STATE OF RIVERS REPORT

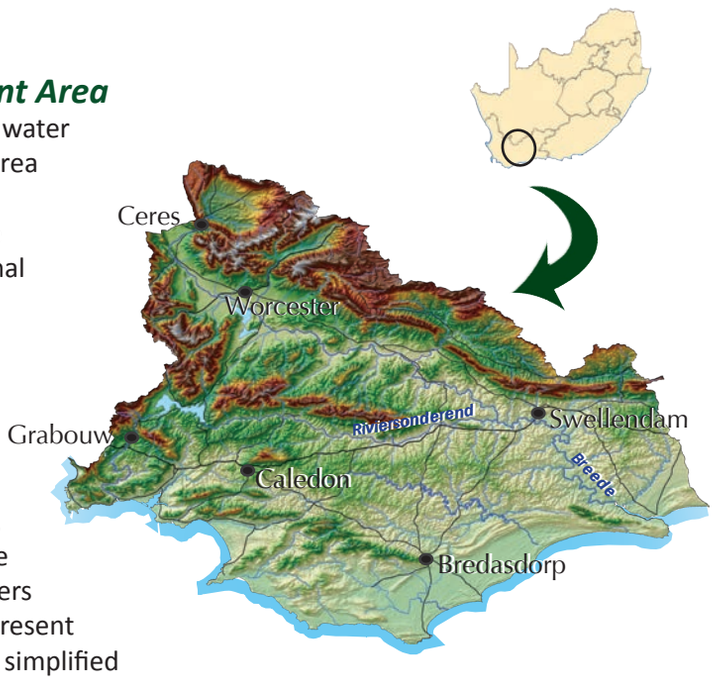
Rivers of the Breede Water Management Area 2011

River Health Programme

Rivers of the Breede Water Management Area 2011: Summary

Introduction to the Breede Water Management Area

The Breede Water Management Area is the southern-most water management area in South Africa. The greater part of the area is drained by the Breede River and its main tributary, the Riviersonderend River. Several small coastal rivers drain the southern part of the water management area, while seasonal rivers and vleis are found in the south-east. The economy of the region is mainly agriculture-based, with tourism at resort towns along the coast.



What is River Health?

Healthy rivers provide various goods and services which contribute to human welfare and economic growth. However, when people use rivers, they impact on river health. The National River Health Programme assesses the health of rivers by measuring selected ecological indicator groups that represent the condition of the larger riverine ecosystem. The data are simplified and represented as indices, while the overall ecological status of a river reach is expressed as the EcoStatus, and the ecological importance and sensitivity rating provides an indication of the relative ecological importance as well as its sensitivity to disturbances and therefore the level of protection that a river should receive.

Overall State

Breede and Overberg Rivers: The rivers of the Breede Water Management Area are generally in a fair ecological state, with only the upper reaches remaining in a good or natural state. Where urban areas and farming practices occur within riparian zones the health of the rivers deteriorate into a poor state. Bulldozing of river bed and banks is common within this area and has a significant impact on the habitat integrity of these rivers. Regular natural disturbance of the rivers during large floods which altered the instream habitat. These disturbed areas provide opportunity for alien invasive plants to establish along the river banks.

Reaches of many of the rivers are also impacted by alien vegetation (black wattle, Port Jackson and river gum) but the presence of sensitive invertebrates and good populations of indigenous fish suggest that these rivers can be rehabilitated. Alien fish (carp, catfish and tilapia) are abundant in the lower reaches of many rivers and impact on indigenous fish populations. Large instream dams, particularly in the Riviersonderend, Koekedouw, Buffeljags and Palmiet rivers, have altered flow, while the use of fertilisers have led to eutrophication and habitat modification in many of the lower river reaches (for example the Sout River).

Breede River upstream of Worcester

Major Impacts

River Channel and Riverbank Modification

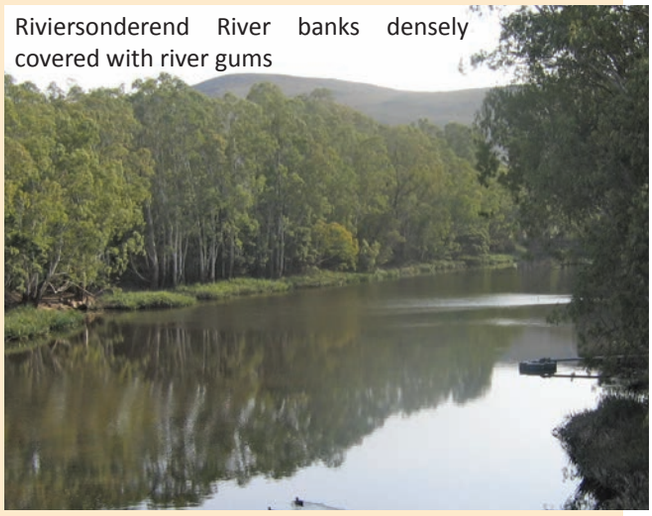
Flood protection measures and construction within the river channels have modified riverbanks (straightened channels and levees). This has resulted in habitat loss and change to the riparian zone and reduced aquatic species diversity.

Instream dams and water abstraction have modified river flows and altered downstream river channels. The attenuation of small floods by instream dams has narrowed and deepened river channels and encouraged further invasion of alien trees.

Alien Species Infestation

Most of the rivers have been invaded by alien vegetation with the exception of the upper reaches of rivers that occur within protected areas. Reaches of some rivers have also been protected from alien plant invasion by fences along the rivers that have provided a buffer from livestock and farming disturbance.

One or more alien fish species (smallmouth and spotted bass, bluegill sunfish, rainbow trout, mosquito fish, tilapia and carp) were present at most sites surveyed. These species compete with the indigenous Berg-Breede whitefish, Cape galaxias, Cape kurper and redfin minnow species for food and habitat, or prey on them.



Riviersonderend River banks densely covered with river gums

Natural Flooding Impacts

Human induced modifications and development over the last century in the riparian zones has increased the vulnerability of these river systems to flood events. These flood events over the past few years have severely modified river channels, particularly altering the aquatic habitats of rivers in the eastern Overberg and central to lower Breede River. The dense growth of alien trees at most sites exacerbated the impact of the floods on the river channel and resulted in extensive scouring of the channel.

Flow modification

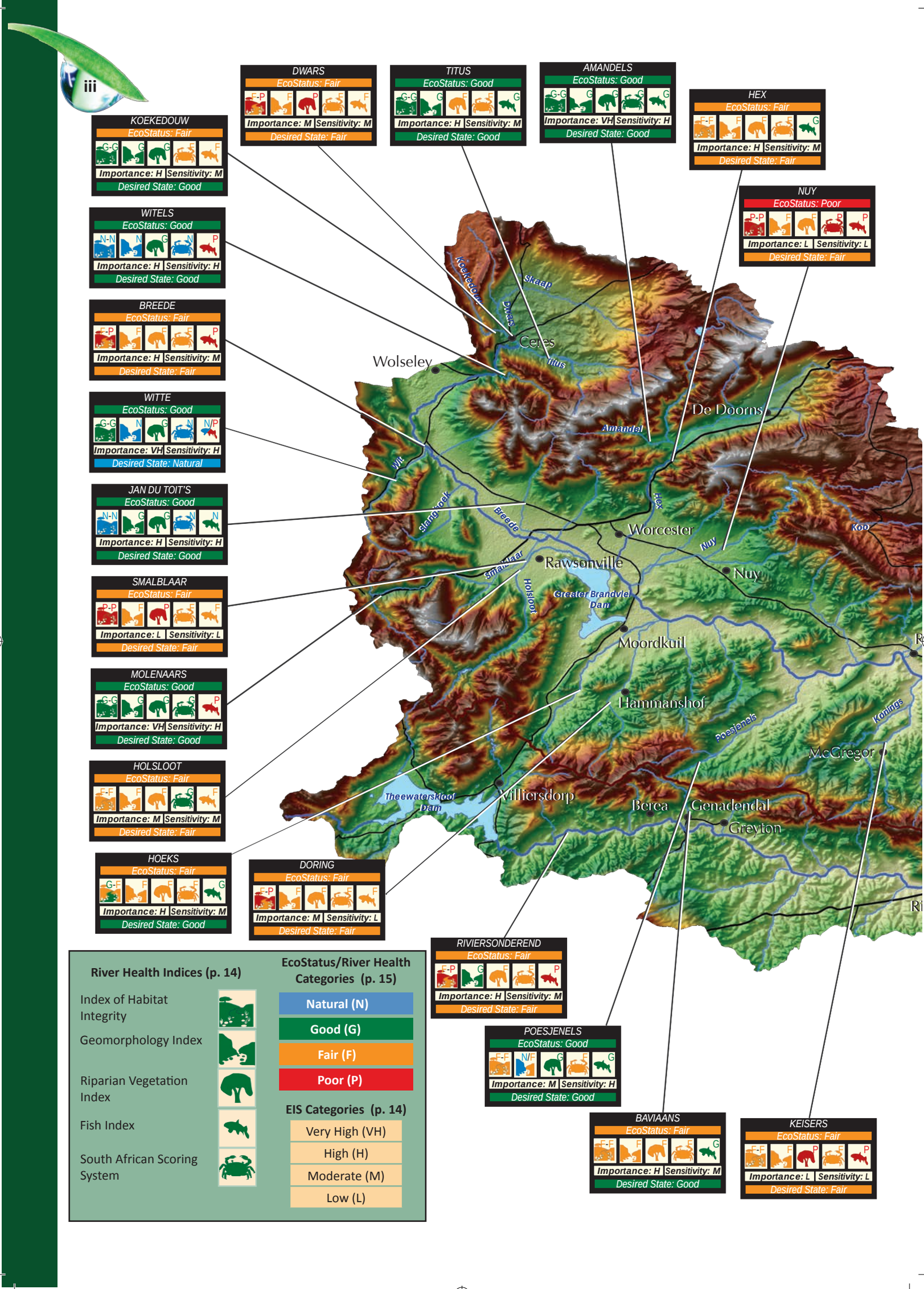
Large instream dams and diversion of flows for the supply of water to urban areas as well as for agricultural use has significantly reduced the flow in the lower reaches of many of these rivers. This is of particular concern during the dry low flowing summer months when the entire flow is often diverted out of the rivers for use. This low flow maintains small pools within the river channels that provides refugia for endemic fish and other aquatic life during the dry periods.

Water quality deterioration

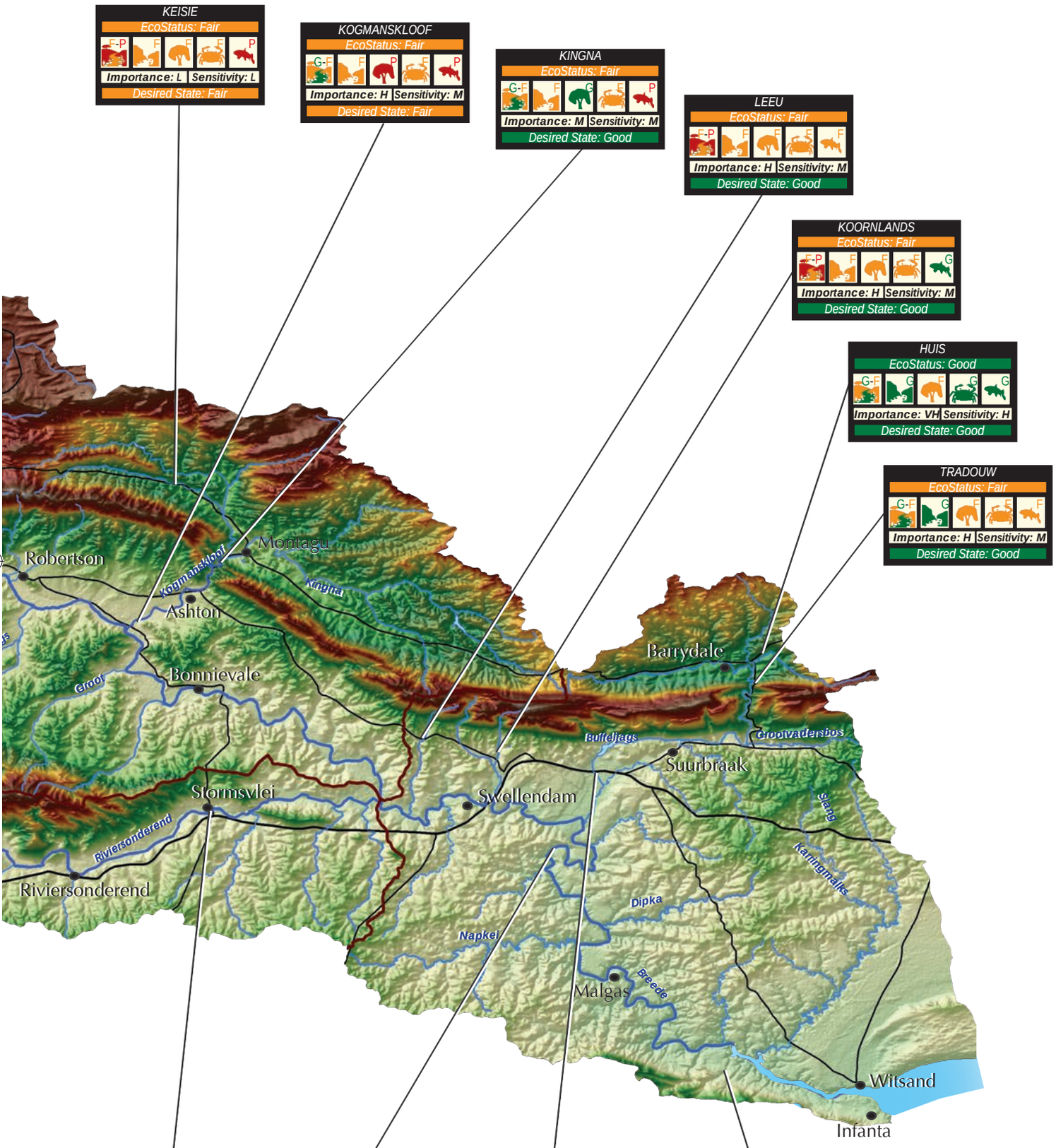
Nutrient and salinity concentrations for most of the rivers tend to continue to increase to unacceptable levels in the lower reaches of the rivers. This is largely as a result of return flows from irrigation throughout the area, as well as wastewater discharges to the rivers and runoff from poorly serviced areas. Pathogen concentrations are elevated downstream of many of the small towns in the region.

MANAGEMENT ACTIONS

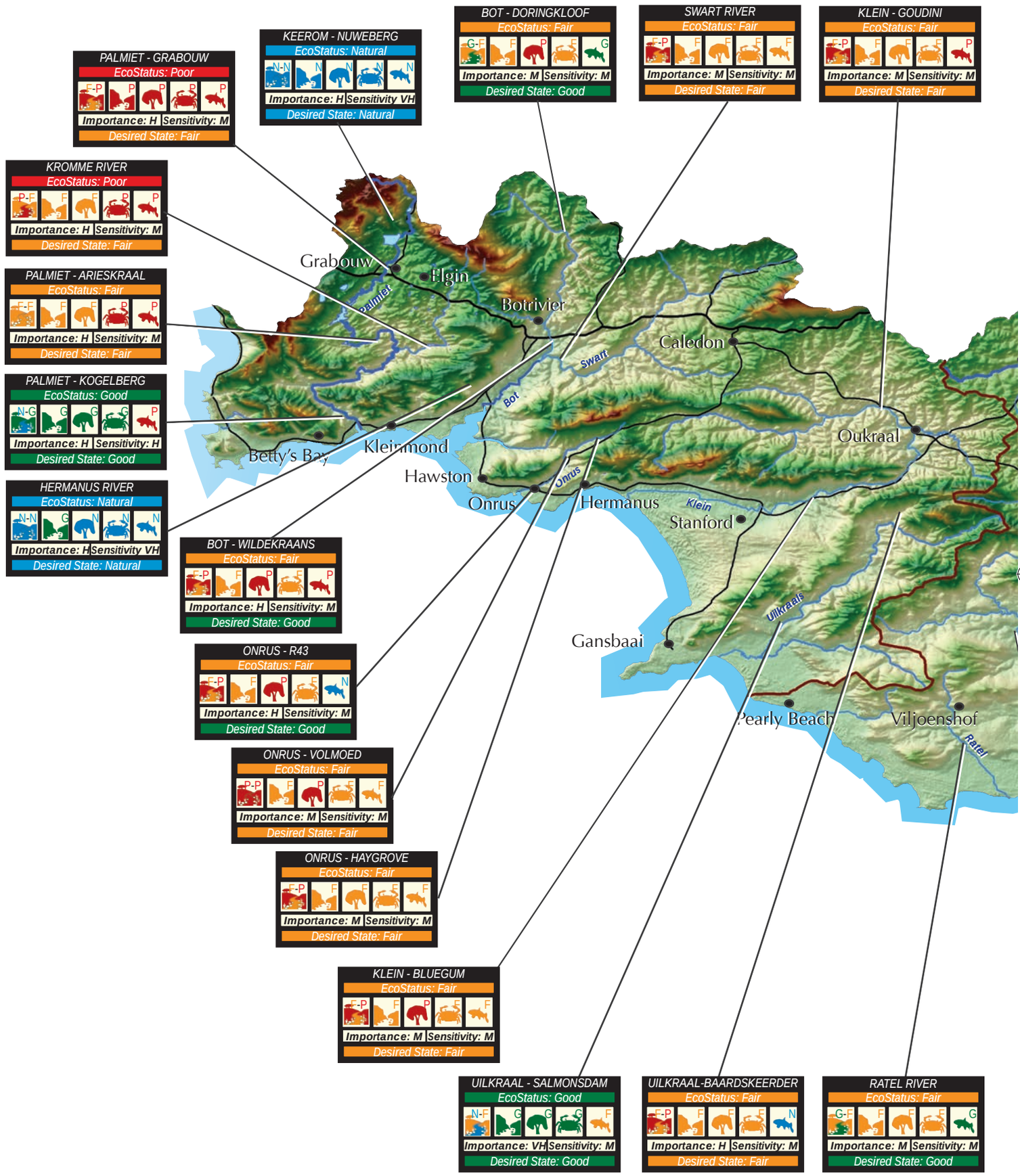
- Elevate the level of conservation in priority rivers and wetlands (see FEPA map page 62)
- Remove alien vegetation from the riparian zone and wetland areas. Ensure that they remain cleared by conducting follow-up operations
- Delineate riparian zones according in the Department of Water Affairs policy. Re-establish these riparian zones with indigenous vegetation
- Create a 30 metre buffer zone between agricultural lands and rivers
- Ensure that environmental flow releases (ecological Reserve) are made from instream dams
- Improve farming practices to reduce sedimentation and water quality problems
- Eradicate alien fish from highly sensitive upper river reaches
- Ensure that permits from CapeNature are obtained before stocking fish into farm dams

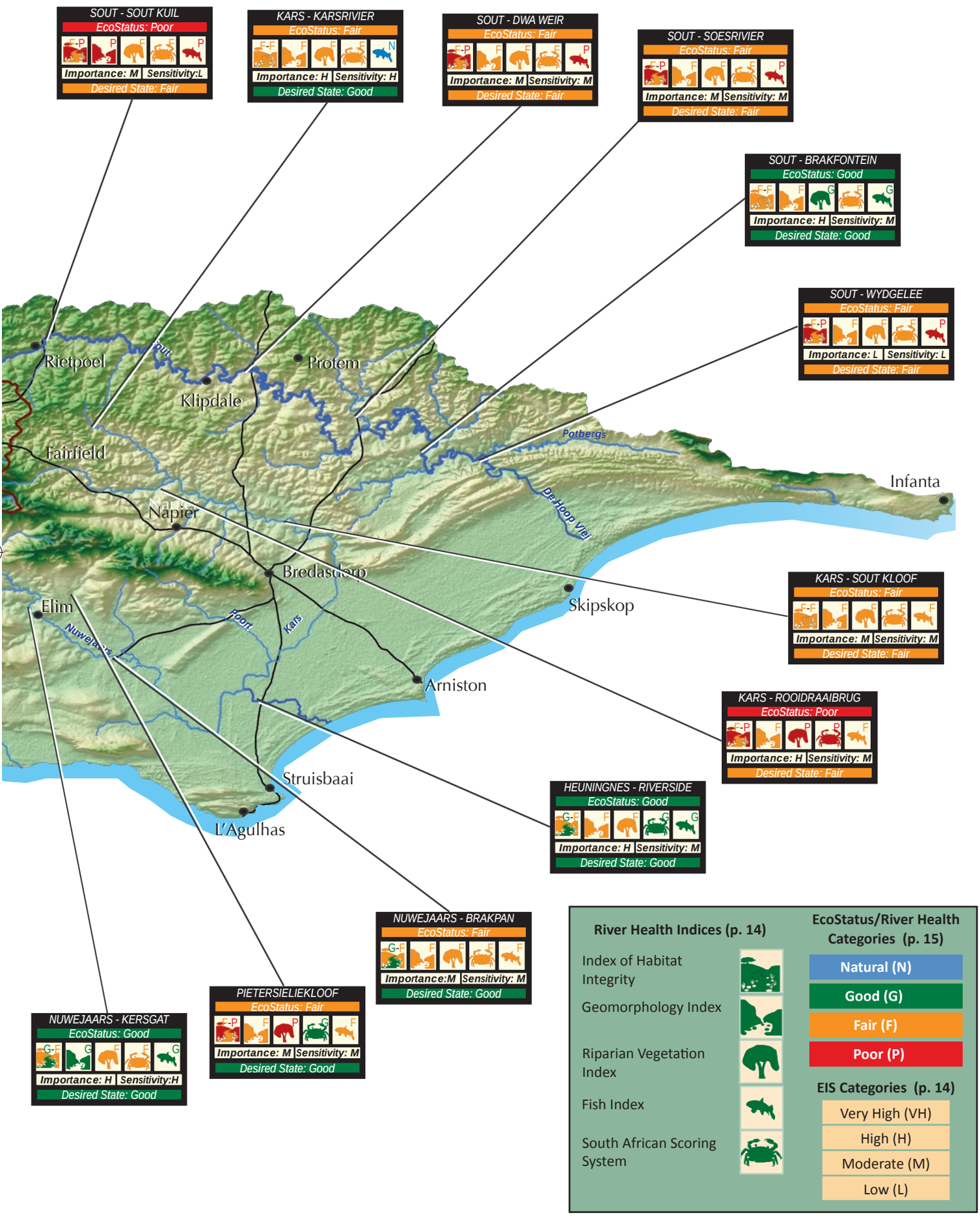

KOEKEDOUW
EcoStatus: Fair
Importance: H | Sensitivity: M
Desired State: Good
DWARS
EcoStatus: Fair
Importance: M | Sensitivity: M
Desired State: Fair
TITUS
EcoStatus: Good
Importance: H | Sensitivity: M
Desired State: Good
AMANDELS
EcoStatus: Good
Importance: VH | Sensitivity: H
Desired State: Good
HEX
EcoStatus: Fair
Importance: H | Sensitivity: M
Desired State: Fair
NUY
EcoStatus: Poor
Importance: L | Sensitivity: L
Desired State: Fair
WITELS
EcoStatus: Good
Importance: H | Sensitivity: H
Desired State: Good
BREEDE
EcoStatus: Fair
Importance: H | Sensitivity: M
Desired State: Fair
WITTE
EcoStatus: Good
Importance: VH | Sensitivity: H
Desired State: Natural
JAN DU TOIT'S
EcoStatus: Good
Importance: H | Sensitivity: H
Desired State: Good
SMALBLAAR
EcoStatus: Fair
Importance: L | Sensitivity: L
Desired State: Fair
MOLENAARS
EcoStatus: Good
Importance: VH | Sensitivity: H
Desired State: Good
HOLSLOOT
EcoStatus: Fair
Importance: M | Sensitivity: M
Desired State: Fair
HOEKS
EcoStatus: Fair
Importance: H | Sensitivity: M
Desired State: Good
DORING
EcoStatus: Fair
Importance: M | Sensitivity: L
Desired State: Fair
RIVIERSONDEREND
EcoStatus: Fair
Importance: H | Sensitivity: M
Desired State: Fair
POESJENELS
EcoStatus: Good
Importance: M | Sensitivity: H
Desired State: Good
BAVIAANS
EcoStatus: Fair
Importance: H | Sensitivity: M
Desired State: Good
KEISERS
EcoStatus: Fair
Importance: L | Sensitivity: L
Desired State: Fair
Wolseley
Ceres
De Doorns
Worcester
Rawsonville
Nuy
Moordkuil
Hammanshof
McGregor
Villiersdorp
Berea
Genadendal
Greyton
Koekedouw
Skeiap
Dwars
Titus
Amandel
Hex
Breede
Nuy
Holsloot
Poesjenels
Koningsvlei
Greater Brandvlei Dam
Theewaterskloof Dam
River Health Indices (p. 14)
Index of Habitat Integrity
Geomorphology Index
Riparian Vegetation Index
Fish Index
South African Scoring System
EcoStatus/River Health Categories (p. 15)
Natural (N)
Good (G)
Fair (F)
Poor (P)
EIS Categories (p. 14)
Very High (VH)
High (H)
Moderate (M)
Low (L)

Present Ecological State: Breede River System



Present Ecological State: Overberg Rivers




SOUT - SOUT KUIL
EcoStatus: Poor
Importance: M | Sensitivity:L
Desired State: Fair
KARS - KARSRIVIER
EcoStatus: Fair
Importance: H | Sensitivity: H
Desired State: Good
SOUT - DWA WEIR
EcoStatus: Fair
Importance: M | Sensitivity: M
Desired State: Fair
SOUT - SOESRIVIER
EcoStatus: Fair
Importance: M | Sensitivity: M
Desired State: Fair
SOUT - BRAKFONTEIN
EcoStatus: Good
Importance: H | Sensitivity: M
Desired State: Good
SOUT - WYDGELEE
EcoStatus: Fair
Importance: L | Sensitivity: L
Desired State: Fair
KARS - SOUT KLOOF
EcoStatus: Fair
Importance: M | Sensitivity: M
Desired State: Fair
KARS - ROOIDRAAIBRUG
EcoStatus: Poor
Importance: H | Sensitivity: M
Desired State: Fair
HEUNINGNES - RIVERSIDE
EcoStatus: Good
Importance: H | Sensitivity: M
Desired State: Good
NUWEJAARS - BRAKPAN
EcoStatus: Fair
Importance:M | Sensitivity: M
Desired State: Good
PIETERSIELIEKLOOF
EcoStatus: Fair
Importance: M | Sensitivity: M
Desired State: Good
NUWEJAARS - KERSGAT
EcoStatus: Good
Importance: H | Sensitivity:H
Desired State: Good
Rietpoel
Klipdale
Protem
Fairfield
Napier
Bredasdorp
Elim
Arniston
Skipskop
Infanta
Struisbaai
L'Agulhas
Potbergs
De Hoop Vlei
Kars
River Health Indices (p. 14)
Index of Habitat Integrity
Geomorphology Index
Riparian Vegetation Index
Fish Index
South African Scoring System
EcoStatus/River Health Categories (p. 15)
Natural (N)
Good (G)
Fair (F)
Poor (P)
EIS Categories (p. 14)
Very High (VH)
High (H)
Moderate (M)
Low (L)

Foreword

The Breede Water Management Area (WMA) is one of 19 WMAs in South Africa and consists of two main regions: the Breede River catchment and the Overberg region. Both the land-use and economy of the region is agriculture based with tourism at resort towns along the coast. Agricultural practices vary from dry-land cultivation of wheat in the Overberg area to intensive irrigation of crops such as vineyards, fruit and citrus as well as cash crops in the Breede area.

The Breede WMA is one of only two WMAs in South Africa where a Catchment Management Agency (CMA) is in place. The Breede-Overberg Catchment Management Agency (BOCMA) has been established by the Minister of Water Affairs in July 2005 and the CMA became operational over the past 3 years. As the lead agent for water resource management within the Breede WMA, BOCMA plays a key role in protecting, using, developing, conserving, managing and controlling water resources.

To achieve integrated water resources management and sustainable use of water resources, it is important to monitor, assess and report on the status of water resources. The Breede WMA State of Rivers Report, the product of various organizations and scientists, informs decision makers, stakeholders and the public on fundamental issues impacting on rivers in an easy to understand format. It raises awareness and understanding about the current ecological state of our rivers, the impacts on them and the management actions that can be taken by all stakeholders to improve them.

Although it is acknowledged that there are serious water quality impacts and threats to water users and human health in the Breede WMA, this report focuses mainly on the ecological state of the rivers in the area. As increasing development places more pressure on these water resources, it becomes increasingly critical that both water resource managers and water users realize how fundamentally important it is to maintain the ecological integrity of these resources in order to ensure sustainable use.

It is envisaged that through this report, all who live in the Breede / Overberg Water Management Area are inspired to protect and use these water resources sustainably and where possible restore and conserve the rivers, wetlands, estuaries and groundwater to sustain the life giving force of these water resources for our children's children to inherit, use and enjoy.

Rashid Khan
Chief Director: Western Cape
Department of Water Affairs

Contributing Organisations

Department of Water Affairs
Department of Environmental Affairs
Water Research Commission
CapeNature

Contributors

Toni Belcher (Compiler & graphic design), Siya Buthelezi, Thembela Bushula, Pumza Buwa, Marilie Carstens, Shaddai Daniels, Pierre de Villiers, Bentley Engelbrecht, Greg Forsyth, Larry Ferguson, Jeanne Gouws, Dana Grobler, Earl Herdien, Dean Impson, Nosiphiwo Ketse, Marysia Janse Van Rensburg, Martine Jordaan, Wilna Kloppers, Melissa Lintnaar-Strauss, Rembu Magoba, Fulufhelo Mafelatshuma, Christa Marais, Mulalo Mbedzi, Jeanne Nel, Tovho Nyamande, Mashudu Pandelani, Chantel Petersen, Micheal Radzilani, Cecile Reed, Miehleketo Rikhotso, John Roberts, Kevin Shaw, Ernst Swartz, W Swanepoel and Graeme Williams

Acknowledge-ments

Breede-Overberg Catchment Management Agency for their contributions to the report content
CSIR for their assistance with the alien vegetation and FEPA work
eWISA.co.za and Department of Water Affairs Hydrology Western Cape for flood and dam photographs
South African National Biodiversity Institute for contributions on fauna and flora
State Archives for historical photographs and other material

State of Rivers Report: Rivers of the Breede Water Management Area

Context

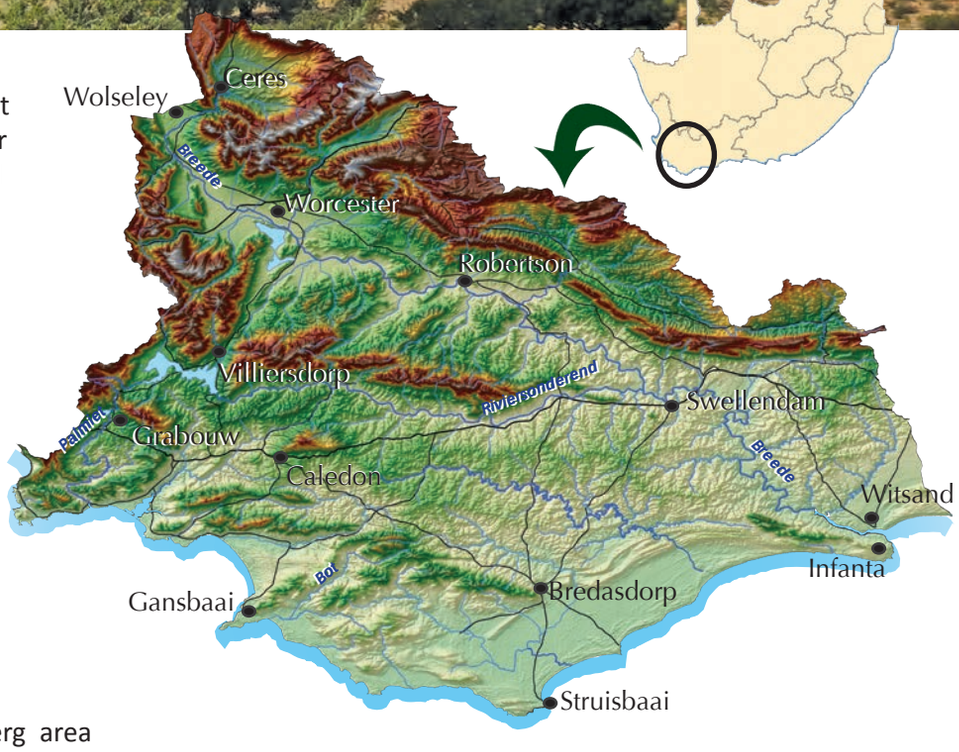
The current state of the aquatic ecosystems presented in this report is based on the findings of river surveys that were conducted in the Rivers as part of the River Health Programme, Western Cape. These surveys took place between 2004 and 2005 for the Overberg Rivers and 2007 and 2008 for the Breede River.

Contents

Suggested Citation:
River Health Programme (2011). State of Rivers Report: Rivers of the Breede Water Management Area.
Department of Water Affairs, Western Cape, Republic of South Africa
ISBN No: 978-0-620-50001-2

Breede WMA Overview

The Breede Water Management Area is the southern-most water management area in South Africa and lies within the Western Cape Province. This area encompasses the Breede, Riviersonderend and Overberg river catchments.



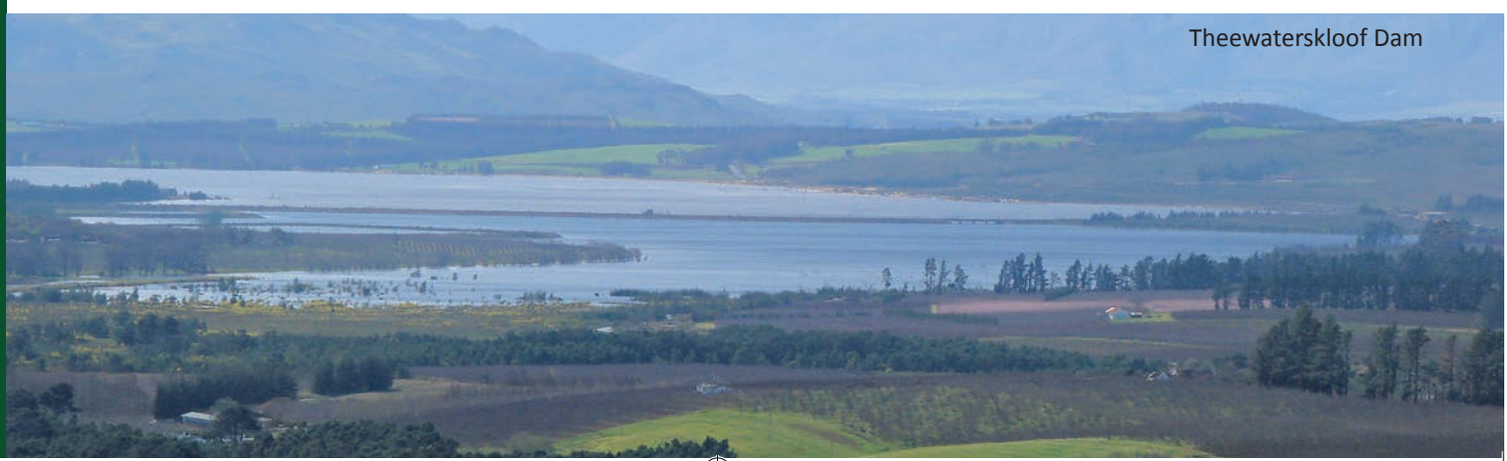
The climate in the area varies considerably. Rainfall is largely in the winter with occasional winter snowfalls occurring on the mountains in the south- and north west of the area. In the western mountainous regions rainfall can exceed 1 800 mm/a, while in the lower eastern parts the rainfall decreases to about 300 mm/a.

The topography of the Breede-Overberg area is characterised 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, with a wide Breede River valley and the rolling hills of the Overberg in the south.

The Breede River Catchment (12 600 km^2) and its main tributary, the Riviersonderend River drain the greater part of the water management area. The Breede River itself is 322 km long, rising in the Skurweberg Mountains near Ceres and draining to the estuary mouth between Infanta and Witsand. In its upper reaches, the Breede River is joined by a number of tributaries, the Wit, Molenaars and Holsloot rivers. The Hex River joins the Breede River near Worcester.

In the middle reach, the Breede River is joined by the Kingna River and extends from below Greater Brandvlei Dam to its confluence with the Riviersonderend River. The Riviersonderend River itself rises upstream of Theewaterskloof Dam, in the Hottentots Holland and Franschhoek Mountains. 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.

Several small coastal rivers drain the Overberg varying from the low salinity perennial Palmiet River in the west to the saline and seasonal rivers of the east. The lower Palmiet River in the Kogelberg Biosphere Reserve and the vlei areas of the Nuwejaars/Heuningnes/Kleinrivier catchments are of high conservation importance.



Theewaterskloof Dam

Future possible development of the water resources

The following have been identified as possible interventions to meet an ever growing demand for water in the South Western Cape:

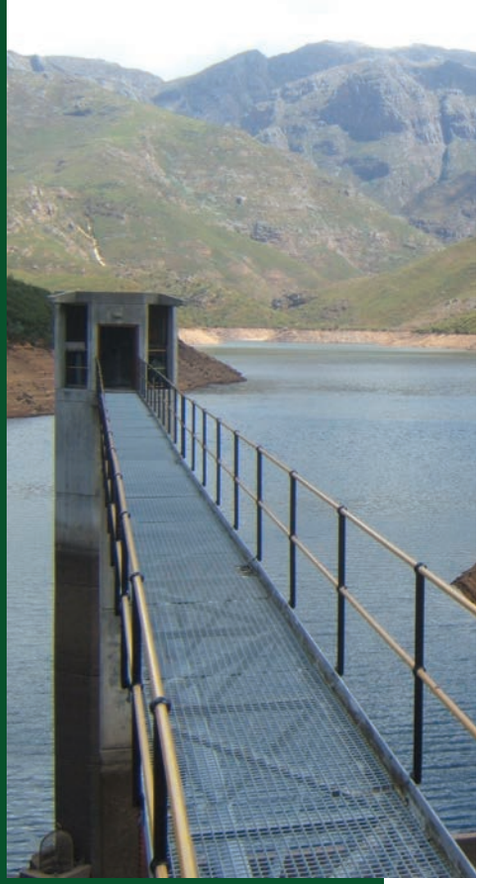
- Surface Water Interventions such as increasing winter storage capacity to Greater Brandvlei and Buffeljags dams;
- Removal of invasive alien vegetation;
- Decreasing the assurance of supply for existing users;
- Increasing groundwater abstraction through exploration of the Table Mountain Group aquifers;
- Desalination of seawater in the Overberg;
- Re-use of water;
- Validation, Verification and Licensing of existing water use
- Improved agricultural and urban Water Conservation and Water Demand
- Management as well as increasing water use control
- Increase compliance with the ecological Reserve water quantity and quality requirements.

A Water Availability Assessment Study is planned to ensure that the latest data for hydrology and land use is used to determine future water availability in the area. The augmentation of Greater Brandvlei Dam and the raising Buffeljags Dam are preferred options for further development of these water resources. Implementation of the ecological Reserve requirements will play a significant role in the future management of the Breede-Overberg rivers and the consideration of the proposed future possible developments.

Impoundments in the Breede-Overberg Rivers

Major impoundments	River	Purpose	Full supply capacity (million m^3)
Breede River System			
Ceres (Koekedouw)	Koekedouw	Urban / Irrigation	17
Theewaterskloof	Riviersonderend	Urban / Irrigation	434
Greater Brandvlei	Breede	Urban / Irrigation	342
Lakenvallei	Sandriftkloof	Irrigation	10
Roode Elsberg	Sandriftkloof	Irrigation	8
Osplaas	Hex	Urban / Irrigation	3
Elandskloof	Elands	Irrigation	11
Poortjieskloof	Groot	Irrigation	10
Buffeljags	Buffeljags	Irrigation	6
Pietersfontein	Keisie	Irrigation	2
Keerom	Nuy	Irrigation	10
Stettynskloof	Holsloot	Urban	15
Overberg Rivers			
Eikenhof	Palmiet	Irrigation	22
Kogelberg	Palmiet	Urban / Hydro power	19
Arieskraal	Palmiet	Irrigation	6
Nuweberg	Palmiet	Urban	4
Applewaite	Palmiet	Irrigation	3
De Bos	Onrus	Urban	6
Kraaibosch	Uilkraals	Irrigation / Urban	5
Klein Sandrift	Klein Sandrift	Urban	4

Stettynskloof Dam



Catchment Characteristics

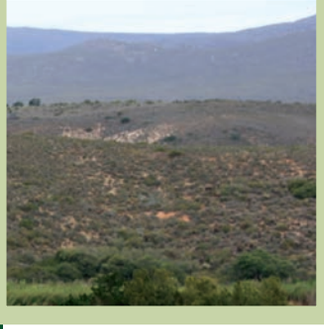
Climate, geology and vegetation influence the distribution and diversity of fauna and flora. Areas of similar ecological characteristics are grouped in ecoregions. Rivers in the same ecoregion are ecologically more similar to one another than rivers in a different ecoregion.

Ecoregions

There are four ecoregions in the Breede Water Management Area, namely the Southern and South-Western Coastal Belts, and the Southern and Western Folded Mountains. Much of the Overberg and lower Breede catchments lies within the Southern Coastal Belt Ecoregion which are low lying and receive a relatively low rainfall.

The upper Breede, Palmiet and Bot Catchments lie within the Western and Southern Folded Mountain Ecoregions that receive higher rainfall and have a higher relief topography.

A very small portion of the South Western Coastal Belt Ecoregion occurs at Wolseley and in the Du Toitskloof.

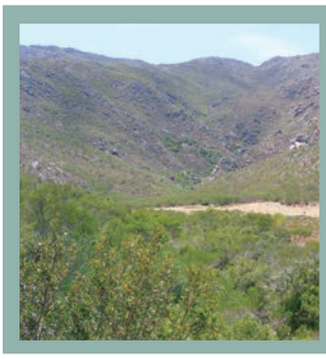


Southern Coastal Belt

Landscape	Moderate/high hills & mountains
Vegetation	South/South West Coast Renosterveld
Mean Altitude (m)	up to 700
Rainfall pattern	Winter to all year
Mean Annual Precipitation (mm)	300 - 600
Mean Annual Runoff (mm)	more than 250
Average Daily Temperature (°C)	10 - 20

South Western Coastal Belt

Landscape	Moderate plains
Vegetation	South Coast Renosterveld, Sandplain Fynbos
Mean Altitude (m)	up to 300
Rainfall pattern	Summer and Winter
Mean Annual Precipitation (mm)	100 - 1000
Mean Annual Runoff (mm)	20 to more than 250
Average Daily Temperature (°C)	4 - 32



Southern Folded Mountains

Landscape	Moderate/high mountains & hills
Vegetation	Sandstone Fynbos, Succulent Karoo
Mean Altitude (m)	300 - 1900
Rainfall pattern	Very late summer to winter, to all year
Mean Annual Precipitation (mm)	200 - 1500
Mean Annual Runoff (mm)	less than 5 to more than 250
Average Daily Temperature (°C)	10 - 32

Western Folded Mountains

Landscape	Moderate/high mountains & hills
Vegetation	Sandstone Fynbos
Mean Altitude (m)	300 - 1700
Rainfall pattern	Winter
Mean Annual Precipitation (mm)	600 - 1800
Mean Annual Runoff (mm)	5 to more than 250
Average Daily Temperature (°C)	0 - 32

Sub-catchments	Upper Breede	Central Breede	Riviersonderend	Lower Breede	Overberg West	Overberg East
Rivers/main tributaries	Breede, Dwars, Witte, Molenaars, Jan du Toit's, Hex, Holsloot	Breede, Nuy, Kogmanskloof, Hoeks, Doring, Keisers	Riviersonderend, Baviaans	Breede, Buffeljags, Napkei, Dipka, Slang	Onrus, Palmiet, Bot, Klein, Uilkraals	Heuningnes/Nuwejaars, Kars, Sout
Catchment size (km^2)	2 879	4 512	2 241	2 922	2 986	4 128
Geology	Quartzitic Table Mountain sandstone, Bokkeveld and Malmesbury shales, Enon conglomerate	Quartzitic Table Mountain sandstone, Bokkeveld and Malmesbury shales	Bokkeveld shales	Table Mountain and Witteberg sandstone, Bokkeveld shales, Enon conglomerate, Coastal deposits	Quartzitic Table Mountain sandstone with Bokkeveld shales	Bokkeveld and Malmesbury shale, limestone and marine sands
Vegetation	Mountain Fynbos and Central Mountain Renosterveld	Mountain Fynbos, Central Mountain Renosterveld, Little Succulent Karoo	Mountain Fynbos, Central Mountain & South/South-West Coast Renosterveld	Mountain Fynbos, Central Mountain Renosterveld, Little Succulent Karoo	Mountain Fynbos and South/South-West Coast Renosterveld	Limestone and Sand Plain Fynbos, South/South-West Coast Renosterveld, Dune Thicket
Mean Annual Precipitation (mm)	761	413	634	446	654	428
Mean Annual Evaporation (mm)	1 633	1 547	1 434	1 433	1 424	1 449
Mean Annual Runoff (million cubic metres)	960	247	459	206	464	99

Land and Water Use

Land-use

Land-use consists of large expanses of dry land cultivation in the southern Overberg areas, where wheat is the main crop type. Intensive irrigation takes place along the Breede, Riviersonderend and Palmiet River catchments. 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 and Upper Riviersonderend River catchments.

Water use

Several large instream and some off-channel dams, as well as many farm dams have been constructed in the water management area. The largest dam, the Theewaterskloof Dam, receives transferred water from the Berg water management area for seasonal storage to be utilised again in summer in that area, with additional water from the Breede catchment. Water is also transferred from the Palmiet River to the Berg water management area via the Palmiet Pumped Storage Scheme for use in Cape Town. With the exception of the dams in the Palmiet River, and a dam on the Onrus River, there are few dams in the Overberg and water use is largely dependant on groundwater.

Population

Most of the population lives within the Overberg West and Upper to Central Breede areas. Demographic projections indicate a population growth in the coastal areas, but a decline in inland areas. The total population is therefore expected to remain relatively constant.

Economy

The economy of the region is mainly agriculture-based, with tourism at resort towns along the coast. Extensive vineyards and fruit orchards are grown under irrigation, fed by water from mountain streams and the Breede River as well as groundwater. Dryland wheat is cultivated between the Riversonderend and the coastal mountains, while livestock farming is practised throughout the region. Less than 1% of the national Gross Domestic Product originates from the Breede Area, however a large proportion of the water available in the area is utilised within the Berg Water Management Area for economic gain. Because of a poor performance of the region's agricultural sector in recent times, no significant economic growth is foreseen over the short term.

Natural vegetation (62%)

Dryland crops (29%)

Irrigated crops and pastures (5%)

Urban areas (1%)

Plantations and forests (1%)

Mines and quarries (<1%)

Bare rock and soil (<1%)

Management Area	Upper Breede	Central Breede	Riviersonderend	Lower Breede	Overberg West	Overberg East
Main land-use	Irrigated and dryland agriculture (orchards and vineyards)	Irrigated and dryland agriculture (orchards and vineyards)	Pastures	Dryland agriculture (grains and livestock)	Irrigated agriculture (orchards and vineyards) and forestry	Dryland agriculture and natural areas, some vineyards
Population (2001)	86 395	203 000	31 203	26 224	142 279	26 471

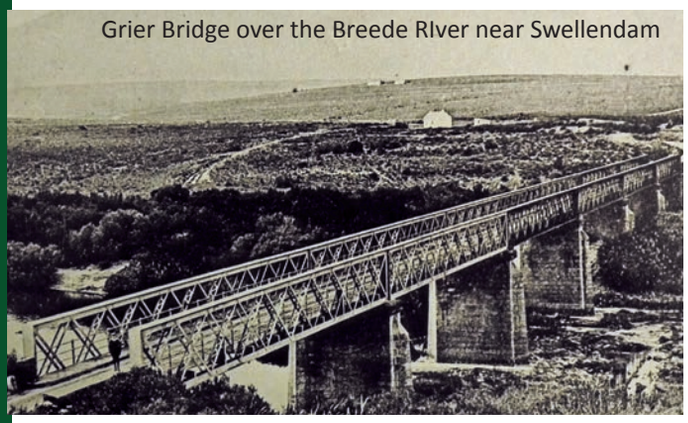
Past Development

Evolution of the Breede River

The Breede River Valley is striking in that it is much wider that the relatively minor river that originally carved it. The Breede Valley is a very old valley, dating back 170 million years to the days of continental rift and drift in the Jurassic Period. An ancient system of deep faults stretches from Tulbagh to Mossel Bay. Over the eons, the ground south of the fault has dropped substantially by 6 000m. But normal erosional forces have leveled the ground continuously, so that while the fault has deepened, erosion has leveled off the surrounding land. The upper portion of the fault has also occasionally moved, as was the case in the Tulbagh/Wolseley earthquake in 1969, which registered a magnitude of 6.3 on the Richter Scale.

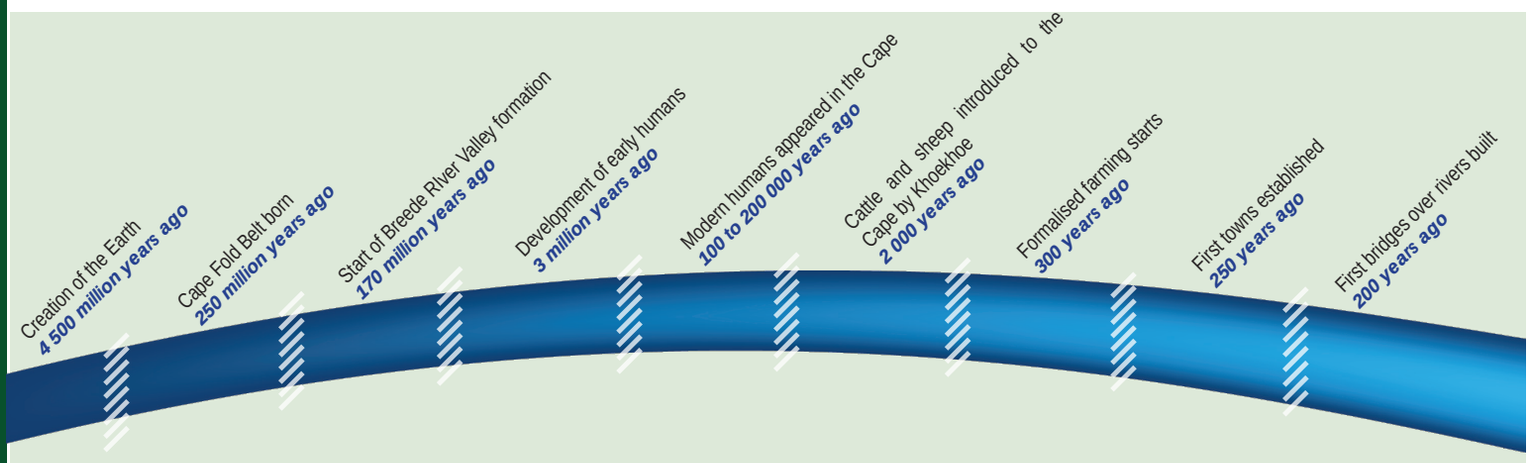
Early development of the Area

Early records of human life in the Breede-Overberg area indicate that it was first inhabited by Stone Age people, ancestral San, who lived mainly along the coast where food and water were plentiful. Archaeologists believe that they may have been responsible for the intertidal fish traps built between 7 000 and 3 300 years ago, remnants of which can be found at Cape L'Agulhas. Rock paintings are also found in the Tradouw's Pass and in the De Hoop Reserve. The Khoekhoe, who originated in the Zambezi Valley, migrated southwards into the area approximately 2 000 years ago. They were pastoralists and pottery-makers and introduced the first cattle and sheep to the area. They were also nomadic and moved regularly from place to place to make use of seasonally available grazing and other resources such as water. Three Khoekhoe tribes were known to occur in this area, the Chainouqua who lived east of the Hottentots Holland Mountains and south-west of the Riviersonderend River, the Hessequa between the Riviersonderend and Breede rivers and the Gouriqua eastwards to Mossel Bay.



Grier Bridge over the Breede RIver near Swellendam

After 1707, the Dutch in the Cape began to encourage the expansion of agriculture into the Breede and Overberg areas. This occurred mostly along the transport routes from the present day Sir Lowry's Pass, to Caledon, and along the Riviersonderend River to Swellendam. Along this route, travellers needed to cross the Palmiet River in Grabouw and the Breede River near Swellendam. At both these rivers pontoons were initially (late 1700 to early 1800s) used to cross the river as the drift crossings were not always safe. The first bridge at Grabouw was built in 1847, while the Grier Bridge near Swellendam was only built in 1895, and the N2 bridge in 1953.

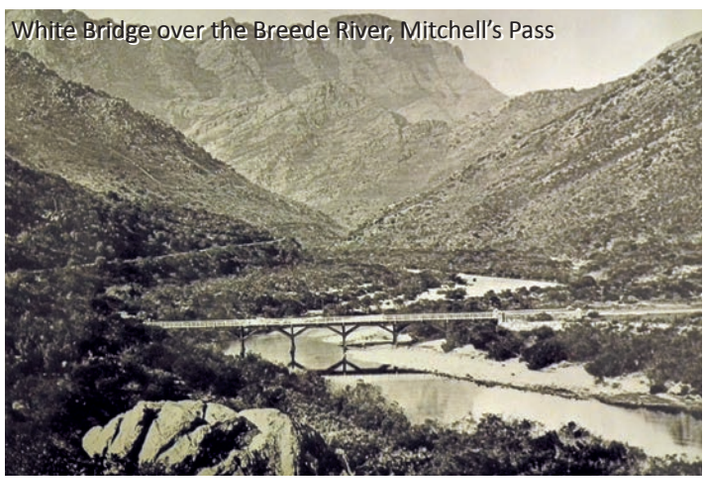


Timeline of Development and major events in the Breede-Overberg Rivers

Recent Development of the Area

Larger-scale development of the area only really followed improved access through the construction of the mountains passes that had remained as barriers to the movement of people. Many of these passes were made through river beds that cut through the mountains, such as:

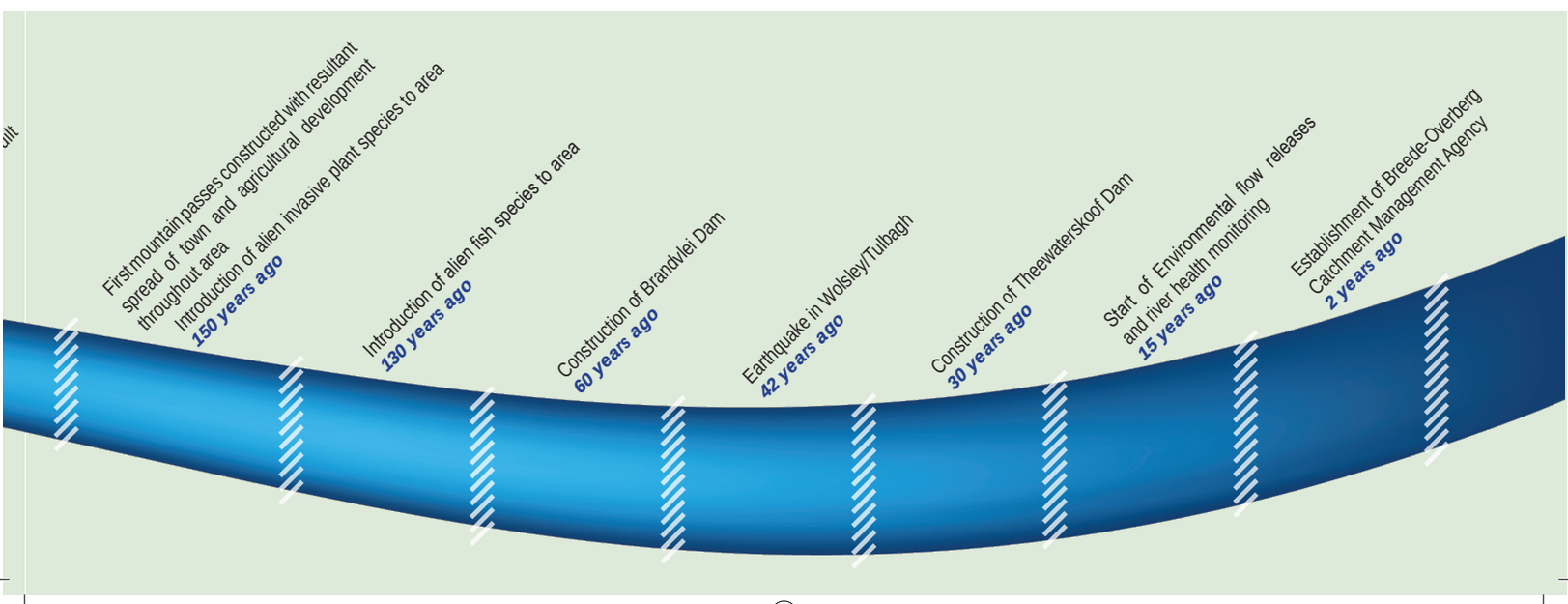
- Michell's Pass near Ceres was constructed in 1846;
- Bain's Kloof Pass near Wellington was completed in 1853 and followed the Witte River for a portion of its length;
- Tradouw Pass completed in 1873 followed the Tradouw River;
- Hex River Mountain Pass began in the kloof of the upper Hex River and was formally constructed in 1876;
- Montagu Pass was constructed in 1877 through Kogmanskloof and followed the path of the Kingna River;
- Koodoosberg/Burger's Pass in the upper Koo River was initiated in 1877 but only finally completed in 1951; and
- Du Toit's Kloof Pass was constructed initially in 1785 from the upper Berg River to the Jan Du Toit's River near Worcester. Access via this route was improved considerably as a result of the construction of the Huguenot Tunnel in 1988.


White Bridge over the Breede River, Mitchell's Pass

The risk of placing the passes along river channels is that they are often subjected to flood damage or become impassible during periods of high flow.

Towns were established in the area in the following sequence:

- Swellendam was established in 1747 as a refreshment and repair station for travellers between Cape Town and Mossel Bay. It is the third oldest district in South Africa after Cape Town and Stellenbosch. Other towns to be established in the 1700s were Hermanus; Genadendal which was established as a mission station; and Greyton.
- Most of the towns were established in the 1800s: Suurbraak and Elim as mission stations; Caledon, originally "Zwartbergbad" after hot springs in the area; Worcester as a major centre in the Boland; Bredasdorp and Napier; Villiersdorp; Ceres, a centre of fruit growing in the Warmbokkeveld; Montagu with its thermal springs; Grabouw; Struisbaai as a harbour; Wolseley as the first wool-washing centre in South Africa; and Barrydale.
- Towns which developed more recently in the 1900s were: Botrivier (named Butter river because Khoekhoe sold butter to Europeans here); Bonnievale; Gansbaai; Riviersonderend (the Hessequa name for the river Zonderend was Kanna-kam-kanne "water, endless water"); and Ashton which developed round the southern hemisphere's biggest fruit and vegetable canning factory.



Alien Fish and Invasive Plant Introduction to the Catchment

Alien fish species were introduced into the rivers and dams of the water management area from 1880 onwards for angling purposes and to provide food. Many of these species found the inland waters of this region much to their liking and 12 species have become invasive (see Table on page 68), with severe predatory and competitive impacts on indigenous fish species and associated biota.

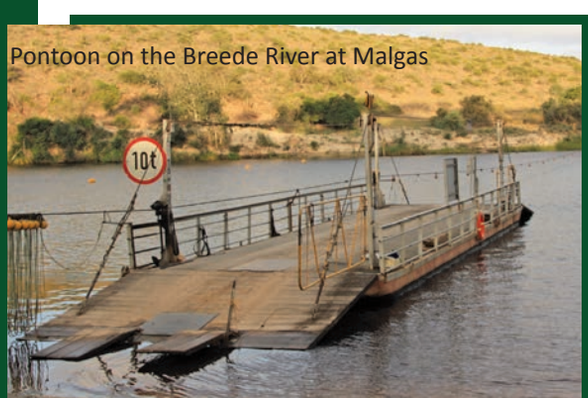
Invasive alien plants such as the black wattle and Port Jackson willow were introduced to the area approximately 150 years ago. The black wattle was introduced from Australia to provide bark products and was mainly grown in plantations in KwaZulu Natal and is now the number one invasive plant in South Africa and the World. Port Jackson willows were also introduced from Australia at about the same time to stabilise the dunes particularly along the routes in the Cape.

Historical Trends in the Flow in the Breede River

Flow data for various sites in the Breede River Valley shows evidence of permanent flow pattern changes since 1960. The following flow changes are evident in the measured flows in the system over the past 50 to 60 years:

- In the upper Breede River, the pre-1958 flow pattern is visibly different from post-1960, with summer low flows dropping by up to 3 orders of magnitude after 1960. These flows would have been affected by increasing agriculture in the Ceres valley over the past 50 years. Koekedouw Dam has only recently influenced flows in this section of the system.
- The lower Riviersonderend River showed a marked difference between its pre- and post-1978 flow data following the construction of Theewaterskloof Dam.
- Below Brandvlei Dam, flow in the middle Breede River dropped by about $2m^3/s$ over the past 50 years. Growth of the grape industry in the Hex River valley has resulted in 2/3 of the water supply for agriculture being utilised by this industry. Major groundwater abstraction from alluvial aquifers and development of many moderate-sized impoundments have affected the river flow in this reach.
- Flow in the lower Breede River, below the confluence of the Breede and the Riviersonderend, has been significantly reduced to less than that of its upstream Breede and Riviersonderend rivers.
- The Du Toit's Kloof is the only Breede tributary with measured flows which is still in a largely pristine condition. This river has shown a significant increase in flow which could be attributed to recent temperature changes.


Bridge over the Breede River near Worcester



Pontoon on the Breede River at Malgas

The Pontoon at Malgas

A wooden pontoon ferry was built in 1830 to cross the Breede River at Malgas. The village was originally a Khoekhoe kraal, Malagas, that became an important inland harbour in the 19th century for the transport of goods to Swellendam via the estuary. In 1862 a steel pontoon was built which was holed by the British during the Anglo-Boer War. The existing steel pontoon was built in 1952 and is the last human drawn ferry to carry people, vehicles and animals over a river in South Africa.

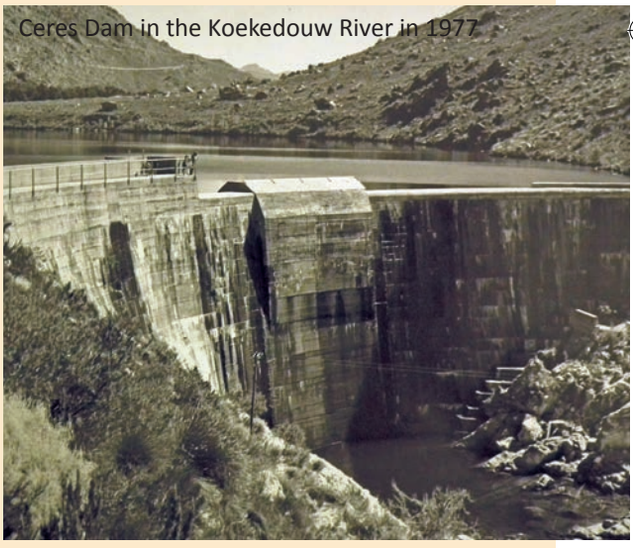
Construction of Dams

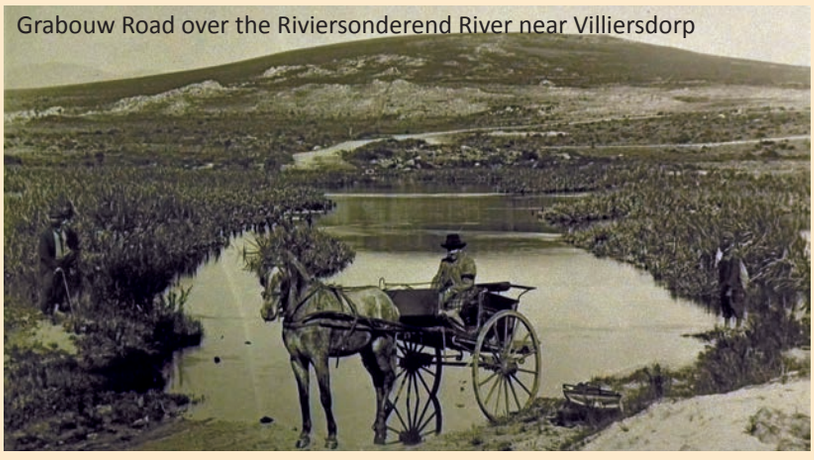
The construction of large water supply dams has significantly impacted on the flow in the Breede and Overberg rivers. The following is a sequence of the construction of larger dams in the Water Management Area:

- Brandvlei Dam was constructed in 1949 and raised in 1972 to incorporate Kwaggaskloof Dam to form Greater Brandvlei Dam;
- Ceres Dam originally constructed in 1954 and reconstructed as the Greater Ceres-Koekedouw Dam in 1998;
- Roode-Elsberg Dam built on the Sandriftkloof River in 1968 is the largest thin-shell arch dam in the country;
- Theewaterskloof Dam in the upper reaches of the Riviersonderend River was constructed in 1979; and
- The Palmiet River contains a number of large instream dams (Nuweberg; Eikenhof; Applethwaite; Arieskraal) that provide water for agricultural purposes. In 1983 the Palmiet River Government Water Scheme resulted in the construction of two more dams in this catchment, the Kogelberg (instream) and Rockview (on the watershed).

None or very few of these dams were designed to make provision for releases to meet the environmental flow requirements downstream.


Brandvlei near Worcester


Ceres Dam in the Koekedouw River in 1977


Grabouw Road over the Riviersonderend River near Villiersdorp


Water mill, Genadendal

Water Mills of the Overberg

Horse Mills were utilised to grind wheat and barley in the drier areas of this grain production area while water mills were used in wetter areas. In 1870 there were 8 water mills in the Swellendam area, 23 in Caledon and 10 in Bredasdorp. Today water mills can be seen at Compagnes Drift, Genadendal, Swellendam (Drostdy Museum and Rheenendal Mill) and Elim. The water mill at Elim was built in 1833 and is the largest wooden water mill in South Africa. It is still operational today. The water mill at Genadendal (opposite) is also still in working order.

River Health Programme: Introduction

'River health' refers to the overall condition of a river. The term can be compared to a person or an economy's health. Healthy rivers are essential to our well-being and is central to social and economic development.

Reports and posters of the River Health Programme will eventually cover all major river systems in South Africa. These will be updated on a regular basis. Previous State of River reports for the Western Cape consist of reports for:

- **Hartenbos and Klein Brak Rivers (2003),**
- **Diep, Hout Bay, Lourens and Palmiet Rivers (2003),**
- **Berg River System (2004),**
- **Greater Cape Town's Rivers (2005),**
- **Olifants/Doring and Sandveld Rivers (2006), and**
- **Rivers of the Gouritz Water Management Area (2007).**

What Is The River Health Programme?

The River Health Programme assesses the biological and habitat integrity of rivers (through evaluation of various indicator fish, aquatic invertebrates and riparian vegetation). This assessment enables reports on the ecological state of river systems to be produced in an objective and scientifically sound manner. Information from the River Health Programme assists with identification of those areas where unacceptable ecological deterioration is taking place. In addition, this programme reflects the effectiveness of existing river management policies, strategies and actions.

Monitoring aquatic ecosystem health is a requirement in terms of the National Water Act and the results are important for the application of the National Environmental Management Act (1998). The continued monitoring and comparison of results over time will allow for the detection of trends and measurement of compliance to the set objectives for aquatic ecosystems

The River Health Programme is a collaborative venture and partnerships are vital for its success. The national organisations leading the River Health Programme are the Department of Water Affairs, Department of Environmental Affairs and the Water Research Commission. A variety of organisations within each province implement the River Health Programme at a local level.

What Are State Of Rivers Reports?

State of Rivers reporting is a spin-off of State of the Environment (SoE) reporting, which has become a recognised form of communication on environmental issues over the past decade. The aim is to provide better information for environmental decision-making. The national SoE uses the Driving Force-Pressure-State-Impact-Response framework to explain what causes environmental change, the wider implication of that change and what we can do to manage the change. State of Rivers reporting uses the same approach, but often with slightly different terminology. State of Rivers reporting disseminates information on river health to:

- assist in ecologically sound management of rivers;
- ensure the sustainable utilisation of water resources;
- detect trends in the condition and health of river ecosystems;
- inform and educate people regarding the condition of our rivers; and
- encourage wide participation by all stakeholders.

How To Read This Report

The first introductory pages to this report provide general background information for the study area, as well as an introduction to the River Health Programme and the methods used. This is followed by six sections dealing with the Breede and Overberg sub-catchments in more detail. Each section outlines catchment activities, ecological importance and sensitivity, present and desired health, ecostatus, pressures on the river and key management actions required. The Breede Water Management Area was subdivided into the following sub-catchments to align it with the Breede-Overberg Catchment Management Strategy: Upper Breede, Central Breede, Riviersonderend, Lower Breede, Overberg West and Overberg East.

Water Policy, Legislation & Management

The need for sustainable, equitable and efficient water use is central to South Africa's water resource management policy and legislation. The National Water Act (Act 36 of 1998) is the principle legal instrument for the protection, use, development, conservation, management and control of our water resources.

The National Water Resources Strategy (which is currently under review) provides a long term plan of how the National Water Act is to be implemented. A protective approach to water resource management has been adopted where water use activities are allowed according to a desired water resource state. This means that water resources are "looked after and used wisely", not "kept separate and preserved".

The Department of Water Affairs as the custodian of South Africa's water resources, protects the health of aquatic ecosystems and ensures the sustainable use of water. The River Health Programme, operational since 1994, is a key part of this responsibility. For more information visit www.dwa.gov.za/iwqs/rhp/

Managing Stressed Water Resources

Marlene van Niekerk in *Agaat* once wrote of the rivers of this area:

"The rivers of my childhood! They are different, their names cannot tell of how beautiful they are: Botrivier, Riviersonderend, Kleinkruisrivier, Duiwenhoks, Maandagssoutrivier, Slangrivier, Buffeljagsrivier, Karringmelksrivier, Korenlandrivier: rivers burgeoning, rivers without end, small rivers crossing; rivers redolent of dovecotes, of salt-on-Mondays, of snakes; rivers of the hunting of the buffalo, rivers like buttermilk, rivers running through fields of wheat. Winding, hopeful, stony rivers"

These rivers are not only valued for their ability to provide water but also for their biodiversity and beauty, important features for a growing tourist trade in the area. Over the recent past there has been a decline in ecosystem health and water quality in many of the Breede and Overberg Rivers or portions thereof.

The current demand for water within the Breede Water Management Area is in some cases exceeding the average available water resources. In addition the area falls within a winter rainfall region, therefore the availability of water from rainfall events does not coincide with the need for irrigation of crops in summer. Abstraction during summer low flow periods often exceeds what is available in many of these rivers, while winter demand also exceeds what is available during low rainfall years.

To continue providing a reliable supply of water for all users and support economic development and social well being, we need to use water resources more sustainably, and at the same time restore and maintain the health of the environment. This means changing our entire approach and our mind-set to the management of water. We need to build an ethic of water conservation, to cut water use and recycle or reuse water wherever possible. It is important for us to place a high value on our water resources, and to restore our water resources to safeguard them for present and future generations.

Climate change will most likely increase the occurrence of dry periods and, on the other extreme, the intensity of flood events which will detrimentally impact on both social and economic activities in the area if rivers are no properly managed and protected.

Measuring River Health

River Health Indices

Index of Habitat Integrity

The availability and diversity of habitats are major determinants of aquatic biota that are present. The index assesses the impact of human disturbance on the riparian and instream habitats.

Geomorphological Index

Geomorphological processes determine the size and shape of river channels, which in turn defines the type of habitat. The index reflects the channel condition and channel stability.

Riparian Vegetation Index

Healthy riparian zones help to maintain river channel shape and filter sediment, nutrients and light. Plant material from these zones provides food for aquatic fauna. The index is a measure of riparian vegetation modification from its natural state.

South African Scoring System

Aquatic invertebrates (crabs, insects, snails) require specific habitats and water quality conditions. They are good indicators of recent localised conditions in a river. The index is based on invertebrate families found at a site.

Fish Index

Fish are good indicators of long-term influences on general habitat conditions within a reach. The index is an expression of the degree to which a fish assemblage deviates from its undisturbed condition.

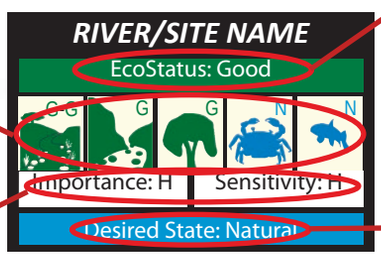
Measuring River Health

Many physical, chemical and biological factors influence river ecosystem health. The River Health Programme focuses on selected ecological indicator groups that represent the larger ecosystem and are feasible to measure. State of river reporting uses RIVER HEALTH INDICES to present data in a format that is easy to understand. Where icons have been given with the halves in different colours, there is usually a substantial difference in the condition of a river within its upper and lower portions of the reach assessed.

The ECOLOGICAL IMPORTANCE AND SENSITIVITY (EIS) ratings are related to the ecological importance of habitat and biota in a river, as well as how sensitive that aquatic ecosystem is to human modification. This provides an indication of the level of protection that a river should receive. The following EIS categories can be assigned to a river:

EIS Category	Description
Very High (VH)	A very high or high EIS indicates a strong ecological motivation for awarding a high level of protection to the associated river. Such rivers should be maintained in a natural or good river health category.
High (H)	
Moderate (M)	A moderate or low/marginal EIS is representative of a river with a relatively lower conservation value. Such river catchments are more impacted and thus more suited to development and may require rehabilitation.
Low/Marginal (L)	

The outcome of the overall assessment is the ecological status (ECOSTATUS), which is an integrated index that indicates the ecological state of a river site or reach in a simple but ecologically-relevant way. The EcoStatus indicates the ability of a river to support an array of indigenous species and provide a variety of goods and services.



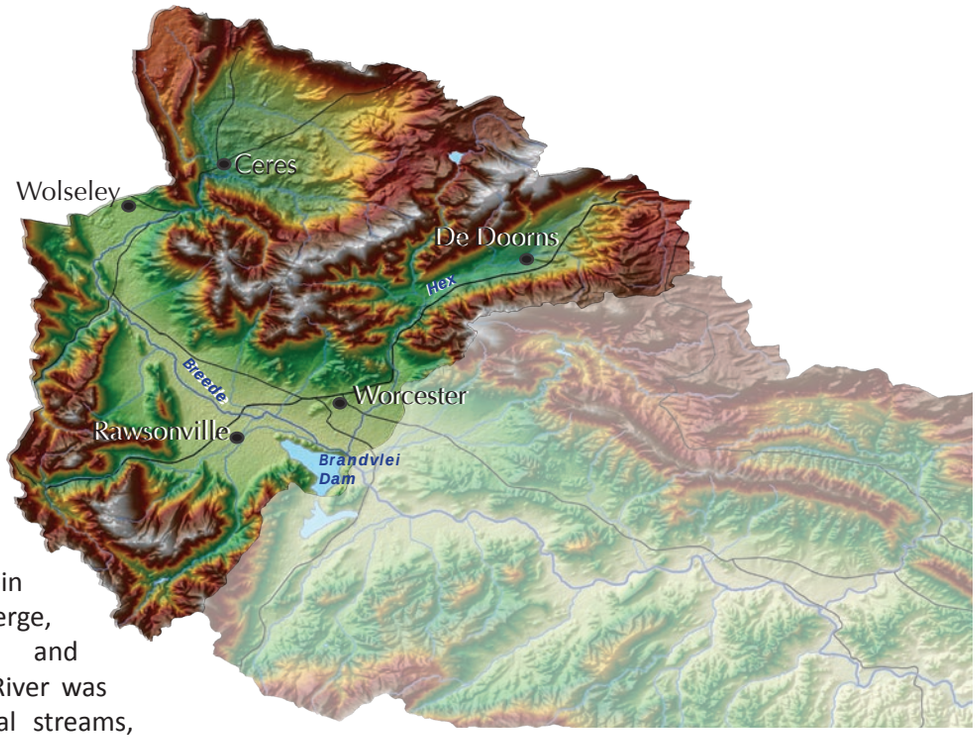
The ***PRESENT HEALTH*** of a river is a measure of the present ecological state of the river during the time of the surveys undertaken between 2004 and 2008, and is presented in terms of the RIVER HEALTH CATEGORIES for the indices described on page 14.

The ***DESIRED HEALTH*** of a river is the envisioned future ecological state of the river. It is based on ecological considerations, the need for sustainable development and management actions (e.g. rehabilitation) concerning the river environment. The desired state for each site has been determined based on the present ecological state, the EIS and the viability of improving the present state.

River Health Category	Ecological Perspective	Management Perspective
Natural N	No or negligible modification from natural	Relatively little human impact
Good G	Biodiversity and integrity largely intact	Some human-related disturbance but ecosystems essentially in good state
Fair F	Sensitive species may be lost; tolerant or opportunistic species dominate	Multiple disturbances associated with the need for socio-economic development
Poor P	Mostly tolerant species; alien invasion, disrupted population dynamics; organisms often diseased	High human densities or extensive resource exploitation

Upper Breede River and Tributaries

The Breede River originates near Ceres and is drained by four main tributaries (Dwars, Koekoedouw, Titus and Witels Rivers) which form its headwaters. The river reach then extends from Mitchells pass, in a south easterly direction to the foot of the Limietberg Mountains. Here it is joined by the Witte, Slanghoek, Molenaars/Smalblaar, Holsloot, Waboomsrivier and Jan du Toit's rivers respectively.



These tributaries drain a number of mountain ranges in this portion of the catchment (Witteberge, Klein Drakensteinberge, Du Toitsberge, Slanghoekberge, Stettynsberge and Waaihoekberge). The Jan Du Toit's River was once a braided system of perennial streams, but due to heavy water abstraction and intensive agricultural practises now joins the Breede as a single, unbraided seasonal stream.

The Hex River rises from several mountain streams draining the southern slopes of the Bonteberg Mountains in the north eastern portion of the Upper Breede area and joins the Breede River north of the Brandvlei dam. Tributaries of the Hex River include the Amandels and Sanddrift rivers. The Amandels River, the highest yielding river, has not been impounded. However the Lakenvallei and Roode-Elsberg dams in the upper reaches of the Sanddrift River has resulted in there being little to no flow in the river below the dam during summer months. The natural run off from the unimpounded upper reaches of the Breede River catchment ensures the continued ecosystem functioning of the heavily utilised mainstem of the Breede River downstream. It is important that this flow variability be maintained within the river system.

Hex River Valley

Inter-Basin Transfers of Water from the Upper Breede River

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

- The Inverdoorn Canal consists of the diversion of 2,5 million m^3/a of water for irrigation from weirs on the Spek and Valschgat Rivers into the Inverdoorn Canal which carries the water into the catchment of the Doring River in the Olifants/Doorn Water Management Area.
- The Artois Canal transfers an estimated 4 million m^3/a of water from the Breede River to the Klein Berg River catchment in the Berg Water Management Area for irrigation use by the Dwars River Water User Association. Wolseley also has an allocation from the scheme.
- The "Gawie se Water" Scheme diverts 5 million m^3/a of water for irrigation from the Upper Witte River to the Kromme River near Wellington in the Berg Water Management Area.
- The Jan Du Toit's River to Franschhoek transfer supplies approximately 0,6 million m^3/a from the upper Breede River to Franschhoek in the Upper Berg River.

Papenkuils Wetland

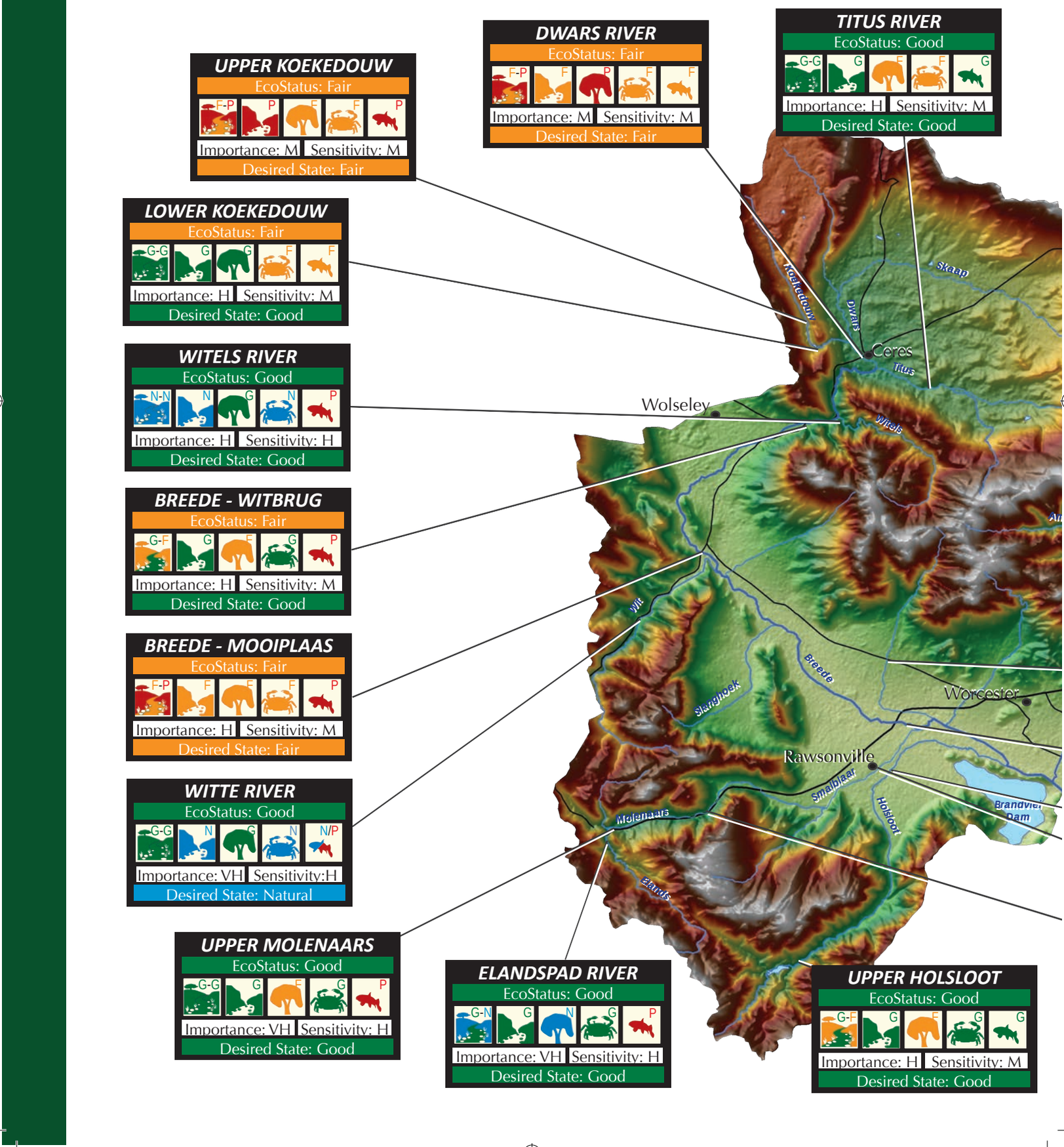
The Papenkuils Wetland is located next to Brandvlei Dam and downstream of the confluence of the Smalblaar (Molenaars) and Breede Rivers. The wetland contains a variety of wetland and terrestrial flora that are worthy of conservation and are not conserved elsewhere in the area. Upstream agricultural activities including the diversion of Papenkuils Wetland inflow into Greater Brandvlei Dam are a threat to the integrity of the wetland. The problems include both reduced water inflow to the wetland as well as non-flow related impacts such as invasive alien vegetation and habitat modification. An intermediate level ecological Reserve determination was carried out for the Papenkuils Wetland. The results indicate that the present ecological status category of the wetland is fair, contrasting with its ecological importance rating of high. This implies that steps must be taken to rehabilitate the functioning of the wetland.

Grey Heron in the Papenkuils Wetland

Ceres-Koekedouw Dam

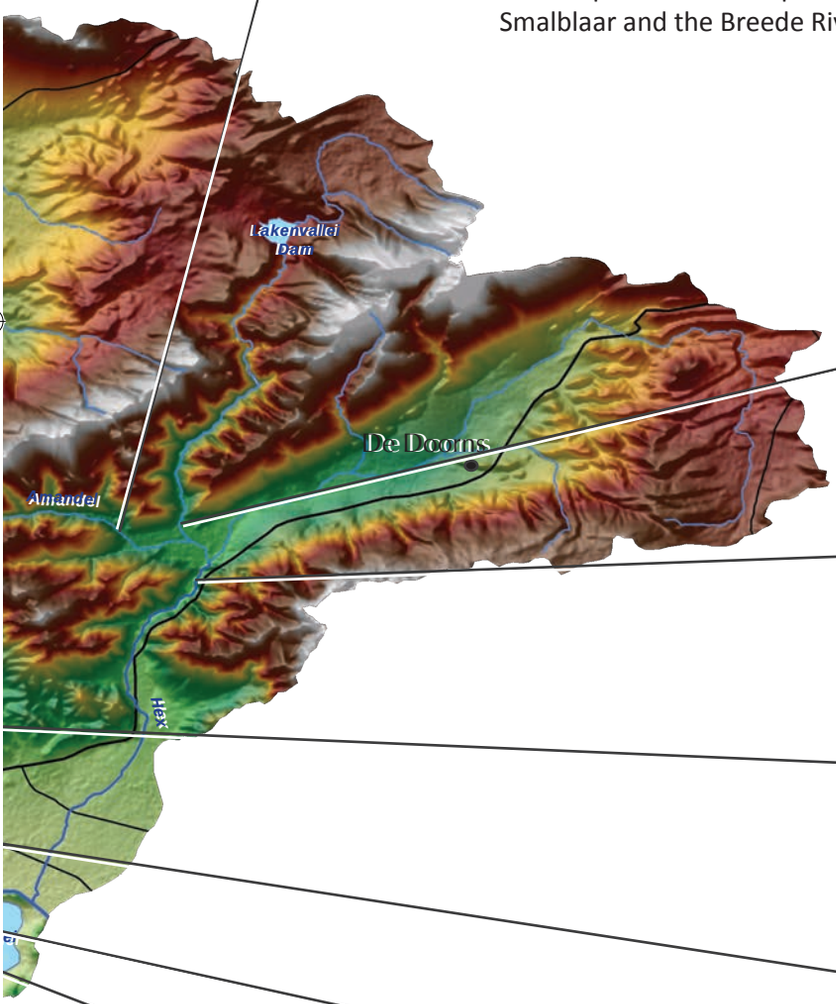
The Ceres Dam was originally built in 1954, approximately 9 km from the source of the Koekedouw River. An earthquake damaged the dam to such an extent that it needed to be demolished and was reconstructed entirely in 1998. The new Greater Ceres-Koekedouw Dam has a capacity of 22,5 million m^3 and a yield of 17 million m^3/a (85% assurance of supply.). The dam supplies water to the Koekedouw Water User Association (WUA) for irrigation, and for urban use in Ceres. The construction of the dam was approved subject to the release of environmental water requirements which are being implemented and monitored to some extent.

Greater Ceres-Koekedouw Dam


UPPER KOEKEDOUW
EcoStatus: Fair
F-P P F F P
Importance: M Sensitivity: M
Desired State: Fair
DWARS RIVER
EcoStatus: Fair
F-P F P F F
Importance: M Sensitivity: M
Desired State: Fair
TITUS RIVER
EcoStatus: Good
G-G G F F G
Importance: H Sensitivity: M
Desired State: Good
LOWER KOEKEDOUW
EcoStatus: Fair
G-G G G F F
Importance: H Sensitivity: M
Desired State: Good
WITELS RIVER
EcoStatus: Good
N-N N G N P
Importance: H Sensitivity: H
Desired State: Good
BREEDE - WITBRUG
EcoStatus: Fair
G-F G F G P
Importance: H Sensitivity: M
Desired State: Good
BREEDE - MOOIPLAAS
EcoStatus: Fair
F-P F F F P
Importance: H Sensitivity: M
Desired State: Fair
WITTE RIVER
EcoStatus: Good
G-G N G N N/P
Importance: VH Sensitivity:H
Desired State: Natural
UPPER MOLENAARS
EcoStatus: Good
G-G G F G P
Importance: VH Sensitivity: H
Desired State: Good
ELANDSPAD RIVER
EcoStatus: Good
G-N G N G P
Importance: VH Sensitivity: H
Desired State: Good
UPPER HOLSLOOT
EcoStatus: Good
G-F G F G G
Importance: H Sensitivity: M
Desired State: Good
Koekedouw
Dwars
Skaap
Ceres
Titus
Wolseley
Witels
Breede
Slangboek
Worcester
Rawsonville
Smalblaar
Holsloot
Molenaars
Elands
Brandvlei Dam

Upper Breede River & Tributaries: Present State

In general, the tributaries of the Upper Breede River are still in a good state and are only degraded to a fair state in and around the towns. The upper Breede River is in a fair state from its very upper reaches below Ceres, with the main impacts being from invasive alien vegetation (black wattle) and alien fish (sharptooth catfish and smallmouth bass). Habitat modification as a result of instream structures (dams and low water bridges), bulldozing, encroaching agricultural activities and mining have impacted on the riparian and instream habitat in the lower Koekedouw, Hex, Smalblaar and the Breede River in this sub-catchment.



AMANDELS
EcoStatus: Good
G-F | G | F | G | G
Importance: VH | Sensitivity: H
Desired State: Good

SANDDRIFT
EcoStatus: Fair
F-F | F | F | F | F
Importance: M | Sensitivity: M
Desired State: Fair

HEX
EcoStatus: Fair
F-F | F | F | F | G
Importance: H | Sensitivity: M
Desired State: Fair

JAN DU TOIT'S
EcoStatus: Good
N-N | G | G | N | G
Importance: M | Sensitivity: H
Desired State: Good

BREEDE - RAWSONVILLE
EcoStatus: Fair
F-P | F | F | F | P
Importance: M | Sensitivity: M
Desired State: Fair

LOWER HOLSLOOT
EcoStatus: Fair
F-F | F | F | G | F
Importance: M | Sensitivity: M
Desired State: Good

LOWER MOLENAARS
EcoStatus: Good
G-G | G | G | G | P
Importance: VH | Sensitivity: H
Desired State: Good

SMALBLAAR
EcoStatus: Fair
P-P | F | P | F | F
Importance: L | Sensitivity: L
Desired State: Fair

Upper Breede River & Tributaries: Major Impacts & Management Actions

Habitat modification

- **T**he presence of several low flow bridges has impacted on the riparian and instream habitat of the Koekedouw and Titus Rivers.
- **I**nstream structures, pump stations and bulldozing of the instream bed have caused extensive habitat disturbance. These effects are exacerbated by extensive water abstraction and impoverished water quality in this section of the Breede River. Extensive modification to the Upper Breede River channel was also evident, with the banks being pushed back to form levees.
- **E**xtensive removal of riparian vegetation and modification to the instream flow and channel due to sandstone mining has reduced the integrity of the lower Hex and Smalblaar river systems.
- **O**rchards and vineyards extend into the riparian zone of particularly the Dwars, Hex and upper Breede rivers and have resulted in encroachment of exotic vegetation and erosion of the river banks.

Habitat modification in the Hex River

Algal growth on rocks in the Titus River

Water quality impacts

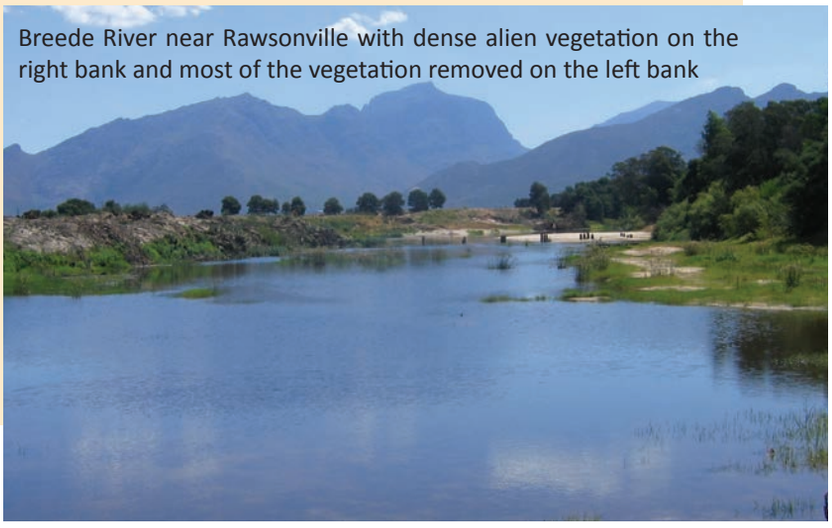
- **W**ater quality has moderately modified the instream habitat of many of the lower reaches of these rivers as a of a high nutrient loading from the surrounding agricultural activities and discharge of treated wastewater from wastewater treatment works at Ceres, Rawsonville, Worcester and De Doorns.
- **W**ater quality impacts also occur as a consequence of the bottom release from the Stettynskloof Dam and result in some sedimentation downstream as well as colder water temperatures.

Flow modification

- **W**ater abstraction and flow modification by impoundments (Koekedouw and Stettynskloof Dams) in the Koekedouw and Holsloot rivers have extensively to critically impacted the instream habitat and water quality of the lower reaches of these rivers, particularly during the summer months.

Invasive alien fish and vegetation

- *T*he presence of the alien invasive fish species in the Witels and lower Witte Rivers have totally displaced indigenous fish species, resulting in a largely modified instream habitat.
- *T*he lower Witte River and the Breede River are highly infested by black wattle, impacting on the integrity of the riparian and instream aquatic ecosystem.

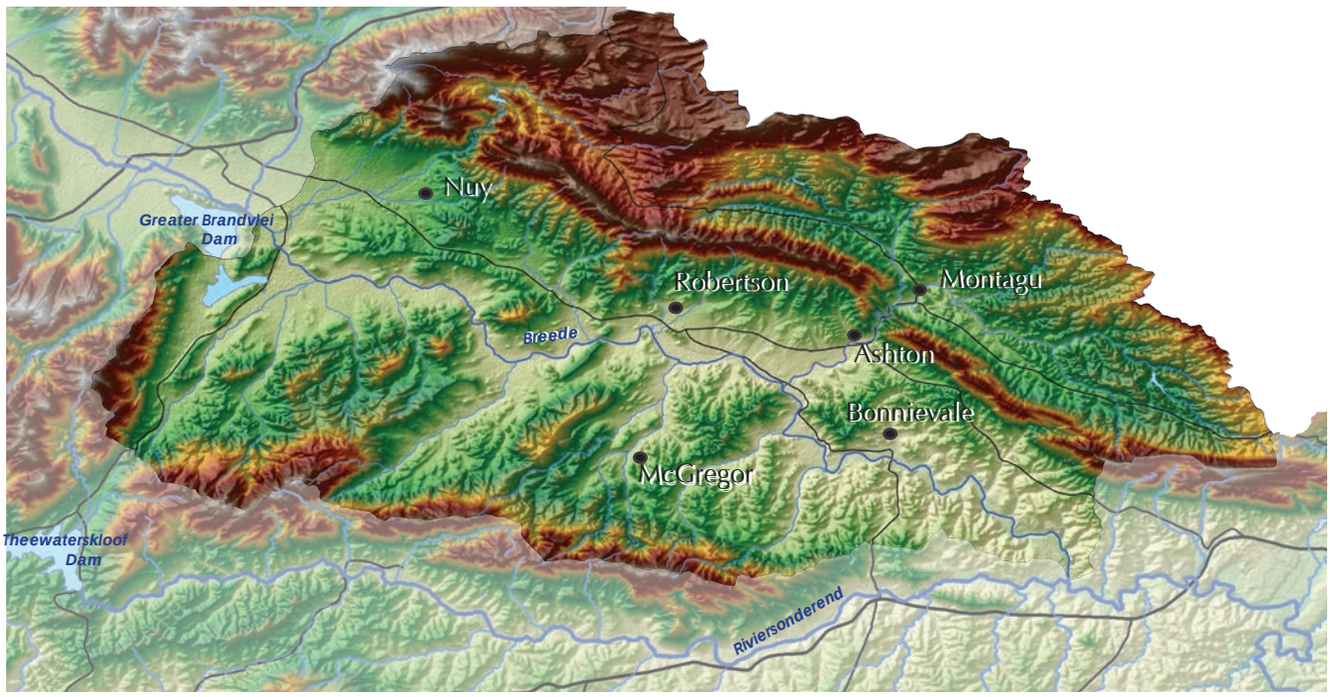


Breede River near Rawsonville with dense alien vegetation on the right bank and most of the vegetation removed on the left bank

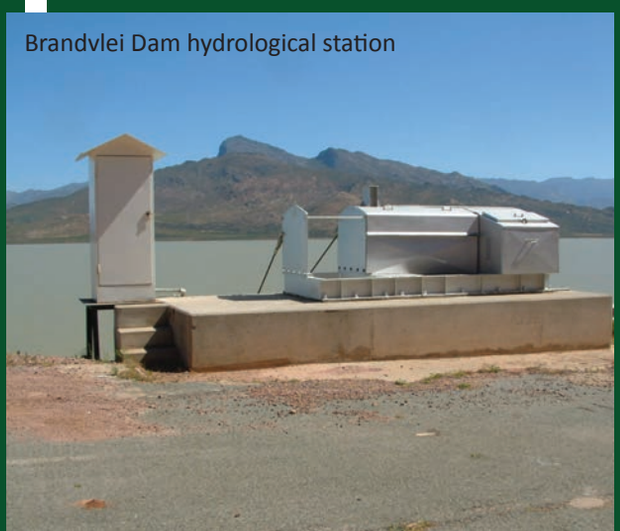
Management recommendations

- Summer water abstraction from the Upper Breede River and its tributaries must be minimised.
- Agricultural impacts such as pesticide and fertilizer pollution must be addressed by having an adequate riparian buffer area.
- Environmental flow releases from the Koekedouw Dam must be implemented to improve the environmental health of the river.
- Management of alien invasive vegetation on river banks and the re-establishment of indigenous plant species in riparian zone needs to be undertaken in many of these rivers.
- Prevent upstream migration of alien fish above the present barrier and eradicate alien fishes from the lower Witte River.
- As trout is commercially farmed in the Upper Molenaars River, the impacts of the trout farming activities must be monitored to prevent any downstream water quality impacts. The river has been designated as a trout stream and is managed by the Cape Piscatorial Society.
- The Stettynskloof Dam and the river above the dam should be considered for alien fish eradication.
- Maintain releases from the Stettynskloof Dam to ensure adequate flow in the lower reaches of the Holsloot River.
- Sand and cobble mining must be managed in the lower Smalblaar River and should not be expanded to upstream areas in the river.
- A tributary of the upper Jan du Toit's River is a reference site for indigenous fish with all expected species present in fair numbers and no signs of predatory alien invasive species. The introduction of these alien fish species must be prevented here at all costs.
- Due to the conservation importance of the Hex River, buffer zones around the river should be increased to 10m and an effort should be made to re-establish the riparian zone. Bulldozing activities must be minimized and improved land use management is required throughout the catchment. Berg-Breede Whitefish may need to be re-introduced into this section of the river from the Roode-Elsberg Dam to speed up their recovery here.
- Environmental flow releases from the Roode-Elsberg Dam and the weir below the dam must be determined to ensure the release of adequate flow in downstream sections of the river, particularly to sustain summer flow. This will improve the river from a category D river to at least category C river, possibly a category B.
- Any bulldozing activity in the river must be prevented and the quality of the riparian zone must be improved and maintained through the maintenance of adequate riparian buffer areas along the river banks.

Central Breede River and Tributaries



The Central Breede sub-catchment is the area downstream of Brandvlei Dam to the confluence of the Breede River with the Riviersonderend River. This area consists of intensively cultivated lands of orchards and vineyards in the Worcester and Robertson area. The sub-catchment contains several relatively small tributaries; such as the Nuy (and Koo), Kogmanskloof, Doring, Poesjenels, Konings, Keisers, Groot and Boesmans Rivers. These rivers drain the Waboomberge, the northern and southern slopes of the Langeberg range, and the northern slopes of the Riviersonderend Mountains. Within this reach the Breede River starts to show characteristics of a lowland system, with the channel broadening, the gradient becoming more gentle and the substrate becoming dominated by gravel and sand. The flow of many of these tributaries has been altered from being perennial streams to becoming mostly seasonal as a result of the abstraction of water for intensive agricultural practices in the surrounding areas.



Brandvlei Dam hydrological station

Greater Brandvlei dam

Brandvlei Dam, constructed in 1949 and raised in 1972, was extended by the construction of Kwaggaskloof Dam to form the Greater Brandvlei Dam. This dam is an off-channel storage dam with a filled capacity of 342 million m^3 (firm yield of 155 million m^3/a). The dam is filled mainly during the winter months via a canal from diversions out of the Smalblaar and Holsloot Rivers.

During the summer irrigation period, water is released from the dam into the Breede River to supplement river flows for use by a number of water user associations. Water is also supplied through pumping schemes directly from the dam to nearby irrigation districts. The dam makes 22 million m^3/a release of water to reduce the salinity of the middle and lower Breede River. The Department of Water Affairs owns and manages the dam in partnership with Central Breede Water User Association.

Floods in the Central Breede River

The Western Cape has long been known as the Cape of Storms, where powerful cold fronts sweep in from the South Atlantic bringing heavy rains and strong winds. The other type of weather system that brings heavy rain is known as a cut-off low. Cut-off lows often result in very heavy rain and are associated with the province's most severe flood losses, including the Montagu floods in 2003 and the South Coast floods of 2006/2007 and 2009 (see page 35). While flooding has devastating impacts on people and properties close to water bodies, these events are also an essential part of nature and floods in rivers and estuaries provide an important function in maintaining the habitats of these systems.

Flooding in the Western Cape has historically been associated with the rainfall events in May and September. However, changing weather patterns have resulted in heavy rainfalls being experienced at other times of the year. The Montagu floods occurred in March 2003 when an intense cut-off low swept across the south coast and adjacent interior, with 178 mm rain being recorded in 24 hours by the rainfall station in Montagu. This, the highest daily value recorded for Montagu in 23 years, led to riverine flooding and severe rain damage to infrastructure, commercial farms and hundreds of low-income homes. It also resulted in the evacuation of more than 500 families in Montagu as well as the local primary school.

This extreme weather system extended more than 800 km eastwards and damaged provincial road infrastructure valued at R15.6 million in the Eden District Municipality; disabled sewage treatment plant in Heidelberg; disrupted electricity supply in Kannaland; and widespread farm losses, including thousands of livestock death. In Hermanus, two women died when a strong wave swept them out to sea and in Knysna, a man lost his life when a tree blew over and crushed him. Two months later there was an 86% increase in the number of young children with lower respiratory infections in the Cape Winelands and Overberg, compared to the previous year.

It cost R66.2 million to repair the 11 km of damage in Kogmanskloof Pass. Over 380 farms reported losses valued at R100.5 million. Twelve primary and secondary schools sustained roof damage due to heavy rain. The damages resulting from flood can be reduced by limiting the development of infrastructure in riparian zones and allowing rehabilitation of these zones to buffer the effects of naturally occurring floods.

Flooding of the Kogmanskloof River in 2003

Flooding of the Vink River in 2008

MIDDLE NUY
EcoStatus: Poor
P-P | F | F | P | P
Importance: L | Sensitivity: L
Desired State: Fair

UPPER NUY
EcoStatus: Good
G-G | G | F | G | P
Importance: M | Sensitivity: M
Desired State: Good

LOWER NUY
EcoStatus: Poor
P-P | F | P | P | P
Importance: L | Sensitivity: L
Desired State: Fair

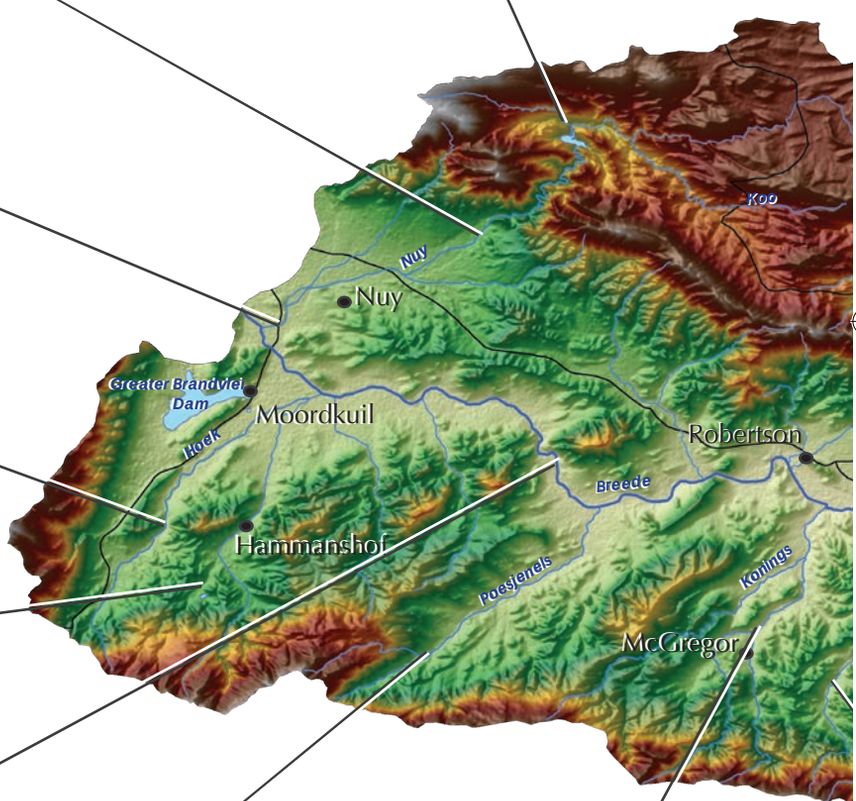
HOEKS RIVER
EcoStatus: Fair
G-F | F | F | F | G
Importance: H | Sensitivity: M
Desired State: Good

DORING RIVER
EcoStatus: Fair
F-P | F | F | F | F
Importance: M | Sensitivity: L
Desired State: Fair

BREEDE - LE CHASSEUR
EcoStatus: Good
G-G | G | G | F | F
Importance: H | Sensitivity: VH
Desired State:Good

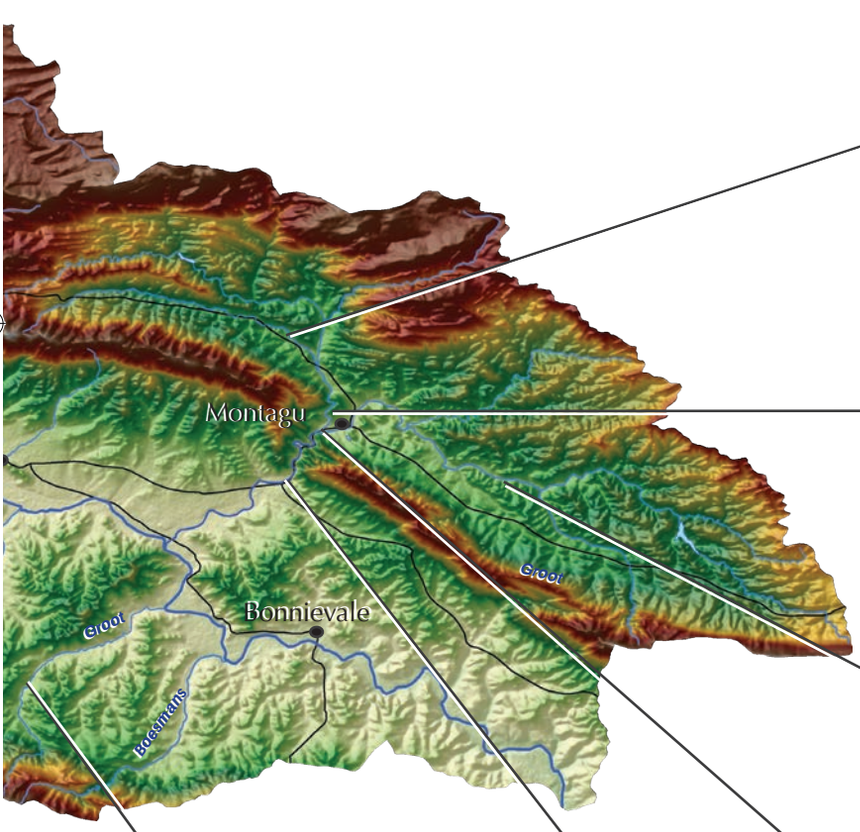
POESJENELS RIVER
EcoStatus: Good
F-F | N/F | G | F | G
Importance: M | Sensitivity: H
Desired State: Good

KEISERS RIVER
EcoStatus: Fair
F-F | F | P | F | P
Importance: L | Sensitivity: L
Desired State: Fair



Central Breede River & Tributaries: Present State

Most of the tributaries in this sub-catchment are in a fair ecological condition. Encroachment of agricultural activities has resulted in the removal of indigenous riparian vegetation and the subsequent invasion by alien plants and erosion of the river banks. The impacts of natural flooding in this area have been exacerbated by human-induced modification of the river channels and development within the floodplain.



UPPER KEISIE
EcoStatus: Fair
F-P | F | F | F | P
Importance: L | Sensitivity: L
Desired State: Fair

LOWER KEISIE
EcoStatus: Fair
G-F | F | P | F | P
Importance: M | Sensitivity: M
Desired State: Fair

UPPER KINGNA RIVER
EcoStatus: Fair
G-F | F | F | F | P
Importance: L | Sensitivity: L
Desired State: Fair

LOWER KINGNA RIVER
EcoStatus: Fair
G-F | F | G | F | P
Importance: M | Sensitivity: M
Desired State: Good

GROOT RIVER
EcoStatus: Fair
F-F | F | P | F | F
Importance: L | Sensitivity:L
Desired State: Fair

KOGMANSKLOOF
EcoStatus: Fair
G-F | F | P | F | P
Importance: M | Sensitivity: M
Desired State: Fair

Central Breede River & Tributaries: Major Impacts & Management Actions

Agricultural impacts

- ***T***he establishment of vineyards and to some degree fruit orchards in this sub-catchment have resulted in a loss of riparian vegetation, decreased flow (particularly during summer) and an increase in levels of nutrients in the water and algal blooms.
- ***R***emoval of indigenous vegetation from the riparian zones of many of the rivers for agriculture and plantations and subsequent invasion by alien invasive plants species have moderately modified the riparian zone.
- ***T***he presence of livestock in the riparian zone of the Groot River together with removal of the indigenous riparian vegetation has resulted in erosion of the banks.

Agricultural impacts on the Groot River

Habitat modification

- ***P***ast bulldozing, damage caused by the 2003, 2005 and 2008 flood events (which has been exacerbated by human induced channel modifications) and the increased sedimentation following the flood event, have moderately to largely modified the instream and riparian habitat of the Keisie and Kingna Rivers.
- ***T***he presence of livestock in the riparian zone in the Kingna River has caused a moderate case of bank erosion.
- ***T***he dumping of solid waste and peri-urban activities in the Keisers River has extensively modified the instream habitat and has largely impacted water quality.
- ***P***rior to the November 2008 flood event, the instream habitat of the Groot River was overgrown with reeds, which were subsequently mostly removed or flattened after the flood. The flood event also caused a moderate impact on water quality with a great deal of sediments having been washed down.
- ***B***ulldozing to repair damage caused by the flood in the river beds as well as along river banks has had a moderate impact on the river banks and ultimately the river channel.

Flood and bulldozing impacts on the Keisies River

Invasive alien fish

- *T*he presence of some alien invasive fish species in the upper Breede River have moderately impacted the instream habitat.

Flow modification

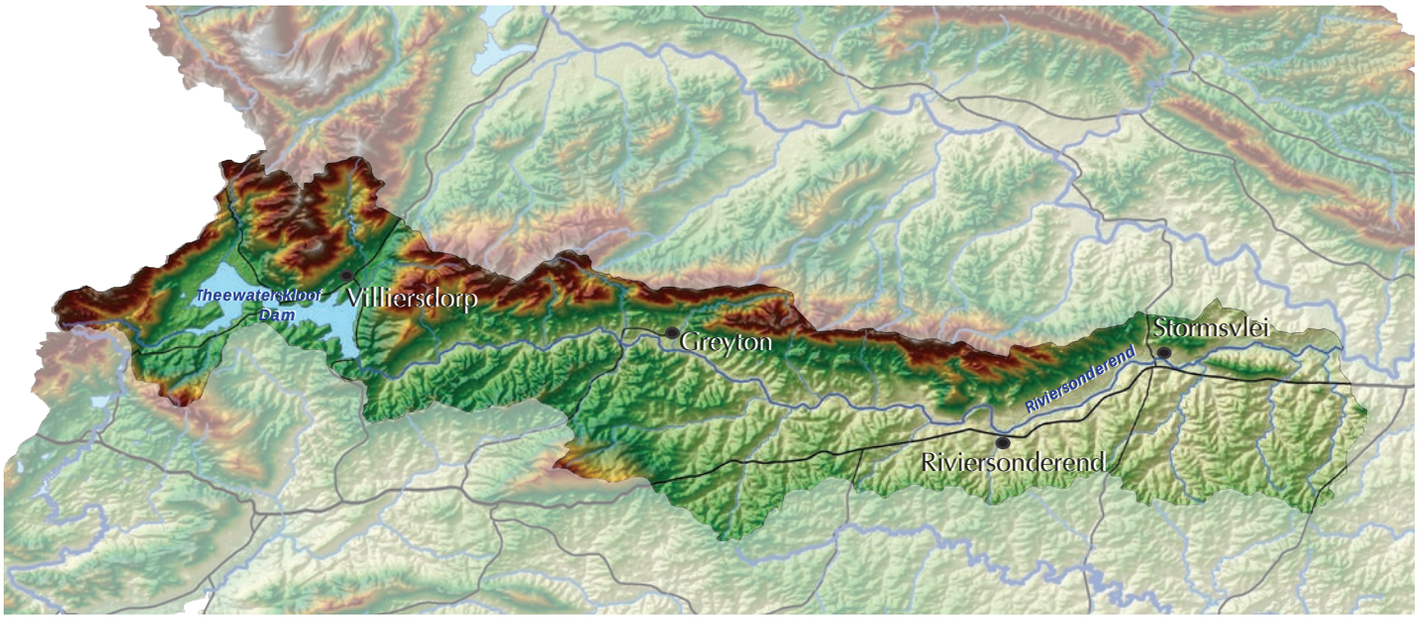
- *T*wo instream dams in the Poesjenels River, divert most of the flow in the river to an off-stream dam and has therefore resulted in a serious alteration to the instream flow regime of the river.
- *T*he Keerom Dam and over abstraction of water in the lower reaches of the Nuy River have seriously undermined levels of flow during the drier summer months and impacted on the integrity of both the instream and riparian habitat of this river.

The Poortjieskloof Dam in the Groot River

Management Recommendations

- Agri-chemical pollution should be reduced in these rivers and a buffer zone must be established between the river and the surrounding orchards.
- Bulldozing activities without authorisation in riverbeds and on the banks should be managed.
- Post-flood stabilization of river banks and re-establishment of riparian vegetation is necessary.
- Ensure compliance from local municipality regarding waste water treatment and formal action must be taken against individual landowners polluting water with agricultural and industrial waste.
- Alien vegetation should be cleared from the riparian zone and summer water abstraction should be minimized to restore summer flow in the rivers.
- Manage water abstraction at source of the Poesjenels River to allow adequate water release into river.
- Prevent upstream migration of alien invasive fish species in the Poesjenels River.
- Aquaculture impacts both upstream and downstream from the Nuy/Keerom Dam must be managed and water abstraction in summer months must be limited.

Riviersonderend River and Tributaries



The Riviersonderend River has its source in the Groot Drakenstein and Franschhoek Mountains and flows eastwards to its confluence with the Breede River to the west of Swellendam. From its source, the river flows through a gorge in the Hottentots Holland Nature Reserve and enters the Theewaterskloof Dam. It then passes through another gorge bounded by the Donkerhoekberge and Keeromspoort and is joined further downstream by several tributaries (Baviaans, Gobos, Soetmelks and Tierkloof Rivers). The river then flows in a north easterly direction through the Bromberg range and eventually reaches its confluence with the Breede River.

Riviersonderend River near Greyton

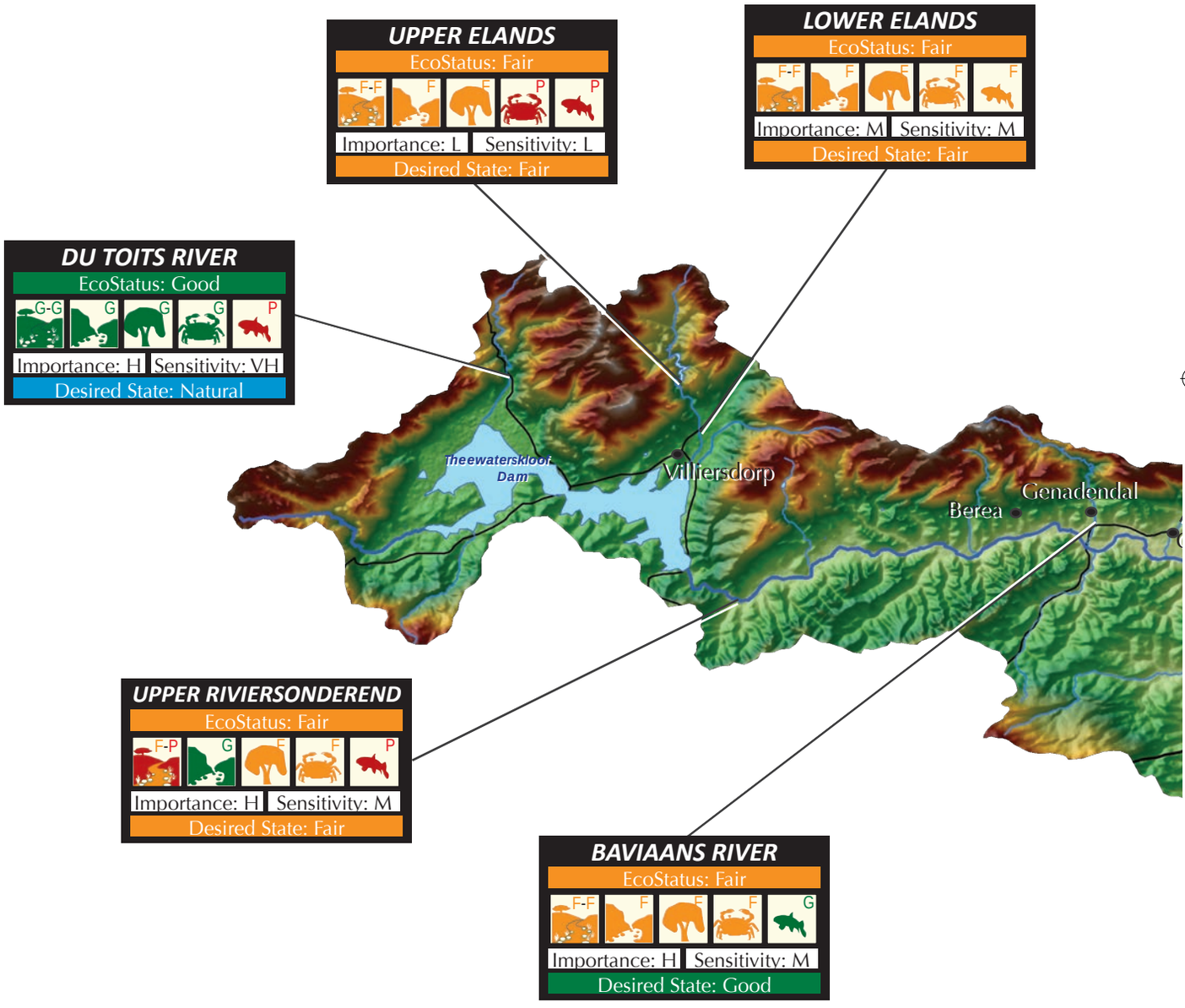
Theewaterskloof Dam

The Theewaterskloof Dam has a capacity of 487 million m^3 and provides water for the Riviersonderend-Berg-Eerste River Government Water Scheme, for urban use to the Greater Cape Town area and 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 Water Management Area 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 Water Management Area via the same tunnel system. The scheme has a 1 in 50 year yield of 217 million m^3/a. 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 Water Management Area.

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 174 million m^3/a into the Berg Water Management Area takes place via this scheme.

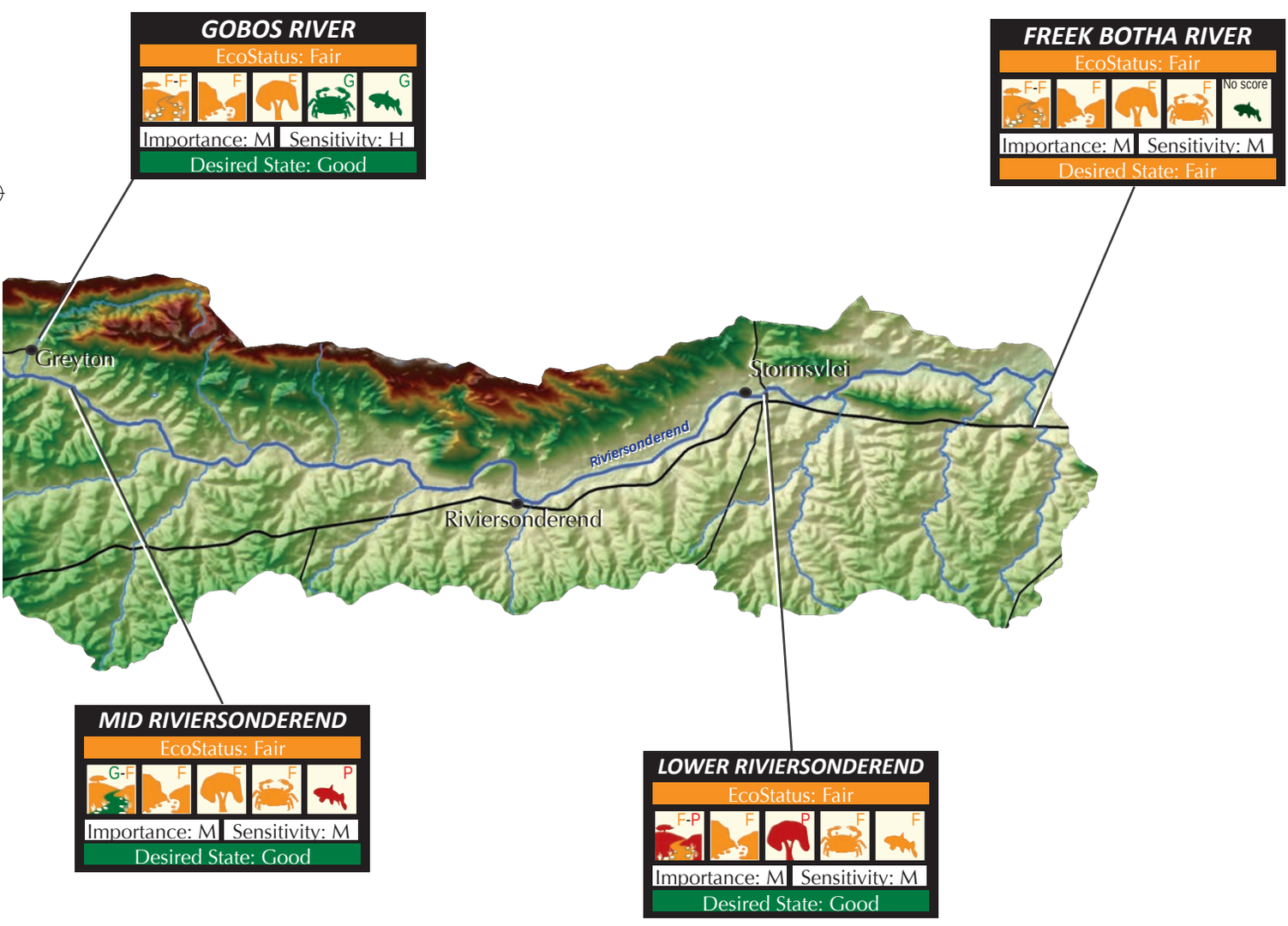
During the early 1990's Theewaterskloof was one of the prime largemouth bass fishing sites in the country, however suspected pollution from surrounding farms and Villiersdorp and the illegal introduction of catfish led to the bass almost disappearing. Carp proliferated, causing turbidity problems and adding the problem of algal blooms in the dam. These blooms in the dam, as well as taste and odour problems in the drinking water originating from the dam have also been increasing since the early 2000's. The water transferred to the Berg River Catchment (into the Berg and Eerste Rivers) has also been noticeably more turbid.

Theewaterskloof Dam


UPPER ELANDS
EcoStatus: Fair
F-F F F P P
Importance: L
Sensitivity: L
Desired State: Fair
LOWER ELANDS
EcoStatus: Fair
F-F F F F F
Importance: M
Sensitivity: M
Desired State: Fair
DU TOITS RIVER
EcoStatus: Good
G-G G G G P
Importance: H
Sensitivity: VH
Desired State: Natural
Theewaterskloof Dam
Villiersdorp
Berea
Genadendal
UPPER RIVIERSONDEREND
EcoStatus: Fair
F-P G F F P
Importance: H
Sensitivity: M
Desired State: Fair
BAVIAANS RIVER
EcoStatus: Fair
F-F F F F G
Importance: H
Sensitivity: M
Desired State: Good

Riviersonderend River and Tributaries: Present State

Flow in the Riviersonderend River has been modified by the Theewaterskloof Dam in its upper reaches. Almost the entire river, as well as the lower reaches of its tributaries, is in a fair state. Agricultural activities within the riparian zones of these rivers have impacted on the river channel and riparian vegetation. Sharptooth catfish and bass species have reduced the indigenous fish populations and reduced the instream habitat integrity. The protection of tributaries contributing to the flow variability and volume of the lower Riviersonderend River is essential.

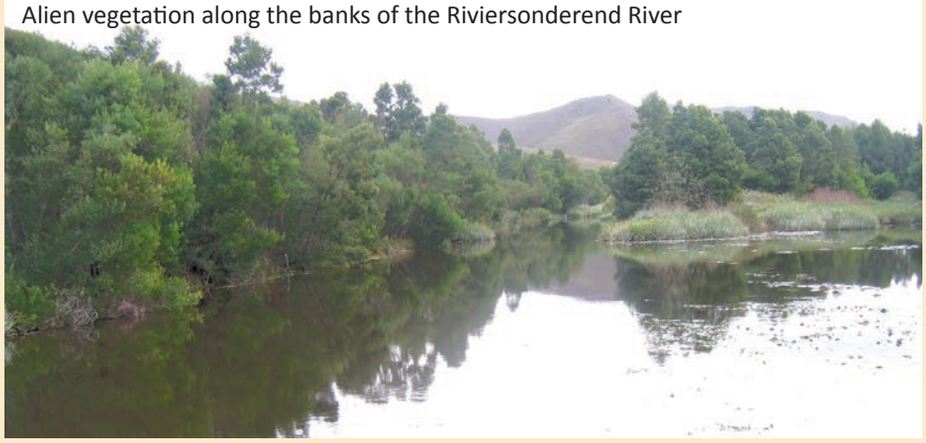


Riviersonderend River and Tributaries: Major Impacts & Management Actions

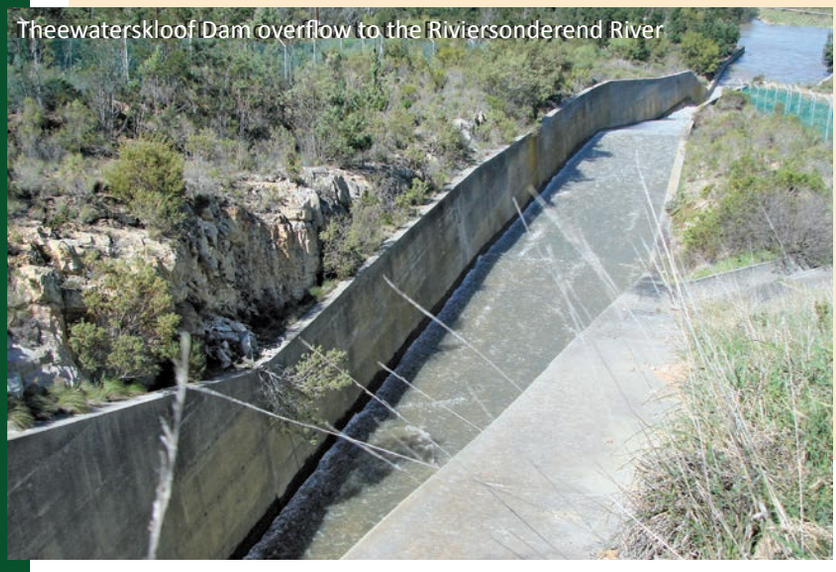
Habitat modification

- ***W***ater quality, bed modification and channel modifications as a result of agricultural activities within and close to many of these tributaries had small to moderate impacts on the instream and riparian habitats.
- ***E***xtensive livestock farming in the Riviersonderend Valley and the removal of vegetation from the river banks has critically modified the riparian habitat, allowing for a large scale invasion by alien trees.

Alien vegetation along the banks of the Riviersonderend River



Theewaterskloof Dam overflow to the Riviersonderend River



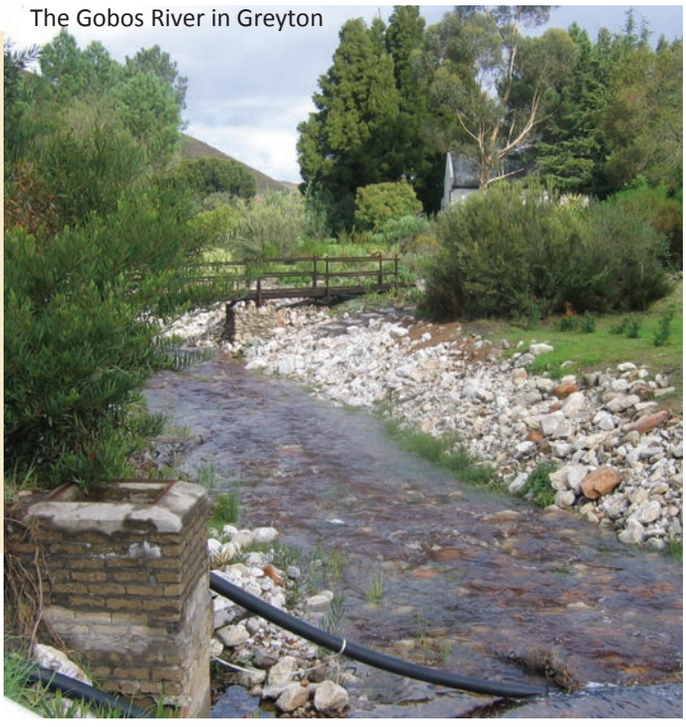
Flow modification

- ***T***heewaterskloof Dam has seriously modified the instream flow regime of the downstream reaches of the Riviersonderend River.
- ***A***gricultural practices in the catchment have led to moderate modifications to the river channels and large modifications with regards to flow.

Invasive alien fish and vegetation

- *T*he presence of invasive alien fish species in the Du Toits River, i.e. spotted bass, has completely displaced the indigenous species.
- *T*he presence of mainly alien invasive fish (sharptooth catfish) in the Riviersonderend River has largely impacted on the instream integrity.
- *T*he riparian zone of the Baviaans and Gobos Rivers was seriously modified by the encroachment of alien plant species and the removal of indigenous vegetation.

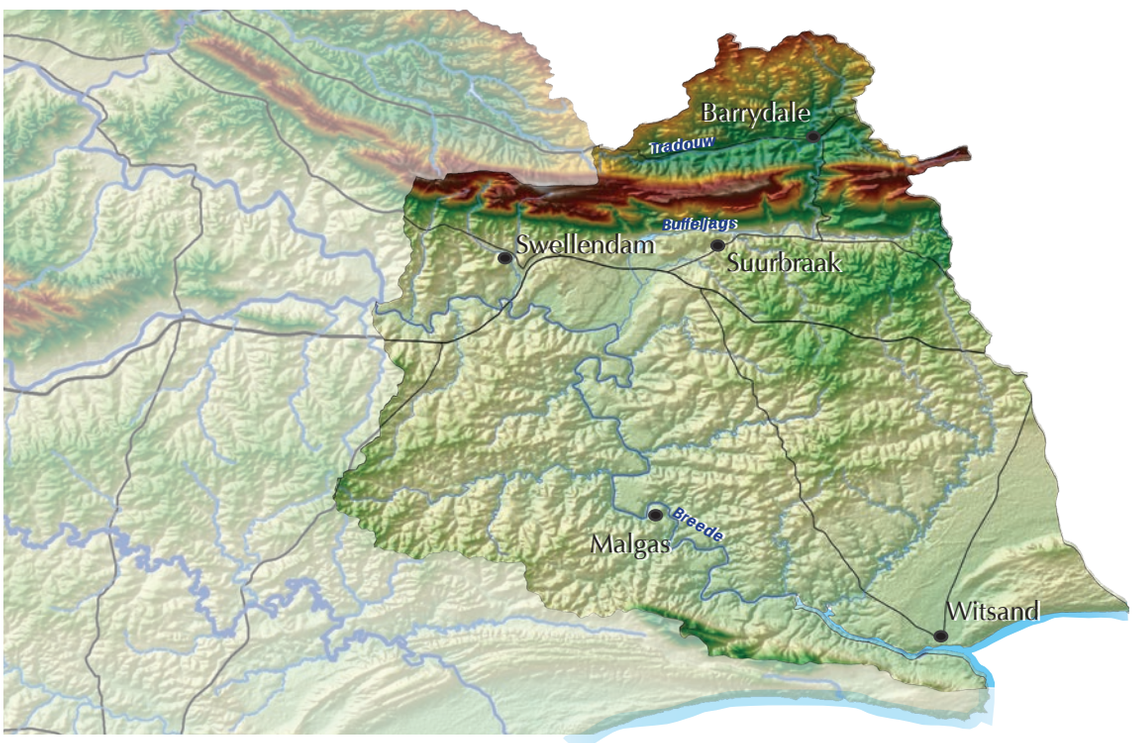
The Gobos River in Greyton



Management recommendations

- The Du Toits River should be maintained in its present condition and future alien fish eradication should be considered for the lower reaches to expand the range of the indigenous fish. A barrier weir needs to be built above Theewaterskloof Dam to prevent re-infestation of alien species from the dam.
- Impacts from agricultural activities (e.g. pesticide spray drift and leaching of fertilizers) must be minimized and there should be no additional water abstraction during summer months to ensure adequate flow downstream.
- Alien vegetation should be cleared from the riparian zone and indigenous vegetation re-established.
- Urban development on river banks at Greyton and Genadendal that takes place within 1/100 year flood line should be controlled and buffer zones should be maintained on the banks.
- A proper bridge needs to be constructed in the Gobos River at the upper end of the town and all further associated bulldozing activity prevented.
- Reinstating some of the flow within the lower Riviersonderend River, particularly during the low flow period, should be investigated in terms of removal of invasive alien trees from the catchment and implementing a low flow release from Theewaterskloof Dam.
- Alien vegetation clearing and management in the riparian zone in the upper and lower Riviersonderend River is critical.
- Alien vegetation clearing was started in the middle reaches of the Riviersonderend River but follow-up work is critical to prevent re-infestation.
- Management of alien fish, especially sharptooth catfish, in the Riviersonderend River will not be feasible due to the fact that the river is completely invaded from its source down to its confluence with the Breede River main stem.
- No instream barriers should be constructed in the lower Riviersonderend River due to the river being a migratory route for freshwater mullet.

Lower Breede River and Tributaries



The Lower Breede sub-catchment includes the lower reaches of the Breede River after its confluence with the Riviersonderend River. In this section the river widens, becoming a meandering lowland system. In these lower reaches the surrounding land use changes from vineyards and orchards to wheat fields. The most significant tributary to join the Breede River along its lower reaches (in terms of flow contribution) is the Buffeljags River, which drains the north-western portion of this sub-area. Upstream of Barrydale, the Buffeljags River is known as the Tradouw River and it drains the northern slopes of the Langeberge. Further downstream the Breede River is joined by several smaller saline perennial river systems which drain the alkaline shales of the Overberg region (Napkei, Dipka and Slang Rivers). The head of the estuary is at Malgas nearly 50km from the sea where the river enters the Indian Ocean at Sebastian Bay, approximately 322 km from its source. The Breede River estuary is currently listed as the 19th most important estuary in South Africa (see page 40).

Buffeljags dam

Buffeljags Dam on the Buffeljags River has a capacity of 5,7 million m^3 and a firm yield of 11 million m^3/a. The dam supplies water for irrigation to the Buffeljags Water User Association and is required to make environmental flow releases.

Buffeljags Dam

Floods in the Lower Breede and Overberg Rivers

In recent years severe weather events have affected more than one municipality or district in the Lower Breede and Overberg areas. A recent report of the provincial Department of Local Government's disaster management centre addresses these events in order to allow for a more pro-active approach to be taken. The report RADAR (Risk and Development Annual Review) 2010 (www.riskreductionafrica.org) focuses particularly on the costly cut-off low weather events that have resulted in more than R2.5 billion (adjusted to 2005 values) in property and infrastructure damage across the Western Cape. In recent years, these weather systems have had a large impact on the province's growing cities, coastal settlements and rural communities, and have emerged as a significant challenge.

Summary of significant flood events from 2003 to 2008:

Dates and Area Affected	Event Type	Area affected	Social impacts	Actual direct damage costs (R million)	Damage costs adjusted to 2005 values (R million)
March 2003 Middle to lower Breede	Cut-off low	Cape Winelands, Eden and Overberg District	2 000 people evacuated, 3 deaths in Hermanus and Knysna	212.4	238.3
December 2004 Middle to lower Breede	Cut-off low	Cape Winelands, Eden and Overberg District	3 700 homes and 40 business premises damaged	54.9	57.9
April 2005 Coastal rivers	Cut-off low	Cape Agulhas Municipality	Residents of Kleinbegin affected	8.9	8.9
August 2006 Riviersonderend	Two cut-off low systems	Cape Winelands, Eden Overberg and Central Karoo District	1 200 people displaced	510.5	479.2
November 2007 Riviersonderend	Cut-off low associated with black southeaster	Cape Winelands, Overberg Central Karoo and Eden District	Over 300 people from settlements and farms provided with relief or evacuated; two fatalities	957.6	830.9
November 2008 Middle to lower Breede	Cut-off low associated with black southeaster	Overberg, Cape Winelands and Eden District	-	996.0	791.3

Flooding in the Breede River near Swellendam in 2008

Flooding of the Breede River at Malgas in 2008

UPPER TRADOUW
EcoStatus: Fair
F-P | F | F | F | P
Importance: M | Sensitivity: L
Desired State: Fair

GLEN RIVER
EcoStatus: Fair
G-F | F | F | F | G
Importance: M | Sensitivity: M
Desired State: Good

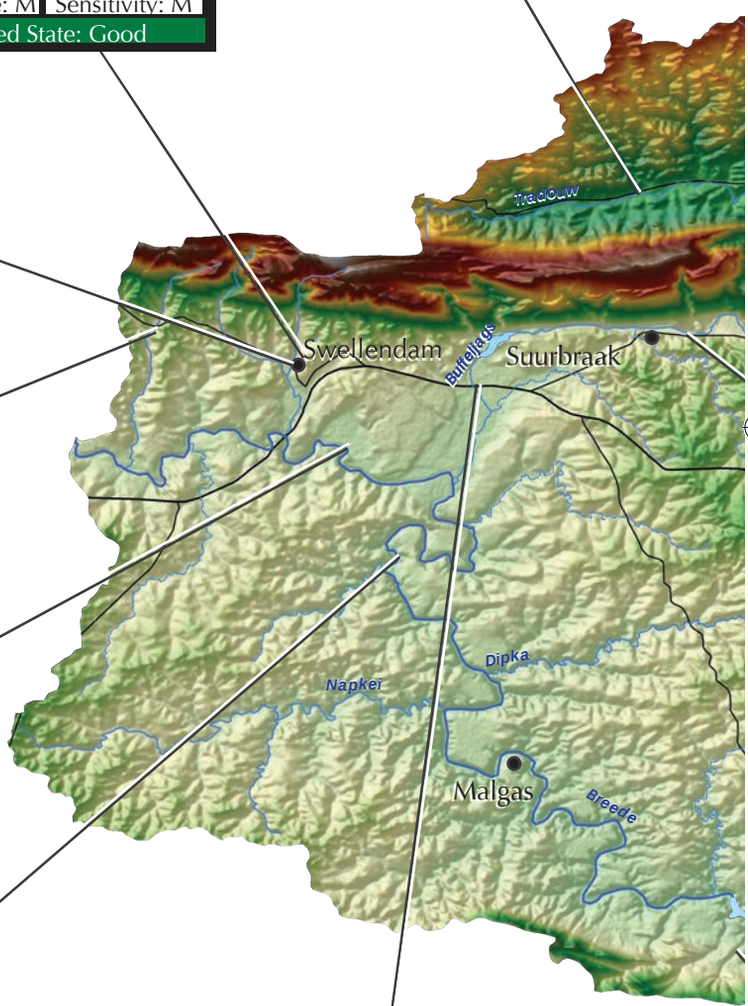
KOORNLANDS
EcoStatus: Fair
F-P | F | F | F | G
Importance: M | Sensitivity: M
Desired State: Good

LEEU RIVER
EcoStatus: Fair
F-P | F | F | F | F
Importance: M | Sensitivity: M
Desired State: Good

BREEDE - BONTEBOK
EcoStatus: Good
G-G | G | F | F | F
Importance: M | Sensitivity: H
Desired State: Good

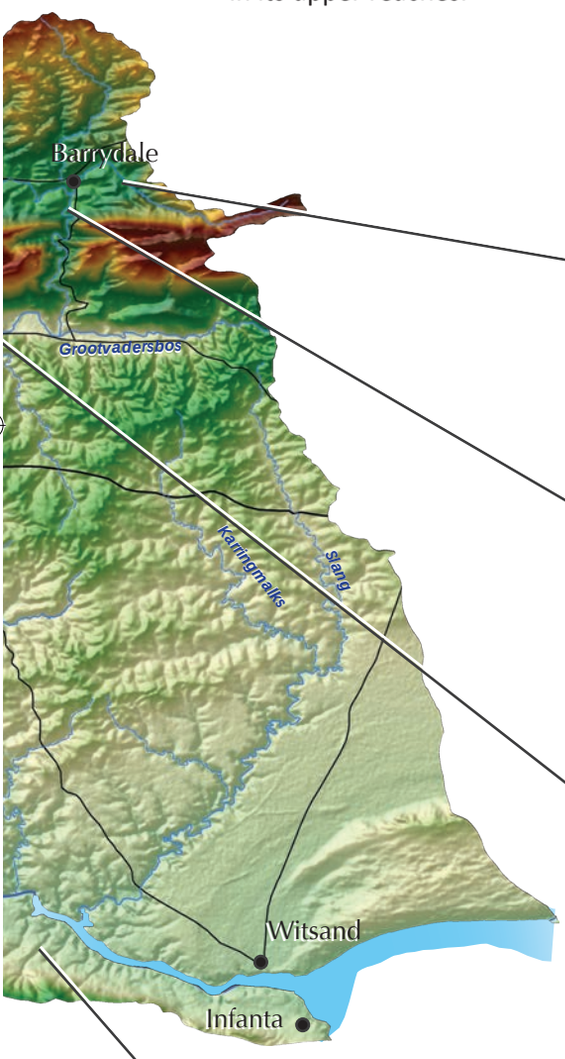
BREEDE - FELIX UNITE
EcoStatus: Good
G-G | G | G | F | F
Importance: H | Sensitivity: VH
Desired State: Good

LOWER BUFFELJAGS
EcoStatus: Fair
F-F | P | F | F | P
Importance: M | Sensitivity: L
Desired State: Fair



Lower Breede River and Tributaries: Present State

The tributaries of the Breede River in its lower reaches are in general in a fair state largely as a result of removal of indigenous riparian vegetation and the resulting invasion of alien vegetation within this zone. Largemouth bass and sharptooth catfish have impacted on indigenous fish populations and instream habitat integrity. The Huis River, a tributary of the Buffeljags River, is still in a good condition in its upper reaches.



HUIS RIVER
EcoStatus: Good
G-F | G | F | G | G
Importance: H | Sensitivity: M
Desired State: Good

LOWER TRADOUW
EcoStatus: Fair
G-F | G | F | F | F
Importance: H | Sensitivity: M
Desired State: Good

UPPER BUFFELJAGS
EcoStatus: Fair
F-P | P | F | F | P
Importance: M | Sensitivity: M
Desired State: Fair

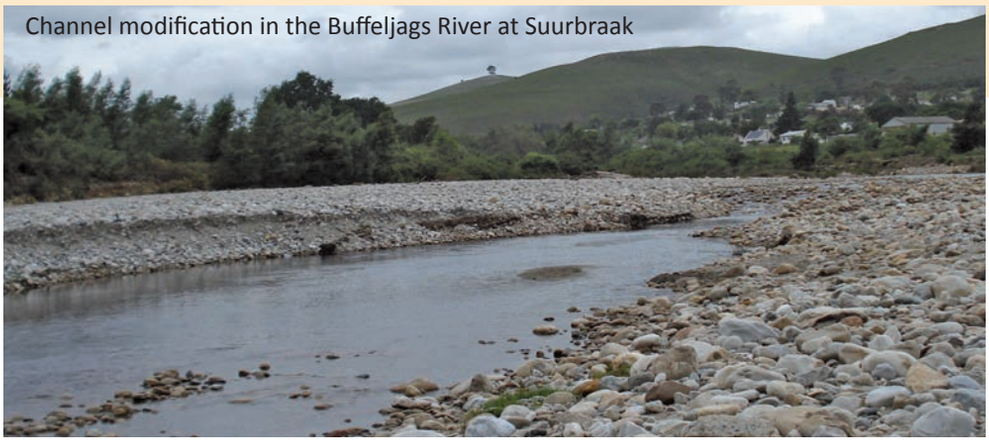
ZIEKENHUIS RIVER
EcoStatus: Fair
G-P | F | P | F | G
Importance: H | Sensitivity: H
Desired State: Good

Lower Breede River and Tributaries: Major Impacts & Management Actions

River Channel, bed and bank modification

- ***C***hannel modification and removal of indigenous vegetation on the river banks near Swellendam have resulted in erosion of the river banks and encroachment by alien invasive plants into the riparian zone.
- ***T***he removal of indigenous vegetation from the river banks, channelisation of the channel, as well as erosion of the banks has largely modified the riparian habitat integrity of the Buffeljags River, while the subsequent encroachment by alien invasive trees has seriously modified this zone.
- ***I***mpacts to the riparian habitat of the Tradouw River include removal of indigenous vegetation, alien invasive species encroachment and modifications to the river banks largely as a result of agricultural activities.

Channel modification in the Buffeljags River at Suurbraak



Flow modification

- ***O***ver abstraction of water in the Huis and Tradouw Rivers has seriously modified the instream habitat integrity. This is especially of concern during the dry summer months when flow levels are reduced to well below the required summer base flow.
- ***T***he presence of alien invasive plants in the upper catchment and the instream Buffeljags Dam have impacted the flow regime of the lower Buffleljags River.
- ***I***nvasive alien trees and water abstraction have modified the flow regime in the Ziekenhuis River.

Port Jackson willows in the Ziekenhuis River

Water quality impacts

- ***U***pstream agricultural as well as urban activities within the catchment have resulted in a moderate water quality modification of the lower Breede River in terms of the salinity and nutrient levels.

Invasive alien fish and vegetation

- ***A***lien invasive fish species, such as sharptooth catfish in the lower Breede River, and largemouth bass and sharptooth catfish in the Buffeljags River, has impacted on the indigenous fish and instream habitat of these rivers.
- ***E***xtensive removal in vegetation from the riparian zone in sections of the lower Breede River has taken place, resulting in growth of alien invasive trees and some bank erosion.

Sharptooth catfish

Management Recommendations

- Reducing upstream impacts from agricultural activities (e.g. pesticide spray drift and leaching of fertilizers) as well as alien vegetation management.
- The impacts of the surrounding residential activities at Swellendam should be managed to ensure that there are minimal impacts on the river.
- The stocking of alien fish species into farm dams should only take place if authorised by CapeNature. In particular, no stocking of alien fish should be allowed in the Koornlands and Tradouw River catchments.
- No summer water abstraction for irrigation purposes should be allowed and alien vegetation should be cleared.
- Implementation of an environmental release from the Buffeljags Dam is essential, particularly during the low flow season.
- Follow-up clearing of alien vegetation and management of subsistence agriculture needs to take place in the Huis River and current abstraction levels monitored to ensure that low flows are left in the Huis River to sustain endangered fish species.
- Agricultural and animal grazing impacts should be minimised on the Tradouw River and certain sections of the river should be strongly considered for alien fish eradication in order to increase available habitat for the Barrydale redfin.
- A Biodiversity Management Plan for Species (see page 63), currently being developed for the Critically Endangered Barrydale Redfin must be implemented with the assistance of key stakeholders, including riparian landowners.

Breede Estuary

Breede Estuary: Present State

The Breede River Estuary stretches roughly from 30 km above Malgas to the town of Witsand. The estuary has a permanently open mouth and the channel is incised to depths of 3 to 6m or more. Tidal influence extends beyond Malgas to approximately 80 km upstream of the mouth. During summer when river flow is at its lowest, the system becomes more saline, while during the rainy season salinities is usually much lower when stronger river flows limit the intrusion of seawater to the lower reaches. The estuary is a large system covering 455ha and supports six of the possible nine plant community types, and 59 fish species from 30 families, of which nearly 40% are entirely dependent on estuaries. It is also considered to provide a relatively important habitat for waterbirds. For these reasons the estuary is ranked 19th in South Africa for estuarine conservation importance and has the 5th highest botanical importance score. The recreational, nursery and scenic value of the estuary is also high. Currently the overall ecological health of the Breede Estuary is considered to be good, with the largest impact being a reduction of river inflow. It is recommended that the estuary condition be maintained in this state which is critically dependant on maintaining a flow regime to the estuary which includes flood and low flows.

Estuarine Health Indices

- Hydrodynamics and Hydrology
- Water Quality
- Physical habitat
- Microalgae
- Macrophytes
- Invertebrates
- Fish
- Birds

Estuarine Health Categories

- Natural (N)
- Good (G)
- Fair (F)
- Poor (P)

Estuarine Ecological Importance Categories

- Very High (VH)
- High (H)
- Moderate (M)
- Low (L)

What is Estuarine Health?

Estuaries provide many goods and services (food and bait collection, nurseries and refugia for fauna, tourism and recreation, cultural and spiritual activities), which contribute to human welfare and economic growth.

This assessment of the present state of Breede Estuary is based on the results of the Breede Ecological Water Requirements Study: Estuarine Component. It highlights the characteristics, benefits and environmental pressures relating to the estuary. The indices used on this page represent the habitat and biotic health of the larger estuarine ecosystem. 'Ecological importance' is an expression of the importance of an estuary to maintain ecological diversity and functioning on local and wider spatial scales.

Breede Estuary: Major Impacts & Management Actions

Water abstraction impacts on the salinity distribution in the Breede River Estuary. Historically the estuary was a fresh water dominated system however, with the increasing reduction in river inflow the system is becoming increasingly marine dominated. This impact is most severe during the summer months (dry season).

Agricultural return flows may lead to nutrient enrichment and other water quality impacts as a result of pesticides and herbicides from the extensive agricultural activities in the catchment.

Over-exploitation of fish resources. The Breede River Estuary is famous for catches of large dusky kob, a species which has been heavily reduced by fishing. The recent national reduction of the bag limit to one fish per angler per day should help to reduce mortality, but in places such as the Breede River Estuary, even this restriction is not sufficient to prevent loss of spawner-biomass. The aggregation of large, sexually mature fish and their vulnerability to capture suggests that additional restriction is required in the Breede River Estuary.

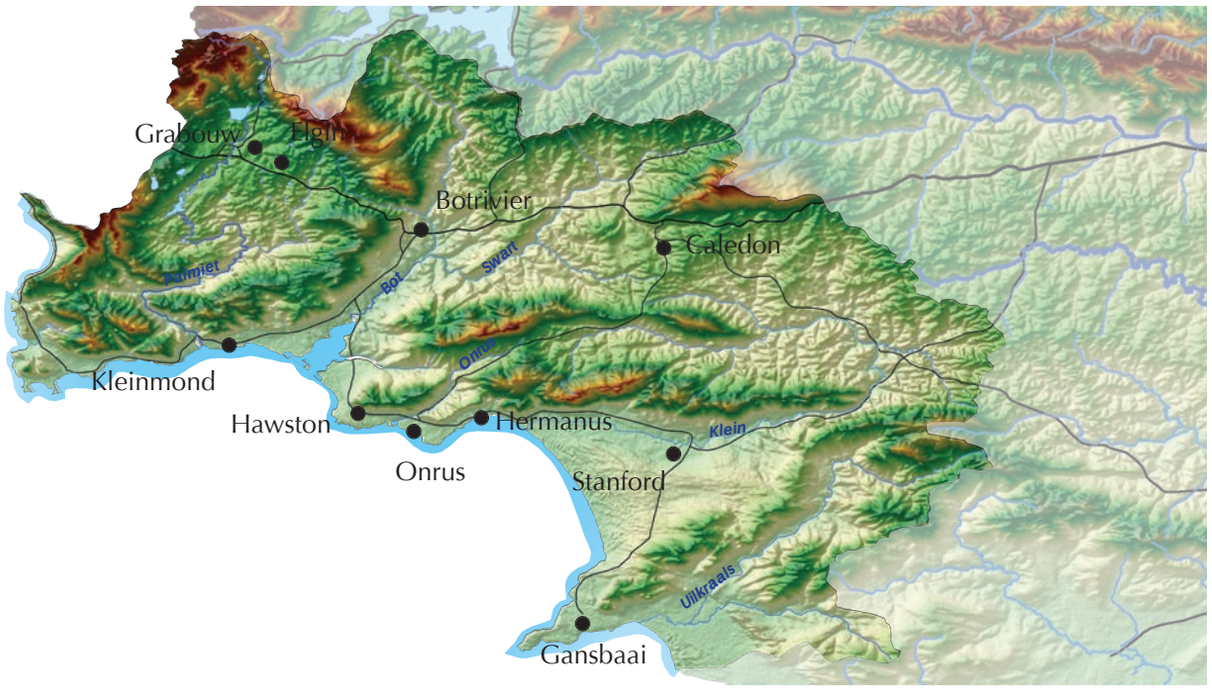
High volumes of boating activity takes place in the estuary during summer when the system is most biologically active. This impacts negatively on the productivity of estuarine biota.


Breede Estuary mouth

Management Recommendations

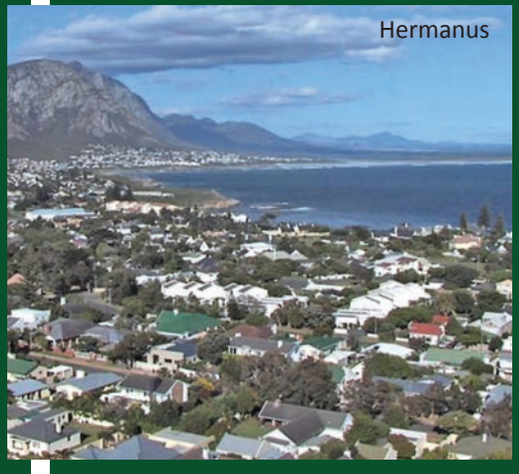
- No further river abstraction should take place during summer (low flow period).
- Where possible, the use of fertilizers and pesticides in the catchment and along the banks of the estuary should be minimised (or applied optimally) to prevent excess nutrients or toxic organic compounds (e.g. pesticides and herbicides) from entering the estuary through return flows.
- A night ban on fishing is being proposed by Marine and Coastal Management that will apply to all fishing between 20H00 and 06H00.
- Emergency regulations should gazetted to protect the Zambezi and all other sharks in the Estuary.
- Bait collection must be controlled through demarcation of areas where it is permissible, and enforced.
- The carrying capacity of the system for boating activities should be determined. The current zonation of the Breede Estuary should be revisited to ensure that sensitive habitats (e.g. bird breeding areas and riparian areas) are not unduly exposed to noise and wave action from boats. The current compliance monitoring should be maintained as it very successful in regulating and enforcing boating regulation on the system, e.g. Compliance with skiing regulations.

Overberg West Rivers



The Overberg West sub-catchment stretches from the Palmiet River at Grabouw in the west to the Uilkraals River east of Gansbaai. This region consists largely of relatively short coastal rivers that are fast-flowing, have a low salinity, and are acidic clear water rivers. The main land-use in the west is the cultivation of cereal crops (wheat and barley) and canola. Urban development includes the towns of Bot River, Caledon, Elgin, Gansbaai, Grabouw, Greater Hermanus, Kleinmond, Onrus, Stanford, Baardskeerdersbos and Pearly Beach.

Other land-use in this area includes livestock farming (sheep, cattle and ostriches), commercial plantations (pine) and irrigated agriculture (fruit), especially in the Palmiet and Bot river catchments. The fruit farms in the Elgin Valley are the largest exporter of apples and pears in southern Africa. Here, the previously Fynbos covered landscape has been completely altered by farming, with the exception of the Hottentots Holland Mountains in the north and the Kogelberg Biosphere Reserve in the south.


Hermanus

Hermanus Water Conservation Programme

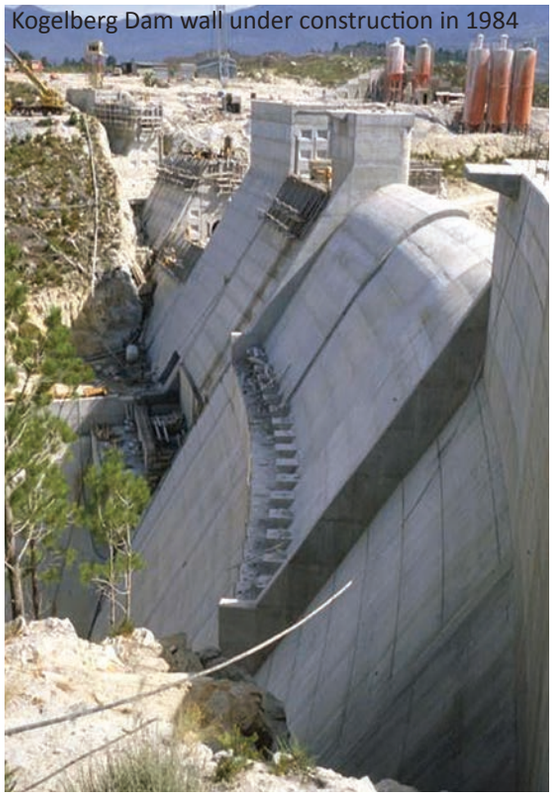
The Greater Hermanus Water Conservation Programme began in 1996 to address a growing demand for water in a water limited area. The programme consisted of an assurance of supply tariff; an 11-point escalating block-rate tariff; informative billing; intensive communication; schools resource audit; the Hermanus Working for Water Project; retrofitting project to install water-saving devices and fixing leaks; water-wise gardening and food production; regulations designed to reduce water wastage (banning automatic-flushing urinals); water loss management (fixing leaks, metering of all consumers and meter replacements); and online pre-payment meters.

The first year of the programme resulted in a 32% reduction in per capita peak-demand for water and a 20% increase in revenue from water sales, with 96% of the residents supporting the initiative. As a result, the need to develop additional water resources was delayed by approximately 7 years. Currently 1.6 million cubic meters of water is abstracted from groundwater and 5.5 million cubic metres is obtained from De Bos Dam.

Palmiet River: Urban Water Supply and Hydro-electric power

The Palmiet River Government Water Scheme transfers water from the Palmiet River to the Berg Water Management Area for use by the City of Cape Town. 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.

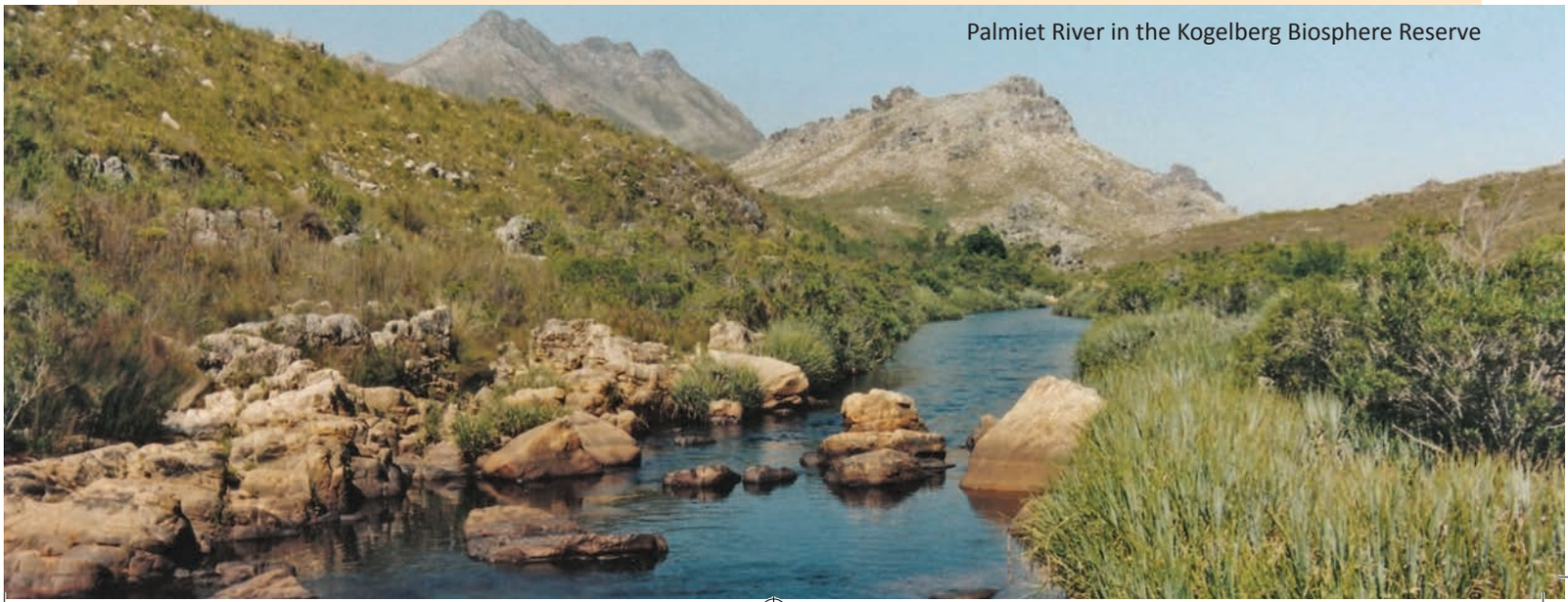
During periods of the week when there is a low demand for electricity, and when there is sufficient water in the Palmiet River, river water may be pumped from Kogelberg Dam to Rockview Dam for transfer into the Upper Steenbras Dam. From there water is released through the Steenbras Hydro-electric Power Station to a pipeline conveying it to the Faure Water Treatment Plant and to City of Cape Town consumers. The average quantity currently transferred is 22,5 million m^3/a. Releases are also being made from the Kogelberg Dam for the downstream aquatic environment, complying with the ecological Reserve.



Kogelberg Dam wall under construction in 1984

Kogelberg Biosphere Reserve

The Kogelberg Biosphere Reserve contains an exceptional quality of fynbos and is considered to be at the heart of the Cape Floral Kingdom. The reserve lies within the southern stretch of the Hottentots Holland mountain range. The Reserve is a protected area that has approximately 1 600 plant species, of which about 150 are endemic. Many Protea species occur in the reserve, including the endangered marsh rose, *Orothamnus zeyheri.* Kogelberg has three patches of relic indigenous forest, Louwbos, Platbos and Oudebos that contain yellowwood, stinkwood and boekenhout trees. The reserve has a few large animals such as leopards; the Cape clawless otter; smaller antelope (klipspringer and grysbok); and baboons, dassies and hares. Peregrine falcons, black eagles and fish eagles are found in the reserve. An endemic freshwater crab and the endangered micro-frog are also found in the area.



Palmiet River in the Kogelberg Biosphere Reserve

KEEROM - NUWEBERG
EcoStatus: Natural
Importance: H | Sensitivity: VH
Desired State: Natural

BOT - WILDEKRANS
EcoStatus: Fair
Importance: H | Sensitivity: M
Desired State: Fair

PALMIET - GRABOUW
EcoStatus: Poor
Importance: H | Sensitivity: M
Desired State: Fair

PALMIET - ARIESKRAAL
EcoStatus: Fair
Importance: H | Sensitivity: M
Desired State: Fair

KROMME RIVER
EcoStatus: Poor
Importance: L | Sensitivity: L
Desired State: Fair

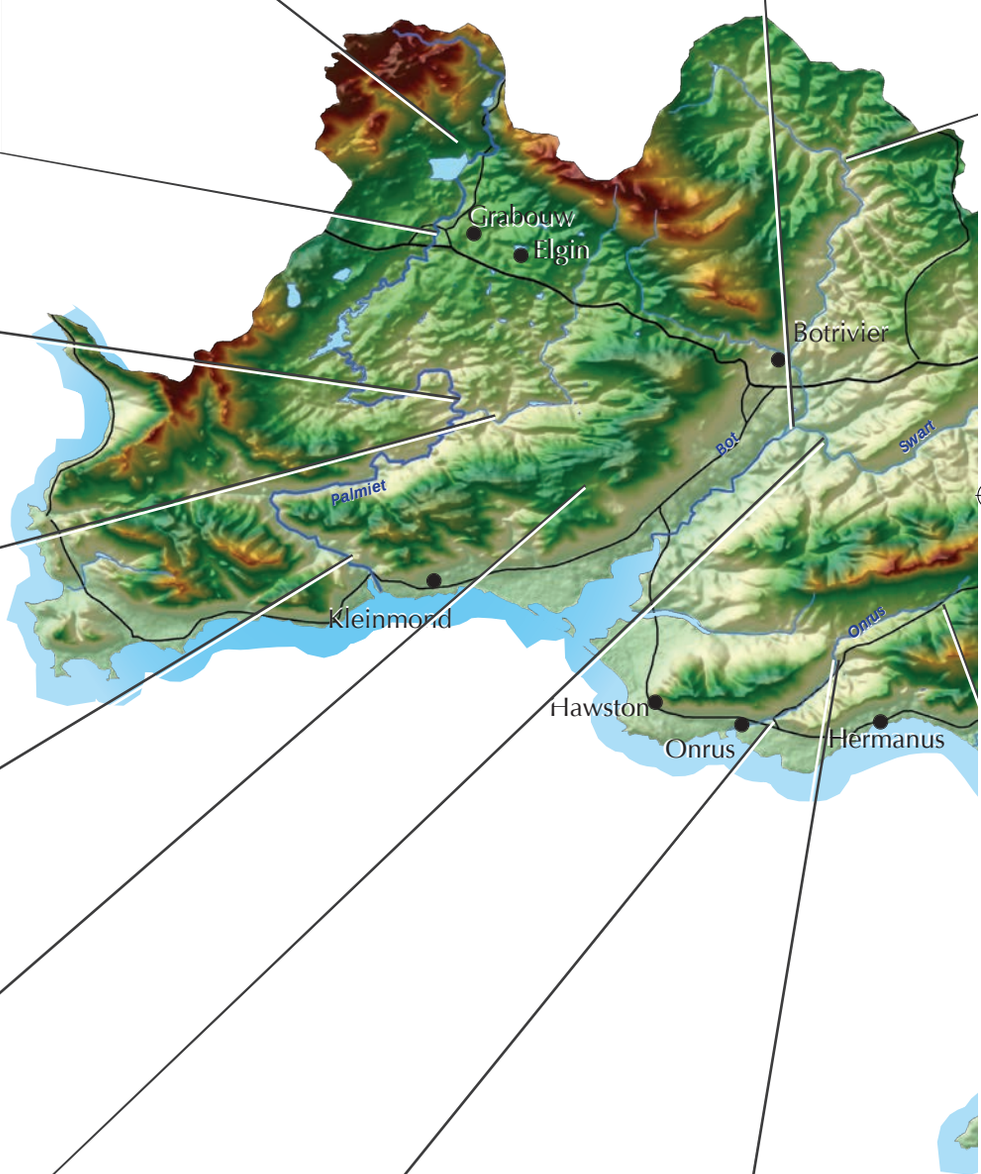
PALMIET - KOGELBERG
EcoStatus: Good
Importance: H | Sensitivity: H
Desired State: Good

HERMANUS RIVER
EcoStatus: Natural
Importance: H | Sensitivity: VH
Desired State: Natural

SWART RIVER
EcoStatus: Fair
Importance: M | Sensitivity: M
Desired State: Fair

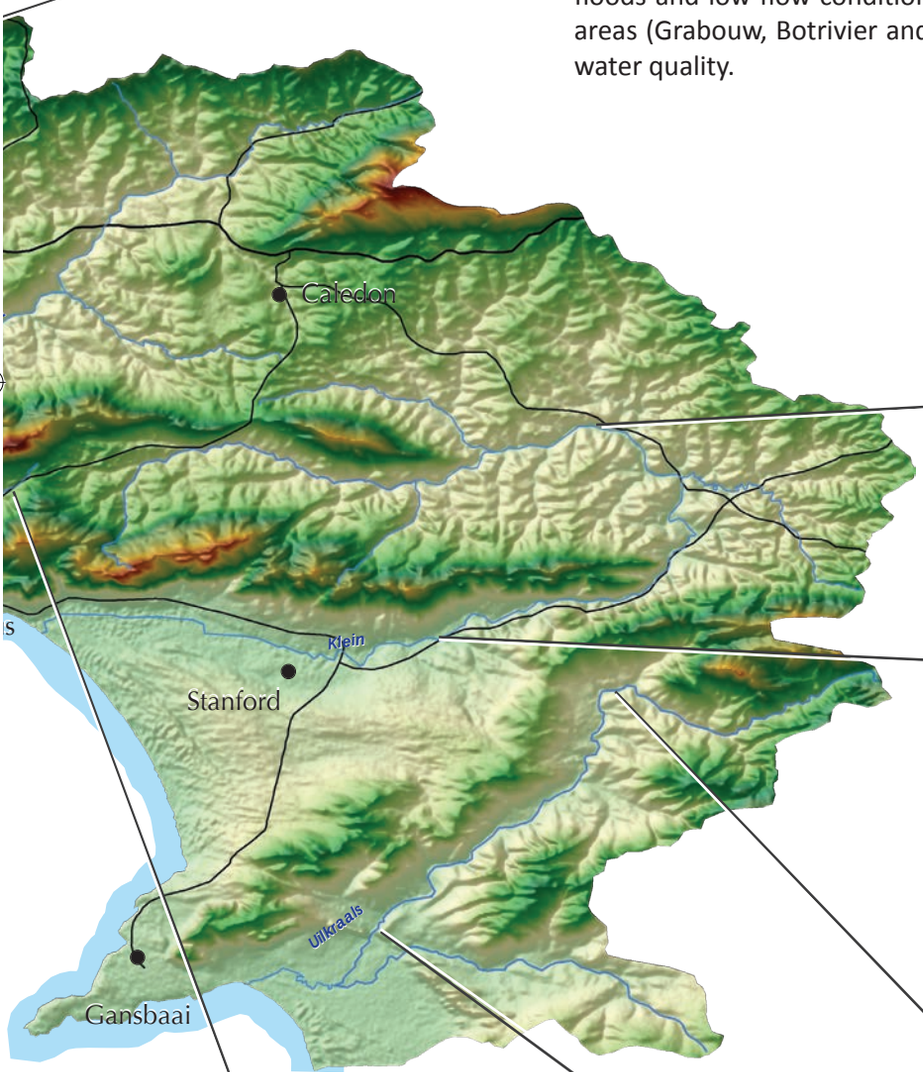
ONRUS - R43
EcoStatus: Fair
Importance: H | Sensitivity: M
Desired State: Good

ONRUS - VOLMOED
EcoStatus: Fair
Importance: M | Sensitivity: M
Desired State: Fair



Overberg West Rivers: Present State

Nearly all of the Overberg West rivers are in a fair condition, except in their very upper reaches or where they are protected within conservation areas such as the Kogelberg and Salmonsdam Nature Reserves. Dams in the upper to middle reaches of the relatively small Overberg West rivers has severely modified the flow patterns in the lower reaches of these rivers, reducing floods and low flow conditions. Treated wastewater discharges from urban areas (Grabouw, Botrivier and Caledon) have impacted on the downstream water quality.



BOT - DORINGKLOOF
EcoStatus: Fair
G-F | F | P | F | P
Importance: H | Sensitivity: M
Desired State: Fair

KLEIN - GOUDINI
EcoStatus: Fair
F-P | F | F | F | P
Importance: M | Sensitivity: M
Desired State: Fair

KLEIN - BLUEGUM
EcoStatus: Fair
F-P | F | P | F | F
Importance: M | Sensitivity: M
Desired State: Fair

UILKRAALS-SALMONSDAM
EcoStatus: Good
G-F | G | G | G | N
Importance: VH | Sensitivity: H
Desired State: Good

UILKRAALS - BAARDSKEER
EcoStatus: Fair
F-P | F | F | F | F
Importance: H | Sensitivity: M
Desired State: Fair

ONRUS - HAYGROVE
EcoStatus: Fair
F-P | F | F | F | F
Importance: M | Sensitivity: M
Desired State: Fair

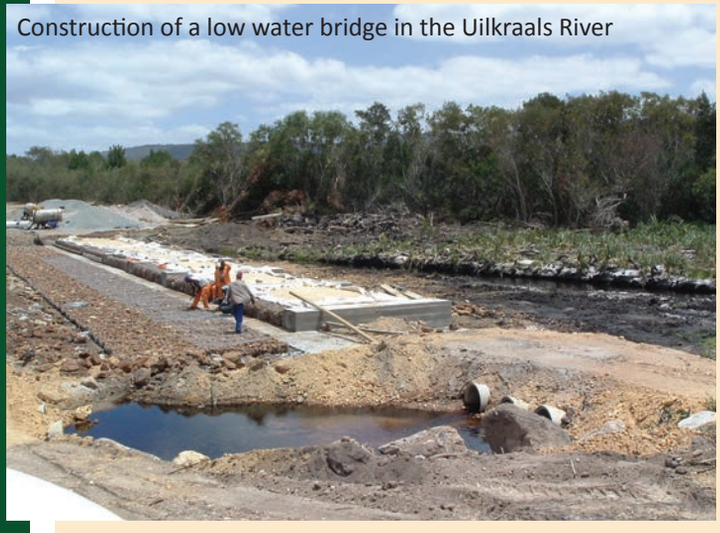
Overberg West Rivers: Major Impacts & Management Actions

Flow modification

- ***D***ams such as the dams in the Palmiet River, Kraaibosch Dam in the Uilkraals River, the De Bos Dam in the Onrus River and the Houtveld Dam in the Upper Bot System exert a major control on flow in the upper and middle reaches of these rivers. These impoundments have severely modified the flow patterns in the river by eliminating most floods and altering the low flow conditions.

Eikenhof Dam in the Palmiet River

Construction of a low water bridge in the Uilkraals River



River channel and riverbank modifications

- ***R***iverbanks were straightened and levees created as a means of protection against flood flows.
- ***A***lien vegetation infestations on the river banks has resulted in channel straightening and over-stabilization of many of these rivers, which leads to evident channel incision and erosion.
- ***C***onstruction within the channels has also occurred, which has resulted in habitat loss and reduced aquatic species diversity.
- ***I***nstream dams and water abstraction have modified river flows and altered the natural flow regime in the downstream river channels.

Alien species infestation

- ***R***ivers were invaded by alien vegetation with the exception of the upper reaches of the Hermanus River (a tributary of the Bot River), which is situated in a protected area (SAFCOL Nature Reserve); and the upper reaches of the Uilkraals River, which is also situated within a protected area (Salmonsdam Nature Reserve).
- ***A***lien fish were also prevalent in most sites surveyed. Small, spotted and largemouth bass and bluegill sunfish were caught during surveys. These fish have an impact on the smaller indigenous fish species by direct competition for food (e.g. banded tilapia).

Water quality impacts

- ***I***ndustrial, agricultural and domestic wastewater and runoff near urban areas such as Grabouw, Botrivier and Caledon result in elevated organic loads in the rivers downstream, causing eutrophication and low dissolved oxygen levels. Litter in these areas is also a problem. Only pollution tolerant aquatic invertebrate species were recorded downstream of these areas.


Black wattle along the Palmiet River

Management Recommendations

- Alien vegetation should be eradicated from the riparian zone and wetland areas, ensuring they remain cleared by follow-up clearing efforts.
- The re-establishment of the natural riparian zone with indigenous vegetation and the construction or extension (where possible) of existing buffer zones between agricultural lands and the river is highly recommended.
- Alien fish species should be eradicated from reaches that could be maintained free from alien fish, so as not to run the risk of re-infestation.
- The impacts of breeding or stocking of alien fish species in farm dams should be better managed and stopped where the risk of invasion is possible.
- Address water quality and litter problems arising from urbanised areas.
- Implement where possible environmental flow releases from instream dams to ensure that in particular the low flow requirements for the downstream aquatic environment are met.

Overberg East Rivers

The Overberg East sub-catchment is situated at the southern tip of Africa and stretches from the Nuwejaars River at Elim in the west to the Breede River. This region consists of slower flowing, more turbid and saline rivers on the Agulhas Plain that are associated with a number of inland water bodies and wetlands.

Land cover on the Agulhas Plain, in the east, is still largely natural and includes shrubland, grassland, bushland, wetlands and waterbodies such as Soetendalsvlei. Wheat and livestock farming are a significant industry for this area.

Urban development comprises only a small percentage of the catchment and includes the towns of Bredasdorp, Elim, Napier, Arniston, L'Agulhas and Struisbaai.

The Agulhas Biodiversity Initiative

The Agulhas Plain (270 000 ha) is the largest habitat of lowland Fynbos and Renosterveld located in the Cape Floristic Region. The vegetation of this area has a high irreplaceability and vulnerability status. This area is particularly unique for its significant amount of wetlands that occur, including Soetendalsvlei, the second largest lacustrine wetland in South Africa. Two Ramsar sites, De Hoop Vlei on the Sout River and De Mond estuary on the Heuningnes River, provide important feeding grounds for several rare and threatened bird species.

The Agulhas Biodiversity Initiative is a joint partnership between South African National Parks, Cape Nature and Fauna and Flora International as part of C.A.P.E. The Initiative was designed to address the main threats to these lowland habitats and improve the livelihoods of local communities. The four main components are:

- Conservation management in the productive landscape of the Agulhas Plain;
- Sustainable harvesting of wild fynbos;
- Development and implementation of nature-based tourism activities; and
- Building local support for biodiversity conservation on the Agulhas Plain through a public awareness programme.

Vleis and Pans of the Agulhas Plain

The Agulhas region is unique in terms of the wide variety of wetlands (freshwater springs, rivers, estuaries, lakes, vleis and endorheic pans) that occur within a relatively small area. This contributes to a high diversity of wetland plants and aquatic invertebrates. These wetlands also attract over 60 water bird species and over 21,000 migrant and resident wetland birds annually, with the highest numbers recorded at Soetendalsvlei, followed by Uilkraals Estuary and Voëlvlei.

The Nuwejaars Wetland system in particular is an area of immense diversity and conservation value. It consists of rare and endemic natural fynbos and wetlands, which are interlinked by the streams of the Nuwejaars River System. This system drains the Southern Agulhas Plain forming a number of seasonal and permanent water bodies or vleis, of which the most notable are Soetendalsvlei and Voëlvlei. These wetlands are inhabited by a large variety of avian and aquatic species, some of them extremely rare and endangered and some endemic to only this area. In addition, this system feeds into the Heuningnes River, a short stretch of river that flows into the sea at the De Mond Estuary. The De Mond Estuary is listed as a Ramsar Wetland of International Importance.

It is due to the very low gradients of the south-eastern Agulhas Plain that there is significant wetland development. Soetendalsvlei is the second largest lacustrine wetland in South Africa. Several endorheic pans have also been formed within the park and are maintained by the interplay of a variety of geomorphological processes, including drainage disruption, aeolian activity, and the solution and weathering of the substrate. The larger bodies of water such as Soetendalsvlei and Voëlvlei, which are directly connected to the Nuwejaars River, are lake-like in that they remain inundated year round. Many of the smaller pans are not connected to any fluvial system or only have small locally sourced channels entering them. They are ephemeral with an annual inundation/drying regime—a function of winter rainfall and subsequent summer evaporation. Soetendalsvlei is moderately saline (2–5 g/kg), whereas several of the smaller pans (Soutpan, Melkbospan, and Vispan) are hypersaline (16–86 g/kg). River waters are brackish (< 2 g/kg salts) and alkaline as a result of passage through limestone-bearing Strandvlei sands.


Soetendalsvlei

Agulhas Working for Wetlands 2011

The Agulhas Working for Wetland project focuses on the rehabilitation of the Nuwejaars Wetland and Ratel River systems. This will comprise the construction of gabions, earth and concrete structures for erosion protection and some revegetation and alien clearing work. Four teams comprising 40 individuals in total, from the surrounding communities, will be employed to undertake the work in the 2011/12 financial year.

KARS - KARSRIVIER
EcoStatus: Fair
F-F | F | F | F | N
Importance: H | Sensitivity: H
Desired State: Good

KARS - ROOIDRAAIBRUG
EcoStatus: Fair
F-P | F | P | P | F
Importance: H | Sensitivity: M
Desired State: Fair

SOUT - SOUTKUIL
EcoStatus: Poor
F-P | P | F | F | P
Importance: M | Sensitivity: L
Desired State: Fair

PIETERSIELIEKLOOF
EcoStatus: Fair
F-P | F | P | G | F
Importance: M | Sensitivity: M
Desired State: Good

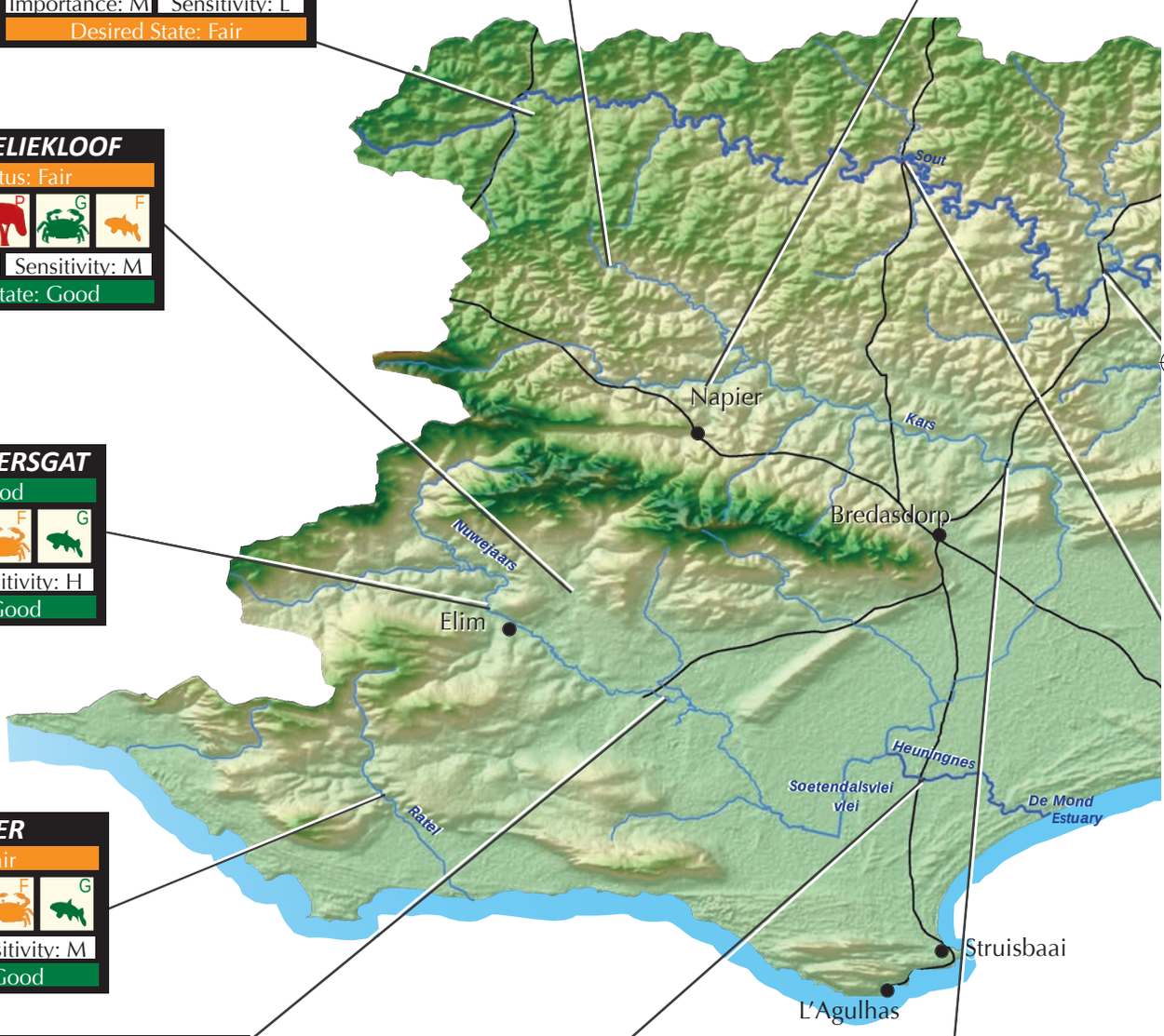
NUWEJAARS - KERSGAT
EcoStatus: Good
G-F | G | F | F | G
Importance: H | Sensitivity: H
Desired State: Good

RATEL RIVER
EcoStatus: Fair
G-F | G | F | F | G
Importance: M | Sensitivity: M
Desired State: Good

NUWEJAARS - BRAKPAN
EcoStatus: Fair
G-F | F | F | F | F
Importance: M | Sensitivity: M
Desired State: Good

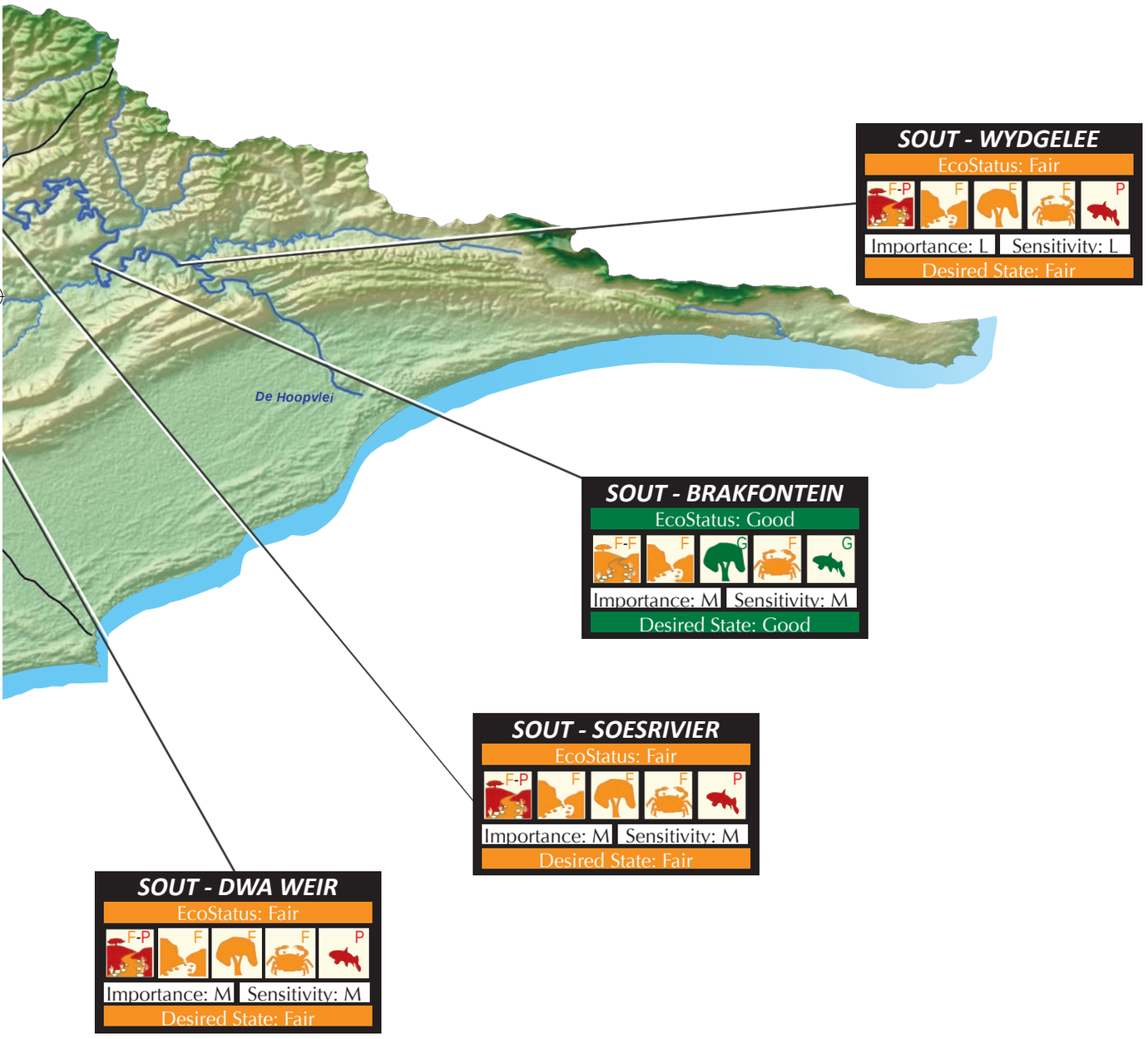
HEUNINGNES
EcoStatus: Good
G-F | F | F | G | G
Importance: H | Sensitivity: M
Desired State: Good

KARS - SOUTKLOOF
EcoStatus: Fair
F-F | F | F | F | F
Importance: M | Sensitivity: M
Desired State: Fair



Overberg East Rivers: Present State

Rivers of the Overberg East sub-catchment are in a good to fair condition. The main impacts are as a result of river channel modification by agricultural activities and invasive alien plants (Acacia sp., eucalyptus trees and poplar trees) within the riparian zone. Alien invasive fish (smallmouth and spotted bass, tilapia and bluegill sunfish) occur throughout the area and have impacted on indigenous fish populations.



Overberg East Rivers: Major Impacts & Management Actions

River channel and riverbank modifications

- ***T***here is a large degree of sedimentation occurring in these rivers as a result of increased availability of soils from agricultural activities. The increased sediment deposition has reduced the habitat diversity.
- ***F***requent river crossings and structures occur in these rivers, which has modified the river bed of the Sout and Nuwejaars Rivers and resulted in some habitat loss and reduced aquatic species diversity.

Nuwejaars Tributary before flooding in 2005

Nuwejaars Tributary after flooding in 2005

Port Jackson willows on the banks of the Nuwejaars River

Alien species infestation

- ***A***lien fish stocks were prevalent in most sites surveyed. Smallmouth and spotted bass, tilapia and bluegill sunfish were caught during surveys. Consequences of alien fish presence include amongst others, indigenous fish predation, indigenous fish stock shortage and poor water quality.
- ***R***ivers (Upper Nuwejaars catchment) were severely invaded by alien vegetation (Acacia species, eucalyptus trees and poplar trees) in riparian zones.
- ***A***lien trees in some of the more 'wetland type' rivers have grown between and over the palmiet reeds. Recent floods removed most of the alien trees but caused he damage to the riparian zone and palmiet beds.

Mocambique tilapia

Bluegill sunfish

Management Recommendations

- Alien vegetation must be eradicated from the riparian zone and wetland areas and kept cleared with follow-up clearing efforts.
- The re-establishment of the natural riparian zone with indigenous vegetation and the construction or extension (where possible) of existing buffer zones between agricultural lands and the river is highly recommended.
- Alien fish species should be eradicated from river areas identified as priorities for rehabilitation.
- Alien fish should only be stocked in designated areas or zones for such species.
- The upper Kars River should be maintained as a priority for freshwater fish as well as the upper Nuwejaars and Uilkraals rivers due to the diverse aquatic life and undisturbed habitat. These rivers drain the Agulhas Plain and associated wetlands and their rehabilitation potential could form part of the Agulhas Biodiversity Initiative.

Overberg Estuaries

Overberg Estuaries

The estuaries of the Overberg include the Palmiet, Bot, Onrus, Klein, Uilkraals, Ratel and Heuningnes. These estuaries are of a high biodiversity importance and have high subsistence, recreational and nursery values (conservatively estimated at around R280 million per year, excluding their tourism and property value). The Klein, Bot/Kleinmond, Breede and Heuningnes are in the top 25 most important estuaries in the country, while the Heuningnes estuary at De Mond has been declared a Ramsar site in 1986. Eight (80%) of the Breede-Overberg estuaries have been identified as priorities for achieving national biodiversity goals in SANBI's recent National Biodiversity Assessment 2010.

The estuaries range from small to large in size and from being temporarily closed, estuarine lake to permanently open. A summary of the characteristics of the Overberg Estuaries is given below:

Name	Type	Importance rating	Relative Size (Floodplain area ha)	Recommended Ecological Category	Recommended Environmental Water Requirement (% MAR)
Palmiet	Temporarily closed	62.8	Medium (27)	Largely natural	67
Bot/Kleinmond	Estuarine lake	96.6	Large (2019)	Largely natural	75-80
Onrus	Temporarily closed	58.9	Medium (15)	Largely modified	40
Klein	Estuarine lake	97.0	Large (1778)	Largely natural	75-80
Uilkraals	Temporarily closed	76.0	Large (855)	Moderately modified	70-90
Ratel	Temporarily closed	32.5	Small (9)	Moderately modified	60
Heuningnes	Permanently open	83.1	Large (14123)	Natural / Largely natural	70-80

Artificial opening of the Uilenkraal mouth

Estuary Management Plans

The term estuary refers to the body of water which forms the interface between a river and the sea into which it flows. Estuaries may be permanently or periodically open to the sea. They are generally highly productive ecosystems, and provide a range of goods and services ranging from nursery areas for juvenile fish, to stopovers for migrant birds, and recreational opportunities for local inhabitants. Their productivity, combined with their natural beauty and the shelter they provide also means that they are highly sensitive and vulnerable to development, with many towns and cities, ports and harbours being deliberately located in and around them. As a result, many estuaries have been seriously degraded.

Despite the value of estuaries, they have been poorly managed to date, largely due to the fact that they did not fit clearly within the mandate of any one government department. Recent development of a National Biodiversity Strategy and Action Plan, addressed this aspect through the inclusion of a requirement for Estuary Management Plans in the Integrated Coastal Management Act. In parallel with the development of the legislation, the C.A.P.E. Estuaries Programme provided funding for the development of Estuary Management Plans for a number of priority estuaries in the Cape Floristic Region, including the Bot, Klein, Uilkraals (in process), Heuningnes and Breede estuaries.

Overberg Estuaries: Present State & Major Impacts

Algae and litter at Kleinmond

The estuaries of the Overberg are particularly sensitive to human development pressures owing to their small size, which makes them more prone to modification as a result of flow reduction and pollution from the surrounding land and associated catchment. The Klein and Onrus River estuaries are being regularly polluted by sewage spills, particularly during the holiday season when reticulation systems are incapable of accommodating peak loads. Diffuse pollution from surface water runoff also contaminates the coastal lakes at Kleinmond and in the Bot River Lagoon.

Estuaries are not only reliant on base flow but also require flood peaks to scour them and maintain their mouth dynamics, therefore any in-channel storage dams can be expected to have a significant impact on any estuary downstream if they are not making the required environmental flow releases. In addition, invasive alien plants severely impact on the flow regime of the Heuningnesvlei and its estuary at De Mond, as well as the Zoetendalsvlei and its associated wetland. These estuaries have not been studied to the same level of detail as the Breede River estuary and no ecological Reserve determinations have been undertaken for them. However some estuary water requirement work has been undertaken on the Palmiet, the Bot, the Klein and the Uilkraals estuaries and estuary management plans have been developed for these estuaries.

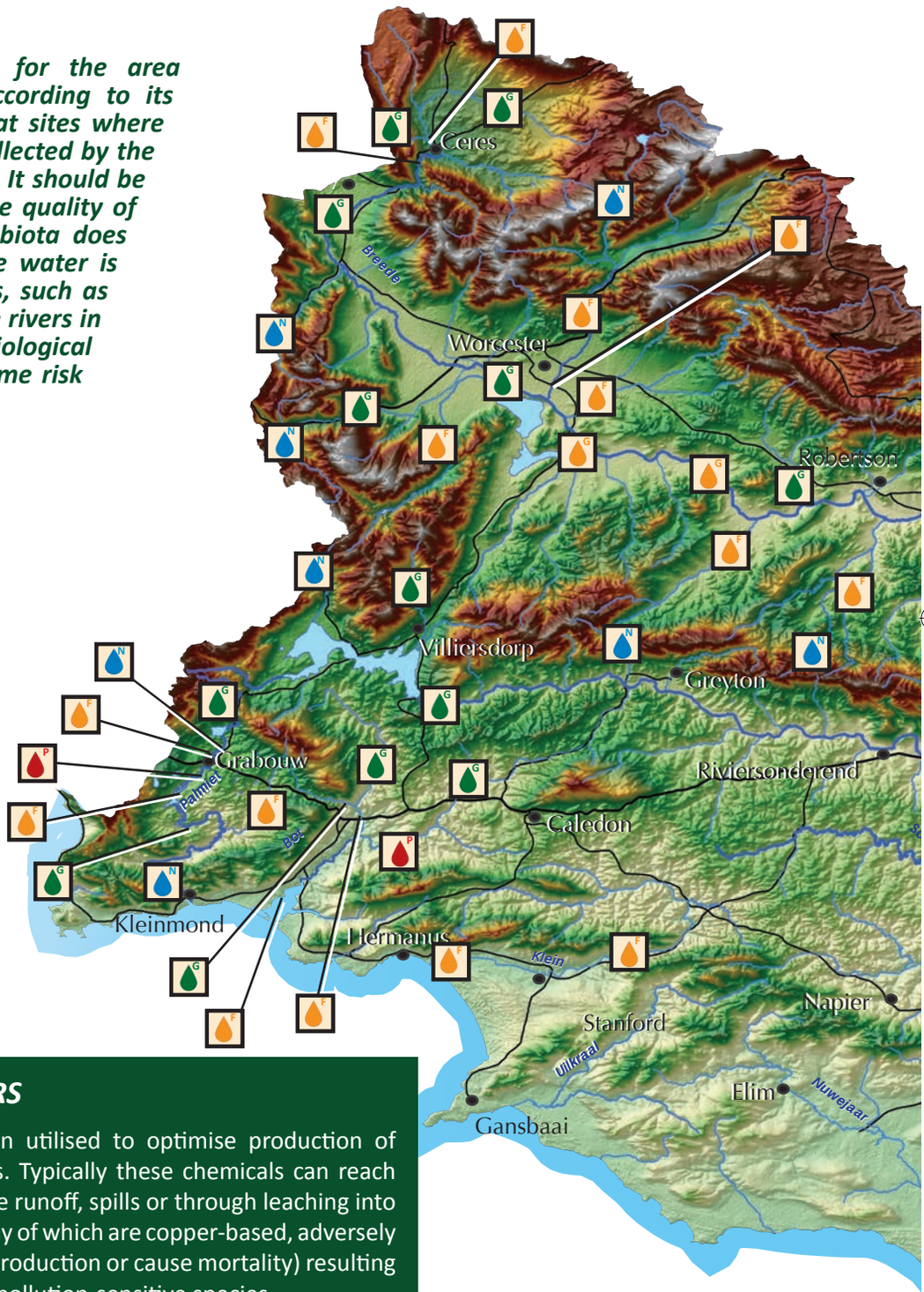
Management Actions

- Develop estuary management plans for priority estuaries such as the Onrus and Palmiet.
- Use existing management plans to guide management of water resources in the catchments of the estuaries.
- Establish estuary management forums to facilitate implementation of the management plans. Forums exist for the Bot, Klein and Breede Estuaries.
- Clarify roles and responsibilities of various implementing agencies undertaking estuary management.
- Integrate estuary management recommendations in catchment management activities.
- Build capacity of catchment managers regarding estuary management issues.


The Klein Lagoon and Estuary

Water Quality

The present water quality for the area is indicated on the map according to its suitability for aquatic biota at sites where water quality samples are collected by the Department of Water Affairs. It should be noted that a suitability of the quality of the river water for aquatic biota does not necessary imply that the water is suitable for other water uses, such as recreational use. Many of the rivers in the area experience microbiological pollution which may pose some risk to human health.



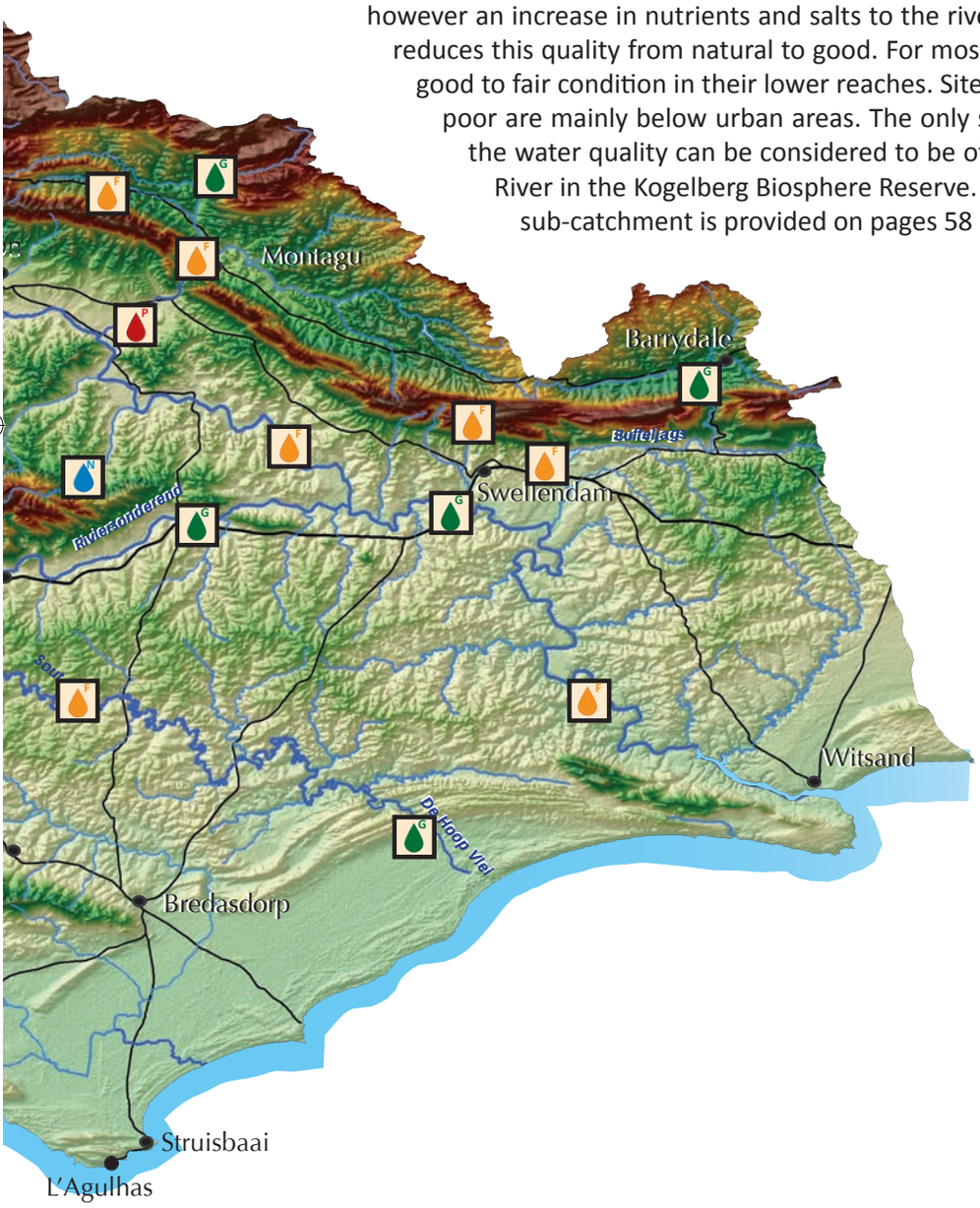
PESTICIDES AND FERTILIZERS

Fertilisers and pesticides are often utilised to optimise production of grapes, deciduous and citrus fruits. Typically these chemicals can reach rivers via vapour/spray drift, surface runoff, spills or through leaching into groundwater. These chemicals, many of which are copper-based, adversely affect aquatic biota (e.g. reduce reproduction or cause mortality) resulting in the disappearance of important pollution-sensitive species.

Environmentally-friendly chemicals, applied appropriately, will reduce the above-mentioned effects. It is also essential that riparian land-owners leave a minimum of a 10 – 20m buffer strip of natural vegetation between the planted crops and the river. This buffer zone protects the river from runoff, spray drift and siltation and plays an important role in maintaining the habitat integrity in the riparian zone.

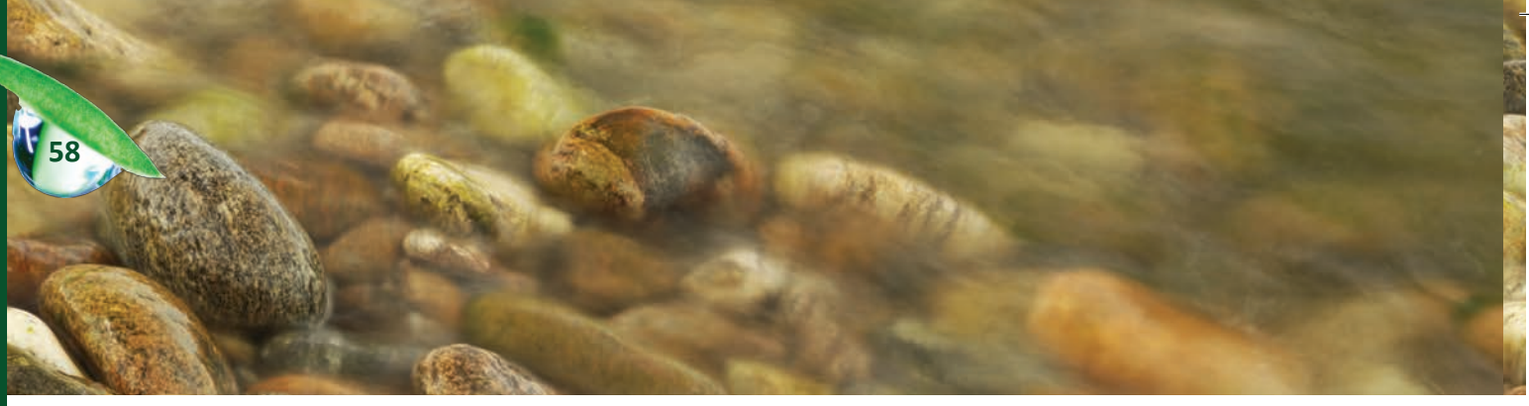
This assessment is based on the phosphate, nitrate/nitrite, ammonia, suspended solids, pH and conductivity concentrations measured in water samples from each sampling site during the period 2005 to 2010. The water quality was assessed specifically in terms of its suitability for aquatic life and does not mean that the water quality indicated on the map has the same level of suitability for the other water users.

Water quality in the upstream sites is still within the target water quality ranges for aquatic life, however an increase in nutrients and salts to the rivers as a result of land use activities quickly reduces this quality from natural to good. For most of the rivers, the water quality is still in a good to fair condition in their lower reaches. Sites where the water quality has degraded to poor are mainly below urban areas. The only sites in the lower reaches of a river where the water quality can be considered to be of a natural water quality are in the Palmiet River in the Kogelberg Biosphere Reserve. A description of the water quality for each sub-catchment is provided on pages 58 and 59.



The following colour-coded icons show the level of suitability of the water quality for aquatic biota

- N — Natural (within Target WQ Range)
- G — Good
- F — Fair
- P — Poor



Water Quality

Upper Breede Sub-catchment

The land-use in the Upper Breede Water Management Area influences the water quality of the sub-catchment. The agricultural activities change from being dominated by orchards and some dryland crops in the Ceres management area to one where vineyards dominate. In response, the water quality in these reaches deteriorates and ranges from a fair to poor modified state as a result of the extensive farming. Total Dissolved Solids concentrations are however still moderately low due to the underlying geology, with concentrations increasing during the winter months. Elevated nitrate concentrations are also recorded in the high flow winter months, peaking in July. These increases in salt and nutrient concentrations are an indication of a wash-off process mobilising salts and nutrients at the start of the winter rainfall in May. Agricultural pesticide concentrations could also be expected to be elevated in these rivers as the area is intensively cultivated.

Central Breede Sub-catchment

As for the Upper Breede Sub-catchment, water quality in this portion of the water management area are a reflection of the land-use. Here urban development also plays an important role. Nutrient enrichment of the river through the addition of nitrogen and phosphorus present in domestic and industrial effluent and from diffuse sources linked to agricultural activities result in occurrence of algal blooms under low flow conditions. In the lower reaches of the Hex River nutrient concentrations are significantly elevated. Phosphorus concentrations in particular are sufficiently high to lead to highly enriched conditions (eutrophic conditions) in the lower reaches of the Nuy, Poesjenels, Kogmanskloof, Riviersonderend and the Huis/Buffeljags Rivers.

Increasing salinity levels (mainly sodium and chloride) are a concern in the Middle and Lower Breede River (for environmental and irrigation requirements). The Central Breede River valley is underlain by shales of marine origin that results in highly saline return flows from irrigation and canal seepage. Freshening releases downstream of Robertson are necessary to maintain acceptable water quality for irrigation.

Downstream of Bonnievale until the confluence with the Riviersonderend River, the water is generally too saline for irrigation. Salinity levels in the Middle Breede River are currently controlled by providing freshening releases from Greater Brandvlei Dam. The salinity level is maintained to achieve an electrical conductivity of less than 70 mS/m for at least 50% of the volume of irrigation water supplied the Zanddrift canal intake (upstream of the confluence of the Breede and Kogmanskloof Rivers). For the remaining 50% of the volume supplied, electrical conductivity is allowed to fluctuate between 70 and 120 mS/m.

Riviersonderend Sub-catchment

Irrigated agriculture in this sub-catchment has limited impact on the salinity of the lower Riviersonderend River and as a result the better quality water from this river is important in diluting the salinity in the Lower Breede River.

Lower Breede Sub-catchment

The lower Breede River is moderately enriched with nutrients (mesotrophic to eutrophic). The salinity levels are also suitable for irrigation and industrial purposes along the entire river, however the Sodium Adsorption Ration is considered unacceptable for irrigation purposes along the entire length of this river. The pH of the water is also occasionally deemed unacceptable for most water uses.

Overberg West Sub-catchment

The quality of the water in the middle to the lower reaches of the Palmiet River has been moderately impacted by urban and agricultural activities in the surrounding catchment, with seasonally elevated nutrient, conductivity and microbiological levels in winter and elevated winter.

Overberg East Sub-catchment

Most of the underlying geology in Overberg East consists of Bokkeveld shales and results in the naturally saline rivers of this sub-catchment. These salinity levels are increased as a result of the surrounding agricultural activities. Water quality is therefore considered to be good in most of the head waters of these rivers but the suitability for use (in particular irrigation) deteriorates as the rivers flow downstream. In this sub-catchment there is insufficient water quality monitoring to assess the situation in any detail. The only monitoring station is at De Hoop Vlei, where salinity on average can be as high as 3 400mg/l and the water is classified as unacceptable for domestic or irrigation use.

Algal growth in the Keisers River

Caring for our Water Resources

Breede Overberg Catchment Management Agency (BOCMA)

The Breede Overberg Catchment Management Agency (BOCMA) was established by the Minister of Water Affairs in July 2005, in terms of the National Water Act (36 of 1998). The Governing Board was appointed in October 2007 and the Catchment Management Agency became operational with the appointment of the Chief Executive Officer and staff in 2008. The Catchment Management Agency is accountable to the Minister, but reports through the Department of Water Affairs. It has a close cooperative relationship with the Department of Water Affairs Western Cape regional office, which is in the process of withdrawing its operational presence in the area and delegating relevant functions to the Agency. The National Water Act (Section 80) provides BOCMA with five initial functions:

- Investigate, and advise interested persons on the protection, use, development, conservation, management and control of the water resources;
- Develop a catchment management strategy (which was initiated in 2010);
- Co-ordinate the related activities of water users, and of water management institutions;
- Promote the co-ordination of the implementation of its catchment management strategy with the implementation of applicable water management and development plans; and
- Promote community participation in its functions.

Additional functions have also been delegated to the Agency in December 2010.

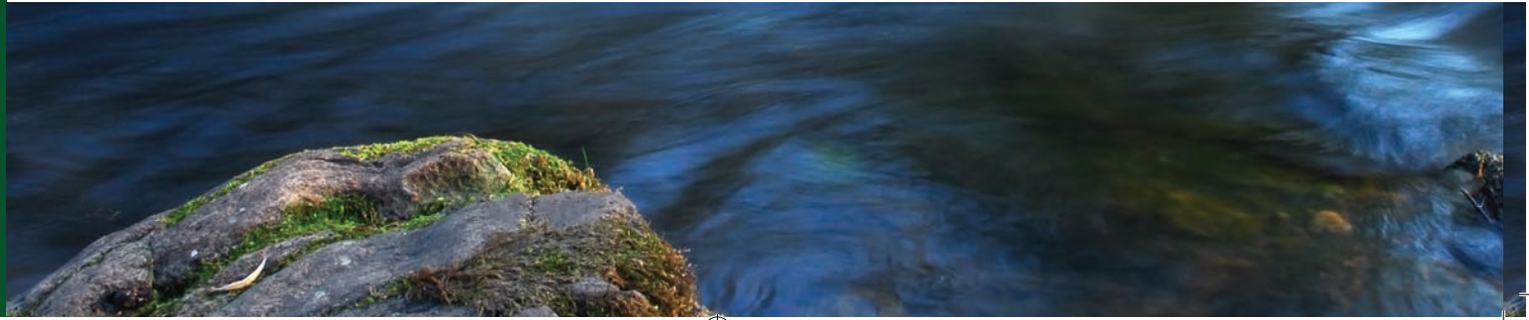
Summary of the Breede-Overberg Catchment Vision

We understand that water will shape the growth and development of the Breede Valley and Overberg region, and that our future is linked to that of Cape Town, the Western Cape and the country as a whole. We also recognise that the way we respond to the challenges and opportunities of change in our natural and social environment, will determine how we live and work together. Then, considering the nature and possibilities of this area, as government and residents we aspire:

- ***To protect the environment that keeps our catchments clean and healthy for people's quality of life and business opportunities;***
- ***To develop agriculture that creates wealth and jobs for our communities, and meets the aspirations of disadvantaged rural people;***
- ***To create opportunities for people and businesses to adapt to our changing world through innovation and technology; and***
- ***To ensure that as our towns and communities grow, our people continue to enjoy improved quality of life and services.***

The Vision for the Breede Overberg water management area is captured by: "Quality water for all forever"

- ***Protecting our rivers, groundwater, wetlands and estuaries in a clean and healthy state, for nature, people and the economy.***
- ***Sharing our available water equitably and efficiently to maintain existing activities, support new development and ensure redress, while adapting to a changing climate and world.***
- ***Cooperating to jointly nurture, take responsibility and comply, so that our water resources are well managed, under the leadership of a strong Breede Overberg Catchment Management Agency.***



Breede River and Estuary Classification and the Reserve

During the Breede River Basin Study in 1999, an intermediate level Reserve determination was undertaken at a total of six sites along the Breede River, Riviersonderend River and their tributaries, as well as the Breede River estuary. Of significance in terms of water availability in the river system for future use was the fact that the Riviersonderend River would require and additional 85 million m^3/a to the existing flow were the river to be improved from its current Class "E" to a recommended Class "D". 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. The following table summarises the environmental flow requirements at selected points in the Water Management Area. The desired state of the estuaries drives the environmental flow requirements of the entire system in these Breede and Overberg Rivers. The estuary requirements include the infrequent floods with return periods in excess of 2 years.

River	Target ecological condition	Natural MAR (Million m^3)	Reserve (Million m^3)	% MAR
Mountain streams	Largely natural	-	-	45% - 50%
Upper Breede	Largely modified	469	117	25%
Central Breede tributaries	Largely modified	-	-	10% - 20%
Central Breede	Moderately to largely modified	1082	415	38%
Breede upstream Riviersonderend	Moderately modified	1188	314	26%
Riviersonderend	Largely modified	450	111	25%
Breede downstream Riviersonderend	Moderately modified	1817	480	26%
Buffeljags	Moderately modified	88	31	35%
Breede upstream estuary	Largely natural to moderately modified	1842	671	36%
Breede Estuary	Largely natural	1785	954	53%*
Overberg Rivers	Moderately modified	-	To be determined	30% - 40%
Palmiet Estuary	Largely natural	97	62	64%
Overberg estuaries	Largely natural	-	To be determined	70% - 80%
Overberg estuaries	Moderately modified	-	To be determined	60% - 70%

The Environmental Water Requirements for most of the water resources in the Breede Water Management Area can be achieved primarily though a combination of water use management and the management of water quality impacts and habitat modification. Improved acquisition and use of monitoring information for aquatic ecosystem health, as well as stream flow and water quality is also required, particularly in the Overberg Rivers. In addition, Reserve determinations are required for most of the Overberg Rivers.

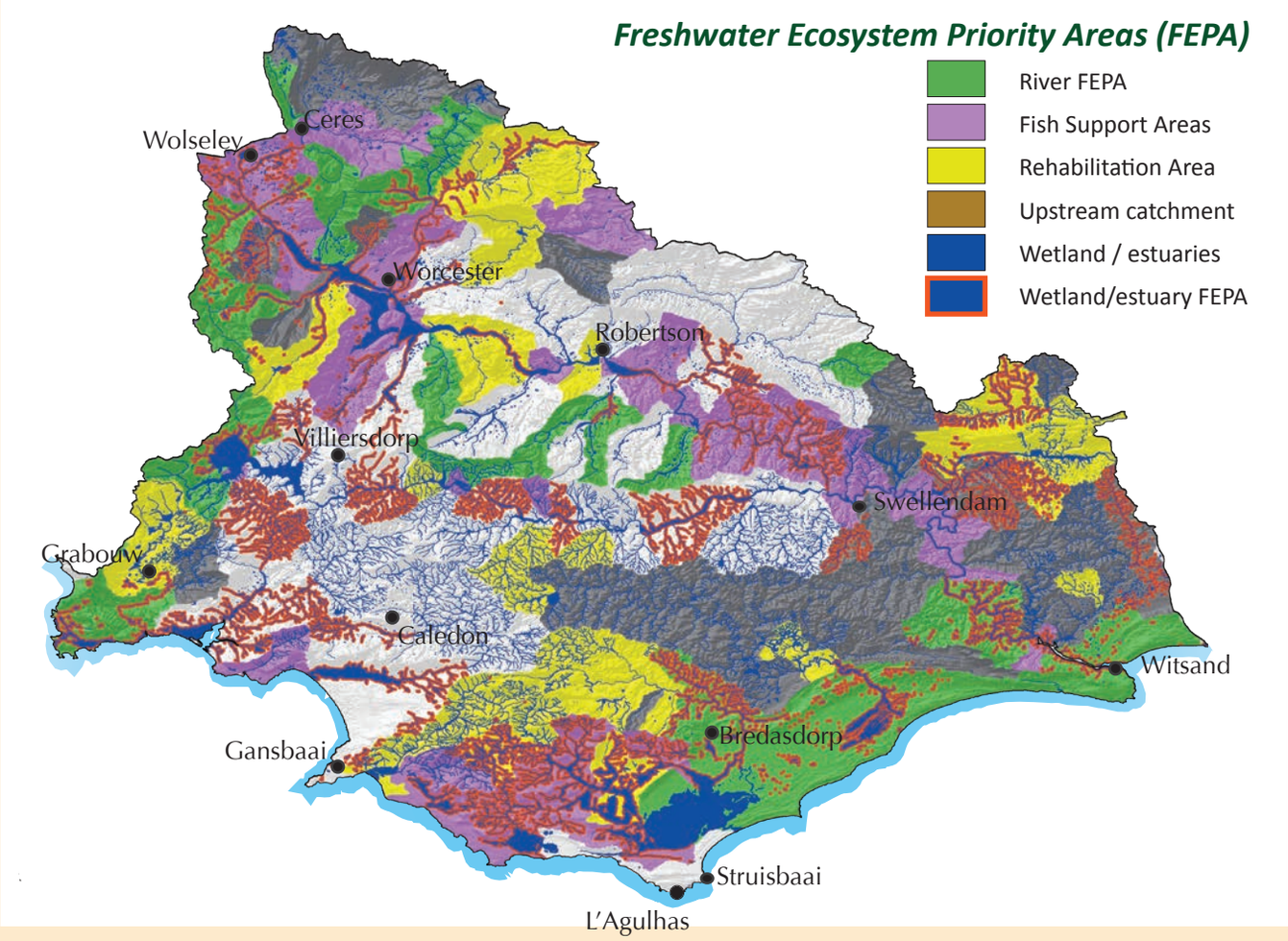
To date, an Ecological Reserve Implementation project has been undertaken under the auspices of C.A.P.E (see page 64) to evaluate the status of implementation of the Ecological Reserves in selected catchments in the Cape Floristic Region. Two of the projects were within the Breede Water Management Area, namely in the lower Palmiet River below the Kogelberg Dam and in the Koekedouw River above Ceres.

The Catchment Management Strategy should provide guidance in terms of the regulatory approach and sequence in which water resource protection measures should be determined, refined and implemented.

Freshwater Ecosystem Priority Areas

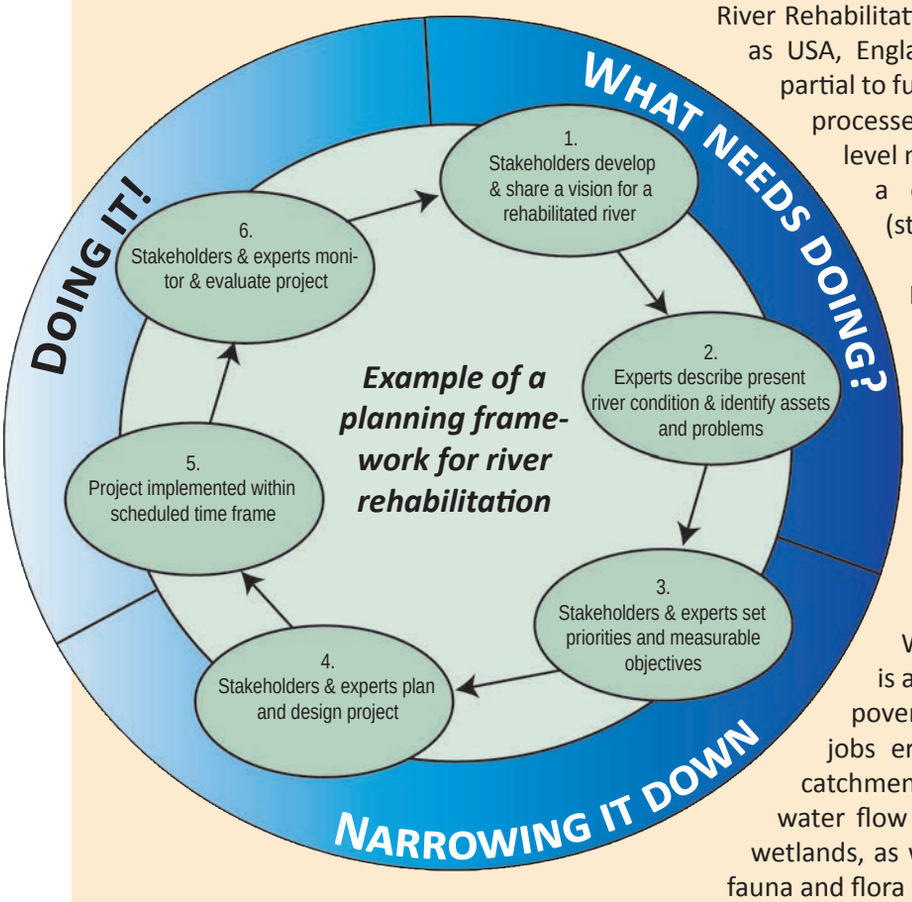
Freshwater Ecosystem Priority Area (FEPA) maps provide guidance on how many rivers, wetlands and estuaries, and which ones, are needed for protecting representative aquatic biodiversity and ecological functioning of South Africa's freshwater ecosystems. In the Breede-Overberg, river FEPAs are the only healthy tributaries remaining in the upper catchments and they support the sustainability of hard-working rivers in the middle and lower Riviersonderend and Breede rivers. Several of the wetland FEPAs also support the sustainability of priority estuaries in the Overberg sub-catchment. FEPA data and guidelines on their use and implementation are available through SANBI's Biodiversity Advisor website (http://bgis.sanbi.org), which provides spatial biodiversity information freely to the public.

This project, initiated in 2008, is a three year partnership project led by the South African National Biodiversity Institute (SANBI) and the Council for Scientific and Industrial Research (CSIR). It aims to identify a national network of freshwater conservation areas and to explore institutional mechanisms for their implementation. One of the NFEPA products that have been produced in collaboration with, amongst others, the South African Institute for Aquatic Biodiversity (SAIAB) and CapeNature, is a map indicating fish sanctuary areas for critical populations of all indigenous fish species in South Africa. Conservation initiatives should include these areas in management plans.



River Rehabilitation

We all live in river catchments, use water and should all take responsibility for looking after rivers. By doing this, we can continue to use and benefit from rivers now and in the future.



River Rehabilitation is common in first world countries such as USA, England and Australia. It is aimed at allowing partial to full recovery of the biodiversity and ecological processes of rivers. Efforts can vary from catchment-level measures (removal of invasive trees invading a catchment) to site-specific interventions (stabilise and vegetate an eroded riverbank).

River rehabilitation cannot however occur in isolation and must be a step by step and integrative process involving river ecologists, engineers, provincial and local authorities, riparian land-owners and other river users (anglers, eco-tourists) towards the gradual improvement of a river.

In South Africa, the national Working for Water and Working for Wetland programmes is a good example of river rehabilitation, where poverty alleviation funding is used to create jobs eradicating invasive alien plants from river catchments. These actions are aimed at increasing water flow and improving water quality in rivers and wetlands, as well as assisting the recovery of indigenous fauna and flora and ecosystem conditions.

Biodiversity Management Plans for Species

The National Environmental Management Biodiversity Act has improved the legal framework for fish conservation by promulgating the Norms and Standards for Biodiversity Management Plans for Species in 2009. These Norms and Standards call for an integrated approach to species conservation whereby stakeholders from government departments, municipalities and private landowners are included through a public participation process. This ensures maximum awareness creation and dissemination of knowledge to non-conservation agencies and aims to align priorities from different stakeholders and sectors.

This also places a legal obligation on implementing agents to ensure that the objectives agreed on in the document are met and monitored through a formal auditing and reporting process. Presently, the only Breede River species for which a plan has been initiated is the Critically Endangered Tradouw redfin that occur in the Tradouw catchment near the town of Barrydale.

Tradouw Gorge near Barrydale

Flora and Fauna

Conservation of Biodiversity in the Breede Water Management Area

Three major vegetation types (Succulent Karoo, Renosterveld and Fynbos) meet in the Breede River valley between Worcester and Ashton and result in an exceptionally high number, of which approximately 400 are unique but highly threatened plants species. However, less than 0.5% of this region enjoys any form of formal protection. The need to conserve this and other unique biodiversity areas within the Cape Floristic Region has sparked a number of initiatives, most of which originated within the Cape Action Plan for People and the Environment (C.A.P.E.) Programme.

C.A.P.E. is an internationally funded initiative aimed at assisting the South African Government to protect the biodiversity of the Cape Floristic Region. C.A.P.E. initiatives in the area include the Agulhas Biodiversity Initiative (see page 48), Fine Scale Planning (where Critical Biodiversity Area Maps have been produced for Hessequa, Witzenberg, Breede Valley and Breede River/Winelands municipalities in the area) and the Biodiversity and Wine Initiative. Other landscape initiatives such as the Kogelberg Biosphere Reserve (page 43) have also contributed to the sustainable management of a mosaic of land uses, where people live and work in harmony with nature and within the natural resource limits of the landscape. Central to this approach is the creation of corridors of continuous natural habitat across the landscape.

The ***Biodiversity and Wine*** Initiative is a partnership programme between the wine industry and conservation sector. Its mandate is to protect natural habitat while encouraging wine producers to farm sustainably. There are approximately 50 members of the initiative in the Breede Water Management Area. Some outstanding examples of this partnership are:

- Weltevrede wine estate near Robertson who has committed a percentage of its River Edge sales for the conservation of the Breede River Yellowwood and the Cape Whitefish; and
- Graham Beck wine estate also near Robertson conserves almost 600 hectares of Breede Sand Fynbos, known habitat for the endangered Riverine Rabbit.


Bontebok

Bontebok

At one time the species D. dorcas must have had a wide and continuous distribution in southern Africa. Through climatic changes at some geological period of time it became split into two populations which, over the intervening ages, have diverged in characters, leading to the recognition of the two subspecies we see today, the endangered Bontebok (***Damaliscus pygargus pygargus***), occurring naturally in the Fynbos and Renosterveld areas of the Western Cape, and the Blesbok (***Damaliscus pygargus phillipsi***) occurring in the highveld.

In the 19th century the bontebok was brought to the brink of extinction by overhunting. In 1926 the remaining bontebok population was estimated to be less than 30 individuals. Due to an initiative by farmers near Swellendam the first Bontebok National Park was proclaimed in 1931 and populated with many the remaining bontebok in the area. Today, the numbers had grown to around 3000 worldwide. Bontebok, nevertheless, remain the least common antelope in the Southern African Subregion.

Bontebok National Park is the smallest in South Africa but has the highest density of rare and endangered bird life, fynbos species and animal life.

Dragonflies and Damselflies


Dark Dropwing dragonfly


Small Scarlet dragonfly

Dragonflies and damselflies form two sub-orders of the Odonata order of insects (which translates as 'toothed jaws'). Odonata are one of the oldest flying creatures known, with recently discovered fossils dating back to 300 million years. Generally speaking, dragonflies are the larger of the two and prey on airborne insects of various types, which are caught by clasping their legs together to form a 'basket'. Damselflies on the other hand are more dainty and can be seen plucking small insects from the leaves of waterside plants.

All dragonflies and damselflies as larvae/nymphs are aquatic for the first part of their lives. The nymphs of the larger dragonflies spend up to four years among the mud and water weeds of ditches, ponds and the river, feeding on other aquatic insects, fish fry and tadpoles. At this stage prey is caught by an extendable mouthpart known as a mask, which is capable of snatching prey as large as small fish and tadpoles. The adult emerges from the nymph after crawling from the water on reeds and other aquatic vegetation.

Approximately 17 dragonfly and 67 damselfly species are known to occur in South Africa, of which 11 dragonfly and 15 to 20 damselfly species occur within the Breede Water Management Area. The dragonfly is the official symbol of the River Health Programme.

Blue Cranes

The Blue Crane (*Anthropoides paradisea)* is South Africa's national bird and is currently listed globally and nationally as 'vulnerable' due to the decline in population numbers over the last few decades. The species naturally only occurred in the grassland areas in the eastern and northern parts of the country. These areas have been subjected to huge habitat changes due to the establishment of plantations with exotic timber species, agriculture and urbanisation, which ultimately together with other anthropogenic impacts (incidental poisoning), caused the decline of the species. The Blue Crane has, however, adapted to the man-made 'grasslands' of the Overberg and Swartland wheat areas, where the small grain crops and dry-land pastures form ideal grassland substitutes.


Blue Crane

The Blue Crane was rare to the Overberg before the 1980s but due to large scale creation of Blue Crane friendly habitat, namely pastures, the area now represents a stronghold for the remaining population. Currently close to 50% of the existing Blue Crane population resides in the Western Cape with the majority (nearly 40%) occurring in the Overberg region. It is unlikely that these birds moved southwards from their natural distribution ranges, but have stemmed from a small local population that used to survive along the edges of many pans occurring in the Overberg area. The local farming community joined forces with CapeNature in 1991 and launched the Overberg Crane Group.


Berg-Breede Whitefish


Breede River redfin


Barrydale redfin


Moony

Fish of the Breede River System

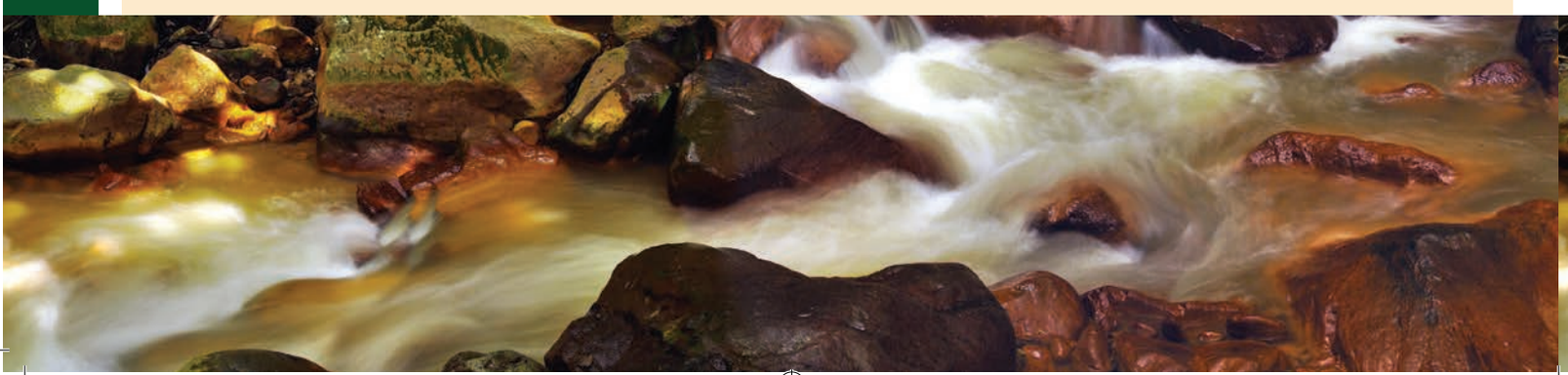
The Breede River is home to a unique indigenous fish fauna and the system has four recognised primary freshwater fish species. These are the Berg-Breede whitefish, Burchell's redfin, Cape Galaxias and the Cape kurper. The longfin eel are also known to occur in the Breede system along with some estuarine dependent species, primarily the freshwater mullet, the estuarine round-herring and the oval moony.

Ongoing genetic and morphological work indicates that the freshwater fishes of the Breede Water Management Area are more diverse than originally believed and that the area is home to a number of unique lineages. In a study of the phylogenetic relationships of South African redfin species it was shown that Burchell's redfin that occur in the Breede and associated river systems is a species complex consisting of three genetically distinct lineages.

The most widespread of these lineages occur in the greater part of the Breede, Duiwenhoks and Goukou river systems Breede redfin, with the more restricted ones occurring in the Heuningnes River system on the Agulhas Plain (Heuningnes redfin) and the Tradouw catchment (part of the lower section of the Breede River system) (Tradouw redfin). Research is ongoing which shows that the Cape galaxias and Cape kurper are also species complexes. A new redfin has just been discovered by SAIAB staff in the Breede River System, which is the largest redfin species discovered to date.

Conservation Status of indigenous fish in the Breede-Overberg Rivers

As a result of ongoing threats and new scientific evidence, several primary freshwater fishes have been listed by the International Union for the Conservation of Nature (IUCN) as being of conservation concern, namely Tradouw redfin (Critically Endangered), Heuningnes redfin (Critically Endangered), Breede redfin (Near Threatened), Berg-Breede whitefish (Endangered), Cape galaxias (Data Deficient) and the Cape kurper (Data Deficient). The Berg-Breede river whitefish, a once abundant species in the main stream Breede River is today almost extinct in the river and this species now occurs mainly in large public dams such as Greater Brandvlei Dam. The Cape Galaxias and Cape kurper were both assessed as Data Deficient, due to the recognition that further research needs to be done to describe the species before a realistic assessment of conservation status can be done.



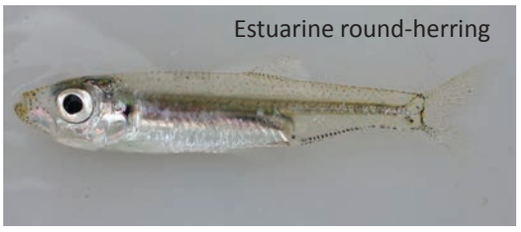
Fish of the Overberg Region

Unique indigenous fishes of the Overberg rivers consist of three primary freshwater fish species, Cape Galaxias, Cape kurper and Burchell's redfin. As for the Breede River system, the longfin eel and some estuarine dependent species, primarily the freshwater mullet, also occurs in the Overberg rivers.

Genetic research has indicated that the Overberg rivers are also home to a unique lineage of redfin minnow, know as the Heuningnes redfin, which is distinct from other lineages in the Burchell's redfin species complex. According to the latest International Union for the Conservation of Nature (IUCN) species assessment, the Heuningnes redfin is Critically Endangered due to the very limited natural distribution range and the severity of the threats facing this species. Current genetic research indicates, as with the Breede River, Cape galaxias and Cape kurper are also a species complexes with unique species that are restricted to the Overberg area. In several rivers, different species of galaxias occur together in this area.


Cape galaxia


Cape kurper

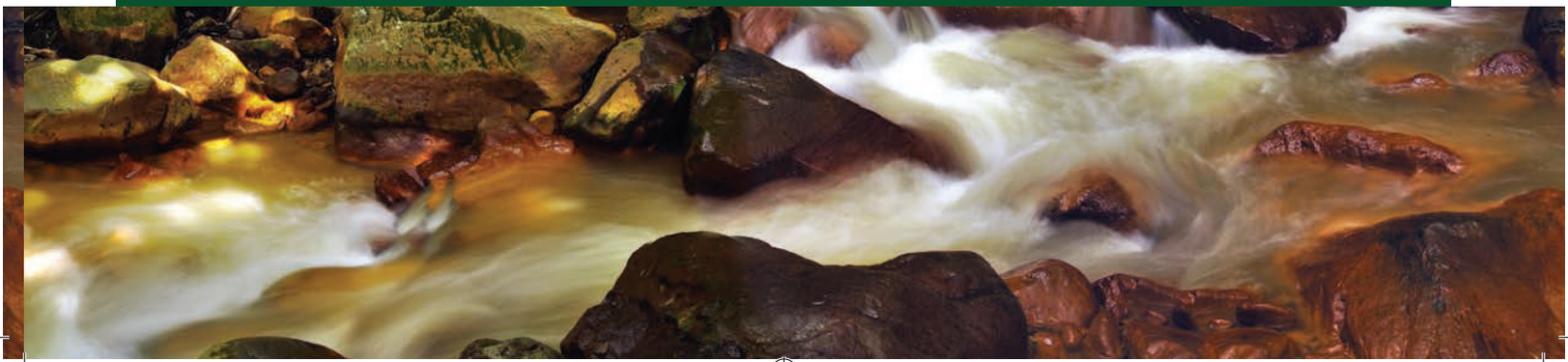

Estuarine round-herring

Threats to indigenous fish

The distribution ranges of all indigenous species are fragmented and have been dramatically reduced by a number of threats. The array of ecological threats in the Breede River and its tributaries is not unique and is typical of many Western Cape rivers.

Physical threats to indigenous fish include water abstraction, habitat modification due to bulldozing and removal of riparian vegetation and diffuse and point-source pollution. Biological threats to indigenous fish include the spread of alien invasive vegetation, as this can affect the integrity of river banks; and the presence of alien fish, as these can displace indigenous species due predation and competition pressure. Particularly the threat of alien invasive fishes has led to the Heuningnes redfin being assessed as Critically Endangered by the IUCN. However, it is already clear that several unique freshwater fishes of the Overberg will be listed in threatened categories of the IUCN.


Streambed modification at Montagu



Alien Flora and Fauna

Invasive Alien fish

The greatest threat to the indigenous fish of the Cape Floristic Region, which includes the Breede Water Management Area, is invasive alien fish. They are the prime reason why several indigenous fish species, especially small species (e.g. Barrydale redfin, Heuningnes redfin) are now restricted to tiny areas where alien fish are absent. Research by the University of Cape Town's Freshwater Research Unit has confirmed that the loss of indigenous fishes in areas dominated by alien fish, has resulted in substantial changes in the structure and functioning of aquatic food webs.

Species	Scientific name	When introduced	Legal introduction?	Impact on indigenous biota
Banded tilapia	Tilapia sparrmani	About 1960	yes	Competitor
Bluegill sunfish	Lepomis macrochirus	About 1940	yes	Predator and competitor
Brown trout	Salmo trutta	About 1890	yes	Predator
Carp	Cyprinus carpio	About 1910	yes	Competitor, degrades habitat
Largemouth bass	Micropterus salmoides	About 1930	yes	Predator
Mosquitofish	Gambusia affinis	About 1950	yes	Competitor
Mozambique tilapia	Oreochromis mossambicus	About 1970	yes	Competitor
Rainbow trout	Oncorhynchus mykiss	About 1900	yes	Predator
Sharptooth catfish	Clarias gariepinus	About 2000	no	Predator and competitor
Smallmouth bass	Micropterus dolomieu	About 1940	yes	Predator
Spotted bass	Micropterus punctalatus	About 1940	yes	Predator
Tench	Tinca tinca	About 1920	yes	Competitor


Banded tilapia


Largemouth bass


Rainbow trout


Carp

Fish may not be stocked into dams and rivers without permits from CapeNature, yet many waters continue to be stocked illegally by the public without permission, which has seen a huge increase in the distribution of the large and hardy sharptooth catfish in the last 10 years.

The alien fish now form the mainstay of a significant recreational angling industry, with provincial and national competitions held at Greater Brandvlei and Theewaterskloof dams. The Worcester Tourism Board is establishing an angling route for the middle Breede River region. Significantly, the most important areas for alien fishes (angling and fish farming) have been identified through the National Environmental Management Biodiversity Act of 2004 as areas to be protected.

In addition, river areas that are priorities for indigenous fish rehabilitation have been identified at a national level, including several rivers in the Breede Water Management Area (e.g. Huis River and lower Witte River). None of these are notable angling waters for the alien species present. Alien fish will be removed from these waters over time to help save highly threatened indigenous fish species.

Alien fish control programmes will be carried out in river reaches identified as priorities for rehabilitation and will be led by CapeNature. These programmes will be subject to risk assessments and will undergo a consultation process with key stakeholders before removal programmes are initiated.

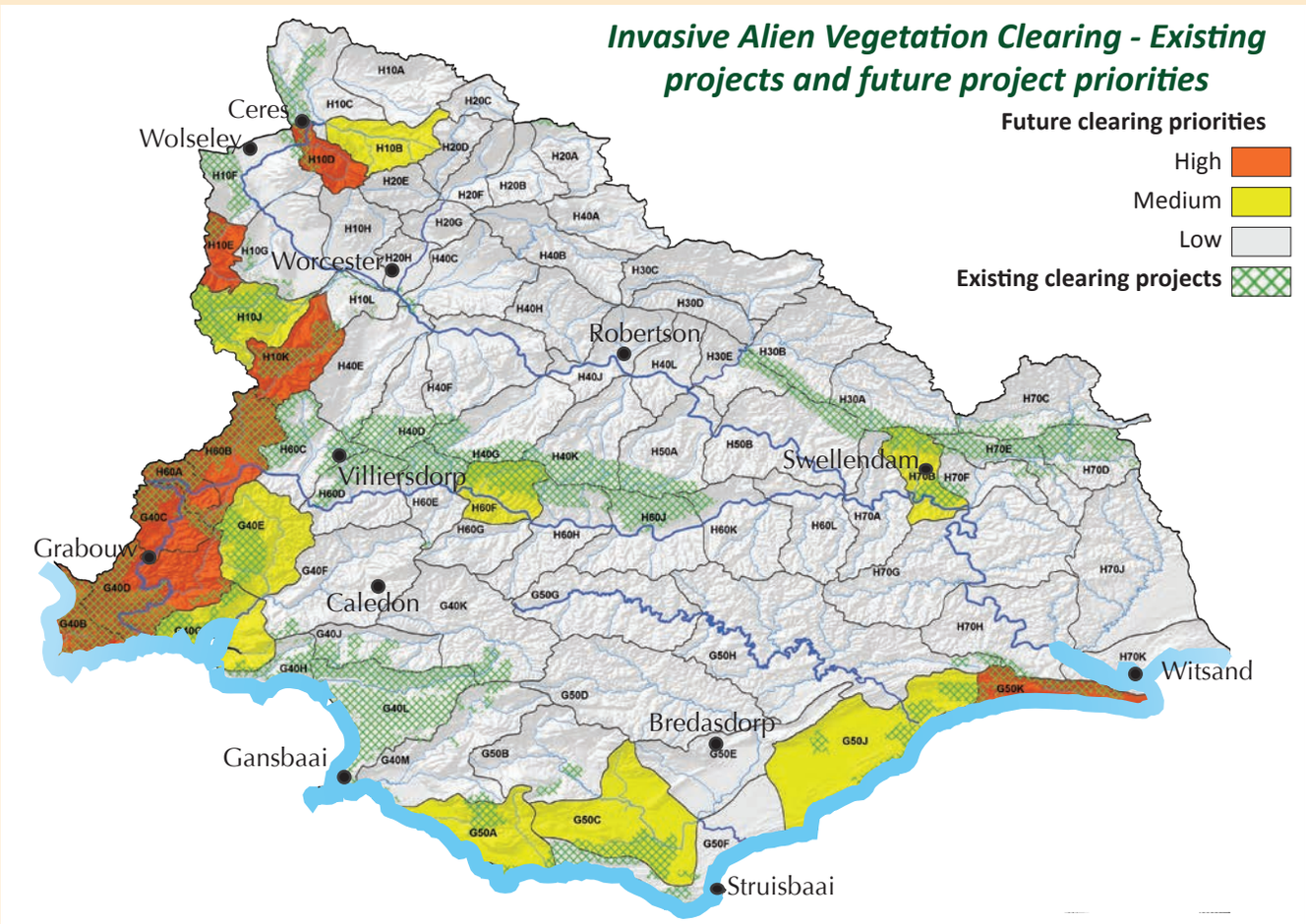
Alien vegetation management

Studies in the Breede-Overberg Water Management Area have shown that there is considerable water loss from river systems by invasive alien plants. Indications are that further substantial losses in river flow, particularly during the low flow season, are likely should the increased spread and densification of invasive alien plants not be actively and timeously prevented.

The Working for Water Programme is actively clearing alien invasive trees from priority areas in the water management area (see map below). Invasive alien plant removal priorities in the Breede Catchment are Witels, Witte, Holsloot, Du Toits, Riviersonderend above Theewaterskloof Dam, while invasive alien plant removal priorities in the Overberg catchments are Buffels (Betty's Bay area), Palmiet and Klipdrifsfontein (De Hoop Reserve).

Rehabilitation of several rivers (see page 63) in the area is possible and should be explored. For most of the rivers, rehabilitation requires alien plant clearing and rehabilitation of riparian zones. Rivers with such rehabilitation potential include:

- Eastern tributaries of the Breede comprising the upper Buffeljags, Tradouw and Grootvadersbosch rivers; Maandagsout and Droogas tributaries of Riviersonderend. The Buffeljags and Suurbraak rivers just upstream of Grootvadersbosch are adjacent to CapeNature protected areas so there is a good opportunity for a rehabilitation programme to be established with agreements between CapeNature and landowners;
- Nuwejaars river that supports the Heuningnes River and Estuary; and
- Sout River just upstream of De Hoop Vlei and feeding De Hoop Estuary.



Glossary

Alien species are fauna and flora introduced intentionally or by accident from other countries.

Aquatic biota is the community of plants and animals that live in rivers and wetlands.

Biodiversity is the variety and variability of living organisms and their ecological complexes.

Buffer zone is a strip on the outer edge of the riparian zone, which is required to protect the habitat and the water resource.

Ecological importance is the diversity, rarity or uniqueness of habitats and biota and the importance of protecting these ecological attributes.

Ecological sensitivity is the ability of a specific ecosystem to tolerate disturbances and to recover from certain impacts.

Ecological water requirements are the quality and quantity of water needed to maintain a river in a pre-determined state of health.

Endemic species is a species which is only found in a given region or location and nowhere else in the world.

Environmental flow / ecological Reserve releases are the quantity and variability of water released from impoundments to ensure long-term maintenance and conservation of riparian vegetation and to ensure sustainable resource utilisation.

Ephemeral rivers have intermittent or periodic flow.

Fauna is the collective term for animals living in a particular area.

Flora is the collective term for plants growing in a particular area.

Goods and services refer to the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfil human life.

Gross Domestic Product is the total market value of all final goods and services produced in a country for a given period.

Indigenous species are the fauna and flora occurring naturally in an area.

Instream refers to “within the river channel”.

Mean Annual Evaporation is the average evaporation over a year.

Mean Annual Precipitation is the average rainfall (including snow, hail and fog condensation) over a year.

Mean Annual Runoff is the average yearly available stream flow at a point in the river which has been calculated over a long period of time (usually 50 years or more), assuming a constant level of development.

Ramsar sites are wetlands of international importance. The Ramsar Convention on Wetlands provides a framework for national action and international co-operation for the conservation and wise use of wetlands and their resources.

Recharge is the process where water is added to an aquifer, for example, from rainfall.

Red Data species are plants or animals that are under threat. The Red Data categorisation of species helps to determine their conservation status. The categorisation follows the IUCN guidelines and includes categories such as extinct, endangered, vulnerable and rare.

Reserve is the quality and quantity of water that is required to provide for basic humans needs and to protect the aquatic ecosystems of a water resource.

Riparian habitat refers to the habitat on the river bank.

Riparian zone is the area adjacent to a river or water body that forms part of the river ecosystem.

Runoff is water that is not absorbed by the soil and flows to lower ground, eventually draining into a stream, river or other water body.

Further Reading

BOCMA. (2010). *Draft Catchment Management Strategy.* Worcester.

Bromilow, C. (2010). *Problem plants and Invasive weeds of South Africa.* Briza Publications, Pretoria

CapeNature. *Technical reports for the Overberg and Breede Rivers*. Jonkershoek.

CSIR. (2000). *Guidelines for indigenous vegetation restoration following invasion by alien plants.*

Du Preez, L. and Carruthers. (2009). *A complete Guide to the frogs of Southern Africa.* Struik Nature, Cape Town.

Davies, B. and Day, J. (1998). *Vanishing waters*. UCT Press, Cape Town.

Department of Water Affairs and Forestry. (1996). *South African Water Quality Guidelines*. First Edition. Pretoria.

Department Of Water Affairs and Forestry (2004). *Breede River Basin Study.* Reports and GIS Data. Directorate of National Water Resource Planning, Pretoria.

Department of Water Affairs and Forestry (2004). *Breede Water Management Area: Internal Strategic Perspective.* Directorate Water Resource Planning. Pretoria.

Department of Water Affairs and Forestry. (2005). *Breede River Ecological Water Requirements Study. Riverine RDM Report.* Pretoria.

Gerber, A. and Gabriel, M.J.M. (2002). *Aquatic Invertebrates of South African Rivers. Field Guide and Illustrations*. Department of Water Affairs and Forestry, Pretoria.

Impson, N.D., Bills, I.R. and Cambray, J.A. (2000). *Freshwater Fishes*. *Western Cape State of Biodiversity 2000.* CapeNature. Cape Town.

Skelton, P.H. (1993). *Freshwater Fishes of Southern Africa*. Southern Book Publishers, Halfway House.

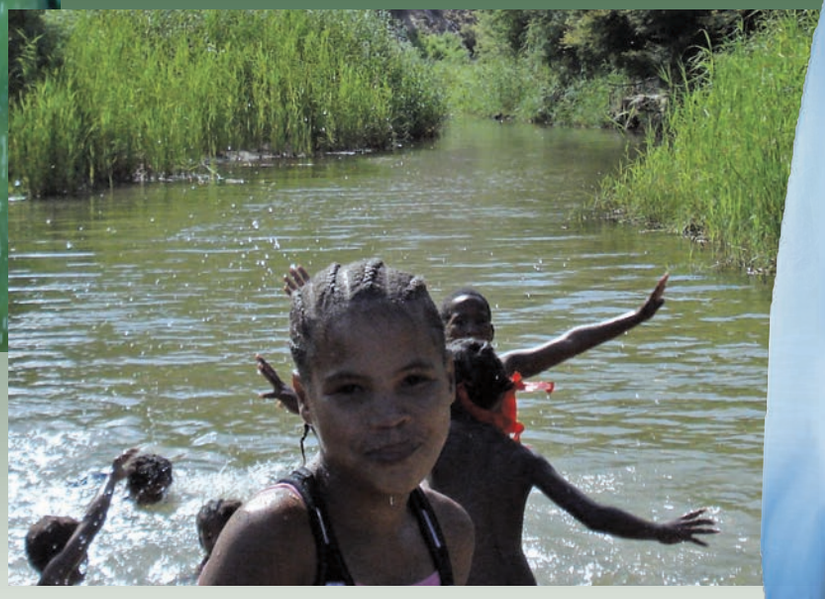
Scott, M & A. (2001). *The Overberg Explorer*, 2nd Edition. Overberg Conservation Services, Gansbaai.

SSI. (2011). *The Breede River Estuary Management Plan.* A project for CapeNature.

Turpie JK and Clark BM (2007). *Development of a Conservation Plan for temperate South African estuaries on the basis of biodiversity importance, ecosystem health and economic costs and benefits.* Report submitted to C.A.P.E.

Web pages to explore are:

River Health Programme: www.dwa.gov.za/iwqs/rhp/index
Department of Water Affairs: www.dwa.gov.za
C.A.P.E.: www.capeaction.org.za
CapeNature: www.capenature.org.za
Department of Environmental Affairs: www.environment.gov.za
Dams and rivers of South Africa: www.eWISA.co.za
South African National Parks: www.sanparks.org
Water Research Commission: www.wrc.org.za
Working for Water: www.dwaf.gov.za/wfw



water affairs

Department:
Water Affairs
REPUBLIC OF SOUTH AFRICA

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

Water Research Commission

CapeNature