MGENI CATCHMENT MANAGEMENT PLAN

A Framework for an Integrated Water Management Plan for the Mgeni Catchment

Department of Water Affairs and Forestry

UMGENI WATER · AMANZI

PREFACE by the Minister of Water Affairs and Forestry

The management of water in any country is a major undertaking. Its management in a semi-arid, semi-industrialised, multi-cultural country where more than 12 million people do not have access to an adequate supply of potable water, becomes a daunting task.

In order to accomplish this task my Department has, as the custodian of the nation's water resources, and in concurrence with international trends, decided to manage this strategic resource on a river basin or catchment basis. Such an integrated catchment management approach which allows water and associated land resources to be managed in such a way that the water remains fit for use for the various present and future users and the health of the water environment is a principle for the development of the new Water Law for the country. According to this principle, the responsibility for the development, apportionment and management of the available water resources are delegated, where possible, to a catchment level. Integral to this approach, various opportunities are provided for the users of water and the impacters on the water resources, to participate in, and contribute to, decision making processes on water resources.

This document is a product of the first phase of a joint project between my Department and Umgeni Water for the management of the Mgeni Catchment. A proposed management plan in which all water problems, relating to both the quality and the quantity of the water, and proposed plans of action to address the problems, has been put on the table. The proposed plan could only be compiled after extensive investigations took place to understand the area, its components and the interactions and interdependencies between these components. Where possible, these investigations included consultation with interest groups through workshops held in various areas.

With the help and commitment and through the participation of all roleplayers, this plan now needs to be reviewed, approved and implemented. I look forward to this collaboration to improve the quality of life in the Mgeni through managing our water resources effectively and efficiently.

Kader Asmal

Prof. Kader Asmal, MP
Minister of Water Affairs and Forestry

PREFACE by the Chief Executive Officer of Umgeni Water

Increasing water demands, reductions in water yield and deteriorating water quality are amongst the most pressing environmental issues facing the people of South Africa. These issues are a symptom of the failure of traditional water resource management approaches. It is no longer acceptable to manage water independently of natural catchment boundaries or as if it were an entity separate from other natural resources.

Water resource managers may currently be failing to provide water in the most cost-effective manner because poor land management practices are imparting a hidden cost to the environment and thereafter to those that rely on water for well-being. It is increasingly important to adopt a holistic approach to water management since it is only by actively managing the causes of these problems and developing appropriate preventative mechanisms that the resource can be assured for future generations. This approach, known as Integrated Catchment Management, is one of Umgeni Water's key strategic objectives. To this end, the organisation has developed considerable expertise in water resources planning, water quality management, pollution prevention, environmental management and environmental education.

The Mgeni Catchment Management Plan embodies the principles of Integrated Catchment Management as they might be applied in order to achieve sustainable water resources management. The plan relies heavily on a partnership between government, industry, farmers and civil society. The needs and aspirations of the various user groups are key considerations in the establishment of targets for water quality and yield . This is ensured by enlisting the support and active involvement of water users both in the development and implementation of the plan.

At the time of writing, all indications are that Integrated Catchment Management principles will be the cornerstone of the ongoing Water Law Review. Institutional arrangements are being finalized and will be a crucial factor in determining the degree to which sustainable water resource management is achieved in South Africa. There is a critical need for authorities to overcome reactive, fragmented management which will necessitate prioritizing problems, focusing efforts, improving communication, coordination and enforcement. We believe that Water Boards, as second tier water management agencies, have an important role to play in providing the skilled manpower, finance and local knowledge to support the Department of Water Affairs and Forestry to manage our water resources wisely.

Support the Department of Water Affairs and Forestry and Umgeni Water, and join our partnership as we strive to realize our vision for the Mgeni Catchment together.

B Walford
Chief Executive Officer

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MGENI CATCHMENT MANAGEMENT PLAN

OVERVIEW

The Mgeni River catchment is one of the most developed catchments in South Africa, providing water to over 3.5 million people and supporting an area which is responsible for about 65% of the total economic production in the KwaZulu-Natal Province. Unfortunately this extensive development has stressed the natural resources of the Mgeni River catchment with serious consequences:

- people are getting sick and dying from using contaminated water;
- costly infrastructure has to be developed to import water from neighbouring catchments;
- the costs of treating water are increasing, due to pollution;
- and the ecological health and resource quality of the catchment is deteriorating.

The Department of Water Affairs and Forestry and Umgeni Water jointly initiated and funded a catchment management plan study for the Mgeni River catchment. The objective of the plan is to mitigate existing problems and prevent further deterioration in the catchment, enable the water resources to be sustainably managed and to provide sufficient water of adequate quality to meet basic needs while supporting economic development and maintaining the healthy functioning of the natural environment. This follows the international trend towards Integrated Catchment Management (ICM), based on a holistic approach to managing resource use and human activity in river catchments.

This study has identified the following issues that require urgent management:

- faecal contamination from urban areas and peri-urban settlements, which are expanding;
- excessive algal growth in Nagle and Inanda dams caused by increasing nutrient loads;
- reduced water availability due to alien vegetation, afforestation and irrigation use;
- increasing water demands to supply a growing population with inefficient water use;
- flood damage and deaths in Pietermaritzburg and Durban, exacerbated by uncontrolled urbanisation;
- soil loss and sedimentation from commercial crop lands and dense rural settlements;
- degraded river health due to bank destabilisation, decreased river flows and pollution associated with urbanisation and agricultural production.

Unless these problems are managed throughout the Mgeni catchment, they will worsen with the increasing population growth (2% per annum) and urbanisation and more intensive industrial and agricultural production predicted in the catchment over the next 30 years.

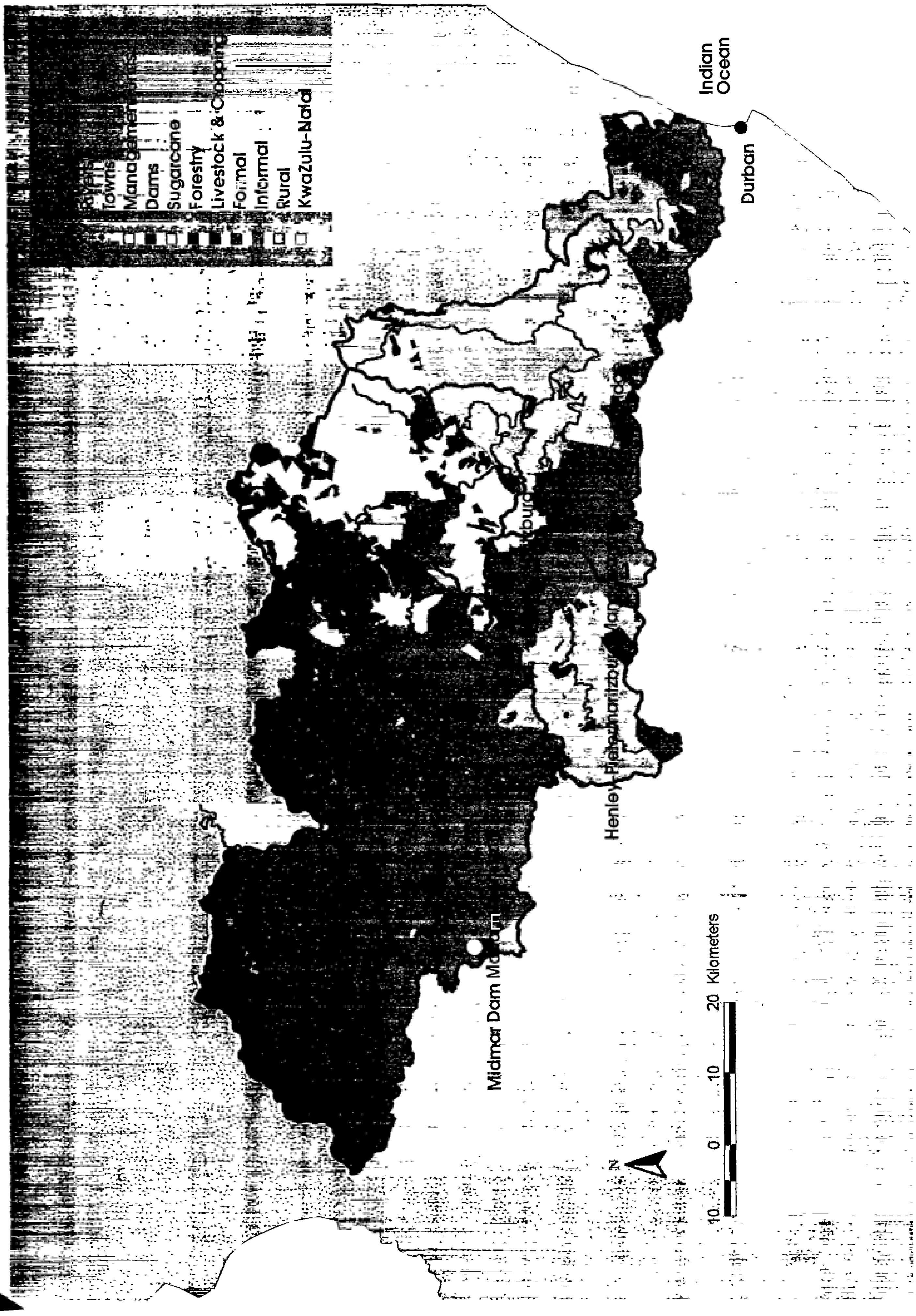
The Mgeni Catchment has been divided into the six sub-catchment based Management Units indicated in the following Map, based on the dominant types of problems, water use and sub-catchment characteristics. Preliminary objectives were developed for the critical problems in each of these Units, to indicate the desired goals for management. Potential management strategies, with probable responsibility and acceptability, were identified to achieve these objectives. This forms the basis of the Catchment Management Plan.

These strategies provide the framework within which individual actions should be developed by the responsible parties. The combination of all these actions will be combined into an Action Plan for Implementation.

An Mgeni Catchment Management Steering Committee representing government and private sector stakeholders should be established to coordinate the implementation of the Management Plan on an integrated catchment wide basis. Stakeholder Forums should be established in each of the management units, which are responsible for the development and implementation of the Action Plans in the different units. These groups should be supported by a secretariat with adequate human and financial resources.

Initially, the Management Plan should be implemented in the Midmar Dam Management Unit, and the Henley-Pietermaritzburg Management Unit, taking advantage of current initiatives in these areas.

Overview of the Mgeni River catchment



MGENI CATCHMENT MANAGEMENT PLAN
An Integrated Water Management Plan for the Mgeni Catchment

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WHY CATCHMENT MANAGEMENT?

The Mgeni River is the lifeblood of the Pietermaritzburg-Durban corridor, supporting about 40% of the population and 65% of the economic production in KwaZulu-Natal. Even during non-drought periods, the demand is fast approaching the water available in the Mgeni River, and the deteriorating quality of that water is already below the requirements of users in parts of the catchment. Consider the following:

- Every year people die, health care costs are significantly increased and many work days are lost due to water borne diseases affecting people who depend upon streams and rivers for domestic purposes or recreation.
- Excessive algal growth in Nagle and Inanda dams increases the water purification costs for household and industrial use substantially. Further deterioration in water quality will result in a significant increase in future treatment costs.
- Evaporation by forest plantations, dryland crops and irrigated areas has reduced the total water available in the catchment by 20%, which is equivalent to the increase in bulk water demand until the year 2010.
- Unless efforts are made to reduce bulk distribution system water losses or increase water use efficiency by domestic and industrial water users, the dams and diversion pipelines required to meet the 2010 demand will cost about R 750 million, resulting in substantially increased water tariffs in the next 15 years.
- Flooding of the informal settlements and urban areas in and around Pietermaritzburg and Durban has caused hundreds of deaths and millions of rands damage in the last 10 years.
- A quarter of a million tonnes of topsoil are lost per year from the Inanda dam catchment alone, reducing the agricultural productivity, reducing the storage capacity of Inanda dam and increasing the filtration requirements of purification for bulk water users.
- Many of the streams and rivers are so choked by alien plants or have been so modified, regulated or polluted that they no longer function as healthy ecosystems, which reduces their recreational quality and ability to provide adequate clean water.
- These conditions will only deteriorate, resulting in greater costs and negative health impacts for inhabitants of the Mgeni River catchment area, unless something is done to reverse the trend.

The Department of Water Affairs and Forestry (DWAF), as the national custodian of South Africa's water resources, and Umgeni Water, as their agents in the Mgeni River catchment, have initiated a Catchment Management Plan which aims to ensure sufficient water of adequate quality for all current and future water users. For this Plan to be a success, all inhabitants of the region must take an active role in managing our precious resources.

Read about the Mgeni Catchment Management Plan in this document, learn how you can make a difference and take ownership of it for the sake of future generations!

Objective of the Mgeni Catchment Management Plan

As custodian of the water resources in South Africa, the Department of Water Affairs and Forestry (DWAF) is responsible for providing sufficient water quantity to meet demands, while maintaining the water quality fit-for-use, for all recognised users. Furthermore, the water resources must be managed to maintain the healthy ecological functioning of the aquatic environment, because this is the resource base upon which all other water users depend, as well as providing for the assimilation of wastes. The DWAF has adopted a comprehensive catchment management approach as the means of achieving this goal.

Umgeni Water has been appointed as water manager and service provider in the Mgeni River catchment, as agents of the DWAF. Together in 1993 they initiated the Mgeni Catchment Management Plan (MCMP).

The objective of the MCMP is to ensure water is managed in a sustainable way to provide sufficient water which is fit-for-use for all recognised users, thereby satisfying basic human needs and supporting economic development, while maintaining resource quality and ecological health.

This document provides information about water resource problems in the Mgeni River catchment, the proposed management objectives and strategies that need to be adopted to address these problems and the responsibilities of all interested and affected parties within the region. It is thus a Management Plan to facilitate the implementation of integrated management of the water resources of the Mgeni River catchment.

Implementation of this plan provides the platform for Integrated Catchment Management (ICM) to attain the holistic and sustainable management of socio-economic development and resource utilisation in the Mgeni River catchment, supporting national, provincial and regional growth and development plans.

Background to the MCMP study

The increasing and often conflicting demands in the Mgeni Catchment necessitate effective water resource planning and management. The Mgeni Catchment Management Plan study was undertaken to develop an affordable, and practically implementable management framework to ensure sustainable water quality for future generations. Initially, water quality issues were emphasised, because a comprehensive water quantity study had been completed in 1994, but the results of all these studies have been synthesised in this plan.

While a management plan for water resources in the Mgeni River catchment was the main aim, the study also had to investigate the general philosophies regarding catchment management, explore various approaches for development of a management plan and accommodate the evolving Water Law principles and legislation to ensure that the specific recommendations for the Mgeni River catchment are appropriate and acceptable.

The study identified and involved interested and affected parties and role players who stated their concerns regarding water quality for specific water uses. They participated in identifying the main pollution sources causing the problems and supplied site specific information for the study. In ongoing consultation, the role players are contributing to the definition of appropriate management strategies and implementation approaches. It is the continuation of this participation that will finally create integrated catchment management for sustainable resource use.

Do we need a structured approach ?

The New Constitution of South Africa ensures the right to a healthy environment for each citizen. The current revision of the Water Law and the identification of principles for water resource management is based on the concept of integrated management of all components of the hydrological cycle. These principles underlie the sustainable use of available water resources, implying that water resources need to be managed together with the development of any catchment.

The Mgeni Catchment is highly developed and most of it's surface water resources are regulated. With the estimated population supplied with water from the Mgeni catchment fast approaching 4 million people, the water demand for basic human needs, agriculture and industry is fast outgrowing the water availability in the catchment. Also, with development comes pollution and contamination of water which impact on the use of water and the health of the rivers. These changes are inevitable but a disaster if not managed in an integrated way.

A complex system such as the Mgeni Catchment requires a structured approach to co-ordinate the multitude of aspects surrounding the management of water resources for sustainable water use.

What is sustainable water use ?

What is sustainability in the context of the water resources of the Mgeni Catchment and why do we use the term?

Water use depends upon the quantity, quality and reliability of water available, as well as the complex interactions governing the ability to receive waste. The aquatic environment (or ecosystem), includes the physical structure, hydrology, water quality and living organisms, which is referred to as the resource base upon which all other use depends. Water abstraction and discharge affect the water quality and quantity of the water resources within a catchment, and together with the physical condition of the river affects the health of the aquatic environment.

If the catchment is not appropriately managed, problems escalate until the water quality, the water quantity and/or the functioning of the resource base cannot satisfy the requirements of the legitimate water users. Under extreme stress, the ecosystem functioning may be impaired beyond its ability to recover. If managed correctly, the health of the resource base is maintained and water use can continue indefinitely.

Sustainable water use requires the maintenance of adequate supply of good quality water to satisfy basic needs of human society, maintain healthy ecological functioning of the rivers and support economic production - indefinitely.

What is catchment management ?

Integrated Catchment Management involves taking a holistic approach to managing natural resources, human activity and their relationships within a river catchment, to ensure continued and co-ordinated use of these resources to the mutual benefit of humans and the natural environment.

Catchment management is based on viewing the entire catchment as a fundamental environmental unit and a common geographical definition of land and water use. In the past catchment elements were managed separately and resulted in emphasis and development of certain elements, with neglect and exploitation of others. In some cases this practice has led to irreparable damage and a permanent loss for future generations.

A catchment can be viewed as having four components representing the major processes in the hydrological and water quality cycles as shown in Figure 1.1. Production of water or contamination at a source in the catchment, delivery into and transport through the receiving water bodies (rivers and impoundments), and finally use. Management of water resources may occur at the source, during delivery and transport, or before use. The holistic and integrated management of these components underlies catchment management,with emphasis on the cause (source), rather than the effects (use).

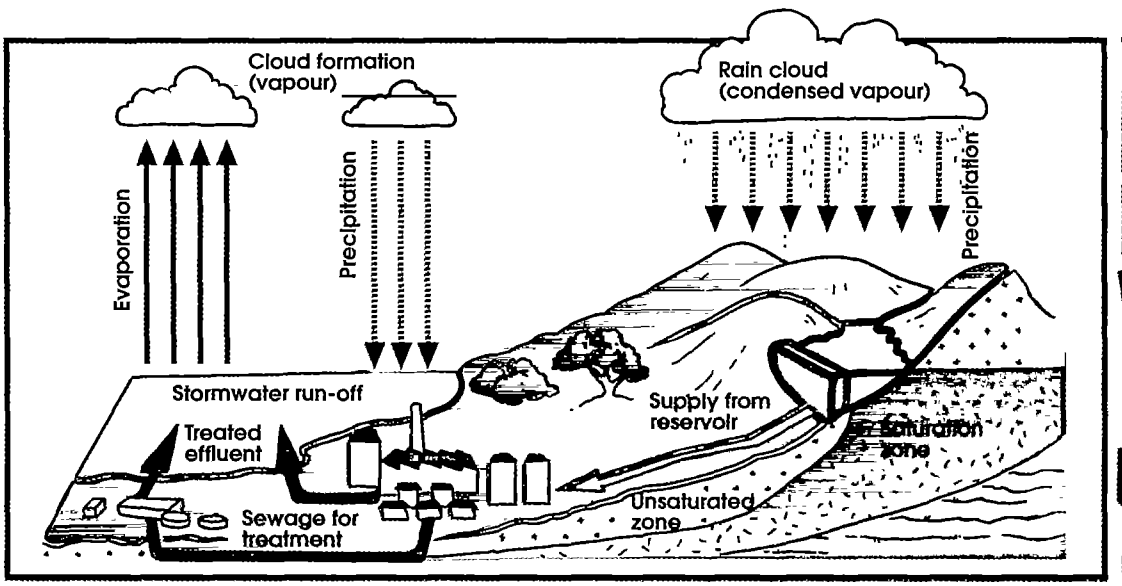


Fig. 1.1 The hydrological and water quality cycles

Catchment management is non-discriminatory. It asks for participation by all and demands responsibility from all. It is about working together to achieve increased effectiveness from resource use.

Integrated management of water resources on a catchment basis is one of the key principles which have been set for the Water Law Review in South Africa. This means that the new Water Law will support and enable the integrated management of water resources in catchments.

Ongoing initiatives by the National Department of Environmental Affairs and Tourism, such as the Consultative National Environmental Policy Process (CONNEPP) and the Integrated Pollution Control (IPC) Project, have also recognised the need for integrated management of resource use and waste disposal.

Who should read this document ?

This document is directed at the elected representatives, managers and officials in the DWAF, Umgeni Water, relevant national and provincial government departments, third tier authorities and stakeholder organisations. You have the mandate and authority to make the Mgeni Catchment Management Plan a reality. A shorter, more accessible discussion document will be produced for general publication.

Every effort has been made to present the relevant information in clear language and a friendly format. Enjoy the reading and react ! Integrated Catchment Management needs your support and participation.

Where to find the information you want

The following four chapters provide background information on conditions in the Mgeni River catchment. While the natural and socio-economic environment in the catchment and the water quantity and quality are inextricably linked, their discussion has been separated into chapters for readability.

- **Chapter 2** briefly describes the physical and environmental characteristics and provides an indication of the political and socio-economic conditions in different parts of the catchment.

- **Chapter 3** outlines the major issues associated with surface and ground water resource availability, flooding, current and projected demand, and existing and planned water resource infrastructure.

- **Chapter 4** describes the major water quality problems and indicates the contribution from different sources of contamination.

- **Chapter 5** synthesizes the priority issues for management, and indicates the probable impacts of future development on water resources, without integrated management of the catchment.

- The next two chapters outline the Mgeni Catchment Management Plan.

- **Chapter 6** provides an outline of the preliminary objectives and proposed strategies required to address the priority management issues in different parts of the catchment, with an indication of the organisations responsible for facilitating the design and implementation of associated actions.

- **Chapter 7** indicates the way forward and interim institutional arrangements required to implement this management plan with the support of the relevant stakeholders.

  The final chapters tell you where to find further information about the management plan.

- **Chapter 8** outlines how and where you can get involved.

- **Chapter 9** provides futher reading around the current national and provincial policy initiatives.

For more detailed information, the reader is referred to the suite of supporting technical reports developed during the Mgeni Catchment Water Quality Management Plan and the Mgeni River System Analysis studies.

THE MGENI RIVER CATCHMENT

The water users in the Mgeni Catchment are agriculture, industry, domestic use and recreation, while the aquatic environment is the resource base upon which these users depend and as such must be maintained in a healthy condition.

Although this is influenced by many factors including water quality, the water quantity issues are highlighted in this chapter. It provides an overview of the availability of water, potential for flooding, existing demands, existing water resource infrastructure and planned water resource developments.

The physical characteristics

The Mgeni River's source is in the Mgeni vlei which forms one of the wetlands of the Mgeni sponge situated on the highland plateau in the KwaZulu-Natal Midlands, at about 1900 m above sea level. Here the river seeps out of the reed and grass wetlands into an incised grass-lined sandy channel. As the river drops off the plateau, the gradient steepens significantly with small waterfalls and rapids. Removal of riparian vegetation and invasion by exotic plants and trees (eg. wattles) have contributed to erosion of the river banks throughout the upper Mgeni River.

The gradient flattens out as the Mgeni River flows through the rolling valleys of the Midlands towards the plain around Midmar Dam. Here, the grass and tree lined river channel alternates between sand-bed pools and shale rapids, while a large number of farm dams regulate the flow and result in additional water losses to evaporation. The river then meanders out onto the flat plain formed by the Ecca series and through a wetland just upstream of Midmar Dam, which is the most upstream major impoundment on the Mgeni River (storage of 177 million m^3). The catchment and channel characteristics of the Lions River, rising near the town of Nottingham Road, the Karkloof River and upper Msunduzi River, are similar to the upper Mgeni. The catchment and banks of the Msunduzi River above Henley Dam (1.5 mill m^3) have been destabilized, with increased erosion, by informal livestock grazing and watering. Although the headwaters of these rivers are not all wetland based, wetlands do occur in places. The upper parts of the Mgeni and Msunduzi River catchments tend to have deep, permeable, well-drained and fertile yellow and red soils, making them agriculturally productive. The relatively low erodibility of the soils, gentle slopes and generally good vegetation reduces the natural erosion in this area.

Fig. 2.1
The Lions River

Immediately downstream of Midmar Dam, the Mgeni River flows through the town of Howick. A dolerite dyke forms a small escarpment which cuts across the catchment, from the headwaters of the Mpolweni River in the north, through the Karkloof and Howick Falls to the Msunduzi River around Henley Dam in the south. This results in the many waterfalls and steep gorges on the rivers along and downstream of this escarpment. The gradients of the Mgeni and Msunduzi Rivers flatten as they flow onto the plain below the escarpment. Here, the Mgeni River meanders in a grass and tree lined channel over a silt bed before flowing into Albert Falls Dam (capacity 289 mill m^3).

Fig. 2.2 Camps Drift on the Msunduzi River in Pietermaritzburg

The Msunduzi River and its tributaries flowing through Pietermaritzburg have been highly modified and redirected. This has contributed to degraded ecological health and a reduction in the natural ability of the rivers to assimilate waste. Camps Drift was constructed to provide flood control and recreation in Pietermaritzburg, but it has also become a receptor for pollutants from Edendale.

Fig. 2.3 The Mgeni River downstream o Howick Falls

As the Mgeni and Msunduzi Rivers enter the Valley of a Thousand Hills, the gradients steepen and the rivers become wide and braided, on coarse sandy beds with rocks and boulders. The incised river banks are covered with dense scrub-bush and dry grass. The Mgeni River flows into Nagle Dam (23 mill m^3) just above its confluence with the Msunduzi River. The Mqeku River rises on the north-eastern plateau and flows south through small rapids and pools until it reaches a waterfall at the edge of the Valley of a Thousand Hills. Downstream of the confluence with the Mqeku River, the Mgeni River flows into Inanda Dam (242 mill m^3). The soil depth, permeability and fertility decrease eastward down the catchment towards and into the Valley of a Thousand Hills, where the soils and vegetation are not well developed, resulting in very high natural erodibility.

Fig. 2.4 Inanda dam is located on the Mgeni river downstream of its confluence with the Msunduzi

Fig. 2.5 The Mgeni River through Springfield Flats

Most of the tributaries on the coastal plain are highly modified urban channels, from the headwaters in Pinetown and Kwa Mashu to the Mgeni River flowing through Springfield Flats. They tend to flow sluggishly between wide artificial grass and reed lined banks (Fig. 2.5), in which the ecological health is reduced. The estuary is wide and shallow and accumulates silt deposits when the mouth is closed. These may be flushed out during large summer floods. The soil depths, permeabilities and fertility of the grey and red sands on the coastal plain are also low, albeit higher than those in the Valley of a Thousand Hills, but less erodible.

The climate and hydrology

There is a marked climatic variation between the coastal plain, the Valley of a Thousand Hills, the central plain and the highland plateau. The average annual rainfall varies from 1 200 mm in the headwaters of the catchment to below 700 mm in the central regions of the study area, rising again to 900 mm at the coast. Rainfall over the catchment is largely due to convectional storms (rising hot air) in summer, during which about two thirds of the total annual rainfall occurs. Rainfall is further enhanced in the headwaters by orographic activity (air rising over hills). Large weather fronts, on-shore winds and cyclones also contribute to heavy rainfall, particularly along the coast. The rainfall in different years may vary from 70% to 150% of the annual average.

Annual potential evaporation varies from about 1 800 mm in the west, to about 1 600 mm in the central catchment and drops to approximately 1 400 mm along the coastal area. This decrease can be attributed to the high summer humidity levels along the coastal zone. The mean catchment air temperature is 13°C in winter and 22°C in summer, although significant spatial differences occur in winter.In the highlands the winter average minimum air temperature is 3°C compared with 13°C along the coast, while the average summer maximums are 21°C and 27°C, respectively.

The seasonal variation of natural river flow follows the rainfall pattern throughout the catchment, with about two thirds occurring from November to March. However, annual river flow is far more variable than rainfall, and may be as low as 17% or as high as 240% of the average. The low flows result from severe drought periods, which are somewhat mitigated by the releases from the large impoundments on the Mgeni River. These releases also reduce the seasonal variation in river flow.

The river flows in the headwaters of the Mgeni River are relatively high, with between 20% and 35% of rainfall making its way into the rivers. Of this, up to a half is ground water, which seeps into the rivers, resulting in sustained flows during dry periods. The relatively high groundwater contribution arises due to significant infiltration caused by high steady rainfall on deep soils.

The relative contribution of the catchment areas to river flow decreases down the Mgeni and Msunduzi River catchments (from west to east) until it reaches a minimum in the Valley of a Thousand Hills. As little as 15% of the total rainfall reaches the rivers in this area, with the remainder only wetting the soil and then being lost through evaporation. However, most (> 90%) of this river flow consists of storm runoff over the land surface, due to poor vegetation cover, steep valleys and thin soils. The rivers in this area may be susceptible to net losses during extended dry periods. Flash floods, which cause the rivers to rise rapidly, are common during summer storms.

The contribution from the coastal plain is quite high, with between 20% and 30% of the annual rainfall reaching the rivers. Higher rainfall and more impervious surfaces in the Durban area means that a large portion of the total river flow runs directly off the land surface. Similar behaviour is observed in the urban areas around Pietermaritzburg.

Land use

Land use activities have the greatest impact on water use, river flow and water quality in the Mgeni Catchment. The major land uses are commercial livestock grazing (25%), cultivated crops (18%), timber plantations (10%), informal peri-urban and rural settlements (25%), formal urban areas (8%), with the remainder being undeveloped or used for other purposes. Table 2.1 provides an indication of the land uses by Management Unit,

The upper Mgeni River catchment above Albert Falls Dam is predominantly under commercial crop and livestock agriculture, with some timber production. The towns of Howick and Mpophomeni, with some surrounding informal settlements, also fall in this region. Land use activities change to timber and sugar in the middle Mgeni Catchment above Nagle Dam. Thus the problems in these parts of the Mgeni River catchment tend to be agriculturally based, including water availability, soil loss and fertilizer washoff.

Land use in the upper Msunduzi catchment above Henley Dam is largely informal rural settlement with mixed crops and livestock. Settlements in and around Pietermaritzburg are a mixture of informal and formal urban, while the lower Msunduzi has some commercial agriculture, but is predominantly rural in character. The Valley of a Thousand Hills has predominantly sparse rural settlements, while the coastal plain around Durban is almost entirely occupied by informal and formal urban settlements. The Msunduzi and lower Mgeni River catchments have a largely urban/peri-urban character, resulting in the associated problems of faecal matter and related water borne disease, soil erosion, flooding, pollutants in urban washoff and effluent discharges.

	Midmar	Albert Falls	Nagle	Henley-Pmb	Thousand Hills	Durban	Total
Area (km^2)	927	726	884	536	965	359	4397
% livestock area	55%	39%	23%		11%		25%
% crop/sugar	11%	14%	35%	8%	20%	7%	18%
% timber	9%	20%	23%	4%	1%		10%
% formal urban	2%	2%	1%	17%	1%	57%	8%
% informal/rural	4%	1%	13%	53%	57%	28%	25%
% other	19%	24%	5%	18%	10%	8%	14%
Population (#)	38 200	33 600	43 800	490 300	62 600	879 600	1 548 100
density (#/km²)	40	40	80	750	250	2000	350
Households (#)	7000	7100	14 200	84 900	93 000	215 200	421 400
% formal house[1]	52%	75%	47%	78%	25%	38%	46%
% no RDP water[2]	20%	14%	28%	10%	34%	11%	17%
% no sanitation[2]	18%	18%	35%	12%	48%	10%	20%
Employment[3]	69%	71%	72%	54%	67%	65%	
Household income Mean monthly	R 3000	R 4700	R 2300	R 3600	R 2200	R 3700	R 3400
% below subs.[4]	34%	20%	37%	29%	37%	25%	29%
Cost Recovery[5]	9%	18%	9%	20%	12%	23%	
GGP[6] (R million)	110	410	480	2900	130	3600	7630
% agricultura[7]	35%	8%	20%	1%	63%	1%	4%

Table 2.1. Socio-economic characteristics of the Management Units in the Mgeni catchment.

Key:

1 The number of formal dwellings is indicated as a portion of the total number of households.
2 Households without access to minimum RDP levels of water supply (25ℓ/d) or sanitation (VIP) as a % of the total households.
3 Percentage of the total economically active population (age 18-64) with formal employment.
4 Percentage of households earning below the minimum subsistence level (R750 in 1996 prices).
5 Estimated percentage recovery of water supply and sanitation capital and operational costs.
6 Approximate formal sector Gross Geographic Product (GGP) estimated from DBSA data by magisterial district.
7 Percentage of GGP in each Management Unit associated with agriculture and forestry.

The socio-economic profile

The total population of the Mgeni catchment is just over 1.5 million, with an average density of about 350 people/km^2, concentrated around Pietermaritzburg, Durban and the smaller towns. In the last decade considerable demographic changes have taken place, due to rapid rural and urban development, and these trends are likely to continue.

About 46% of the houses in the catchment are formal, while about 20% are informal and just over 34% are traditional. There is a 50-50 formal-traditional dwelling split in the farming areas, traditional dwellings dominate in the rural settlements, and most houses in the urban areas are formal, with some informal. About one fifth of the households have no access to minimum RDP levels of water supply and sanitation services, most of which are concentrated in the rural subsistence and commercial farming areas. Less than a quarter of the households have full household water supply and sanitation. About one third of the population have no waste disposal service, whereas only another third have regular household waste collection. The average household is about 4.6 people, with larger households in the farming area and smaller households in formal urban areas

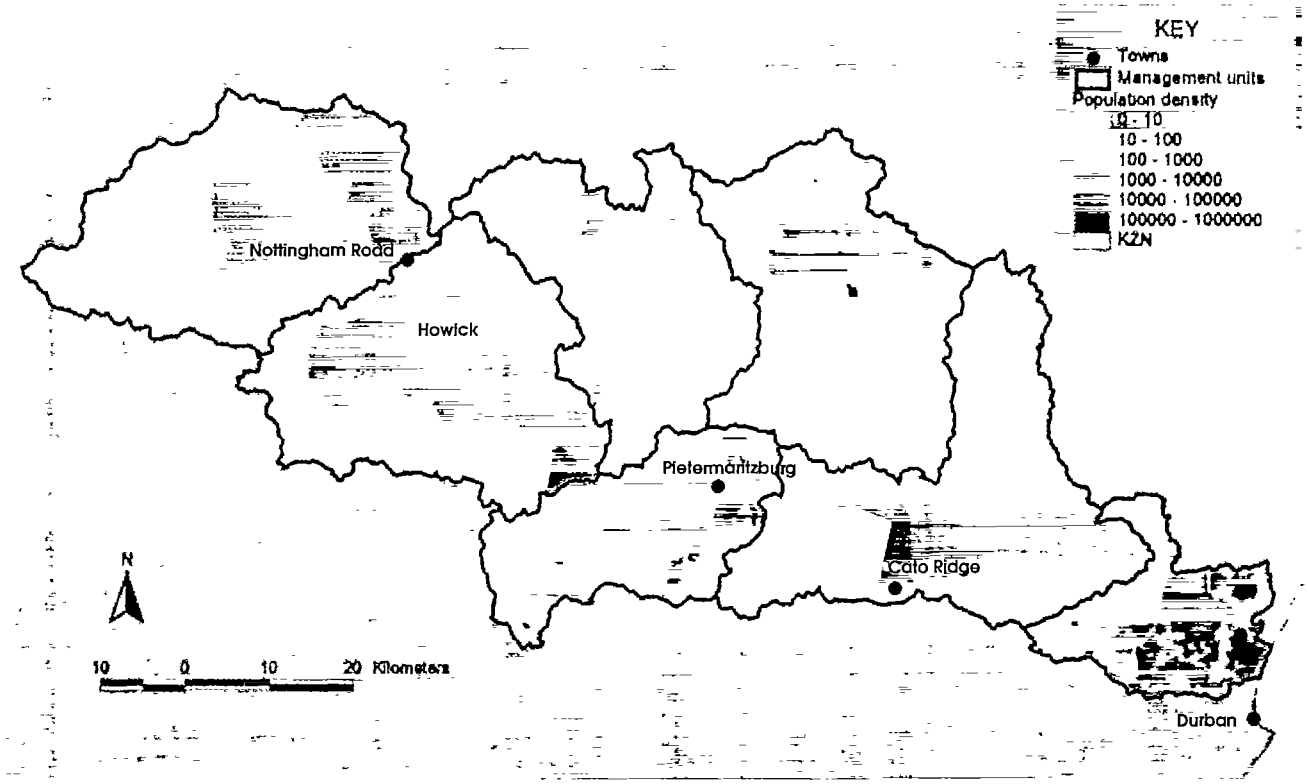
Fig. 2.6

As indicated above, informal and rural settlements have grown considerably and are a major cause for concern in terms of the limited water supply, sanitation and waste disposal services causing water quality and health problems, which accompany uncontrolled growth. The formal industrial and residential areas represent the greatest part of the current water use in the catchment, while RDP upgrading and future settlements will represent a major part of the future water demand.

As in the whole of South Africa, income distribution is highly skewed, with most households in rural and informal settlements earning less than R 1250 a month, while over three quarters of formal urban households earn in excess of R 3000 per month. However, about 30% of the total households in the Mgeni catchment have a monthly income less than the subsistence level of R 750/month. These are usually the households without access to water supply and sanitation infrastructure, which reduces the possibility of cost recovery.

Total economic production in the Mgeni catchment area has been estimated at about 55% service based, 30% manufacturing and construction, 3% agriculture, with an estimated 12% informal sector (the informal sector is not measured by DBSA data, and thus is not represented in Table 2.1). The gross geographic product (GGP) values presented in Table 2.1, do not include the non-agricultural GGP of areas outside the Mgeni catchment boundary which are supplied with water from the catchment, which is about two times the GGP within the catchment, largely centred around Durban. This represents about 70% of the total GGP in the province of KwaZulu-Natal, which highlights the importance of the Mgeni River catchment.

Fig. 2.7
Population density in the Mgeni River Catchment



The political-institutional environment

The institutional structures in the Mgeni catchment area are in a process of reform and change, responding to the fundamental political changes which have occurred at a national, provincial and now local level, including the Reconstruction and Development Programme (RDP). This has resulted in considerable uncertainty as to the funding and operation of key institutional players in the region. Thus, this summary only outlines the political-institutional environment, which will crystallise during the restructuring process.

There are a number of government departments and authorities responsible for various parts and functions of the Mgeni catchment. They are key players, as they control the public funds available for development. National and KwaZulu-Natal Provincial departments have jurisdiction over their constitutional responsibilities, including land use planning, housing, agriculture, health, nature conservation and environment. The National Government's role affecting catchment management is largely in policy development and legislation, particularly in the fields of water and land reform.

The Department of Water Affairs and Forestry is the custodian and regulatory authority for water resources and is responsible for planning the Community Water Supply and Sanitation programme, while Umgeni Water is its agent delegated with the responsibility for bulk water supply and implementation of rural water supply and sanitation. The Midmar dam catchment has been designated a Government Water Supply Area, so water use, irrigation and forestry in this area is controlled by the DWAF.

The Provincial Government has prime responsibility for growth development and service provision and has control over the bulk of the funds to do this. Thus, it will have a major influence in the development processes affecting the Mgeni catchment. However, it is still coping with the amalgamation of the former Natal and KwaZulu administrations, as well as other government bodies, so will require pressure and support to successfully fulfill its mandate.

Following the recent 1996 democratic local elections, local authorities have the legitimacy to assist implementation of the RDP. The new Regional Councils have the administrative base of the JSB's, but the large number of Regional Councillors may complicate effective management. The formal role of Traditional Authorities in development is unclear, even though traditional leaders are ex-officio members of the Regional Councils. However, they have considerable influence over the rural areas under their jurisdiction.

The Transitional Local Councils (TLC's) are responsible for service provision and RDP implementation, have authority for by-laws, and have access to significant funds through property taxes and service charges. However, they are facing problems with amalgamating areas administered by different bodies and are struggling with funding and provision of services to disadvantaged communities. The performance, effectiveness and support of the TLC's is integral to the success of the Management Plan. Similarly the Durban Metro has a significant role to play in the Management Plan within its jurisdiction, which includes the population and economic base, as well as the major water use in the catchment.

Various Fora provide a useful means of mobilising resources for and communicating the implementation of the Management Plan. The Regional Economic Forum, including the Trade and Industry, Water and Sanitation and Land and Agricultural Committees, has the resources and capacity to mobilise development in the province, while Umgeni Water, Eskom, Telkom and the Department of Transport coordinate their capital investment programmes through a Service Providers Forum.

Environmental and development NGO's and CBO's play an important role in the prioritisation for development, communication between communities and service providers and the building of capacity in local communities, so can play an effective role in popularising and supporting the Management Plan. Sector representatives, such as the Agricultural Unions and Chambers of Commerce, also play an important role in developing support for the Management Plan from the private sector, which has control over significant resources.

The effective communication and coordination of the interests and responsibilities of these various organisations will be one of the major factors leading to the successful implementation of the Mgeni Catchment Management Plan.

The state of the natural environment

The water, land and air in a catchment provide the natural resource base upon which all life and economic development depend. Sustainable use of these resources requires management to maintain their productive potential and to avoid degradation of the environmental capacity to assimilate waste. In general, the quality of the natural resource base in the Mgeni River catchment is good, although specific issues and areas should be highlighted:

Air:

General air quality tends to be good, except in Pietermaritzburg and Durban, due to the high concentration of vehicle and industrial emissions, not all of which originate within the catchment. The local air quality in and around informal households which depend upon wood, coal and paraffin for cooking and heat tends to be very bad, with resulting respiratory problems for the inhabitants.

Land:

The quality and status of the land is influenced by both its natural potential and actual use. Agricultural potential and status of land is good in the upper and central Mgeni catchment. Soil erosion and overgrazing in Vulindlela above Henley dam has degraded the condition of this area. Climate and topography limit the land potential in the Valley of a Thousand Hills, which is further reduced by soil erosion and overgrazing. Urbanisation around Durban and Pietermaritzburg is encroaching onto prime agricultural land. Spills of hazardous materials and disposal of waste onto the land surface degrade the soil and groundwater quality, particularly around industrial urban areas. Most of the catchment is already developed, with only about a third under natural vegetation, much of which is grazed commercially. Only 3% of the catchment is formally conserved in provincial parks and nature reserves. Headwater areas contribute a large quantity of water to the Mgeni River, so these should be protected or conserved, particularly for the Mgeni, Lions, Karkloof and Mpolweni Rivers.

Aquatic:

The negative impacts of development on water quantity and quality in the aquatic riverine and estuarine environments are the central theme of this document, and are discussed in the following sections.

Conditions other than the quantity and quality of water also influence the aquatic ecology. Internationally, wetlands represent one of the most threatened ecosystems, due to encroachment of agricultural production. Within the Mgeni River catchment only the Mgeni Vlei has conservation status. Riparian riverine environments in the upper and central Mgeni River catchment are under threat from invasive aliens, crop cultivation, timber plantations and commercial livestock. The riverine environments in the rural areas of Vulindlela and the Valley of a Thousand Hills have been heavily impacted and destabilised by livestock. The rivers in the urban areas of Pietermaritzburg and Durban are highly modified, have been significantly rerouted for development and are scoured by the changing urban flood hydrology. The Mgeni estuary has been highly modified and rerouted as a result of development and reduction in the flow regime.

The Mgeni River catchment is a ecologically diverse, highly developed and regulated system, which needs to be managed to address the competing needs of different users and economic activities, while maintaining a healthy environment for people, animals and plants.

Important issues are:

- Institutional arrangements are in transition at present, but policies and functions should be stabilised within the next couple of years.
- The water and sanitation needs of the entire population must be addressed.
- Economic growth and employment must be supported, taking account of natural resource availability.
- Currently healthy land and aquatic environments must be conserved.
- Degraded aquatic and land environments must be rehabilitated.

WATER QUANTITY PROBLEMS

The water users in the Mgeni Catchment are agriculture, industry, domestic use and recreation, while the aquatic environment is the resource base upon which these users depend and as such must be maintained in a healthy condition.

Although this is influenced by many factors including water quality, the water quantity issues are highlighted in this chapter. It provides an overview of the availability of water, potential for flooding, existing demands, existing water resource infrastructure and planned water resource developments.

Water availability in the Mgeni River Catchment

Almost all water used in the Mgeni catchment comes from surface water, which includes springs, streams, rivers and impoundments. Surface water from the Mgeni River is also the source of water for people and industries outside the catchment boundaries, particularly in the southern parts of Durban. Water supply management is particularly needed when the quantity of water available is not adequate to supply the demand.

How much surface water is there ?

There was substantially more water in the Mgeni River before any development occurred in the Mgeni catchment. The greatest proportion of this natural flow was generated in the upper Mgeni and Msunduzi River catchments, with the relative contribution decreasing towards the Valley of a Thousand Hills. On average about 730 million m^3 of water flowed out of the Mgeni River mouth each year, which is equivalent to about four times the volume of Midmar dam. This is referred to as the mean annual runoff (MAR).

Due to the introduction of timber plantations, agricultural crops and urban development, all of which change the hydrology of the catchment and/or abstract water, the river flows have decreased. On the other hand, impervious surfaces associated with urban development increase the runoff. Land use changes, farm dams and abstractions for irrigation have reduced the total current flow available (current-day MAR) in the Mgeni River catchment by about one fifth. Agricultural land use changes, such as forestry, sugar cane and dryland crops have reduced the MAR by about 13%, while urbanisation has increased it by about 3%. Irrigation of agricultural crops uses a further 9% of the MAR.

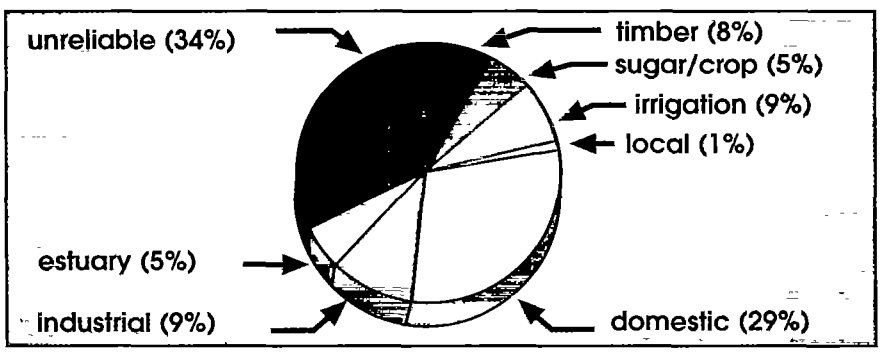


Figure 3.1 Current use water in the Mgeni Catchment

When abstractions for bulk water supply to domestic and industrial users are also considered, today on average less than 50% of the natural MAR flows out of the Mgeni River mouth each year. Most of this occurs during floods in very wet years, and includes water that has been used for domestic or industrial purposes and is returned to the rivers after treatment. It is also compulsory to release water from Inanda dam, to maintain the functioning of the Mgeni estuary. No other allocations are presently specified for the aquatic environment, although minimum releases are usually made for users downstream of the major impoundments (see Table 3.1). The water in the Mgeni River is so highly utilised and regulated, that it has a negative impact on the natural functioning of parts of the aquatic and estuarine environment.

Of the 340 million m^3 of water which is currently abstracted from the Mgeni River catchment each year, 62% is used for bulk domestic water supply, 19% for industry, 18% for irrigation and 1% for direct local domestic use and livestock watering. Just over half of the bulk domestic and industrial abstraction (275 million m^3) is supplied to areas outside the Mgeni catchment, largely to users around Durban, while 20% returns to the Mgeni catchment through discharges from waste water works in Pietermaritzburg and Durban. Domestic users exert the greatest demand abstracted for water at about 210 million m^3/year, whereas annual industrial use is only about 65 million m^3.

How reliable is the supply?

The availability of surface water flows varies considerably seasonally and annually, which reduces its reliability. Average summer flows during January and February are generally ten times higher than the winter flows during July and August, due to the occurrence of wet summers and dry winters in the Mgeni River catchment. There is also a great deal of variability between years, with the wettest years having total flows which are up to twenty times higher than those during the driest years (see Figure 3.2). This reduces the assured quantity of water which can be reliably supplied to bulk domestic and industrial users, which is called the yield.

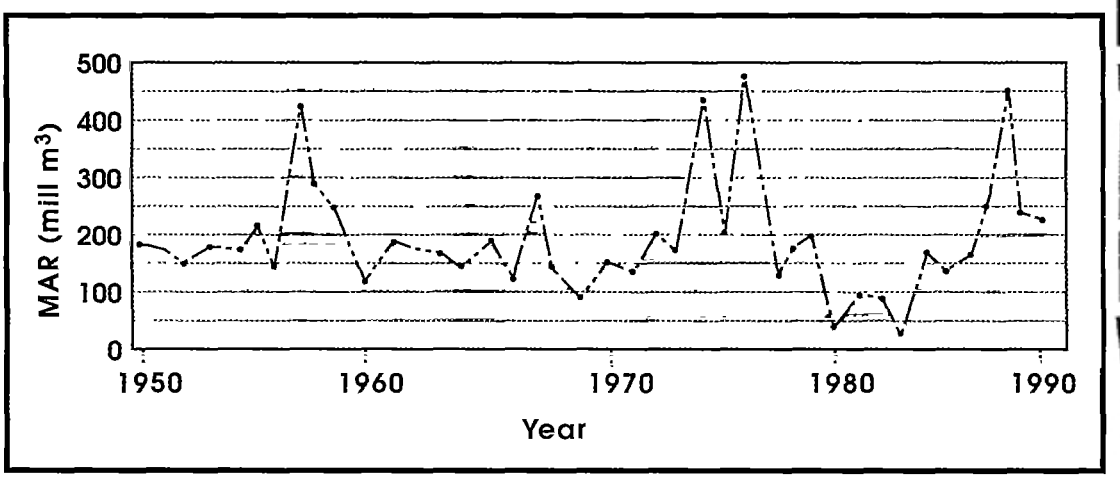


Figure 3.2 Variability of the Annual Observed Inflow (mill m^3) to Midmar Dam

Currently, the total quantity of water which can reliably be abstracted from the Mgeni River system is only about half of the total average flow, due to the extreme variability of river flows.

The threat of flooding

The large flow variability also has implications for flooding during heavy storms. Problems with floods are usually encountered where storm rainfall causes rivers to rise rapidly in developed areas. Except in cases where there is little warning, floods in rural areas do not usually cause problems, because people live away from the river banks and the aquatic vegetation and stream characteristics attenuate the impact.

Although, the Valley of a Thousand Hills is characterised by floods, the impact on the inhabitants of the rural settlements is limited to periods when they or their livestock are near the streams.

Urbanisation compounds flooding problems, because the development of impervious areas increases the total storm runoff volume, while reducing the time taken to swell the rivers. The degradation and modification of streams and rivers reduce their attenuating characteristics, so floods are not naturally mitigated. Finally, the shortage of land in urban areas causes people to settle close to rivers, within the flooding zone, so the impacts of increased flooding are devastating. The Christmas 1995 floods in the Msunduzi catchment, where almost 150 people lost their lives, was a gruesome reminder of this problem.

Some unplanned informal settlements and formal areas in Pietermaritzburg, Durban and to a lesser extent Howick, are particularly vulnerable to flooding.

Groundwater resources

The groundwater aquifer potential is limited throughout the catchment, except where fracture zones increase the yield. The lowest potential is in the granites of the Valley of a Thousand Hills, where many of the people with limited water supply service levels are located. The sandstones in the central catchment provide better yields, although these are still low. The dolerite sills in the shales and mudstones in the headwater areas provide the highest abstraction potential and result in the surface seeps and springs which are widespread in the upper Msunduzi River catchment. The Springfield Flats aquifer in Durban is the only major groundwater source in the Mgeni catchment. The localised nature of groundwater potential requires site specific investigation for particular developments, but can be appropriate for small isolated settlements.

Groundwater currently represents a very small proportion of the total water used in the Mgeni River catchment. Some of the outlying towns (such as Lidgeton, Lions River and Albert Falls) rural communities (in Vulindlela and the Valley of a Thousand Hills) and farms and country hotels (in the upper and central catchment) depend upon springs and boreholes, while some formal urban households supplement their use with borehole water. Groundwater is also used for irrigation of crops, particularly in the upper catchment.

Reliable groundwater resources are relatively limited in the Mgeni catchment, implying that most water supply will have to be based on surface water resources.

Water use requirements

Users require water of suitable quality, in addition to adequate quantities, to avoid negative impacts, such as human and livestock sickness, increased treatment costs, reduced crop yield, low aesthetic value or environmental deterioration. The quality of water is defined in comparison with the specified requirements of the users of that water. DWAF has produced water quality guidelines for the recognised users, and these may be used to assess site-specific water quality requirements in the different parts of the catchment, based on the distribution of water users.

In developing an approach to managing the catchment, different demand regions, impoundments and the marine environment have been identified as having different water quality requirements associated with the dominant users. The demand regions include the agricultural upper and central Mgeni catchment, the domestic use of local resources in the upper Msunduzi and lower Mgeni catchments, to bulk supply of treated water demanded by domestic and industrial users in the Pietermaritzburg and Durban areas. The water quality requirements associated with impoundments are oriented to bulk water supply abstraction and/or recreation.

The entire Mgeni River catchment has been divided into six sub-catchments with similar water use and land use characteristics, called Management Units.

	WATER AVAILABILITY AND USE (million m^3/year)						
	Midmar	Albert Falls	Nagle	Henley-Pmb	Thousand Hills	Durban	Total
Source (availability)							
Nat MAR inc[1]	209	125	161	80	102	55	732
Forestry[2]	-10 (5%)	-18 (14%)	-28 (17%)	-	-	-	-56
Sugar cane[2]	-			-			
Urbanisation[3]	-	-	-	+10 (13%)		+14 (25%)	+24
Point sources[4]	+0 3	+0.4	-	+22 (28%)	+1.2	+25.6	+49.5
Transport (flow)							
Inflow[5]	+ import	+118	+207	-	+269	+265	+ import
Stream losses[6]	unknown	unknown	unknown	unknown	unknown	unknown	-
Dam evapor.[6]	-4	-4	-1	-	-4	-	-13
Farm dams	-2	-1	-1	-	-	-	-4
Outflow[7] (min. comp)	-118 (-0.9m^3/s)	-207 (-5.5m^3/s)	-169 (-0.7m^3/s)	-100 -	-265 (-1.5m^3/s)	-356 -	-356 -
Use (abstraction)							
Irrigation[8]	-25 (13%)	-10 (9%)	-15 (10%)	-2 (2%)	-7 (7%)	-	-59
Local[8]	-0.8	-0.6	-0.75	-0.9	-1.75	-0.8	-5.6
Yield (1:100)[9]	59	-	135	10	151	-	355
Bulk abstract[10]	-49	-	-133	-9	-87	-	-278

Table 3.1. Summary of water availability and use by Management Unit in the Mgeni River catchment.

Key:

For each Management Unit, the water supply and demand has been separated into:

(i) the total water available in the rivers from the various sources,
(ii) the water flowing (transported) in and between the Management Units, and
(iii) the water abstracted for use.

1 **The naturalised incremental MAR would be the total water available from that Management Unit under pristine conditions, not including the inflow from any upstream Management Units.**
2 **The water used by forestry and sugar cane reduces the water that ends up in the river.**
3 **Urbanisation increases impervious areas and thus the water getting into the rivers.**
4 **Return flows from effluent discharges increase the water flowing in the rivers.**
5 **The inflow indicates the water entering the Management Unit from an upstream Unit.**
6 **This section should indicate the losses from streams (e.g. unknown evapotranspiration from riparian alien vegetation and seepage).**
7 **The water flowing out of the Management Unit, directly or as a result of dam releases or spills; the minimum required compensation release from impoundments is also indicated in m^3/s.**
8 **The water abstracted for irrigation or local use for domestic purposes and stockwatering in each Management Unit.**
9 **The 1 in 100 year yield indicates the water which is reliably available for bulk abstraction from the relevant impoundment, taking account of upstream land use changes and abstractions.**
10 **The bulk abstraction is the water which is currently used from that water supply impoundment.**

Current water resource infrastructure

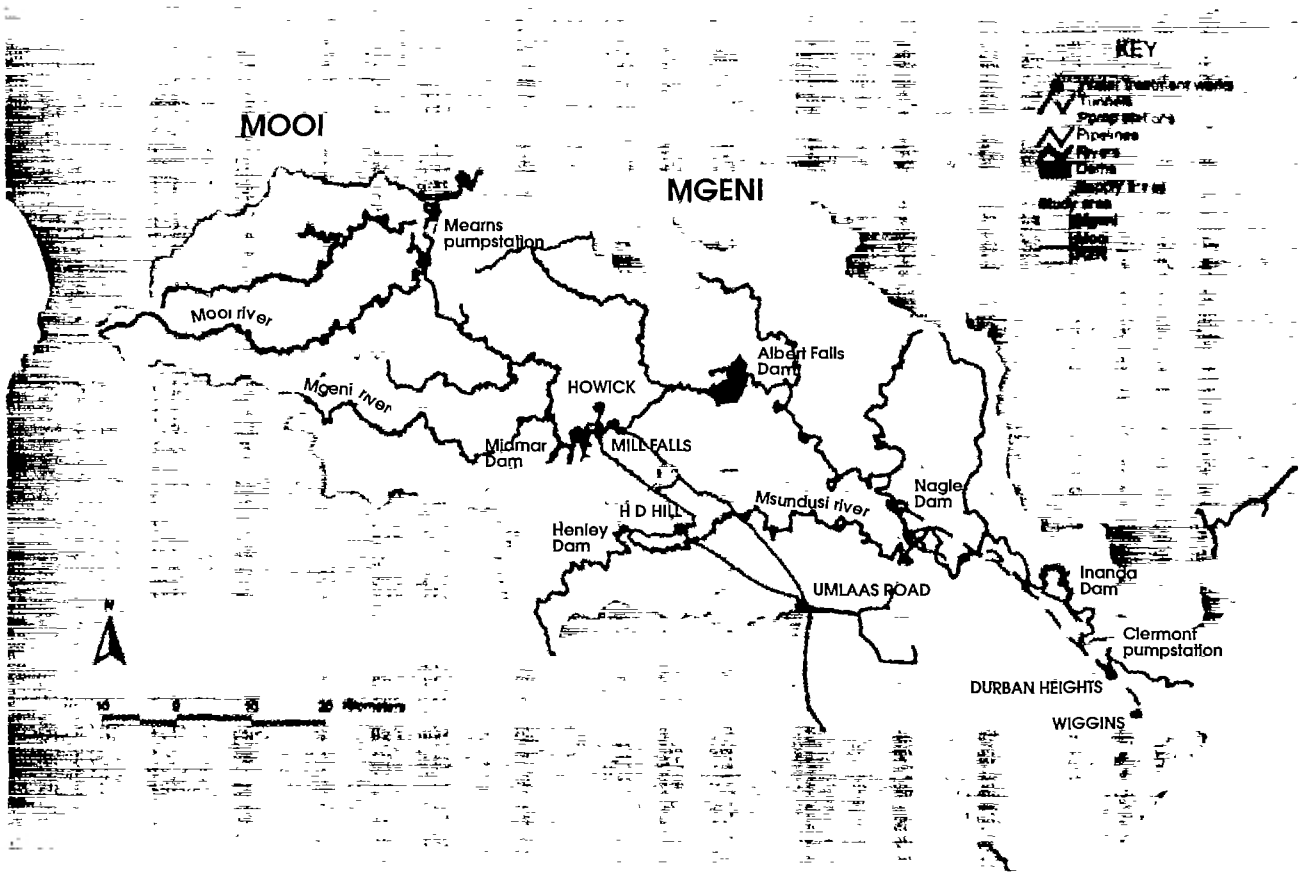
As indicated above, the surface water resources of the Mgeni River catchment are highly variable and under considerable demand by a number of users. To supply these demands with acceptable reliability, large impoundments are required. The water resource developments in the Mgeni Catchment are largely orlented towards the provision of bulk clean water supplies to domestic and industrial users, requiring extensive water purification, distribution and waste water treatment systems (see Figure 3.3).

Bulk water supply impoundments

The Mgeni River catchment is a highly regulated system with the five water supply impoundments for bulk water supply having a combined capacity which is 30% greater than the annual average current-day flow of the river. These impoundments can reliably provide about 355 million m^3 per year under current conditions. One fifth of this volume can be abstracted from Midmar (and Henley) dams, which just meets the current bulk water abstraction. The remainder may be abstracted from Nagle (fed by Albert Falls) and Inanda dams.

The assured yield of the existing water resource developments on the Mgeni River system just meets the current domestic and industrial demand.

Fig. 3.3
Bulk water supply infrastructue and supply areas from the Mgeni Catchment



Bulk water distribution infrastructure

The water distribution infrastructure in the Mgeni system is divided into the Inland and Durban Supply Regions (see Figure 3.3). The Inland Region covers the areas from Pietermaritzburg, Howick and New Hanover, to Richmond, Pinetown and Hammarsdale, supplied from Midmar and Henley dams. The Durban Region supplies lower Pinetown, Kwa Mashu, Durban, Mlazi and Amanzimtoti, abstracting water from Nagle and Inanda dams distributing it through a network of pipelines and pump-stations.

There are a number of small water purification plants serving the Inland Supply Region, of which all, except DV Harris, will be decommissioned after the new works at Midmar dam is commissioned in 1996. The Wiggins and Durban Heights water purification plants provide clean water to the Durban Supply Region.

Costly extensions to the bulk water purification and distribution system have recently been implemented to supply the increasing demands around Pietermaritzburg and Durban.

Waste water works

A few large and a number of smaller waste water works (WWW) treat domestic and industrial effluent which is returned to the Mgeni River catchment. The major works are Darvill in Pietermaritzburg (with an effluent discharge of 22 million m^3 per year), and Kwa Mashu (11 million m^3) and Northern (13 million m^3) in Durban, with smaller works at New Germany, KwaDabeka, Cato Ridge, Howick and Mpophomeni. Combined, these WWW represent about 7% of the total water available in the Mgeni River catchment, and contribute up to 50% of the river flow in the lower Msunduzi River and Mgeni estuary during the dry winter season.

South Africa is a relatively water scarce country, so legislation requires that abstracted water which is not consumed must be returned to the rivers, thereby increasing the available flow.

Is there adequate water for future demands ?

The current demand for water in the Mgeni River catchment is approaching that which can be reliably supplied with existing water resource infrastructure. This requires integrated water resource management to supply the demands, which are increasing rapidly with the current RDP initiatives.

There are three basic approaches to water resource management, reflecting the fundamental elements of catchment management.

i Manage the water availability, through land use planning and control.
ii Assure adequate and reliable supply through water resource infrastructure development and operation.
iii Control water demand through greater efficiency of use and appropriate tariff structures.

The implications of future development for each of these issues is addressed in the following sections, because cost-effective water resource management requires a combination of management approaches.

What impact will land use changes have?

The greatest reductions in runoff are associated with afforestation and sugar cane, while farm dams and irrigation reduce the total water availability downstream, particularly for low flows during the dry winter season. The Midmar dam catchment is a Government Water Control Area, so the area under forestry and irrigation are limited to the present albeit relatively high levels. The high levels of sugar cane cultivation in the central Mgeni River catchment, compounded by irrigation abstraction, could increase further. However, DWAF permitting and the revision of the Water Law and water tariff structure should result in improved agricultural water use efficiency, which would counter-balance any increases in the area under crops.

The already significant afforestation, sugar cane and irrigation in the Albert Falls and Nagle Management Units may increase, unless they are controlled or water tariffs revised.

The other three Management Units in the Msunduzi and lower Mgeni River catchments are not currently heavily utilised for large scale commercial agricultural purposes. However, pressure for irrigation to emerging small-holdings associated with the rural settlements may increase.

Irrigation of small-holdings in Vulindlela and the Valley of a Thousand Hills represents a possible source of future water demand.

Urbanisation and informal settlements will also have tremendous impacts on the water availability in the Msunduzi and lower Mgeni River catchments. The population of Pietermaritzburg is currently growing, which will increase the runoff from the Henley-Pietermaritzburg Management Unit. The increasing demand associated with this growth and the provision of water to previously disadvantaged communities will result in increased waste water return flows. 60% of the demand supplied in Pietermaritzburg is returned to the Msunduzi River via Darvill waste water works which will result in a further increase in the flow from this Management Unit every year. Durban is undergoing similar development, with the associated increased flow into the Mgeni estuary.

The river flows (MAR) from Pietermaritzburg and Durban will increase, due to greater storm surface runoff and increasing effluent return flows associated with urbanisation.

This increased flow largely occurs during storm periods, while low flows are reduced. Therefore, the volume of floods in these areas will increase, while the time before the peak will decrease, resulting in less warning and greater damage. On the other hand, the health of the streams and tributaries in the urban areas will be further impacted, due to the decrease in low flows and the impact on stream banks.

Flooding will increase and the health of the aquatic environment will deteriorate, particularly in Durban and Pietermaritzburg.

What are the predicted future demands?

The demands on the bulk water supply system in the Inland Region have been increasing at about 8% per year for the last six years, and this trend is likely to continue. The Durban Region has had an average demand increase of about 7% over the last ten years, but this is expected to drop to about 5.5% in the future. It is predicted that the total bulk water demand on the Mgeni River system will increase from about 270 million m^3 to about 360 million m^3 in the next ten years and to about 620 million m^3 by 2025, with about one third of this demand for the Inland system and two thirds for the Durban system. The other demands on the system are not likely to increase significantly, so bulk water supply will represent over 90% of all use from the Mgeni River catchment by 2025.

Bulk water demand on the Mgeni catchment will double in the next 25 years.

Planned future water resource developments

A comprehensive water resource study, to identify water resource developments which would meet the rapidly increasing demands was completed in 1994 (see Table 3.2). This study resulted in the following proposed development options (see Map/Fig. 3.3):

- raise Midmar dam to increase the storage capacity from 177 million m^3 to 255 million m^3;
- increase the diversion capacity from the Mooi River to Midmar dam through the 6 m^3/s Wellington-Midmar tunnel;
- construct the 150 million m^3 Mearns dam and the 140 million m^3 Springgrove dam to increase the inter basin transfer from the Mooi River;
- develop a 12 m^3/s diversion tunnel from Impendle on the Mkomazi River to Midmar dam;
- construct the 220 million m^3 Impendle dam on the Mkomazi River to increase diversions to Midmar dam;
- identify and implement further developments by 2024.

Table 3.2 Planned water resource infrastructure characteristics versus future bulk demand projections.

Year	Projected Demand (million m^3/year)			Planned Development to meet this Demand			
	Inland	Durban	Total	Water Resource Development	Year	+ Yield (mill m^3)	Unit cost (c/m^3)
1995	58	215	273	Raise Midmar dam wall	1998	+18	6
				Wellington-Midmar diversion	1998	+58	28
2005	73	290	363	Mearns dam	2001	+82	56
				Springgrove dam	2004	+28	75
2015	126	355	481	Impendle-Midmar diversion	2007	+169	76
				Impendle dam	2018	+226	80
2025	195	427	622	Further developments	2024		

Current initiatives are oriented towards increasing the available supply in the Mgeni River catchment, through the development of water resource infrastructure. However, water resource management philosophy in South Africa (as embodied in the Water Law Principles) is based on the holistic management of catchments, which also includes control of the availability (land use planning) and demand (water conservation) management, as well as the impacts on water quality and the ecological functioning of the aquatic environment.

The implementation of planned water resource developments, associated with an active water conservation and land use management programme, should result in a reliable supply of water to meet the increasing demand over the next decades.

These planned water resource developments and the associated changes in demand patterns may have considerable impacts on the quality of water and ecological functioning of the Mgeni River, so any future developments must be evaluated from a holistic environmental perspective.

Summary or the water quantity management priorities in the Mgeni River catchment

- Bulk water abstraction from Midmar dam for the Inland Supply System is close to exceeding the assured supply, while irrigation and afforestation reduce the available flow by one fifth.

- Afforestation, sugar cane and irrigation reduce the available water in Albert Falls and Nagle dam catchments by one third.

- The increasing demand in the Durban Supply Region will soon exceed the assured supply.

- The groundwater potential is limited and can only meet the requirements of small towns and settlements in the upper Mgeni catchment, which implies that most RDP initiatives are likely to be based on surface water supplies.

- The planned water resource developments to meet the increasing demand will significantly increase the cost of water.

- Urbanisation in Durban and Pietermaritzburg has increased the risk of flooding, as well as the flow produced through runoff and WWW discharges.

- Changing flow regimes throughout the Mgeni River catchment have impacted on the aquatic environment and estuary.

- Alien riparian vegetation reduces the streamflow, particularly during low-flow periods in the upper catchment.

4 WATER QUALITY PROBLEMS

When the quality of water is not adequate to sustain a healthy aquatic environment nor fit-for-use for domestic, industrial, agricultural or recreational purposes, there is a water quality problem.

This Chapter describes the water quality problems in the Mgeni River catchment and presents the most important causes of those problems. The critical water quality problems, key catchment areas and priority pollution sources for water quality management are indicated.

What are the major water quality problems?

There are a multitude of land use activities and water users distributed throughout the Mgeni River catchment. Each of these has some impact on the quality of water in the catchment. The following issues have been identified as the major water quality problems in the Mgeni River catchment.

Faecal contamination causes illness and death

Faecal matter from humans and warm blooded animals carry large numbers of pathogens which may cause diseases, such as diarrhoea, cholera, typhoid and meningitis, in people who drink or bathe in contaminated water. This results in increased health care costs, lost work days, learning disabilities and even death, particularly in the most vulnerable sections of the population, such as children, the elderly and the infirm. Settlements with inadequate sanitation infrastructure or livestock control tend to have the greatest problems. Unfortunately, these are the same settlements in which the people are most dependent upon the local streams and water sources. The impact of faecal contamination is localised, because most pathogens die-off outside the host body, but "acute", because the risk of infection increases with higher numbers of pathogens.

Fig. 4.1 A sewer manhole discharging untreated sewage presents a severe health hazard

Serious faecal contamination problems occur in Pietermaritzburg and Durban, as well as in the settlements in the Valley of a Thousand Hills and Vulindlela (Henley), with as many as 2000 deaths every year associated with water borne diseases.

Plant nutrients cause algal growth, which increases water treatment costs

A significant increase in the load of plant nutrients (particularly phosphorus and nitrogen) to an impoundment due to human activities (called "cultural eutrophication") can cause excessive growth of algae and larger aquatic plants. This is aesthetically unpleasant for recreation, can produce toxic by-products for humans, animals and aquatic biota and can cause biological problems in the impoundment with increased costs for water treatment. Nutrient impacts are usually located in down-stream impoundments, through the "cumulative" effect of nutrient loads.

Nagle and Inanda dams periodically suffer from excessive algal "blooms", which affect the water supply to the coastal region by significantly increasing treatment costs.
Pietermaritzburg contributes about 50% of the phosphorus load to Inanda Dam, while the Nagle by-pass provides 10%.

Soil loss affects the land potential and sediment fills impoundments

Soil erosion from the land surface results in reduced agricultural potential of the land. Once in the streams and rivers sediment is aesthetically unattractive for recreation, can have a negative impact on the aquatic environment through siltation of stream habitats, and eventually settles out in dams and impoundments, reducing their storage capacity. Thus, the impact of sediment is cumulative, and is related to long term total sediment loads.

Fig. 4.2 Soil erosion in a dense rural settlement

ient (of a Thousand Hills) has naturally , erodible soils and poor vegetation

lation rate, while the streams and uffer from siltation. Sedimentation y-pass facility which contributes to Inanda dam.

Are there any other potential problems?

In addition to the three major types of water quality problems observed in the Mgeni River, there are other less severe or potentially threatening problems which need to be identified to prevent further deterioration. A Catchment Management Plan must consider all current and possible future problems.

Some metals are poisonous

Although trace concentrations of some metallic elements are required to sustain life, the same metals can be toxic at higher concentrations. Toxic metals usually affect the functioning of body tissue and may accumulate in the tissues of higher order aquatic organisms over time, even when instream concentrations are low. Metals also accumulate in river sediments and can be released into the water at a later time, when environmental conditions change. Thus, metals have "acute" toxic impacts, but the "chronic" impact is also important in cases of continual exposure.

At times, elevated levels of lead and chromium are present in some urban streams flowing through formal industrial, commercial and residential areas in Pietermaritzburg and Durban.

Some chemicals are toxic

Since the industrial revolution, thousands of chemicals have been developed, many of which are highly toxic to people, animals or plants. These include pesticides, household chemicals and by-products of industrial processes. Unfortunately, the vast number of chemicals produced restricts possibilities for their measurement in water bodies. However, pesticides have been observed in some and may be present in other streams and downstream of intensive agricultural catchments, such as the Midmar, Albert Falls and Nagle dam catchments, while other toxic chemicals are likely to occur around industrial areas in Pietermaritzburg and Durban.

Other metals cause aesthetic problems

While not all metals are highly toxic, some cause aesthetic problems for domestic household and industrial use, such as taste, discolouration and staining. Many of these problems occur in impoundments at certain times of the year when dissolved oxygen concentrations are low. They need to be removed during treatment, which increases the treatment costs.

Water abstracted from Inanda dam during autumn can have increased levels of dissolved iron and manganese.

Litter blocks streams and is unattractive

Fig. 4.3 Informal ettlements on the banks of the Slangspruit River

Litter can suffocate aquatic and marine animals, clog stream bottoms and release harmful substances into the aquatic environment. Furthermore it reduces the aesthetic quality of riverine, estuarine and marine areas for both formal and informal recreational purposes.

Pietermaritzburg and Durban have severe litter problems, particularly in central Pietermaritzburg, in the Mgeni estuary and on the beaches.

Soaps, oils and grease affect aquatic life and cause problems for treatment

A wide range of plant, animal, mineral and petroleum products fall into this group and can cause damage to the functioning of the aquatic environment by lowering dissolved oxygen concentrations and coating sediments. They also cause problems in the treatment of waste water and the purification of clean water.

Soaps, oils and greases are a problem in some of the urban streams in Pietermaritzburg and Durban, as well as in the influent for treatment at the large waste water works (WWW), such as Darvill WWW in Pietermaritzburg.

Low oxygen and rapid temperature changes kill fish

Animals which live in water, such as fish, require oxygen to survive and are adapted to a particular temperature range. Thus the functioning of the aquatic environment may be severely impaired if the level of dissolved oxygen decreases significantly, due to the increased concentration of substances which use oxygen during decay. Also, aquatic animals are very sensitive to rapid changes in temperature in streams and impoundments, associated with effluent discharges or changing flood, catchment and riverine characteristics. The parts of the catchment which are threatened by low dissolved oxygen are the Msunduzi River downstream of Pietermaritzburg and the lower Mgeni River and estuary in Durban. Temperature problems occur in Midmar and Albert Falls dams as well as the urban rivers through Pietermaritzburg and Durban.

Salts can affect the health of plants, animals and people

A high salt content can cause problems for irrigation, industrial and drinking water. Fortunately, the Mgeni River catchment has naturally low surface water salt concentrations. However, these increase through the urban areas of Pietermaritzburg and Durban, so may present a future threat with further development. The salt concentrations of some groundwater aquifers near the coast is quite high, which may influence the use of this water for domestic supplies.

Contaminated groundwater restricts local use

Although groundwater is not extensively used in the Mgeni River catchment for major water supply schemes, many local communities depend upon boreholes and springs for domestic water supply. Contamination of the groundwater resources by nitrates and faecal pathogens from inadequate sanitation or agricultural practices, toxic chemicals and metals from industrial and agricultural areas, as well as natural geological salinity can negatively affect the health of those communities.

Informal and rural settlements and urban borehole users in the Vulindlela-Pietermaritzburg and the Valley of a Thousand Hills-Durban areas are most vulnerable to groundwater contamination, but information on the degree of the problem is lacking.

Contamination during floods is particularly severe

Many of the above problems are particularly bad during storm events, when contaminated washoff dominates the flow. When this is associated with damage of houses and sanitation systems in urban areas, the problems are exacerbated, particularly for the marginalised sections of the community in informal settlements.

Contamination during extreme flood events has potentially severe impacts on people in informal peri-urban settlements.

What is causing these problems?

In order to manage the impacts of water quality problems, we need to know where they are coming from (sources) and the contribution from each of these sources. Some portion of most water quality problems can be attributed to natural "background" sources, which would occur in an undeveloped catchment. The "pollution" increase above this background can be viewed as the manageable component, which is caused by human activity in the catchment. In most cases, human impacts exceed the background contribution to the major water quality problems in the Mgeni River catchment.

Point sources include all discharges from pipes and canals into streams and impoundments. Nonpoint sources are all other sources, including diffuse agricultural fields, urban areas and even concentrated waste disposal sites. Nonpoint sources are the major causes of water quality problems in the Mgeni River catchment.

The most important pollution sources in the Mgeni River catchment are discussed in approximate order of their contribution to the major water quality problems (i.e. faecal pathogens, nutrients, sediment and toxic metals). Although these source types may occur at various places in the catchment, only those areas where they make a significant contribution (i.e. >10%) to one of the water quality problems have been highlighted, indicating the priority sources for management.

Based on calculations performed during the Mgeni Catchment Management Plan study contributions from each source type to the water quality problems have been classified as:
significant (10%-25%)
major (25%-50%)
dominant (>50%)

Formal residential urban areas

Formally serviced residential areas in the urban centres contribute to low flow contamination through leaking and blocked sewers, ill-informed and illegal disposal of waste into stormwater drains and general drainage. Stormwater washoff from impervious surfaces and overflowing sewers result in significant contamination during high flow periods. The formal areas of:

- **Central Pietermaritzburg, Edendale-Imbali and Sobantu are dominant faecal and metal contamination sources and are a major nutrient (phosphorus) source in the Pietermaritzburg management sub-catchment.**
- **KwaMashu-Ntuzuma, Pinetown and Durban North dominate metal contamination and are a major source of faecal contamination sources in Durban.**
- **Mpophomeni and Howick, as well as formal towns in New Hanover, are smaller but significant local sources of nutrients and faecal contamination.**

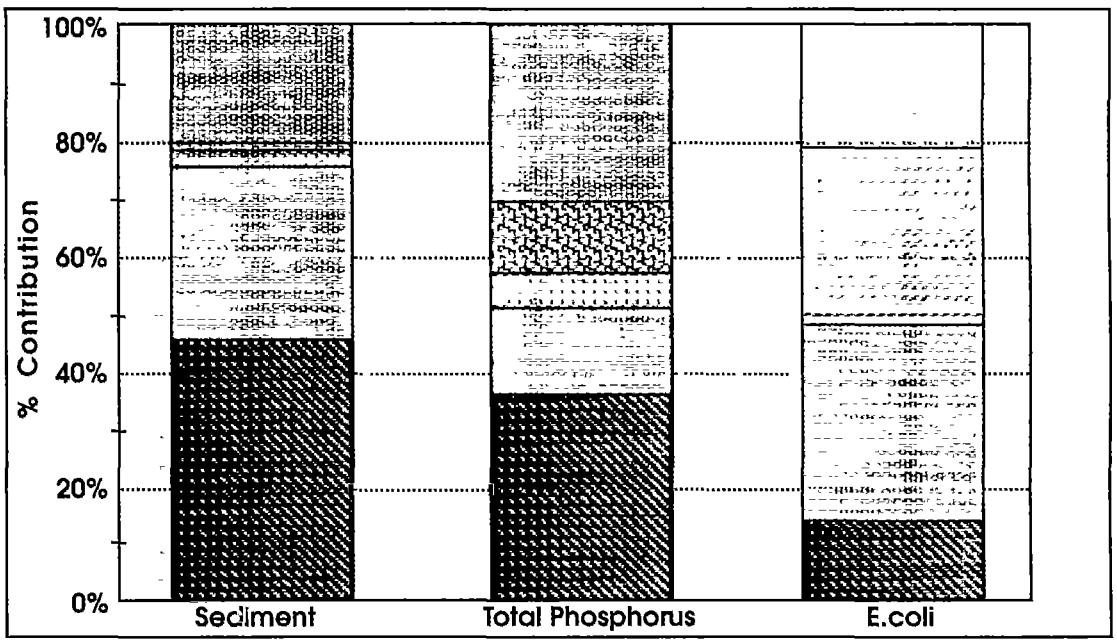


Fig. 4.4 Relative source contributions to water quality problems in the Nagle Management Unit

Informal peri-urban settlements

Poorly serviced settlements in and around urban centres contribute to low flow contamination through washing and bathing in local streams, seepage from inadequate sanitation and grey-water flowing from communal water supplies Storm washoff of accumulated human, animal and domestic waste material and overflowing pit-latrines cause contamination during high flows. Informal and transitional settlements in and around:

the Edendale valley and Sobantu are major sources of faecal contamination and nutrients, and are the dominant sources of sediment in Pietermaritzburg.

Ntuzuma-Kwa Mashu, Clermont-Pinetown and Inanda Mission Reserve are major sources of faecal contamination in Durban.

Mpophomeni, Vulindlela, Mpolweni, Coolair, Cato Ridge and Table Mountain are localised, but still significant sources of faecal contamination and nutrients.

Rural settlements

Largely unserviced settlements located away from the urban centres in rural areas of the former KwaZulu contribute to low flow contamination through direct human and livestock activity in the streams, as well as seepage from the limited and often poorly constructed sanitation and water supply infrastructure. Washoff of accumulated human and animal waste, erosion from areas under mixed crops, and overflow of pit-latrines result in contamination during high flows.The rural settlements in:

the Valley of a Thousand Hills is a major source of faecal contamination and sediment, and a significant source of phosphorus in the Inanda and Nagle dam catchments.

Vulindlela is the dominant source of faecal contamination, sediment and phosphorus in the Henley dam catchment, but has a relatively minor impact downstream of Henley dam in the Inanda dam catchment.

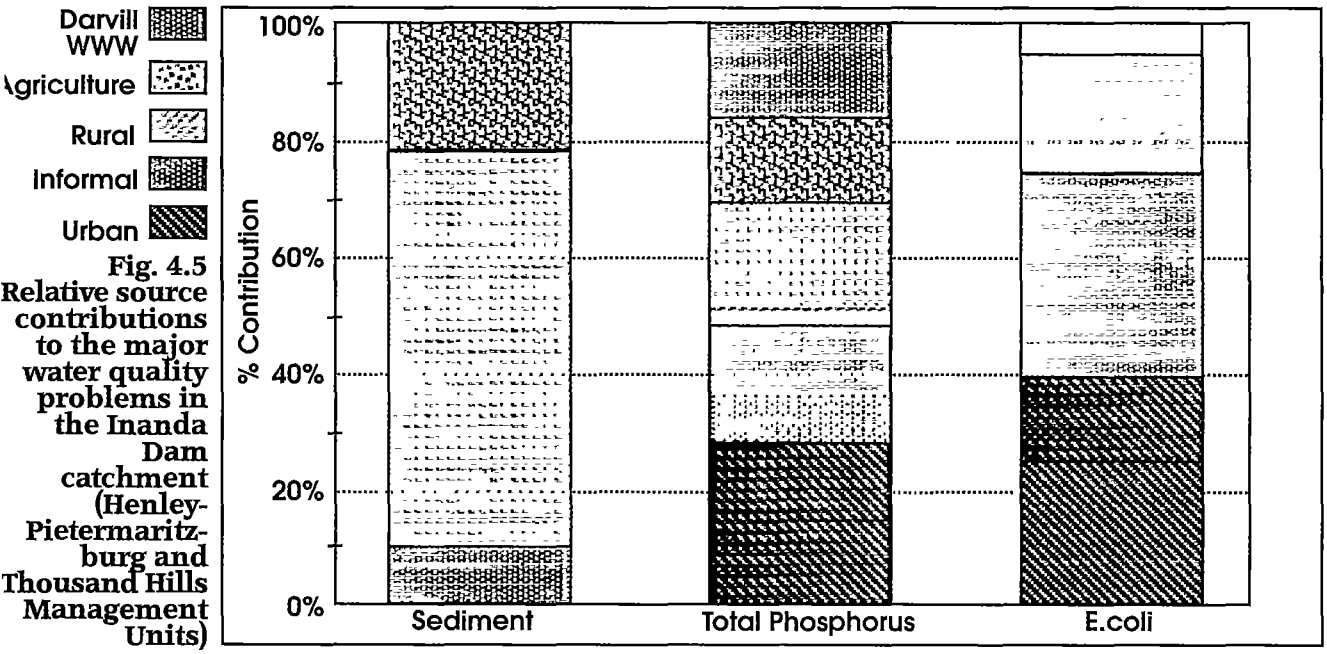


Fig. 4.5 Relative source contributions to the major water quality problems in the Inanda Dam catchment (Henley-Pietermaritzburg and Thousand Hills Management Units)

Industrial and commercial urban CBD areas

Urban commercial and industrial areas have an impact on low flows through illegal discharges, leaking sewers carrying industrial effluent, and seepage from storage and handling areas. The major impacts are during high flow periods, from stormwater washoff of accumulated matter from impervious surfaces, such as factory roofs, surrounding areas, roads and parking lots, and groundwater infiltration of poorly maintained sewers causing overflows. The industrial and commercial CBD areas of:

Central Pietermaritzburg and Edendale are major sources of metals and significant sources of phosphorus in Pietermaritzburg.

Pinetown-New Germany, Springfield Flats-Durban North and Phoenix are significant sources of metals in Durban.

Discharges from waste water works

Waste water works (WWW) produce effluent, which may have been treated to remove contamination. In the Mgeni catchment, most of the WWW treat both domestic (household) and industrial effluent. The effluent is usually chlorinated, which kills faecal pathogens in the effluent, and sometimes in the stream receiving the effluent, but may result in the production of toxic organic compounds. Effluent discharges have the greatest impact during low flow conditions when the ratio of effluent to streamflow volume is high.

Darvill WWW treats domestic and industrial effluent from Pietermaritzburg, contributing a significant nutrient load (total phosphorus 15% and soluble phosphorus 50%) to Inanda dam, as well as effluent with a high oxygen demand; this may become more significant with the proposed extension.

Mpophomeni WWW contributes a significant nutrient load (total phosphorus 10% and soluble 45%) to Midmar dam, which is not currently eutrophic, but may develop problems with increased settlement and development of the catchment, the raising of the dam wall or interbasin transfers from the Mooi River.

Kwa Mashu and Northern WWW's discharge treated domestic and industrial effluent with high nutrient load and oxygen demand, which should not cause significant problems, provided the Mgeni estuary mouth is kept open.

Commercial agricultural croplands

Extensive and intensive commercial crop production and timber reduce natural vegetation cover, disturb the soil and are often based on the addition of fertilizer and pesticides. The major impacts occur during high flows associated with storm events, when applied substances are washed off the land surface with soil erosion.

Sugar farming, and to a lesser extent maize farming cover a third of the Nagle dam catchment and are major contributors to the sediment and nutrient loads at Nagle dam, while timber covers a quarter and has a significant impact on sediment production.
Commercial crops, which cover a third of the Mqeku (sugar) and Table Mountain (maize, vegetables and sugar) sub-catchments, contribute a significant portion of the total phosphorus and sediment loads to Inanda dam.
Maize and vegetables are a significant source of nutrients to the Midmar dam catchment, while only representing 10% of the entire catchment area.

Commercial livestock areas

The rearing of commercial livestock may be extensive, on natural grassland and cultivated pastures, or intensive in confined animal facilities, such as piggeries, feedlots, dairies and chicken houses. The impacts of extensive grazing are largely dependent upon the access to river channels, which causes contamination during both low and high flows, but washoff from the land surface during storm events also occurs. Confined animal facilities can be managed to prevent contamination of nearby streams, but problems may occur during either low flows or storm events, when the containment systems are poorly designed or managed.

Livestock production, largely cattle grazing and pasturing is the dominant source of faecal contamination in the Midmar and Albert Falls dam catchments and is a major source of nutrients into Midmar dam, because it covers about half the catchment area. Poorly managed dairies and piggeries represent a significant part of this problem. Livestock (cattle) production is a significant source of sediment, nutrients and faecal contamination in the Nagle dam catchment, representing a quarter of the catchment area.

Other sources

There are a range of other sources in the Mgeni River catchment which do not have significant impacts on the major water quality problems, but can have local effects if they are not managed appropriately. Most of these sources already have management systems, but the continued implementation of these systems is necessary to prevent problems from developing. Although most of the management approaches are currently aimed at mitigating the impacts on receiving waters, more preventative approaches at source should be adopted.

Domestic and industrial waste disposal sites, particularly in Pietermaritzburg and Durban, can produce highly concentrated leachate, which must be contained.
Construction and development sites, usually in the urban and peri-urban areas around Pietermaritzburg and Durban, produce high sediment loads which must be intercepted.
Sludge application fields, irrigated effluent fields and evaporation ponds can result in contaminated seepage or overflow, which must be prevented by correct application and management.

- Timber plantations in the New Hanover and Karkloof catchments could contribute significantly to sediment loads if harvesting and road construction are not managed.
- Transport routes in the Pietermaritzburg, Durban, Lions and Table Mountain catchments are possible hazardous material spill sites which require accident response programmes.
- Quarries and sandwinning operations, largely in the Mgeni valley in Durban, can produce high sediment loads which should be intercepted.

What are the Water Quality Management Priorities in the Mgeni River Catchment?

- Leaking sewers and polluted storm washoff from the formal urban residential and commercial-industrial CBD areas in Pietermaritzburg and Durban, causing bacterial and toxic metal contamination, as well as nutrient loads.
- Inadequate sanitation and water supply infrastructure in the peri-urban informal settlements around Pietermaritzburg and Durban, causing bacterial contamination and nutrient loads.
- Point source discharges from domestic waste water works, particularly Darvill, Mpophomeni, Kwa Mashu, Northern, Howick and Cato Ridge WWW's, causing nutrient loads and possible toxic metal contamination.
- Inadequate sanitation and water supply, with poor crop and livestock management, in the dense rural settlements of the Valley of a Thousand Hills and Vulindlela, causing sediment erosion, bacterial contamination and nutrient loads.
- Commercial agricultural crop production, particularly sugar in the Nagle dam and Mqeku River catchments, maize and vegetables in the Midmar dam catchment and Table Mountain, causing sediment erosion and nutrient (fertilizer) loads.
- Commercial livestock production in the Midmar, Albert Falls and Nagle dam catchments, causing bacterial contamination and nutrient loads.

Fig. 4.6

5

WHAT IF THERE IS NO CATCHMENT MANAGEMENT?

Unless actions are taken to reverse existing water resource problems and prevent threats from being realised, the problems in the Mgeni River catchment are likely to worsen with increasing development and water use. This chapter indicates the likely future without implementation of the Mgeni Catchment Management Plan, based on the trends and management issues identified in the previous three chapters. The importance of addressing all water resource issues, including quantity, quality and ecology in an integrated manner must be emphasised.

Likely future developments

The national and provincial growth and development strategies aim at sustainable development, much of which will be centred in and around the Mgeni catchment. The predictions of future demographic and economic trends provide the basis from which to identify the likely impact for water resources in the Mgeni River catchment (see Table 5.1). Current problems or issues are likely to worsen with development along current trends, while other problems may develop due to changes in development patterns. Future development in the Mgeni River catchment is likely to include:

- population growth, associated with urban and peri-urban settlement development and upgrading in and around Pietermaritzburg and Durban;
- relatively high economic growth in and around the urban areas supplied with water from the Mgeni catchment, whereas lower growth rates in the agricultural sector are expected;
- densification and extension of rural settlements in Vulindlela and the Valley of a Thousand Hills,
- associated with intensification of informal crop and livestock production;
- limited changes in the patterns of commercial agricultural crop, timber and livestock production in the upper and central Mgeni River catchment
- possible increased sugar cane production in the central Mgeni catchment;
- increasing importation and use of water from the Mooi and Mkomazi River catchments, particularly into the Midmar dam catchment, to meet the increasing demands from domestic and industrial users;
- increased water supply to informal and rural settlements in the Msunduzi and lower Mgeni River catchments, resulting in increased grey-water return flows; and
- increasing waste water works effluent return flows from Pietermaritzburg (Darvill) and Durban (Kwa Mashu, Northern, KwaDabeka and New Germany).

	Midmar	Albert Falls	Nagle	Henley-Pmb	Thousand Hills	Durban	Total
Population % growth	15%	30%	40%	33%	20%	25%	34%
GGP % increase	7%	30%	30%	40%	50%	45%	40%

Table 5.1. DBSA predicted population and economi (GGP) growth in the Mgeni catchment by 2010.

River health will deteriorate

The aquatic environment is the resource base upon which all other water users depend, in terms of both quantity and quality of water. It has a natural environmental capacity to assimilate contamination through natural physical, chemical and biological processes, when the ecological functioning of the river is healthy. This functioning can be degraded or destroyed if the quantity or quality of water deteriorates beyond certain thresholds, the riverine habitat itself is modified, or some combination of these factors occurs. This also has an impact on the aesthetic quality of the aquatic environment and thus its desirability for recreation. Sensitive issues and areas in the Mgeni River catchment include:

- impaired ecological functioning resulting from changing flow regime with increasing land use development, instream regulation and water abstraction from large impoundments and farm dams;
- invasion of river channels by exotic plants and trees, resulting in increased water loss, choking and destabilisation of rivers and reduction of natural habitats, particularly in the upper Mgeni catchment;
- modification and rerouting of rivers flowing through urban areas, particularly Pietermaritzburg and Durban, resulting in degraded aquatic habitats, limited flood attenuation and reduced assimilation;
- rural and agricultural development throughout the Mgeni catchment;
- increasing siltation of the streams and rivers in the Valley of a Thousand Hills;
- limited biotic diversity and aesthetic quality in the streams and rivers flowing through Pietermaritzburg and Durban, due to contamination by metals, toxic chemicals and litter deposition; and loss of biotic diversity in rivers due to increased pesticide use for commercial and informal agriculture.

Human health risks will increase

People who depend upon local water resources for domestic use, bathing, washing or swimming are particularly vulnerable to deterioration in its quality, especially from a health perspective. Furthermore, "contact" recreational users are at risk when using faecally contaminated water. Issues of concern are:

- worsening faecal contamination of streams flowing through Pietermaritzburg and Durban, associated with the growth of formal and informal settlements;
- increasing health risks for inhabitants of densifying rural settlements in the Valley of a Thousand Hills and Vulindlela, despite improvements in water supply;
- hygiene problems in expanding settlements without adequate quantities of clean water;
- potential epidemics resulting after extreme flood damage to houses and sanitation systems, particularly in informal settlements around Pietermaritzburg and Durban;
- contamination of groundwater resources which supply local settlements and households will increase if siting of sanitation and industry is inappropriate; and
- intermediate urbanisation and informal settlement near streams and rivers in Pietermaritzburg and Durban increases the risk of death and property damage from flooding.

Water supply will not meet demands

Population growth, economic development and associated water demands have increased, while the availability of water in the Mgeni catchment has decreased over the last few decades. This trend is likely to continue, unless holistic management of water resources is implemented. Issues of concern are:

- the bulk water demand on the Mgeni River is rapidly exceeding the assured supply, especially from Midmar dam;
- afforestation, sugar cane, farm dams and irrigation have significantly reduced the water available in the Nagle, Albert Falls and Midmar dam catchments;
- the headwaters of the Mgeni, Lions, Karkloof and Mpolweni Rivers should be protected as these contribute significant portions of the low flows and influence the health of the rivers;
- water resource developments to import water from the Mooi and Mkomazi Rivers to meet the demand from the Mgeni catchment will substantially increase the cost of water.

Providing clean water will cost more

The major dams in the Mgeni River catchment supply most domestic and industrial users in the region. The operation of these impoundments is impaired by water quality problems, which in turn increases the cost of treating water for bulk water supply. Potential issues include:

- worsening eutrophication problems in Inanda dam, due to increasing urban development and effluent discharges from the extended Darvill waste water works;
- sedimentation of Inanda dam, with the resulting loss of storage capacity, resulting in the need for further water resource development with higher costs;
- increasing stratification, eutrophication and sedimentation of Midmar dam with the raising of the wall and importation of water from the Mooi and Mkomazi Rivers; and
- increasing treatment costs associated with eutrophication, stratification and sedimentation of Midmar and Inanda dams, as well as high treatment costs associated with Nagle dam.

The estuary, ocean and beaches will be degraded

The estuarine and marine environments are particularly susceptible to poor management, by being at the receiving end of the catchment. Possible issues are:

- increasing contamination by metals, toxic chemicals and phosphorus, due to development in Durban, which affects the functioning of the estuarine and marine ecology;
- increasing faecal contamination and associated recreational health risks in the estuary and coastal marine zone near the river mouth;
- increased litter deposition in the estuary and on the beaches, reducing their aesthetic desirability for recreation; and
- insufficient releases from Inanda dam required to keep the estuary mouth open, and thus prevent build-up of nutrients, oxygen depleting substances, metals and toxic chemicals.

The results of inadequate management of the Mgeni River catchment will be:

- More deaths and illness associated with recreational and local domestic use of streams in the Msunduzi and lower Mgeni River catchments.
- Further expensive water resource developments will be needed to provide water for the growing demand in Pietermaritzburg and Durban.
- Increasing bulk water treatment costs and impoundment operation problems will occur, particularly with Inanda and Midmar dams.
- Reduction in the water available from Nagle dam, due to increased afforestation, agricultural cultivation and irrigation in the central and upper Mgeni River catchment.
- Further loss of agriculturally productive land through soil erosion and urbanisation.
- More deaths and property damage from flooding of informal settlements and urban areas in Pietermaritzburg and Durban.
- Further degradation of the streams and rivers of the Msunduzi and lower Mgeni River catchments, and the estuarine and marine environments in Durban, with the associated reduction in ecological integrity, aesthetic and recreational quality.

Fig. 4.7

6

THE MGENI CATCHMENT MANAGEMENT PLAN

The Mgeni Catchment Management Plan requires preliminary objectives and associated strategies to address the major water resource issues in different parts of the Mgeni River catchment. The ultimate aim is to provide sufficient water with adequate quality to supply the legitimate demands of users, while maintaining healthy functioning of the aquatic environment.

This chapter provides a summary of the management plan, introduces the recommended strategies to achieve the preliminary management objectives in each management unit, and indicates the responsibilities, typical implementation costs, sustainability and time frame for implementation of these strategies.

The previous chapters have dealt with different aspect of the problems and issues in the Mgeni River catchment, indicating priorities for management. Only the critical issues can be addressed during the initial implementation of the Management Plan. The information presented in this Chapter is a summary of the preliminary Management Plan for the Mgeni River catchment.

Preliminary objectives have been set through a process of consultation with water resource managers. These need to be achieved in order to address the critical water resource issues in the catchment. Strategies have been recommended to achieve these objectives, together with an indication of:

the organisations or parties responsible for regulation and implementation,

the estimated costs for responsible parties,

the physical and social sustainability of the strategy after implementation,

the time frame for implementation.

This information is presented in a series of tables, a general catchment wide strategy table and then one for each Management Unit. The seven tables on the following pages are a summary of the detailed strategy tables presented in the Appendix document. They represent the preliminary Management Plan which must be presented as a "straw-dog" to the Stakeholders in each Management Unit.

This preliminary Management Plan provides the basis for agreeing responsibilities for the development and implementation of actions needed for the plan to work.

The responsible organisations are required to develop site-specific actions, based on "best management practices", which they are willing to implement for each of the proposed strategies. An indication of the cost, effectiveness, design, time frame and auditing procedure associated with each action must be presented. If the strategy is deemed to be too stringent or onerous, the reasons must be clearly outlined.

In some cases, it may be necessary to re-evaluate the technical, economic or social viability of the preliminary objectives and strategies, and indicate possible modifications which need to be incorporated in the implemented Management Plan. The combination of all agreed actions in a particular management unit represents the Action Plan to be implemented under the auspices of the Management Plan.

To be completed by the Steering Committee

TABLE 6.1: GENERAL MANAGEMENT STRATEGIES FOR THE ENTIRE MGENI CATCHMENT

Issues	Objectives	Strategies	Responsibility	Cost	Sustain	Timing
Inefficient use of water	Allocate more efficiently	Perform and publicise a cost-benefit investigation of the use and allocation of water to different sectors and users from the Mgeni River catchment	DWAF/UW*	Low*	Med*	Immed*
		Support ongoing and implement further bulk domestic, industrial and agricultural water conservation initiatives				
		Support the national initiatives for reassessing water tariffs and apply to irrigation and bulk supply (and possibly forestry and sugar cane)				
Inappropriate agricultural practices for water quality	Effective and efficient practices and land use	Evaluate the costs and benefits of afforestation and sugar cane in terms of water use and sediment yield.				
		Investigate the use of economic instruments to influence agricultural land use, particularly sugar cane and forestry				
		Investigate the use of economic instruments to assist soil erosion, fertilizer and pesticide management				
		Encourage and enforce the development and extension of crop-specific agricultural practices				
Surface water resources	Manage the surface water sustainably	Identify environmental requirements for the ecological reserve and ensure their maintenance				
		Optimize the yield from the Mgeni system through ongoing analysis, taking consideration of water quality issues				
		Remove alien invasive vegetation from river courses and rehabilitate the riparian zone.				
Groundwater resources	Identify and protect key groundwater sources	Evaluate the importance of groundwater for domestic supplies and baseflow recharge in different parts of the catchment				
		Provide a framework within which to manage groundwater recharge, utilization, discharge and contamination throughout the Mgeni catchment				
Auditing the plan		The use of environmental legislation to influence development.				
		Develop techniques and responsibilities for monitoring the success of the plan according to the specified problems and objectives				

TABLE 6.2: SUMMARY MANAGEMENT PLAN FOR THE MIDMAR MANAGEMENT UNIT

Issues	Objectives	Strategies	Responsibility	Cost	Sustain	Timing
Phosphorus into Midmar dam	Maintain current mean in-dam concentrations TP < 15 µg/ℓ	Limit SRP discharge from Mpophomeni WWW to current 1400 kg/year	UW/DWAF	Med	High	Medium
		Control settlement and urbanisation in the Midmar Dam catchment through land use planning	KNPA/DWAF/UW	Med	High	Immed
		Limit agricultural land use increase in the Midmar Dam catchment, particularly afforestation, sugar cane and irrigation through permitting	KNPA/DWAF/UW	Med	High	Immed
		Maintain adequate algal problem treatment capacity at Midmar treatment works	UW	Med	Med	Med
		Reduce inappropriate afforestation, particularly in riparian areas	DWAF	Med	High	Long
Faecal cont. in: - Lions - Mthinzima	E.coli <100/100mℓ	Enforce appropriate use of parlour washing containment facilities for dairies and piggeries	DWAF/KNPA/DoA	Low	Med	Immed
		Enforce commercial livestock management i.t.o. density and river access	KNPA/DoA	Low	High	Immed
		Support ongoing agricultural sediment control and fertiliser use extension efforts to commercial vegetable, maize and pasture farms	DoA/Cedara	Low	High	Immed
		Relocate housing away from the riparian zone and/or upgrade water supply and sanitation of informal settlements on the Mthinzima stream in Mpophomeni	KNPA/TLC	Med	Med	Med
		Improve the stormwater system in Mpophomeni to reduce urban washoff and low flow contamination	KNPA/TLC	Med	Med	Med
		Provide water supply and sanitation to rural settlements in the Mthinzima River catchment, with an education programme about the use of local rivers and the control of livestock	UW/KNPA	Med	Med	Med
Reduced MAR to Midmar dam	No further reduction of MAR through land use change or stream losses	Raise Midmar Dam and import water from the Mooi and Mkomazi to meet increasing demand, but reduce the impacts of flooding from imported water	DWAF/UW	High	Med	Med
		Ensure lower phosphorus concentration for imported water, than the current Mgeni River inflow to Midmar dam: mean flow weighted TP < 60 µg/l (15% SRP)	DWAF/UW	Med	High	Med
Increasing bulk demand on Midmar dam	Ensure sufficient reliable water is available to meet the valid demand	Implement a water conservation programme, emphasising water use efficiency and reduced distribution losses in the Inland Water Supply Region	DWAF/UW/TLC	Low	High	Immed
		Develop Midmar Dam operating rules to maximise yield, while addressing water quality problems, taking account of the entire Mgeni system	UW/DWAF	Low	High	Med

TABLE 6.2: CONT.

Issues	Objectives	Strategies	Responsibility	Cost	Sustain	Timing
Functioning of aquatic env.	Maintain ecological health of the rivers and wetlands	Ensure adequate instream flow downstream of afforestation, farms dams and irrigation abstractions	UW	Med	Med	Med
		Rehabilitate the Mthinzima River riparian zone in Mpophomeni and the rural settlements	UW/DWAF/KNPA	Low	Med	Med
		Protect and rehabilitate the Mgeni Vlei and other wetland areas	UW/DWAF/KNPA	Low	Med	Med
Groundwater exploitation/ contamination	Ensure protection of groundwater level and quality	Remove riparian alien invasive plants from streams and rivers (support DWAF initiatives)	DWAF/UW	Low	Med	
		Prevent over-utilisation of groundwater resources (through future Water Law)	DWAF	Low	Med	
		Protect groundwater sources where groundwater is the source for small towns or villages.	UW/DWAF/KNPA	Med	High	L

TABLE 6.3: SUMMARY MANAGEMENT PLAN FOR THE ALBERT FALLS MANAGEMENT UNIT

Issues	Objectives	Strategies	Responsibility	Cost	Sustain	Timing
Faecal cont. in - Howick - Karkloof	E.coli < 1000/100ml	Upgrade and maintain sewer and stormwater system in Howick formal and industrial areas	* To be completed by the Stakeholder Forum			
		Provide water supply and sanitation to informal settlements to limit direct use of rivers around Howick				
		Enforce livestock management practices to restrict direct contamination of streams				
		Enforce dairy and piggery containment facilities in the Karkloof catchment				
Phosphorus in Albert Falls and Nagle dams	Reduce load to Albert Falls by 25% (TP <10 t/a)	Warn and educate about the direct recreational use of Karkloof and Howick Falls during storms				
		Use Midmar compensation release to dilute low flows through Howick				
		Implement Phosphate standard on the WWW's in Howick, with effluent return flows				
		Upgrade and operate WWW's in Howick to prevent storm surcharge				
		Operate Albert Falls dam to increase sediment and phosphorus settling and reduce their release				
Aquatic env. health in Mgeni and Karkloof	Maintain health and assimilative capacity	Rehabilitate and remove alien riparian vegetation from the Mgeni and Karkloof rivers				
		Promote erosion control, fertilizer and pesticide management programmes on croplands and timber plantations				
		Rehabilitate and protect wetlands and headwaters of the Karkloof River				
		Limit further afforestation and sugar cane production				
		Encourage appropriate siting of existing afforestation and rehabilitation of riparian areas				
Reduced water availability	Prevent further reduction in MAR an instream losses	Limit further development of farm dams and irrigation				
		Promote irrigation efficiency				
Groundwater potential	Utilize and protect groundwater sources	Investigate the sustainable utilization of groundwater to supply small settlements and farms				
		Protect groundwater supplies from agricultural and urban land use contamination				

TABLE 6.4: SUMMARY MANAGEMENT PLAN FOR THE NAGLE MANAGEMENT UNIT

Issues	Objectives	Strategies	Responsibility	Cost	Sustain	Timing
Faecal cont. in - Mpolweni - Trust Feed - Coolair - Rural settle.	E.coli < 1000/100ml	Provide water supply and sanitation to informal settlements to limit direct use of streams	* To be completed by the Stakeholder Forum			
		Assess the level of faecal contamination and develop site specific plans in these settlements				
		Prevent rural settlement livestock access to rivers through education and alternative supplies				
		Promote alternative energy and electrify to reduce dependence on local wood				
		Educate tribal authorities about location of settlement and control of livestock				
		Enforce commercial livestock management practices to restrict direct contamination of streams				
Phosphorus in Nagle dam	Reduce input load to Nagle 50% (TP <10 t/a)	Enforce effective operation of feedlot containment facilities				
		Warn and educate about the direct domestic and recreational use of local rivers				
		Operate Nagle by-pass to limit sediment and phosphorus loads into the impoundment				
		Promote fertilizer and pesticide management programmes on croplands, sugar cane and timber plantations				
Sediment loss		Rehabilitate areas with serious erosion, and develop flow dissipation structures in tributaries				
		Maintain sediment and algal treatment capabilities for bulk water supplies from Nagle dam, with abstraction operational capabilities, such as differential off-takes				
		Promote and enforce soil conservation guidelines in all agricultural areas				
		Limit further afforestation and sugar cane production				
Aquatic env. health in Mgeni River	Maintain health and assimilative capacity	Rehabilitate and remove alien riparian vegetation from the Mgeni River				
		Rehabilitate and protect wetlands and headwaters of the Mpolweni and Sterkspruit Rivers				
		Operate Albert Falls to minimize flow, sediment and phosphorus impact on Mgeni and Nagle				
Reduced water availability	Prevent further reduction in MAR an instream losses	Encourage appropriate siting of existing afforestation and rehabilitation of riparian areas				
		Limit further development of farm dams and irrigation				
		Monitor and reduce illegal abstractions of releases from Albert Falls to Nagle dam				
Increasing demand in Durban	Meet demands, and increase efficiency	Promote water conservation w. r t. bulk domestic and industrial users in Durban, as well as irrigation users, in terms of efficiency and reduced distribution losses				

TABLE 6.4: CONT.

Issues	Objectives	Strategies	Responsibility	Cost	Sustain	Timing
Groundwater potential	Utilize and protect groundwater sources	Import water from the Mooi and Mkomazi, via releases from Midmar dam				
		Promote irrigation efficiency through extension and economic incentives/tariffs				
		Investigate the sustainable utilization of groundwater to supply rural settlements and farms				
		Protect groundwater supplies from agricultural and local settlement contamination				

TABLE 6.5: SUMMARY MANAGEMENT PLAN FOR THE HENLEY-PIETERMARITZBURG MANAGEMENT UNIT

Issues	Objectives	Strategies	Responsibility	Cost	Sustain	Timing
Faecal Cont. in - streams - Camps Drift	E.coli <1000/100ml	Upgrade and maintain sewer and stormwater systems in formal areas	* To be completed by the Stakeholder Forum			
		Upgrade sanitation, water supply and stormwater systems in informal and rural settlements				
		Conduct comprehensive water and sanitation education programme				
		Implement pet and livestock waste control programmes				
		Develop site specific plans for faecal contamination in particularly affected areas (Bayne's spruit, Dorpspruit, Camps Drift)				
		Release during low flows from Henley dam to provide dilution in the Msunduzi River and prevent the Henley bypass from operating				
		Provide flood storage capacity in Henley and Camps Drift to assist assimilation and flood attenuation during high flows				
Sediment into - Camps Drift - Inanda dam	Reduce load by - 50% - 20%	Provide warnings for recreational and domestic use and provide alternatives				
		Increase instream sediment, phosphorus and pathogen assimilation and flood attenuation in smaller tributaries through wetlands/pond systems				
		Implement livestock and crop control practices to reduce soil erosion				
		Promote the use of vegetation cover (e.g. trees) in rural and informal settlements				
		Implement pro-active planning taking account of water quality and flooding				
		Dredge Camps Drift to remove sediment and other contaminants				
		Enforce bylaws governing urban construction and development				
		Relocate settlements out of the flood zone and provide alternative areas				
Phosphorus to Inanda dam	Reduce P load: TP 50% of current SRP 75% of current	Detain first flush for storm events from industrial sites/factories				
		Monitor and prosecute illegal effluent discharges				
		Continue monitoring and assessment of Darvill contribution to Inanda dam phosphorus				
		Further reduce the phosphorus concentration from Darvill, through improved processes and/or maintain current P loads, even with increased return flow and Darvill upgrade				

TABLE 6.5: CONT.

Issues	Objectives	Strategies	Responsibility	Cost	Sustain	Timing
Metal contamination	Maintain target conc for aquatic environ.	Improve sewer systems to increase the return flow from bulk water supplies, but prevent surcharge/bypass of Darvill during storm events				
		Promote the use of lead free petrol				
		Monitor and assess lead and chromium concentrations in Pietermaritzburg				
Aquatic health	Rehabilitate rivers	Rehabilitate rivers and aquatic vegetation through Pietermaritzburg to provide a healthy resource base, flood attenuation and pollutant assimilation				
		Remove alien riparian vegetation and gross pollutants				
Flooding in Pmb.		Estimate 50-year flood lines and incorporate into land use planning				
		Construct flood levees in critical areas				
		Increase pervious surfaces in urban areas through land use planning and appropriate design				

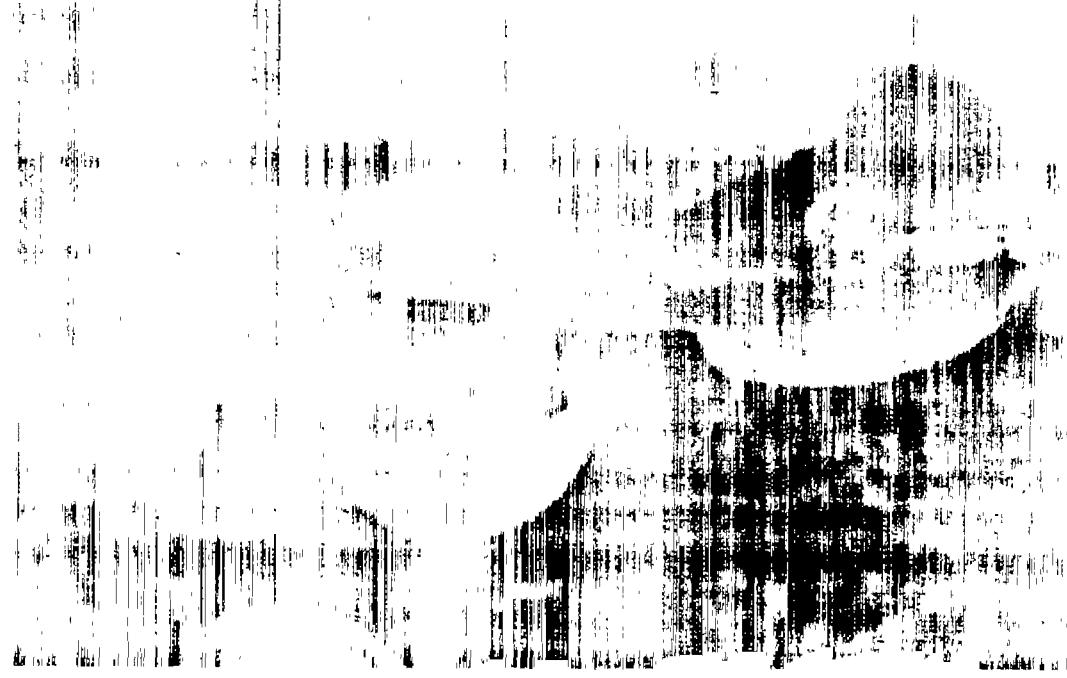
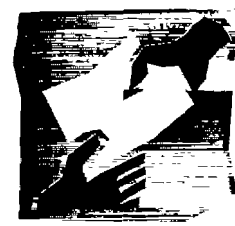


TABLE 6.6: SUMMARY MANAGEMENT PLAN FOR THE THOUSAND HILLS MANAGEMENT UNIT

Issues	Objectives	Strategies	Responsibility	Cost	Sustain	Timing
Faecal cont. in rural settlements	E.coli < 1000 /100ml	Provide water supply and sanitation to informal/rural settlements to limit direct use of streams	*To be completed by the Stakeholder Forum			
		Assess the level of faecal contamination and develop site specific plans in these settlements				
		Prevent rural settlement livestock access to rivers through education and alternative supplies				
		Promote alternative energy and electrify to reduce dependence on local wood				
		Educate tribal authorities about location of settlement and control of livestock				
Phosphorus in Nagle dam	Reduce input load to Nagle 50% (TP <10 t/a)	Monitor and evaluate the impact of phosphorus loads from Pietermaritzburg on Inanda dam				
		Warn and educate about the direct domestic and recreational use of local rivers				
		Identify appropriate operation of Nagle bypass to minimize sediment and phosphorus loads to Nagle and Inanda dams				
		Promote sediment fertilizer and pesticide management programmes for sugar cane and crops				
	Reduce to 80% of current load Sed. <200 000 t/a SS load < 80 000 t/a	Rehabilitate areas with serious erosion, and develop flow dissipation structures in tributaries				
		Maintain sediment and algal treatment capabilities for bulk water supplies from Inanda dam, with abstraction operational capabilities, such as differential off-takes				
		Scour sediment from Inanda dam when possible and purge sediment laden flood waters				
		Limit further sugar cane production				
Aquatic env. health in Mgeni River	Maintain health and assimilative capacity	Rehabilitate rivers and remove alien riparian vegetation from the lower Msunduzi and Mgeni Rivers				
		Restrict use and destabilisation of the river banks by agriculture and livestock				
		Protect and rehabilitate natural wetlands and headwaters in Mqeku and Table Mountain				
Reduced water availability	Prevent further reduction in MAR an instream losses	Operate Henley to support low flows in the lower Msunduzi and provide additional yield				
		Limit further development of farm dams and irrigation and ensure sustainable/appropriate development of small scale subsistence irrigation when necessary				
Increasing demand in Durban	Meet demands, and increase efficiency	Promote water conservation bulk domestic and industrial users in Durban, as well as irrigation users, in terms of efficiency and reduced distribution losses				
		Import water from the Mooi and Mkomazi, via releases from Midmar dam				
Groundwater potential	Utilize and protect groundwater sources	Investigate the sustainable utilization of groundwater to supply rural settlements				
		Protect groundwater supplies from contamination by local settlements				

TABLE 6.7:- SUMMARY MANAGEMENT PLAN FOR THE DURBAN MANAGEMENT UNIT

Issues	Objectives	Strategies	Responsibility	Cost	Sustain	Timing
Faecal Cont. in - streams - estuary	E.coli < 1000/100ml	Upgrade and maintain sewer and stormwater systems in formal areas	* To be completed by the Stakeholder Forum			
		Upgrade sanitation, water supply and stormwater systems in informal and rural settlements				
		Conduct comprehensive water and sanitation education programme				
		Implement pet and livestock waste control programmes				
		Develop site specific plans for faecal contamination in particularly affected areas (Kwa Masha, Pinetown, Mgeni estuary)				
		Release during low flows from Inanda dam to provide dilution in the Mgeni River and support the functioning of the estuary				
		Increase pathogen assimilation and flood attenuation in tributaries through wetlands/ponds				
		Provide warnings for recreational and domestic use and provide alternatives				
		Implement pro-active planning taking account of water quality and flooding				
		Relocate settlements out of the flood zone and provide alternative areas				
Metal contamination	Maintain target conc for aquatic environ.	Detain first flush for storm events from industrial sites/factories				
		Monitor and prosecute illegal effluent discharges				
		Improve sewer systems to increase the return flow from bulk water supplies, for the estuary				
		Promote the use of lead free petrol				
		Monitor and assess lead and chromium concentrations in Durban and the estuary				
Aquatic health in rivers and estuary	Rehabilitate rivers and maintain estuary functioning	Rehabilitate rivers and aquatic vegetation through Durban to provide a healthy resource base, flood attenuation and pollutant assimilation				
		Identify the estuary flow requirements and maintain this from Inanda, taking account of increasing WWW's return flows				
		Remove alien riparian vegetation and gross pollutants				
Flooding in Durban	Reduce flood risk	Estimate 50-year flood lines and incorporate into land use planning and construct flood levees in critical areas				
		Increase pervious surfaces in urban areas through land use planning and appropriate design				



HOW TO IMPLEMENT THE PLAN

The Management Plan provides a framework through which to design and implement integrated solutions to the water resource problems in the Mgeni River catchment. The responsible Stakeholders now have to translate this Management Plan into concrete actions which can be implemented at specific places in the catchment. This chapter outlines the way forward for successful catchment management.

What do we want from the Management Plan ?

This document has motivated and proposed a set of preliminary objectives and strategies to address the major water resource problems and protect the sensitive areas in the Mgeni River catchment. This forms the basis of a Management Plan which provides a framework for integrated catchment management.

To make the plan a reality, these strategies must be translated into specific actions, by the organisations and parties who are responsible for their implementation. The resulting Action Plan must be supported by all the stakeholders in the catchment.

To engender this support, the structures which are responsible for facilitating the ongoing development and implementation of the Action Plan must be flexible and sensitive to the conflicting needs of different stakeholders and the dynamic conditions in South Africa today.

Ultimately, we need a dynamic action-oriented plan to meet the challenges of catchment management!

What do we need to succeed ?

In South Africa we are making our first attempts at integrated catchment management, so we have only limited experience. Experience elsewhere in the world suggests that integrated catchment management can only succeed if the following are present:

Participation by all the stakeholders in the catchment through suitable democratic structures for the development and implementation of the catchment management plan.

Agreement amongst the stakeholders in the catchment concerning the vision, objectives and strategies for managing the catchment.

Acceptance of responsibility and identification of appropriate actions to achieve these objectives.

An organisation which has the necessary resources and expertise to coordinate the implementation of the agreed actions.

Effective coordination, implementation and auditing of actions by this organisation to clearly illustrate the benefits of catchment management to the stakeholders.

Sufficient human and financial resources for those responsible for co-ordinating the plan and the many operating organisations that must implement it.

What constraints are we working with ?

The Catchment Plan is obviously site-specific in terms of the problems it addresses. However, it must also reflect the specific political and economic environment in which it operates, which create the institutional, legal and resource constraints.

Institutional

Integrated catchment management requires that regulatory authorities at national, provincial (secondary) and local (tertiary) levels join with water resource managers to address issues on a catchment basis. The water managers in the catchment (i.e. the DWAF and Umgeni Water) are the architects of the Mgeni Catchment Management Plan, so are fully committed to the process.

Provincial government and local authorities must become involved if the catchment is to be effectively managed in an integrated manner, rather than only the water resources in the rivers, dams and water supply systems. Unfortunately, they are not entirely aware of the impacts that areas under their jurisdiction have on water resources. This document is aimed at raising awareness in these circles, by indicating the impact water resource problems have on all sectors of society.

Legislative

The present South African Law, while not hindering catchment management, does little to support it. The powers that are required for integrated catchment management are either fragmented between departments and levels of government or are not sufficiently comprehensive. Loopholes exist, there is overlap in legislation, confusion about who is the lead agency, and the legal process is slow when needed. At present it is cumbersome to use the available laws, but this may change with the ongoing revision of policy and legislation in most government departments.

Fortunately, the use of legislation is only one of the management tools required for catchment management. It is normally accepted that prosecution should be the last resort to force people to do what is necessary. Enforcement requires human and financial resources, whereas compromise and consensus is more sustainable in the long term.

The most significant deficiency is the enabling legislation allowing appropriate organisations to accept authority and raise funds for infegrated catchment management. Fortunately, these problems are being addressed during the current Water Law Review in which catchment management plays a central role.

Other initiatives addressing the management of natural resources include the Consultative National Environmental Policy Process (CONNEPP) and Integrated Pollution Control (IPC) Process, the delegation of powers and functions from national to provincial and third tier governments, and the ongoing review of the functions and areas of responsibility of water boards. Environmental legislation is particularly important for catchment management, as it provides mechanisms for control over development and land use change.

Resources

Notwithstanding the legislative and institutional constraints, there is general support across many, if not all, of the economic sectors which need to support integrated catchment management, including agriculture, recreation, industry, domestic water users, bulk water suppliers and environmental groups, as well as regulatory and implementing authorities in national, provincial and local government.

There is also an increasing appreciation amongst the people living in catchments that they have a responsibility for what happens in their catchment and that integrated management provides the best way of managing the resources on which they rely.

This support needs to be translated into the allocation of resources to support catchment management, because in the long term this will be the single greatest factor determining the success of the Mgeni Catchment Management Plan.

Where should we start ?

The conditions in the Mgeni Catchment are technically well understood, despite being extremely complex. Its water resources are under great pressure both in terms of the quantity available to meet demands and the fitness of its quality to meet user requirements.

We are trying to start something that is new in South Africa and it is therefore suggested that we begin by tackling only part of the catchment. Suggestions have been made that the catchment be divided into six management units. If these are agreed to, then it would be sensible to start with one or two management units as a pilot catchment management plan, so that we can learn on an area which is not too large.

The catchments

It is suggested that implementation of Integrated Catchment Management should start in only one or two of the Management Units proposed for the Mgeni Catchment. This is because:

we haven't done it before;
we need to test the approach in a manageable area; and
we need to understand what resources are required before tackling too large an area.

For technical reasons it is better to start with a management unit which includes the headwaters of the catchment. This means that all the sources contributing water and pollutants to the rivers in that management unit are included in the area to be managed.

The management unit which comprises the whole catchment upstream of Midmar Dam would be a good place to start, because:

Midmar Dam supplies a large percentage of the drinking water which is abstracted from the Mgeni Catchment, and the demand is fast approaching the reliable supply. It is an area where the quality of water is relatively good, but changing activities could alter this quality and thus increase the cost of treating water.

It is a catchment where good land management can make water available while also ensuring the continued fitness for use of that water.

The Midmar Catchment does not have any direct upstream sub-catchments which are not part of the management unit.

However, scheduled transfers from the Mooi catchment will increase the water flowing into Midmar dam, which requires increased management of the water resources and donor catchments.

Current initiatives, such as the recent review of the Midmar Development Policy have recommended the implementation of Integrated Catchment Management. There is general consensus among the major planning and administrative organisations that this should be pursued vigorously, so this process should be supported and used to achieve the objectives of the MCMP. Similarly, the upper Msunduzi River catchment including Vulindlela and Pietermaritzburg provides a possible pilot study, because:

Pietermaritzburg uses a large portion of the water abstracted from Midmar dam, so current water conservation initiatives provide a high profile strategy that may be associated with the plan.

Some of the worst water quality and flooding problems in the catchment are centred around Pietermaritzburg, so mitigation of these problems will provide support and impetus for the management plan.

There are no sub-catchments upstream and no diversions into the catchment. The operation of Henley dam provides opportunities for instream management of the Msunduzi River.

This area is predicted to have significant population and economic growth, which requires planning to manage the potential negative impacts of flooding and water quality contamination.

It is an urban catchment with strong local authorities and an healthy economic base to support planning and appropriate development.

Current initiatives for flood management and catchment planning may be incorporated and used to achieve the objectives of the management plan.

It is proposed that the Management Plan is initially implemented on the Midmar Management Unit, with parallel implementation of the Management Plan in the Henley-Pietermaritzburg Management Unit.

The institutions

There is no established way of tackling Integrated Catchment Management and because of the initiatives which are under way we do not have the legislative framework or clear direction for the best way to operate. However, we need to start now and cannot wait for all the other initiatives which are under way to reach completion. Therefore it is suggested that we start with some interim arrangements. These can be amended as we see how they work and more guidance comes from the other initiatives.

The work that has been done to identify ways of undertaking integrated catchment management has proposed that the required activities be divided into five levels of management.

- **National Policy and Legislation**
- **Regional Regulation and Control**
- **Catchment Co-ordination and Planning**
- **Local Stakeholders**
- **Local Operational Activities**

As the custodian of water resources in South Africa, the national DWAF is responsible for water resource policy and legislation, while the regional DWAF is the regulatory and control authority. Other national and provincial authorities are responsible for policy and regulation affecting catchment management, such Land Affairs, Planning, Agriculture, Housing, Environment Affairs and Health.

While there is much to do to establish Integrated Catchment Management, the key institutional issues are:

establishing a committee to coordinate the implementation of Integrated Catchment Management;

establishing suitable fora through which to involve the stakeholders;

establishing a secretariat to provide operational support for catchment management.

It is suggested that, for the interim phase while national policy is being established, a Mgeni Catchment Management Steering Committee be established. The Steering Committee would comprise representatives of:

- **The Department of Water Affairs and Forestry**
- **KwaZulu-Natal Provincial Administration**
- **Umgeni Water**
- **The stakeholders (from the stakeholder Forum for each Management Unit)**

A designated secretariat with access to adequate human and financial resources would be required to support this Steering Committee and the Stakeholder Fora, thereby facilitating the ongoing development and implementation of the Action Plan.

The stakeholders

If the steering committee accepts these suggestions then the next step would be to establish a Stakeholder Forum in the Midmar Management Unit, followed by the Henley-Pietermaritzburg Management Unit. These should link in with the existing community groupings and elected councils, and current planning initiatives in these two areas.

While everyone should have the opportunity to contribute to the management of their catchment it is suggested that involvement of the following organisations would provide a good starting point for the Midmar Unit:

- **Steering Committee**
- **The Natal Midlands Joint Services Board**
- **District councils**
- **Transitional local councils or representatives of local council**
- **The Natal Parks Board**
- **Commercial farmers organisations**
- **Representative land owner organisations**
- **Representatives of domestic and industrial water users in the Inland Supply System**

The Action Plan

This Stakeholder Forum, in consultation with the Steering Committee, would be responsible for developing and implementing an Action Plan to address the critical problems in the Midmar Management Unit. A similar Stakeholder Forum, obviously with different composition, would be responsible in the Henley-Pietermaritzburg Management Unit.

This is an iterative process whereby the organisations or parties responsible for the priority strategies outlined in the Management Plan are required to propose site-specific actions or practices to achieve those strategies. The identification, design, resourcing and auditing of the proposed actions, as well as an evaluation of their impact on the specified problem(s), must be provided.

In cases where the costs are deemed to be prohibitive, alternatives must be proposed and the reasons for the objection. The development of an Action Plan involves the evaluation of all the proposals and recommendations, with the aim of identifying a set of agreed actions which equitably address the critical problems. In cases were the resources are not available or the preliminary objectives are not feasible, the Management Plan will need to be modified.

Once the Action Plan has been agreed, the Stakeholders are responsible for its implementation.

Where to from here ?

This document provides a framework for integrated management of the water resources of the Mgeni Catchment. It provides a lot of information to enable people to choose what to do.

What is needed now is for the Stakeholder Organisations to become involved and for the key role-players in the catchment to make their inputs.

While a number of meetings have been held with users and role players in the catchment the main technical input into this report has been by the experts from the Department of Water Affairs and Forestry and Umgeni Water together with their consultants.

We need to establish the steering committee to co-ordinate activities and agree who will provide the resources, particularly the full-time staff required, to enable it to function. Stakeholder Fora must be developed, using existing organisations and fora wherever possible.

Together, the Stakeholders and the Steering Committee must now plan the way forward!

QUALITY WATER FOR EVERYONE FOR EVER?

Is it feasible ?

Yes, with the support of the people and organisations in the Mgeni catchment, the Mgeni Catchment Management Plan outlined in this document will be implemented. This will be a first for South Africa and the point of reference for others to follow.

It is the only means of managing the precious resources of the Mgeni catchment for future generations, so it has to succeed !

Please participate !

Hopefully, the information in this document has highlighted the urgency required to address the water resource problems in the Mgeni River catchment.

The Management Plan will only succeed with the support of the people living in the catchment. It is your responsibility to ensure that the catchment you leave to the next generation provides their requirements in the same way as it did for your generation.

Join the Stakeholder Forum in your Management Unit and contribute to the success of this Plan !

Where to find information

You can get more information about the Mgeni Catchment Management Plan and its implementation from:

The Director
Scientific Services
Umgeni Water
PO Box 9
Pietermaritzburg
3200

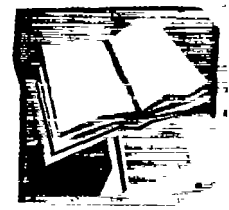
OR

The Director
Water Quality Management
Department of Water Affairs and Forestry
Private Bag X313
Pretoria
0001

The following list of documents and reports provide background to the information and philosophies upon which this document and the Mgeni Catchment Management Plan is based.

The information provided in this document was based on the reports from the following two projects:

- **Mgeni Catchment Water Quality Management Plan: conducted for DWAF and Umgeni Water by NSI, DWAF Report Series WQ U200/00/0094, Pretoria.**
- **Mgeni River System Analysis Study: conducted for DWAF and Umgeni Water by BKS (and NSI), DWAF Report Series PB U000/00/0092**



FURTHER READING

The following documents provide background to water resource management in South Africa:

- **DEAT (1992)**
  Integrated Environmental Management Guideline Series, Pretoria.

- **DEAT (1996)**
  Towards a New Environmental Policy for South Africa, Discussion Document Pretoria

- **DWAF (1991)**
  Water Quality Management Policies and Strategies in the RSA, Pretoria

- **DWAF (1994)**
  Water Quality Management: Introduction Document, Directorate of Water Quality Management, DWAF, January 1994, Pretoria.

- **DWAF (1995)**
  Water Supply and Sanitation White Paper, Pretoria

- **DWAF (1995)**
  Procedures to Assess Effluent Discharge Impacts, Pretoria

- **DWAF (1995)**
  South African Water Quality Guidelines (second edition). Vols 1-5, CSIR, Pretoria.

- **DWAF (1996)**
  Water Law Principles, Discussion Document, Pretoria

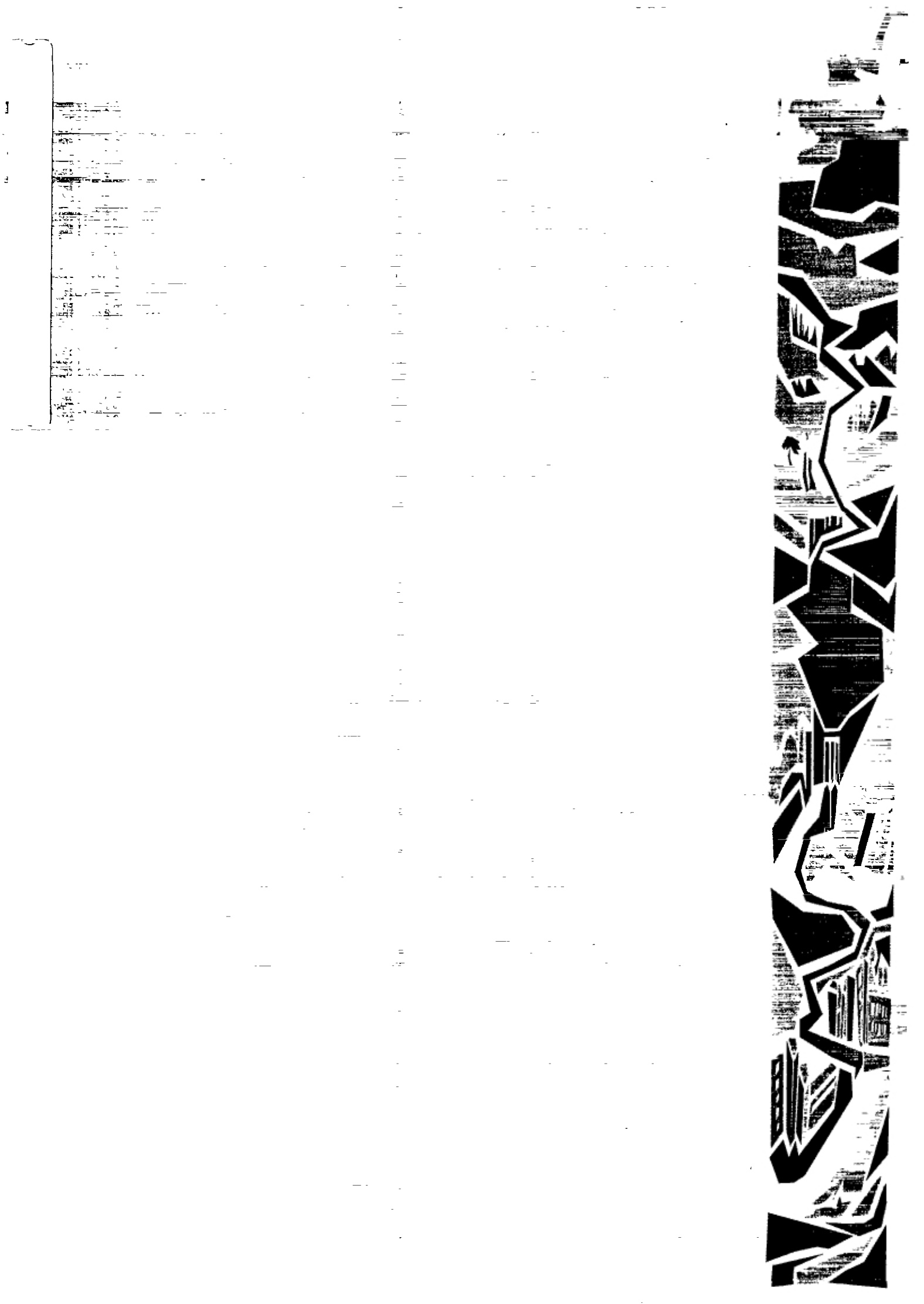
- **DWAF/WISA (1996)**
  Institutional Arrangements and Enabling Legislation for Integrated River Basin Management, based on the Participative Workshop held on 23/24 February 1996, Midrand.

- **Howard, JR, ME Ligthelm and A Tanner (1995)**
  "The development of a water quality management plan for the Mgeni River catchment," International Specialised Conference on River Basin Management for Sustainable Development, May 1995, Kruger National Park, IAWQ/WISA.

- **KwaZulu-Natal Provincial Administration (1996)**
  The Provincial Growth and Development Strategy for KwaZulu-Natal, compiled by the Development Planning Committee of KwaZulu-Natal, Third Draft, May
  1996.

- **NSI (1996)**
  An Introduction to Water Quality Management, MCWQMP, DWAF Report Number
  WQ U200/00/1395, Pretoria.

- **Pegram, GC, G Quibell and AHM Görgens (1996)**
  A Situation Assessment of Nonpoint Sources in South Africa, WRC Report, Pretoria.



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