
G40C	Theewaterskloof Municipality	Grabouw	532B	08/10/1985	
G40E		Bot River			
G40F		Caledon	2051B	29/03/2000	30/03/2002
H60C		Villiersdorp	1112B	27/08/1984	
H60E		Genadendal			
H60F		Greyton			
H60J		Riviersonderend	1780B	11/09/1998	30/11/2002
G40C	Overstrand Municipality	Kleinmond	853B	06/02/1980	
G40G		Hawston			
G40H		Hermanus	1894B	29/03/2000	30/03/2004
G40L		Gansbaai	1742B	27/09/1997	30/05/2002
G40L		Stanford			
G50A		Pearly Beach			

APPENDIX 3 (cntd)

Quat	Responsible Authority / Owner	Name of Treatment Works	Permit No.	Date Issued	Expiry Date
G50B	Cape Agulhas Municipality	Elim			
G50D		Napier	2006B	19/01/2000	31/07/2004
G50E		Bredasdorp			
G50F		Struisbaai			
G50J		Waenhuiskrans			
H70B	Swellendam Municipality	Swellendam	1699B	05/12/1996	31/12/2001
H70C		Barrydale	1687B	24/10/1996	31/08/2001
H70D		Suurbraak	1657B	03/11/1995	
H70K	Langeberg Municipality	Witsand			
OTHER					
H40E	Brandvlei Prison Kommandement	Brandvlei Prison (Worcester)	1642B	20/02/1995	01/12/1999
G40C	SAFCOL	Lebanon	1725B	31/07/1997	28/02/2002
H70F	Buffeljagsrivier Prison	Buffeljagsrivier Prison			
H10F	Correctional Services	Dwarsrivier Prison (Wolseley)			
G40C	De Rust Landgoed (EDMS) Bpk	De Rust Landgoed	P199	24/10/1995	
G40C	Elgin Fruit Juices (Pty) Ltd	Elgin Fruit Juices PTY LTD	1899B	03/03/2000	30/04/2004
G40C	Elgin Orchards	Elgin Orchards PTY LTD	875B	02/03/1980	
G40F	Helderstroom Prison	Helderstroom Prison (Caledon)	1446B	01/10/1990	
G40L	Klein River Holiday Resort	Hermanus - Lagoon Edge	1374B	27/07/1989	
G40C	Kromco Ltd	KROMCO LTD	847B	20/11/1979	
H10H	Umzingisi School (Goudini)	Umzingisi School (Goudini)			

APPENDIX 4: SOLID WASTE DISPOSAL SITES IN THE BREEDE WMA

Quat	Responsible Authority / Owner	Solid Waste Disposal Site	Permit No.	Date Issued
H10C	Witzenberg Municipality	Ceres	P194	?
H10F		Wolseley		
H10C		Prince Alfred Hamlet		
G40H	Overberg District Municipality	Overberg General Solid Waste		
G40F		Karwyderskraal	P374	30/03/2000
H10L	Breede Valley Municipality	Rawsonville		
H20H		Worcester	P70	15/06/1993
H20B		De Doorns		
H30E	Breede River / Winelands Municipality	Ashton	P332	04/02/1999
H30B		Montagu	P169	27/03/1995
H40J		Robertson	P20	14/08/1992
H40J		Robertson - Composting Site		
H40J		Robertson - New Solid Waste Site		
H40K		McGregor		
H50B		Bonnievale	P304	31/07/1998
G40C	Theewaterskloof Municipality	Grabouw		
G40C		Grabouw Transfer Station	P427	03/07/2002
G40F		Caledon	P259	30/01/1997
G40E		Bot River		
H60F		Greyton		
H60F		Greyton - New Waste Disposal Site		
H60E		Genadendal		
H60C		Villiersdorp	P357	30/11/1999
H60J		Riviersonderend		

APPENDIX 4 (cntd)

Quat	Responsible Authority / Owner	Solid Waste Disposal Site	Permit No.	Date Issued
G40C	Overstrand Municipality	Kleinmond		
G40C		Kleinmond Transfer Station	P458	08/01/2002
G40B		Betty's Bay Drop Off Facility		
G40B		Betty's Bay		
G40H		Hermanus Waste Transfer Station	P457	08/01/2002
G40H		Greater Hermanus Solid Waste Transfer Station		
G40L		Gansbaai	P335	30/03/1999
G40L		Stanford	P254	08/01/1997
G50E	Cape Agulhas Municipality	Bredasdorp	P329	11/12/1998
G50F		L'Agulhas		
G50J		Waenhuiskrans		
G50D		Napier		
G50B		Elim	P337	14/04/1999
G50F		Struisbaai		
G50F		Struisbaai Regional Waste Site	?	16/07/2002
H70B	Swellendam Municipality	Swellendam	P171	05/04/1995
H70D	Langeberg Municipality	Suurbraak	P236	06/06/1996
OTHER				
H40E	Brandvlei Prison Kommandement	Brandvlei Prison (Worcester)		
G40F	Helderstroom Prison	Helderstroom Prison (Caledon)		
H60B	Theewaters Holiday Resort	Theewaters Holiday Resort - Villiersdorp	1302B	09/09/1987
	Boland District Municipality	Breede River - General Solid Waste		

APPENDIX 5: LATEST PROPOSED GENERAL AUTHORISATIONS IN THE BREEDE WMA (April 2004)

(Groundwater abstraction)

Abstraction Rate per Quaternary Catchment (m^3 per hectare per annum)				
Zero	**45**	**75**	**150**	**400**
H10C H70F	H40F	G40K G50G,H H10A H50B H60G,K,L H70A,B,G,H,J	G40F G50B-E H10L H20A,H H30A-E H40A,C-E,G,H,J,L H50A H60B,E,F,H,J H70C-E,K	G40A-E,G,H,J,L,M G50A,F,J,K H10B-F-H,J,K H20B-G H40B,K H60A,C,D

(Surface Water Abstraction = 15 litres per second, excluding the following areas)

Quaternaries excluded	**Area**
G40B to D	Palmiet sub-area
G40E	Upper Bot River
G40H	Onrus River
G40J to L	Klein sub-area
G50B,C, E & F	Nuwejaars River
H10A to L (excluding H10J)	Titus, Koekedouw, Dwars, Holsloot, Wabooms and Slang Rivers (excluding Molenaars River)
H20A	Hex River to confluence with Breede River
H30	Kingna River
H40B to H 40L	All tributaries to Breede River contributing to and downstream of Greater Brandvlei Dam to confluence with the Kingna River
H50A & B	Tributaries to confluence and main stream Breede River to s/e boundaries of Zanddrift & Langeberg WUA's
H60A to F	Tributaries of Riviersonderend River to confluence with the Breede River
H70C,D & E	Tradouws River to confluence with Buffeljags River

APPENDIX 6: FORUMS IN THE BREEDE WMA

Forum Name	Comment
Bot - Swart River	Established and Functioning
Central Breede	Established and Functioning
CBR Kingna	Established and Functioning
Ceres	Established and Functioning
Hex River	Established and Functioning
Klein River	Established and Functioning
Lower Breede	Established and Functioning
Onrus River	Established and Functioning
Overberg East	Established and Functioning
Palmiet	Established and Functioning
Riviersonderend	Established and Functioning
Tradouw	Established and Functioning
Uilkraals River	Established and Functioning
Upper Breede	Established and Functioning

APPENDIX 8: MUNICIPALITIES IN THE BREEDE WMA

District Municipality	Local Municipality	Main Towns
BOLAND	Witzenberg	Ceres Gouda Tulbagh Wolseley
	Drakenstein	No major towns in this WMA
	Stellenbosch	No major towns in this WMA
	Breede Valley	Brandwacht De Doorns Rawsonville Worcester
	Breede River Winelands	Ashton Bonnievale McGregor Montagu Robertson
OVERBERG	Theewaterskloof	Botrivier Caledon Genadendal Grabouw Greyton Middleton Riviersonderend Villiersdorp

APPENDIX 8 (cntd)

District Municipality	Local Municipality	Main Towns
OVERBERG (cntd)	Overstrand	Betty's Bay Fisherhaven Franskraalstrand Gansbaai Hawston Hermanus Kleinbaai Kleinmond Onrus Pearly Beach Pringle Bay Rooi-Els Sandbaai Stanford
	Cape Agulhas	Bredasdorp Elim L'Agulhas Napier Struisbaai Waenhuiskrans / Arniston
	Swellendam	Barrydale Infanta Riviersonderend Suurbraak Swellendam
GARDEN ROUTE / KLEIN KAROO	Langeberg	Suurbraak Witsand

APPENDIX 9: RESOURCE POOR FARMERS IN THE BREEDE WMA

Area	Location	Project Name	Property/Farm	Farming with
CURRENTLY ACTIVE				
HEX	Worcester	Henque Project	Portion 1 of Louzaan 317. (16,1812 ha)	Table Grapes for Export
		Riverside Waterblommetjies Farm	Portion 11 Onder Brandvlei 374. (3,4261 ha), Portion 14 of Onder Brandvlei 374. (20,9199 ha), Portion 15 of Onder Brandvlei 374. (22,4067ha),Remainder of portion 5 of Onder Brandvlei (201,7566 ha).	Waterblommetjies
		Winola Park Trust	Portion 779 of the previously known Nooitgedacht farms (135,08 ha)	Vines, Lucerne, Mixed Farming
CERES	Ceres	Cold Harvest Business Plan	Establishment of a cold storage building. On property Rietvallei 364.	Cold Storage Facility
		N'duli Vukani Deelnemings Trust	a portion of Portion 10 of Twee Fonteinen 368. (6,5 ha)	Vegetables & Chickens
		N'Duli Masiphile small farmers Deelnemings Trust	a portion of Portion 10 of Twee Fonteinen 368. (5,5 ha)	Vegetables & Chickens
		Aurora Plaaswerkers Deelnemings Trust	a portion of Portion 1 of Rietvalley 364 (46,8 ha)	Lucerne & Pasture
		La Vouere Estate Deelnemings Trust	a portion of Portion 10 of Twee Fonteinen 368. (188 ha)	Irrigated Pastures for Horse training & Vegetables
		Witzenberg Deelnemings Trust	a portion of Portion 10 of Twee Fonteinen 368. (52ha)	Pastures, Orchards & Vegetables
		Morceaux Boerdery Trust	Remainder Erf 7915.(ha), Erf 7917. (ha), Remainder of Erven 7913. (ha)	Pears
		Vickervlei Deelnemings Trust	Portion 28 of Tweefonteinen 368 (19 ha)	Vegetables and Fruit
MIDDLE BREEDE	Robertson	Robertson Development Company	Remainder of Portion 6 of the farm Appels Drift nr 107, size 147,3638	Lucerne / Vines
		Breede River Winelands Municipality	Communal ground of Robertson Municipality	Lucerne - Pastures
LOWER BREEDE	Bonnievale	Eland Boerdery Deelnemings Trust	Portion 42 of Angora 176, Remainder of Portion 46 of Angora 176, Portion 31 f Farm 176	Vines & Lucerne
		Mountain Boerdery Trust	Remainder of Erven 867. (4,6060 ha),Remainder of Erven 884 (7,2455 ha), Erven 865. (1,8651 ha)	Vines & Lucerne
		Oudekraal Trust	Portion 9 of Oudekraal 170.(12,0999 ha), Portion 29 of Oudekraal 170. (39,3160 ha)	Cultivated pastures, Vineyards & Orchards

APPENDIX 9 (cntd)

CURRENTLY ACTIVE (cntd)				
Area	**Location**	**Project Name**	**Property/Farm**	**Farming with**
RIVIERSONDEREND	Villiersdorp	Dwarstrek SF	Klein Dwarstrek No 118 and Dwarstrek Uitspanning No 117	Grapes
	Villiersdorp	Theewaterskloof	Ptn 4 (a ptn of Ptn 4) of the farm Theewaterskloof No 68	Mixed
	Villiersdorp	Waterval (Gert Balie)	Ptn 109, a ptn of Ptn 61 of the farm Waterval No 72	Fruit, vegetables
	Vyeboom	Klipfontein	Ptn 23, a ptn of Ptn 8 of the farm Klipfontein No 82	Fruit
TRADOUW	Swellendam	Bordeau Trust	Remainder of Portion 35 of Gelukshoop 223. (22,9537 ha), Portion 38 of Gelukshoop 223. (24,8256 ha), Portion 49 of Gelukshoop 223 (2,6756 ha)	Peaches, Apricots, Grapes, Olives & Lucerne
	Swellendam	Swellendam Rooms Katolieke Kerk	Convent Farm (99 year lease)	Fruit, vegetables
	Barrydale	Barrydale Gemeenskaps Boerdery Trust	Rem of Ptn 12, Ptn 25 and Rem of Ptn 21 of the farm Het Goed Geloof No 70, Farm No 570, Ptn 16 and Ptn 14 of the farm Weltevreden No 67 and 1/2 share in Ptn 5 of the farm Annex Weltevreden no 57.	Fruit
	Suurbraak	Pieterse Familie Trust	Erf 543 and Erf 560 , Suurbraak	Cattle, pigs
BOT	Caledon	Boontjieskraal	Boontjieskraal Uitspanning, No 413, Caledon	Koring, Canola
	Caledon	Riviersonderend (Mnr Palmer)	De Poort No 408	Vegetables, Boerbokke, Buchu, Chickens
OVERBERG EAST	Bredasdorp	Retrospective BK	Ptn 1 of the farm Luipaards Kop No 53	Wheat, ostriches, sheep, cattle
FUTURE (NEW)				
RIVIERSONDEREND	Villiersdorp	John Pickard	Thistledown Trust No T 26464/88	Apples and pears
	Villiersdorp	N Louw		Vegetables
	Villiersdorp	Adam Potberg		Vegetables, olives
TRADOUW	Swellendam	Abraham Johannes Plaatjes	Suurbraak Act 9 land	Graze land, sheep, pigs

APPENDIX 9 (cntd)

FUTURE (NEW) - cntd				
BOT	Caledon	AB Cloete	Boontjieskraal No 413 Uitspanning	Livestock, Vegetables
	Caledon	DP Theunis	Matjiesdrif No 369	Livestock
	Caledon	Jan Hugo	Matjiesdrif No 369	Bokke
	Caledon	Josef Moses	Boontjieskraal No 413 Uitspanning	Small Livestock
	Caledon	Stephen Issel	Hagedisberg, Plaas No 661	Bokke
	Kleinmond	Kleinmond Landbougroep		Boegoe, blue berries, framboos, tomatoes
KLEIN	Gansbaai	Gansbaai Groepering		Proteas, Livestock
OVERBERG EAST	Bredasdorp	Overberg Small Farmers	Remainder of the farm Wolvengat No 297	Livestock, flowers
	Elim	Elim Boere	Elim Mission Station land	Cattle, Sheep, Chicken, Vegetables, Wheat
	Elim	Elim Suiwelprojek	Elim Mission Station land	Diary
PALMIET	Grabouw	Overberg Khoi Kulturele Vereniging	Erf 1, Kamp B, C, D, E, F	Chicken, Pigs, Vegetables, Livestock
	Kleinmond / Grabouw	Cornelius Petersen	Geelbeck's vallei No 544 [T2740/1936] of New Forest No 334 [T17758/1962] of Knoflokskraal No 335 [T1363/1911]	Fruit (apples, grapes) vegetables
	Grabouw	Weltevreden		Vegetables
	Suurbraak	Suurbraak Boere	Suurbraak Act 9 land	Cattle, Sheep, pigs, Chicken, Vegetables
	Vyeboom	Bushman Cold Store	Ptn 29 (ptn of ptn 8) of the farm Vygeboom No 86 [T71894/2002]	CA Cold Store
Dormant (standing still)				
BOT	Tesselaarsdal	Tesselaarsdal	Ptn 86 of the farm No 811	Organic fruit & Vegetables
OVERBERG EAST	Bredasdorp	Bredasdorp Landbou Ontwikkelingsunie	Farm no 347, known as Swartjeskop	Dairy, ostriches, pigs
PALMIET	Grabouw	Dalfarms	Ptn 3 of the farm De Hoop	Fruit & Vegetables
TRADOUW	Barrydale	Andes Trust	Ptn 18, Ptn 20, Ptn 21, Ptn 25, Ptn 26, Ptn 43, Ptn 44, Ptn 48 of the farm Tradouw No 69 3/48 share in the farm Zuurplaats No 71, 1/36 share in the farm Zuurplaats Nr 71	Fruit

APPENDIX 10: MAJOR DAMS IN THE BREEDE WMA

Area	Dam Name	Quat	Live Storage ($10^6 m^3$)	Yield	Use	Owner
MIDDLE BREEDE	Keerom	H40B	10.4	3.8		Nuy Irrigation Board
	Klipberg	H40K	2	0.63	Irrigation	DWAF
	Moordkuil	H40E	1.07	2.6	Irrigation	Moordkuil Irrigation Board
CBR/KINGNA	Poortjieskloof	H30A	9.2	2	Irrigation	DWAF
	Knipes Hope	H30B	3.1	0	Store water from Breede River	Cogmanskloof Irrigation Board
	Pietersfontein	H30C	2	0.7	Not known	DWAF
CERES	Greater Brandvlei	H10L	342 (1)	155 (2)	Irrigation	DWAF
	Koekedouw	H10C	22.5	17	Irrigation	Ceres Municipality
	Stettynskloof	H10K	15.5	25	Domestic	Worcester Municipality
HEX	Roode Elsberg	H20C	7.7	9	Domestic and irrigation	DWAF
	Lakenvallei	H20D	10.3	-		DWAF
ONRUS	De Bos	G40H	6.3	3.3	Domestic and irrigation	Hermanus
PALMIET	Applethwaite	G40C	3.5	2.1	Irrigation	Elgin Orchards
	Eikenhof	G40C	29	35	Irrigation	Groenland Irrigation Board
	Grootvlei	G40C	1.6	1.7	Irrigation	Elgin Orchards
	Nuweberg	G40C	3.9	4.7	Domestic and irrigation	Nuweberg Dam Syndicate
	Arieskraal	G40D	4.4	3.6	Irrigation	Arieskraal Farm
	Kogelberg	G40D	17.28	24.5	Irrigation	DWAF
	Rockview	G40D	17.5	0	Hydropower generation	DWAF
RIVIERSONDEREND	Elandskloof	H60C	11.4	12	Domestic and irrigation	DWAF
	Theewaterskloof	H60D	480.2	204	Domestic and irrigation	DWAF
TRADOUW	Buffeljags	H70E	5.2	11	Irrigation	DWAF
UILKRAALS	Kraaibosch	G40M	?	?	Irrigation and Domestic	Kraaibosch Dam Syndicate

1) Greater Brandvlei Dam is filled by diversions from the Holsloot and Smalblaar Rivers via a canal which enters the dam 3m below FSL, and corresponds to a capacity of 342 million m^3, with 133 million m^3 spare capacity remaining (Ref. 8).
2) The firm yield of the existing system is 155 million m^3/a for a storage of 342 million m^3.

APPENDIX 11: FLOW GAUGING STATIONS IN THE BREEDE WMA

Drainage Region	Gauge No.	River Name	Place	Catchment Area	Position		Primary Data	
					Latitude	Longitude	From	To
H10	H1H002-A01	HOLSLOOT RIVER	RAWSONVILLE	195	33 41'05"	19 20'04"	01/12/1914	30/04/1919
	H1H003-A01	BREE RIVER	CERES TOEKEN GEB.	657	33 22'52"	19 18'10"	22/02/1923	28/08/2002
	H1H004-A01	JAN DUTOITS RIVER	DE BREEDE RIVER	54	33 33'45"	19 20'29"	07/02/1928	01/01/1941
	H1H005-A01	JAN DUTOITS RIVER	GOUDINIWEG	80	33 36'31"	19 18'04"	01/04/1950	31/12/1951
	H1H006-A01	BREE RIVER	CERES TOEKEN GEB.	753	33 25'18"	19 16'06"	16/04/1950	28/08/2002
	H1H007-A01	WIT RIVER	DROSTERSKLOOF	84	33 34'05"	19 08'54"	01/10/1935	29/08/2002
	H1H008-A01	SMALBLAAR RIVER	RAWSONVILLE	215	33 41'39"	19 18'54"	01/04/1950	25/06/1954
	H1H009-A01	HOLSLOOT RIVER	BOONTJIES RIVER	193	33 41'37"	19 19'29"	01/05/1950	23/08/2002
	H1H010-A01	HOLSLOOT RIVER	RAWSONVILLE	196	33 40'20"	19 20'23"	22/04/1970	27/03/1979
	H1H011-A01	WIT RIVER	OOSTENBERG	28	33 38'37"	19 06'43"	12/02/1953	19/08/1954
	H1H012-A01	HOLSLOOT RIVER	DASCHBOSCH	146	33 45'24"	19 19'50"	15/03/1963	18/04/1986
	H1H013-A01	KOEKEDOE RIVER	CERES	53	33 21'32"	19 17'54"	24/02/1965	28/08/2002
	H1H014-A01	VALS RIVER	BEN ETIVE	9	33 26'05"	19 24'17"	26/02/1965	13/05/1982
	H1H015-A01	BREE RIVER	DIE NEKKIES	1981	33 41'03"	19 25'19"	01/10/1966	31/10/1982
	H1H016-A01	ROOIKLOOF RIVER	BEN ETIVE	11	33 25'15"	19 28'43"	04/06/1966	10/04/1991
	H1H017-A01	ELANDS RIVER	HAWEQUAS FOREST RES.	61	33 44'00"	19 06'54"	10/03/1969	17/06/1992
	H1H018-A01	MOLENAARS	HAWEQUAS FOREST RES.	113	33 43'24"	19 10'13"	26/02/1969	23/08/2002
	H1H019-A01	SLANGHOEK RIVER	SLANGHOEK	66	33 35'06"	19 13'31"	11/03/1969	14/01/1977
	H1H020-A01	HARTEBEES RIVER	BRANDWACHTSBERG	13	33 33'29"	19 26'10"	04/07/1972	03/12/1981
	H1H021-A01	SMALBLAAR/ HOLSLOOT	RAWSONVILLE	N/A	33 41'06"	19 19'58"	08/07/1985	23/08/2002
	H1H022-A01	LEFT CANAL FROM	CERES TOEKEN GEB.	N/A	33 25'18"	19 16'06"	04/02/1958	28/08/2002
	H1H025-A01	RIGHT PRICIPAL CAN.	EZELSFONTEIN	N/A	33 23'27"	19 24'52"	06/05/1965	16/02/1984
	H1H027-A01	RIGHT CANAL FROM	LOWER BRANDVLEI	N/A	33 42'16"	19 27'13"	07/11/1943	01/07/1981
	H1H028-A01	CANAL FROM	DIE NEKKIES	N/A	33 41'32"	19 26'10"	01/07/1981	12/07/2002
	H1H029-A01	SUPPLY CANAL	BOKKEKRAAL	N/A	33 42'06"	19 27'00"	07/06/1963	23/08/2002
	H1H032-A01	HOLSLOOT RIVER	HAWEQUAS FOREST RES.	55	33 50'13"	19 15'12"	28/06/1963	01/12/1978
	H1H033-A01	ELANDS RIVER	HAWEQUAS FOREST RES.	32	33 44'05"	19 06'54"	29/04/1991	08/08/2002
	H1R001-A01	BRANDVLEI DAM	DE KOPPEN	62	33 42'06"	19 27'00"	01/02/1926	01/08/2002

APPENDIX 11 (cntd)

Drainage Region	Gauge No.	River Name	Place	Catchment Area	Position		Primary Data	
					Latitude	Longitude	From	To
H10 (cntd)	H1R002-A01	STETTYNSKLOOF DAM	HAWEQUAS FOREST RES.	55	33 50'11"	19 15'10"	01/05/1958	23/08/2002
	H1R003-A01	CERES DAM	CERES	49.8	33 21'45"	19 16'30"	01/04/1997	01/06/1997
H20	H2H001-A01	HEX RIVER	NEW GLEN HEATLIE	697	33 33'44"	19 30'39"	01/10/1927	06/03/1989
	H2H003-A01	HEX RIVER	DE WET	718	33 36'00"	19 30'33"	01/05/1950	05/05/1986
	H2H004-A01	SANDDRIFSKLOOF	ZANDRIFTSKLOOF	175	33 29'03"	19 31'46"	01/06/1965	18/01/2002
	H2H005-A01	ROOI ELSKLOOF RIVER	ROOI ELSBERG	15	33 27'42"	19 32'06"	26/09/1969	30/08/2002
	H2H006-A01	HEX RIVER	GLEN HEATLIE	703	33 34'39"	39 30'12"	11/08/1980	30/08/2002
	H2H007-A01	INVERDOORN CANAL	HOTTENTOTS KRAAL	N/A	33 19'49"	19 38'12"	22/07/1982	24/04/2002
	H2H008-A01	VALSGAT RIVER	HOTTENTOTS KRAAL	16	33 19'49"	19 38'12"	29/06/1982	03/07/2002
	H2H009-A01	SPEK CANAL FROM	UITKOMST	N/A	33 20'42"	19 37'15"	29/06/1982	28/08/2002
	H2H011-A01	DE WET CANAL FROM	NEW GLEN HEATLIE	N/A	33 33'44"	19 30'39"	01/10/1932	30/08/2002
	H2H012-A01	NONNA CANAL FROM	NEW GLEN HEATLIE	N/A	33 33'44"	19 30'39"	16/03/1971	30/08/2002
	H2H013-A01	RIGHT CANAL FROM	DE WET	N/A	33 36'00"	19 30'33"	21/08/1979	05/05/1986
	H2H015-A01	SANDDRIFSKLOOF	ROODE ELS BERG	139	33 26'12"	19 34'08"	01/06/1965	30/08/2002
	H2H016-A01	SANDDRIFSKLOOF	LAKENVLEI	80	33 22'00"	19 34'50"	01/06/1970	17/03/2002
	H2R001-A01	ROODE ELSBERG DAM	ROODE ELS BERG	139	33 26'12"	19 34'08"	01/08/1967	30/08/2002
	H2R002-A01	LAKENVALLEI DAM	LAKENVLEI	80	33 22'00"	19 34'50"	07/07/1975	28/08/2002
H30	H3H001-A01	KINGNA	MONTAGU	593	33 47'28"	20 07'29"	01/11/1925	01/05/1928
	H3H002-A01	GROOT RIVER	POORTJIES KLOOF	184	33 49'13"	20 19'00"	01/11/1925	30/04/1934
	H3H003-A01	GROOT RIVER	POORTJIES KLOOF	93	33 51'49"	20 22'19"	01/05/1934	30/09/1948
	H3H004-A01	KEISIE	HARMONIE	14	33 41'47"	19 55'44"	20/03/1965	08/09/1992
	H3H005-A01	KEISIE	KEISIESDOORNS	76	33 42'31"	20 03'33"	17/03/1965	30/07/2002
	H3H006-A01	WARMWATERSKLOOF	AAN DE COGMANSKLOOF	51	33 42'06"	20 07'23"	06/08/1969	31/01/1975
	H3H007-A01	BADENFONTEINE EYE	AAN DE COGMANSKLOOF	N/A	33 42'18"	20 07'19"	04/10/1969	31/01/1975
	H3H008-A01	WARMWATERSKLOOF	AAN DE COGMANSKLOOF	51	33 42'36"	20 07'02"	04/04/1969	01/11/1974
	H3H009-A01	DWARIEGA RIVER	RIET RIVER	14	33 53'22"	20 20'08"	11/03/1969	11/10/1979
	H3H010-A01	WARMWATERSKLOOF	AAN DE COGMANSKLOOF	51	33 42'23"	20 07'08"	04/10/1969	24/09/1971
	H3H011-A01	KOGMANSKLOOF RIVER	GOLD MINE	1201	33 52'15"	20 00'12"	10/12/1985	26/08/2002
	H3H012-A01	LEFT CANAL FROM	RIET RIVER	N/A	33 53'28"	20 20'08"	01/12/1977	20/09/1979

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Drainage Region	Gauge No.	River Name	Place	Catchment Area	Position		Primary Data	
					Latitude	Longitude	From	To
H30 (cntd)	H3H013-A01	LEFT CANAL FROM	POORTJIES KLOOF	N/A	33 51'13"	20 22'30"	21/03/1957	27/08/2002
	H3H014-A01	IRRIGATION PIPELINE	PIETERSFONTEIN	N/A	33 40'00"	20 01'00"	01/10/1969	01/04/1982
	H3H015-A01	PIETERSFONTEIN	PIETERSFONTEIN	116	33 40'13"	20 01'02"	01/03/1979	30/07/2002
	H3R001-A01	POORTJIESKLOOF DAM	POORTJIES KLOOF	94	33 51'30"	20 22'20"	21/03/1957	27/08/2002
	H3R002-A01	PIETERSFONTEIN DAM	PIETERSFONTEIN	N/A	33 40'00"	20 01'00"	07/04/1969	27/08/2002
H40	H4H001-A01	BREE RIVER	APPELS DRIFT	5025	33 49'50"	19 50'00"	01/01/1911	01/02/1917
	H4H002-A01	BREE RIVER	DE GORREE	4644	33 49'49"	19 47'19"	01/03/1933	30/06/1954
	H4H003-A01	VINK RIVER	VINK RIVER	57	33 41'29"	19 43'08"	24/04/1931	31/10/1947
	H4H004-A01	NUY RIVER	WAAIKLOOFSBERG	10.7	33 37'53"	19 40'37"	16/03/1940	30/09/1948
	H4H005-A01	WILLEM NELS RIVER	LANGEVALLEY	24	33 45'50"	19 51'06"	01/04/1950	21/12/1981
	H4H006-A01	BREE RIVER	LOWER BRANDVLEI	2939	33 42'26"	19 27'56"	19/04/1950	06/08/1990
	H4H007-A01	KOO RIVER	DIE KOO	48	33 38'19"	19 48'52"	30/03/1965	08/09/1992
	H4H008-A01	KOO RIVER	DWARS IN DIE WEG	101	33 35'47"	19 45'46"	09/04/1965	08/09/1992
	H4H009-A01	HOEKS RIVER TRIB. OF	HOEKSBERG	18	34 00'37"	19 50'19"	26/04/1967	07/09/1992
	H4H010-A01	HOUTBAAISRIVER	SCHURFBERG	26	33 59'21"	19 49'13"	20/04/1967	01/02/1982
	H4H011-A01	KEISERS RIVER	UITNOOD	267	33 51'31"	19 52'54"	01/03/1968	28/02/1983
	H4H012-A01	WATERKLOOF SPRUIT	POESJENELS RIVER	14	33 57'15"	19 35'17"	28/02/1969	25/05/1992
	H4H013-A01	HOEKS RIVER	MODDERGAT	103	33 51'36"	19 24'31"	06/03/1970	17/06/1991
	H4H014-A01	BREE RIVER	KARROO	4140	33 46'00"	19 32'41"	26/03/1973	15/06/1992
	H4H015-A01	HOUTBAAISRIVER	SCHURFBERG	25	33 59'34"	19 49'15"	10/05/1978	15/07/2002
	H4H016-A01	KEISERS RIVER	MC GREGOR TOEKEN GEB	117	33 56'25"	19 50'28"	08/12/1978	26/08/2002
	H4H017-A01	BREE RIVER	LE CHASSEUR	4336	33 49'05"	19 41'41"	29/04/1980	26/08/2002
	H4H018-A01	POESJENELS RIVER	LE CHASSEUR	237	33 52'03"	19 43'02"	13/06/1980	26/08/2002
	H4H019-A01	VINK RIVER	DE GORREE	204	33 49'10"	19 47'43"	04/09/1980	15/07/2002
	H4H020-A01	NUY RIVER	DOORN RIVER	622	33 43'05"	19 28'56"	20/02/1984	26/08/2002
	H4H024-A01	ROBERTSON CANAL	DE GORREE	N/A	33 49'49"	19 47'21"	27/11/1977	24/09/1979
	H4H027-A01	RIGHT CANAL FROM	HOEKSBERG	N/A	34 00'37"	19 50'19"	26/04/1967	15/06/1992
	H4H029-A01	LEFT CANAL FROM	POESJENELS RIVER	N/A	33 57'15"	19 35'17"	29/09/1980	05/06/1989
	H4H030-A01	LEFT CANAL FROM	MODDERGAT	N/A	33 51'36"	19 24'31"	30/12/1976	05/06/1989

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Drainage Region	Gauge No.	River Name	Place	Catchment Area	Position		Primary Data	
					Latitude	Longitude	From	To
H40 (cntd)	H4H031-A01	RIGHT CANAL FROM	MODDERGAT	N/A	33 51'36"	19 24'31"	06/03/1970	22/12/1976
	H4H032-A01	RIGHT CANAL FROM	DRAAIVLEI	N/A	33 47'42"	19 28'21"	06/07/1950	31/07/1974
	H4H033-A01	RIGHT CANAL FROM	RHEBOKS VLAK	N/A	33 35'07"	19 42'40"	18/05/1954	16/07/2002
	H4H034-A01	LEFT CANAL FROM	KLIP BERG	N/A	33 56'20"	19 47'40"	16/05/1967	26/08/2002
	H4H035-A01	LEFT CANAL FROM	DOORN RIVER	N/A	33 45'45"	19 28'27"	20/11/1975	26/08/2002
	H4R001-A01	MOORDKUIL DAM	DRAAIVLEI	176	33 47'42"	19 28'21"	17/04/1950	28/10/1982
	H4R002-A01	KEEROM DAM	RHEBOKS VLAK	377	33 35'07"	19 42'40"	18/05/1954	27/08/2002
	H4R003-A01	KLIPBERG DAM	KLIP BERG	54	33 56'20"	19 47'40"	16/05/1967	26/08/2002
	H4R004-A01	KWAGGASKLOOF DAM	DOORN RIVER	64	33 45'45"	19 28'27"	24/06/1975	26/08/2002
H50	H5H002-A01	BREE RIVER	GOLD MINE	6684	33 53'19"	20 00'48"	03/08/1954	20/02/1997
	H5H003-A01	BOESMANS RIVER	BOSJESMANS RIVER	25	34 02'25"	19 58'48"	07/04/1969	26/08/2002
	H5H004-A01	BREE RIVER	WOLWENDRIFT	6690	33 53'52"	20 00'46"	23/03/1970	26/08/2002
	H5H005-A01	BREE RIVER	WAGENSBOOMSHEUWEL	7253	34 00'08"	20 12'48"	06/11/1975	18/06/1991
H60	H6H001-A01	RIVIERSONDEREND	RUS VALLEY	280	34 01'34"	19 12'29"	01/03/1932	29/02/1948
	H6H002-A01	RIVIERSONDEREND	GLORIA	486	34 00'00"	19 00'00"	22/02/1932	10/03/1936
	H6H003-A01	RIVIERSONDEREND	DWARSHOEK	497	34 04'39"	19 17'27"	01/10/1932	11/11/1974
	H6H004-A01	BAVIAANS RIVER	GENADENDAL	34	34 02'57"	19 33'37"	16/03/1949	30/06/1963
	H6H005-A01	BAVIAANS RIVER	GENADENDAL	24	34 01'44"	19 33'27"	24/06/1963	19/08/2002
	H6H006-A01	ELANDS RIVER	TWIST NIET	56	33 57'53"	19 17'32"	24/02/1964	24/11/1982
	H6H007-A01	DU TOITS RIVER	PURGATORY UITSPAN	46	33 56'19"	19 10'17"	14/03/1964	07/09/1992
	H6H008-A01	RIVIERSONDEREND	SWARTE RIVER	38	34 03'44"	19 04'23"	18/04/1964	07/09/1992
	H6H009-A01	RIVIERSONDEREND	REENEN	2007	34 04'32"	20 08'44"	09/05/1964	26/08/2002
	H6H010-A01	WATERKLOOF RIVER	WAGGENSBOOMS KLOOF	15	33 59'00"	19 19'48"	17/02/1969	19/08/2002
	H6H011-A01	WATERKLOOF RIVER	TYDSGENOEG	11	34 05'45"	19 07'19"	07/05/1974	07/09/1992
	H6H012-A01	RIVIERSONDEREND	DWARSTREK	515	34 04'39"	19 17'27"	05/06/1974	19/08/2002
	H6H013-A01	LEFT CANAL FROM	TWIST NIET	N/A	33 57'53"	19 17'32"	09/09/1972	29/01/1980
	H6H014-A01	LEFT CANAL FROM	REENEN	N/A	34 04'32"	20 08'44"	01/05/1964	30/01/1989
	H6H015-A01	ELANDS RIVER	TWIST NIET	56	33 57'07"	19 15'06"	01/01/1980	08/07/2002
	H6H016-A01	LEFT CANAL FROM	TWIST NIET	N/A	33 57'07"	19 15'06"	01/01/1980	19/08/2002

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Drainage Region	Gauge No.	River Name	Place	Catchment Area	Position		Primary Data	
					Latitude	Longitude	From	To
H60 (cntd)	H6H017-A01	RIGHT CANAL FROM	TWIST NIET	N/A	33 57'07"	19 15'06"	01/05/1979	19/08/2002
	H6H018-A01	CANAL OVERFLOW TO	BOXTWIST NIET	N/A	33 57'07"	19 15'06"	08/11/1981	19/08/2002
	H6H019-A01	CANAL FROM BAVIAANS	GENADENDAL	N/A	34 01'44"	19 33'27"	30/10/1995	19/08/2002
	H6R001-A01	THEEWATERSKLOOF	THEE WATERS KLOOF	497	34 03'29"	19 16'36"	18/06/1979	22/07/2002
	H6R002-A01	ELANKSKLOOF DAM	TWIST NIET	50	33 57'07"	19 15'06"	14/05/1975	15/04/2002
H70	H7H001-A01	BREE RIVER	OUDE POINT	9829	34 04'13"	20 23'27"	01/12/1912	30/11/1940
	H7H002-A01	HUIS RIVER	TRADOUWSHOEK	16	33 55'00"	20 45'00"	01/03/1938	30/09/1948
	H7H003-A01	BUFFELJAGS RIVER	SUURBRAK	450	34 00'10"	20 39'25"	15/03/1949	01/10/1992
	H7H004-A01	HUIS RIVER	BARRYDALE	28	33 54'42"	20 42'43"	02/05/1951	05/09/2002
	H7H005-A01	HERMITAGE RIVER	SWELLENDAM FOR. RES.	9	33 59'18"	20 25'21"	25/01/1960	26/08/2002
	H7H006-A01	BREE RIVER	SWELLEN DAM	9842	34 03'57"	20 24'15"	15/03/1966	15/07/2002
	H7H007-A01	GROOTKLOOF RIVER	SPARKENBOSCH	24	34 01'11"	20 32'54"	21/02/1968	05/09/2002
	H7H008-A01	LEFT CANAL FROM	EENZAAMHEID	N/A	34 01'07"	20 32'02"	01/09/1974	24/07/2002
	H7H009-A01	RIGHT CANAL FROM	EENZAAMHEID	N/A	34 01'07"	20 32'02"	01/09/1974	24/07/2002
	H7H013-A01	BUFFELJAGS RIVER	EENZAAMHEID	602	34 01'07"	20 32'02"	01/07/1965	24/07/2002
	H7H014-A01	BREE RIVER	WITSAND	N/A	34 23'49"	20 49'42"	23/01/2002	04/09/2002
	H7R001-A01	BUFFELJAGS DAM	EENZAAMHEID	601	34 01'07"	20 32'02"	10/01/1967	18/09/2002
G30	G3H001-A01	KRUIS RIVER	TWEEKUILEN	647	32 36'05"	18 45'02"	01/04/1970	21/08/2002
	G3H005-A01	HOL RIVER	WITTEWATER	86	32 39'05"	18 38'10"	12/04/1973	01/12/1981
	G3R001-A01	VERLOREVLEI	BONTEHEUVEL	N/A	32 19'03"	18 23'51"	16/03/1994	23/08/2002
	G3R002-A01	WADRIFTSOUTPAN	ELANDSBAAI	N/A	32 12'27"	18 20'07"	22/04/1999	21/08/2002
G40	G4H002-A01	KLEIN RIVER	OUKRAAL	531	34 20'24"	19 38'00"	21/04/1950	28/02/1951
	G4H003-A01	PALMIET RIVER	VAN ARIES KRAAL	144	34 11'36"	18 59'12"	01/04/1950	30/10/1954
	G4H004-A01	KLEIN RIVER	DE KLEINE RIVIERSVAL	689	34 26'27"	19 28'13"	01/05/1951	01/02/1960
	G4H005-A01	PALMIET RIVER	VAN ARIES KRAAL	146	34 11'49"	18 58'50"	11/03/1957	19/08/2002
	G4H006-A01	KLEIN RIVER	HAGEDISBERG OUTSPAN	600	34 24'21"	19 36'02"	28/03/1963	19/08/2002
	G4H007-A01	PALMIET RIVER	FARM 562 WELGEMOED	465	34 19'47"	18 59'25"	30/03/1963	19/08/2002
	G4H008-A01	KLEIN-JAKKALS RIVER	LEBANON FOREST	1.5	34 09'13"	19 08'11"	11/04/1964	05/05/1992
	G4H009-A01	JAKKALS RIVER	LEBANON FOREST RES.	2	34 09'58"	19 08'00"	11/04/1964	28/04/1992

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	G4H010-A01	JAKKALS RIVER	LEBANON FOREST RES.	6.7	34 10'28"	19 07'37"	11/04/1964	05/05/1992
	G4H011-A01	PALMIET RIVER	WESSELSGAT	63	34 07'24"	19 02'00"	24/03/1965	08/04/1975
	G4H012-A01	KLEIN-JAKKALS RIVER	LEBANON FOREST RES.	0.65	34 08'55"	19 08'35"	19/03/1965	05/05/1992
	G4H013-A01	KLEIN-JAKKALS RIVER	LEBANON FOREST RES.	2.1	34 09'44"	19 08'08"	12/03/1965	05/05/1992
	G4H014-A01	BOT RIVER	ROODE HEUVEL	252	34 12'25"	19 14'06"	13/04/1967	19/08/2002
	G4H023-A01	ROCKVIEW-STEENBRAS	ROCK VIEW	N/A	34 10'53"	18 57'03"	20/01/2000	19/08/2002
	G4H029-A01	PALMIET RIVER	VAN ARIES KRAAL	180.41	34 13'06"	18 58'33"	20/05/1987	19/08/2002
	G4H030-A01	PALMIET RIVER	KRABBE FONTEIN	N/A	34 16'05"	19 01'48"	21/07/1998	19/08/2002
	G4H033-A01	ONRUS RIVER	HEMEL EN AARDE	22	34 21'32"	19 15'16"	28/04/1977	19/08/2002
G40 (cntd)	G4R001-A01	STEENBRAS DAM	KOGEL BAAI	66.8	34 11'13"	18 51'10"	01/01/1989	30/09/2002
	G4R002-A01	EIKENHOF DAM	WESSELSGAT	63	34 07'39"	19 02'10"	16/05/1978	19/08/2002
	G4R003-A01	BOT RIVER WETLAND	HERMANUS RIVER	N/A	34 19'26"	19 07'22"	01/10/1979	19/08/2002
	G4R004-A01	KLEIN RIVER WETLAND	ROCKLANDS	N/A	34 24'34"	19 20'56"	08/08/1979	19/08/2002
	G4R006-A01	KOGELBERG DAM	VAN ARIES KRAAL	179.46	34 12'56"	18 58'19"	20/05/1987	02/09/2002
	G4R007-A01	STEENBRAS DAM	STEENBRAS RIVER	26.65	34 10'06"	18 54'00"	01/07/1993	30/09/2002
	G4R009-A01	PALMIET RIVER	KLEINMOND	N/A	34 20'09"	18 51'29"	21/01/1992	19/08/2002
	G4R010-A01	ONRUS RIVER	HEMEL EN AARDE	31	34 22'07"	19 14'06"	06/10/1977	26/04/1987
	G4R011-A01	ONRUS RIVER	ONRUS RIVER	56	34 24'59"	19 10'44"	30/11/1994	19/08/2002
	G4R012-A01	KLEINMOND-MOND	KLEINMOND-MOND	N/A	34 20'24"	19 02'22"	20/10/1999	07/08/2002
	G5H003-A01	KARS RIVER	RHENOSTER FONTEIN	559	34 29'39"	20 07'21"	22/04/1950	31/05/1954
	G5H004-A01	KARS RIVER	MELK BOSCH	377	34 27'15"	20 00'23"	21/02/1953	31/12/1958
	G5H005-A01	KARS RIVER	NAGT WAGT	658	34 34'18"	20 06'58"	24/02/1953	30/09/1963
G50	G5H006-A01	LITTLE SANDDRIF	ZOETMUISBERG	3.2	34 31'02"	19 58'37"	08/05/1956	08/11/1994
	G5H007-A01	KARS RIVER	MELK BOSCH	658	34 34'18"	20 06'58"	29/07/1953	04/09/1958
	G5H008-A01	SOUT RIVER	KYKOEDY	382	34 17'31"	20 01'25"	02/03/1964	27/08/2002
	G5R001-A01	DE HOOP WETLAND	FARM 74	1274.6	34 27'22"	20 23'15"	20/06/1963	14/08/2002