Integrated Water Resource Planning for South Africa

A Situation Analysis 2010

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Water has a multiplicity of roles:

- in bringing food security
- in providing for domestic and social needs
- in supporting the development that will bring about economic growth
- in maintaining the environment (with domestic and social objectives)
- in improving overall quality of life.

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1 INTRODUCTION

This report is an updated expression of the thinking and planning of the Department of Water Affairs, and includes a summary of the water resource situation for all the identified growth areas in the country as at 31 May 2010. This water resource situation analysis was first prepared in September 2009. The approach is one of 'water balance reconciliation', with immediate and expected future requirements of water balanced, as far as is reasonably possible, by available sources. The Department aims to update this knowledge base annually.

The objective is to provide information on the Department's strategic-level planning activities aimed at ensuring adequate water supplies in support of economic growth and development in the country. The plans of the Department are set against an understanding of water resource requirements, availability, and the limitations and challenges facing the water sector.

It is the Department's responsibility to ensure that South Africa's scarce water resources are made available to meet the country's needs. Today, almost all readily accessible fresh surface water has been put to use and there are very few opportunities for additional new dams. Groundwater provides more opportunity for use, especially in smaller towns. Water resource planners are shifting focus towards the careful management and optimisation of existing use, the re-use of water, as well as the desalination of brackish groundwater, mine water, and seawater.

The Department of Water Affairs is expected to ensure that water is available for growth centres, whilst also ensuring that industrial and agricultural requirements at regional and national scale are met. For this, water resource information must be available to inform national planning functions. Water resource planning must account for ecological imperatives (maintaining or improving river ecosystems), international obligations, and human needs at local level. Water can make a difference to people's lives at all levels of growth and development, and approaches must be developed to optimise such benefits.

The Situation Analysis of 2009 made it clear that the adequate supply of water for many areas can be sustained only if immediate actions are taken to stave off imminent shortages. The most important action was identified as the concerted implementation of water conservation and demand management measures, with the re-use of water offering an immediate and practical supply intervention for cities and fast growing development centres. Opportunities for groundwater must also be taken up, and other long-term supply interventions brought to fruition in time. In reporting for 2010, it can be seen that progress has been made in all of these areas, but that there is no room for complacency.

The challenge of deteriorating water quality was noted in 2009 as being as important to security of supply as the issue of quantity available. With this document focusing on the quantity of the resource, an equivalent assessment of the position regarding water quality has since been commissioned by the Department through its Chief Directorate: Integrated Water Resources Planning. Provisional output is summarised in Section 4.

2 PLANNING FOR WATER

Planning for water resources must be undertaken long before the need is felt. The role of water resource planners is to respond to expected growth initiatives, to advise on water sources and supply, and to ensure that the necessary water is available when and where it is required. It will not always be practically or economically viable to source the required water, and development plans must take account of water availability.

The water requirements for the ecological Reserve and for basic human needs must be factored into all planning activities, both within the Department and by all other authorities where planned development projects require water. The National Water Act (NWA) and the National Water Resource Strategy (NWRS) make provision for the basic water needs of both people and the environment. It is recognised that making water available only to meet basic requirements is not enough and that

improved quality of life must be provided for. Water is needed to grow and sustain the economy, but also to sustain livelihoods and people in achieving a healthy and happy South African society. This document looks at economic growth and development in the context of the national economy (see the National Spatial Development Perspective, section 7), but also takes account of the needs of the deeper rural livelihoods economy.

District and Local Municipalities are responsible for their Integrated Development Plans (IDPs). An important part of every IDP is the Water Services Development Plan (WSDP), and the Department's Regional Offices provide support for developing both the IDPs and WSDPs. Giving attention to the water resources required has, however, proved to be an unfortunate gap in most IDP planning and it is one of the objectives of the Department to put information and strategies in place that can be assimilated into IDPs to address this gap. The water resource reconciliation strategies for large systems and metropolitan areas, and for all other towns (see sections 10 and 11) should go a long way towards achieving this.

3 SOURCES OF WATER

The National Water Resource Strategy (2004) shows that, after allowing for water for ecological flow requirements, half of South Africa's Water Management Areas are in water deficit (i.e. the water requirement exceeds availability) despite significant transfers in from other systems. This highlights the lack of readily available water and the need to reduce requirements and optimise existing sources whilst also seeking alternative solutions.

3.1 SURFACE WATER

Total available water in South Africa in year 2000 was about 12 800 million m^3 per annum. Surface water, from dams and direct abstraction from rivers, accounted for 9 500 million m^3, or 74% of all the water available, with groundwater, return flows and water used by afforestation making up the rest. A very significant volume of the surface water yield (3 000 million m^3 per annum) is also currently moved via inter-basin transfers to areas in the country where requirements exceed supply.

The limits to the development of surface water sources have almost been reached, and the opportunities for the economic siting of new dams are few and far between. The Department of Water Affairs is exploring all of these remaining options from a social, economic and environmental perspective.

3.2 GROUNDWATER

The volume of groundwater use is at present about 2 000 million m^3 per annum. However, the most recent estimate of sustainable potential yield at high assurance is in the order of 7 500 million m^3 per annum, which means that there is additional potential of 5 500 million m^3 available. This water is very widely distributed across the country and its potential availability offers particular opportunity to small towns, villages, mines, and individual users. (Groundwater is already an essential source in many such instances.) The wide distribution of groundwater does also mean that a significant portion of the additional resource will probably never be economically exploitable as it is too far away from any point of use.

Careful monitoring and management of groundwater aquifers are vital due to the 'invisibility' of the resource, and failures in management have led to an unfortunate and undeserved negative perception towards groundwater use that needs to be dispelled.

Groundwater is recharged by rainfall, but storage is generally well buffered against droughts so that, with good management practice, a constant level of sustainable use can be relied on. Groundwater is often the source turned to when emergency sources are required during droughts. There is potential for improving groundwater supplies through artificial recharge, i.e. the deliberate directing of surface water into the groundwater aquifer, where it is stored for later use.

3.3 RETURN FLOWS AND RE-USE

Return flows do not provide what could strictly be called "new water", but are nevertheless a very important source of additional water. Approximately 10% of all water used in agricultural irrigation ultimately seeps back into streams and rivers, while the return flow from urban areas may be 50% or even higher. In the inland areas the urban return flow is discharged back into rivers and used downstream, whereas in coastal areas this water is usually discharged into the ocean.

The beneficial use of previously-used water from a range of sources such as irrigation return flow, mine dewatering, industrial effluents and sewage discharges, with or without further treatment, is termed 'water re-use'. The Department has identified re-use as an important water reconciliation strategy and is developing a separate water re-use strategy. In many cases, desalination will be required in remediation as part of water re-use schemes.

Water can be re-used any number of times, depending on the efficacy of the purification process. Industrial and urban domestic wastewater can be re-used for further industrial or irrigation use, or may even be brought back to drinking water quality. Whilst some water is always lost with each cycle, the use of water can be greatly extended through re-use. Purification will depend on the degree of contamination, but can certainly be cost-effective from wastewater treatment works. The re-use of water at present accounts for about 14% of all available water, and this could be significantly increased with more re-use of coastal return flows.

3.4 DESALINATION

Desalination is the removal of salt from water, typically brackish water and seawater, but the process can also remove a spectrum of other pollutants such as metals, nutrients and organics from contaminated water. Desalination can render return flows and treated effluents fit for use by a wide range of water users and is a valuable technology in many water reclamation and re-use schemes. A National Desalination Strategy is currently being developed by the Department.

The reclamation and re-use of effluents after treatment, which may include desalination, is now becoming financially attractive compared to other water resource developments. The desalination of mining and industrial effluent discharges will reduce the need for fresh water releases to provide dilution. (See also section 4.2)

Desalination projects include:

- seawater desalination
- treatment of brackish surface water or saline effluents
- development of brackish groundwater
- treatment of municipal effluents and return flows to discharge standards
- treatment of mining and industrial effluents (typically acid mine drainage and cooling water from power stations).

Technologies include distillation, precipitation, ion exchange, and membrane separation (including reverse osmosis). All of the technologies have a place in South Africa, depending on the nature of the water requiring desalination and the availability of energy. In all cases, a residue stream is generated (sludge, brine). The ocean has assimilative capacity for brine and hyper-saline solutions produced by seawater desalination, but there could be environmental issues with regard to the dispersal of sludge wastes from effluent desalination. Sludge and brine waste products are even more difficult to dispose of inland.

Desalination treatment technologies have become more energy efficient over time. The energy requirement for seawater reverse osmosis has come down from 22 kWhr to produce a cubic metre of water in 1970, to 8 kWhr/m^3 in 1990, and 4 kWhr/m^3 today. This latter figure is comparable to the energy it takes to deliver Thukela water from the Driel Barrage to Rand Water users in northern Gauteng.

For brackish water these figures are as low as 2 kWhr/m^3, and for conventional sewage treatment 0.6-1.0 kWhr/m^3. Further improvements are expected as the technology matures.

Desalination plants can provide additional fresh water at a high but affordable cost, with a rapid implementation time possible. Even a major plant can be commissioned within two years of project approval. Although energy remains the key factor in desalination, the energy demand could be mitigated by solar or wind generation, bringing a fully sustainable source of water.

The long-term strategic implications of desalination are that it should always be possible to meet water requirements close to the coast, but the pumping of desalinated water inland, uphill and over long distances, may prove too expensive even for industry to sustain. This economic reality may result in industrial development moving to coastal locations.

3.5 RAINWATER HARVESTING

Rainwater harvesting is any human activity involving the collection and storage of rainwater, either for immediate use or use before the onset of the next rainy season. Rainwater can be harvested with infiltration bunds, swales, ditches and a variety of dams, storage tanks and containers.

Across the world, rainwater harvesting has been used to provide drinking water, water for livestock, water for irrigation, or to refill aquifers through the recharge of groundwater. Rainwater harvesting also includes improved conservation of local surface runoff for rain-fed agriculture in arid and semi-arid regions. It is an important technique for catchment management and in ecological restoration. Applied correctly, Rainwater harvesting can reduce evaporation losses, erosion and flood peaks, and increase and stabilise river baseflows.

Rainwater is either harvested from the ground surface or from a roof. The rate at which water can be collected from either system is dependent on the plan area of the system, its efficiency, and the intensity and regularity of rainfall. The potential of rainwater harvesting as a water resource (other than through large dams) has not yet been quantified for South Africa, neither has a guideline yet been prepared for the selection and design of suitable rainwater harvesting techniques and applications across the different climatic zones.

DWA supports a national rainwater harvesting programme, which presently has a narrow but important focus on the construction of above- and below-ground rainwater storage tanks by rural households for food gardens and other productive water uses. Several municipalities now have experience with roof rainwater tanks for domestic use, which have been found to be particularly effective when used conjunctively with other water supplies.

Opportunities for rainwater harvesting should be explored by all water management authorities.

3.6 WATER CONSERVATION AND WATER DEMAND MANAGEMENT

Water Conservation and Water Demand Management (WC/WDM) reduces the need for additional new sources of water. So, whilst not in itself strictly a 'source', WC/WDM is a foremost strategy in reconciling the water balance.

In the water resource reconciliation strategies undertaken for large systems it has been found that water use could be reduced by up to 30% through WC/WDM, but the strategies have generally set a 15% saving as an initial target. The City of Cape Town and eThekwini Municipality have made progress with implementation but in all metros this is slower than anticipated and significantly more resources, both human and financial, will have to be put to this.

The situation in the smaller towns is even more severe, with losses often estimated at 50% or even higher. Very few towns measure water use properly and thus municipalities have a very limited knowledge of their water use, not to mention losses. Very often these towns now want to solve the problem of water "shortage" by developing additional resources, often at a very high cost, when this shortage is entirely induced by water losses.

Ageing municipal infrastructure is one of the key causes of losses, but poor plumbing in low-cost housing can play a big part. This is exacerbated where water use by households is not metered and payment for use above the free basic allowance is not enforced. This has led to a per capita use of up to 300l/person/day while the basic allowance is set between 25l and 50l, with supplies planned on this basis. This is clearly not sustainable – neither from the resource side nor from a municipal services perspective.

Management, infrastructure maintenance and replacement, and the education and motivation of users will have to be stepped up if benchmarks are to be achieved. It can be stated again that this is a first line of defence against water shortages, and failure to implement efficiency measures will mean failure to achieve a positive water balance reconciliation in many South African situations. With about 60% of the water in the country used for irrigation, even small savings made by the agricultural sector could make large volumes of water available for additional use. It has been the view of the Department that such saving in the agricultural sector should be used for increased agricultural production - but specifically through the redressing of inequities in the distribution of this water. It is, however, not inconceivable that municipalities or other users could invest in water efficiency measures in irrigation in order to "convert" the savings for other urgent use. (See also Section 13 – Water Supply to the Agricultural Sector).

3.7 CATCHMENT REHABILITATION AND MANAGEMENT

Catchment management is important for water in terms of runoff and water yield, but also in terms of erosion and the siltation of dams.

A well-managed catchment with a good vegetative cover will maximise infiltration, optimise groundwater recharge, minimise overland flow, and minimise erosion and consequent siltation. This all helps to both optimise and regulate yield. At the same time a very high biomass (excessively dense or over-age vegetation) will increase interception and evaporation losses and result in reduced water yields. This is the rationale behind Working for Water's clearing of invasive alien plants, and also behind the regulation of forestry plantations. In the past, Western Cape mountain catchments were burnt on a regular rotation (typically 12-15 years) to reduce biomass and increase water yields. This practice was stopped primarily for logistical and liability reasons. The grasslands of the Drakensberg are burnt biennially by Ezemvelo KZN Wildlife, with maintenance of a healthy grass cover and water production the management motivation. This is the underpinning concept of "ecosystem services".

Siltation of dams is not held to be a major problem in terms of South Africa's total water resource, having a relatively low impact on the really big dams. However, in the case of smaller storage facilities on large rivers with high silt loads, siltation quickly becomes a major problem. Siltation is a serious issue in some municipal dams, affecting smaller towns and communities. There are bigger examples too, such as the Welbedacht Dam on the Caledon River supplying Bloemfontein, where

capacity declined from 115 million m^3 to 16 million m^3 over 20 years, and the Shongweni dam in KZN. The feasibility of a multi-purpose storage dam at Ntabelanga on the Tsitsa River in the Mzimvubu Catchment is also affected by high levels of erosion in the catchment area.

Catchment management, and the rehabilitation of eroded catchments, is critical to resource sustainability.

4 THE QUALITY OF OUR WATER

The requirement for water is not only for quantity but also for quality. All people deserve water of a quality that is fit for use and complies with the water quality objectives or guidelines. However, man's social and economic development needs often result in water pollution. This can manifest itself in many forms, ranging from suspended material, a wide range of chemicals, and aesthetic pollution. It is the Department's task to manage the water resource as best possible within the context of socio-political demands.

4.1 WASTE WATER POLLUTION AND TREATMENT

Many wastewater treatment works do not currently comply with the standards required for the discharge of water containing waste. The recent Green Drop Report (DWA, 2009) is testament to this growing non-compliance. This decline in compliance is mainly due to a lack of trained operators, a lack of appropriate management skills, along with limited budgets for infrastructure maintenance and upgrades of wastewater treatment works. Effluents from the wastewater treatment works result in microbial, biological and chemical pollution of the water resources downstream of these facilities. High levels of nutrients originating from poorly treated sewage cause eutrophication in rivers and dams, affecting both human well-being and the economy. The treatment of water for drinking becomes more difficult, and much more expensive. Severe eutrophication may lead to toxic algal blooms - affecting all aquatic life, as well as people and animals that come in contact with these toxins. One of the emerging families of pollutants is Endocrine Disrupting Compounds originating from waste water treatment works, which can result in genetic and hormonal disturbance.

4.2 MINE WATER POLLUTION

Mining is the key economic driver of the South African economy - but is also regarded as its biggest polluter. Mining areas affecting water quality are mainly in Northern KZN, Free State, North West, Western Mpumalanga and Gauteng. Some mine water (especially in certain coal and gold mining areas) is highly acidic. This can be treated through a "neutralisation" process where heavy metals are also precipitated. However, the mine effluent is still left with a high load of salinity. The biggest impact of mines is thus on the salinity of water resources. In the Vaal and Olifants systems this is first managed through dilution, for which there must be sufficient high-quality inflows. Chemical dosing or reverse osmosis can be used to treat saline mine water, but the disposal of brine remains a problem. The installation of a desalination plant in the Emalahleni area to treat polluted water from the mines to drinking water standards is a positive step and more such initiatives are urgently required to mitigate mining impacts. Salinity in surface and groundwater, as a result of mining activities, also leads to scaling in irrigation systems and to increased soil salinity levels that can result in soils becoming unusable.

4.3 AGRICULTURAL POLLUTION

Agriculture is not only the country's largest water consumer but also impacts heavily on the quality of water resources, typically through the diffuse runoff of salts and fertilizers (nutrient enrichment). This can result in an unacceptable quality of downstream water. Pesticides from aerial and direct application to crops also lead to water pollution, impacting on the aquatic biota as well as humans through bioaccumulation.

4.4 AESTHETIC POLLUTION

Aesthetic pollution of streams and rivers does not get enough attention. Much more can be done to remove litter from urban storm water runoff before this enters rivers. The tons of waste disposed of in this way goes largely unnoticed because this type of pollution does not have the same economic impacts on the water supply system as other forms of pollution.

4.5 PLANNING, POLICY AND STRATEGY DEVELOPMENT

The mandates of different government departments regarding 'resource utilisation and protection' need to be addressed through cooperative planning. The protection of water resources should be a key consideration in the setting aside of land for protection and conservation.

In adapting to the changing environment the Department applies a continuous improvement policy regarding its management of water quality impacts. The most recent management instruments developed by the Department include the Resource Directed Management of Water Quality Policy (DWAF, 2006), Best Practice Guidelines for Water Resource Protection in the South African Mining Industry (DWAF, 2006), the Strategy for the Waste Discharge Charge System (DWAF, 2007), and the Blue and Green Drop Initiative and Reports (DWA 2009 and DWA 2010).

The Department (Directorate Water Resource Planning Systems) is undertaking a national assessment of the water quality of water resources for all Water Management Areas, based on information from its long-term National Chemical Monitoring Programme. Resource Water Quality Objectives have been determined at a national level for ecological, domestic, recreation, industrial and agricultural users and it will be possible to compare status and consider trends in water quality against these objectives. Strategies and solutions to problems identified will be adopted accordingly. This assessment is entitled *"Resource Directed Management of Water Quality in South Africa, Internal Review Document on the Current Water Quality Status of Surface Water Resources"*, and is due for completion in September 2010.

5 THE COST OF FUTURE WATER SUPPLIES

South Africa will have to keep on growing its water resource, but the country is very close to the full utilisation of all easily accessible water. The few remaining large-scale water resource development opportunities are distant from centres of water demand, making water ever more expensive to deliver. There is still significant groundwater available close to some sources of demand, such as small towns, villages, and some mines, but insufficient to meet the requirements of large-scale developments such as big power stations. Re-use of water, and desalination of seawater, are rapidly becoming attractive where the capture, storage and transfer of additional surface flows is becoming prohibitively expensive. Reducing requirements through water conservation and water demand management is the primary first-line approach.

The Department of Water Affairs is close to completing a study report entitled *'An assessment of the ultimate potential and future marginal cost of water in South Africa'*. This report will provide estimates of the ultimate availability of water and a comparative costing of the development of these new supplies. Meeting new demand from increasingly expensive new schemes may prove too costly to the

country - with serious reassessment of how water is used by different sectors, what sort of development is encouraged, and the planning of growth nodes, required. An understanding of these costs will inform both the Department and the National Planning Commission.

Options for increasing the water availability in the Vaal River System, for example, include the following:

- Processing of acid mine drainage for potable use
- Phase II of the Lesotho Highlands Water Project
- New dam at Bosberg on the Orange River, and transfer of water
- Thukela Water Project, for transfer to the Vaal River system
- Dams on the Mzimvubu River and transfer of water via the Orange River to the Vaal River System
- Desalination of seawater and pumping to the Gauteng area

The unit cost of water from these options are all estimated to be in the order of two to ten times the cost of the most recently undertaken new resource developments.

6 STRATEGIC WATER RESOURCE PLANNING IN THE DEPARTMENT OF WATER AFFAIRS

The Directorate: National Water Resource Planning, within the Chief Directorate: Integrated Water Resource Planning, is responsible for strategic level planning to ensure sufficient and sustainable water resources for the country.

The planning approach is to seek reconciliation of the available water resource with growing requirements. The Directorate's work is aimed at the provisioning of raw water up to the point where this water is abstracted for purification and distribution to users. These latter functions are largely the responsibility of municipalities and other water management institutions.

6.1 CONSIDERATIONS IN PLANNING

- The Department must respond to growth and development needs and must plan for projected future water needs. In some instances the required water may not be readily available. Water management authorities need to understand the constraints imposed by a scarcity of water so that they, too, can work towards a convergence of need and supply in their own planning and development initiatives.
- Water quality, and the delivery of water fit for use, is a very critical consideration in determining availability.
- The Department's water resource planning activities are integral to water supply and management functions. So, for example, water resources are fundamental to domestic supply and the need for close alignment with Local Government goes without saying.
- On the raw water supply side the Directorate: Options Analysis, also in the Chief Directorate: Integrated Water Resource Planning, does the pre-feasibility and feasibility studies necessary for the construction of large government water schemes. Water Boards and/or Municipalities may address local supply-side solutions such as desalination, re-use of water, and use of local groundwater and surface water sources.

6.2 TIMEFRAMES

The time from planning to execution of some large projects can be as long as 15-20 years, and water resource planners are accustomed to a 25 year timeframe. However, thinking has to be extended even beyond this to a time when conventional sources of water will no longer be available.

6.3 LEVELS OF PLANNING

The water resource situation is contextualised in a logical sequence of strategies, plans and tools that serve all levels of decisions:

- The National Spatial Development Perspective (NSDP, 2006), as noted in section 7 below, continues to provide a useful basis for planning.
- The National Water Resource Strategy (NWRS, 2004) (see section 8).
- The Department's Internal Strategic Perspectives (ISPs - 2005), which address each of the 19 Water Management Areas. These considerably increase and improve the level of detail in the NWRS (see section 9).
- Intensive studies covering the major metropolitan areas and large water resource systems. Some have been completed; others are now being addressed (see section 10).
- Water resource reconciliation studies that cover all other towns and villages across the country (see section 11).

7 THE NATIONAL SPATIAL DEVELOPMENT PERSPECTIVE (NSDP)

The State President's Office completed the National Spatial Development Perspective in 2006, identifying 26 areas in the country considered key to the national economy. A map depicting these areas is provided at the end of this document (Map 1) along with a table (Table 1) of socio-economic statistics. These can be found as Map 27 and Table 26 in the NSDP.

The NSDP concluded that *"... The principles and methodology of the NSDP should inform the development plans, policies and programmes of all spheres and agencies of government as a matter of policy"*. The Department has taken its cue from this and a short description of water resource planning initiatives for each of the 26 growth points, with a précis of the water situation for each area, is given in Annexure 1.

It is expected that the National Planning Commission will review the NSDP, and that this may have an impact on strategic water resource planning. The Department will work closely with the Commission in this regard.

8 THE NATIONAL WATER RESOURCE STRATEGY (NWRS)

The first edition of the NWRS (September 2004) gives a good indication of the overall state of the country's water resources at year 2000, projected also to 2025. Many catchments, such as the Olifants and Vaal, are under stress, with water requirements exceeding the available supply. Much of the stress reflected in the NWRS is because the requirements of the ecological Reserve were taken fully into account. These needs are often not met and one way of looking at the situation could be to say that it is the Reserve that is stressed. Further to this, other user requirements will continue to grow, and additional development of resources will have to be undertaken to address these requirements and those of the Reserve. It is imperative that, alongside the immediate management of use, the implications of an increase in water requirements are understood and planned for.

THE NWRS (2004) STATES THE FOLLOWING:

"In general, sufficient water can be made available at all significant urban and industrial growth points in the country for water not to be a limiting factor to economic development. However, given the long lead

times for developing new supply schemes, co-operative planning will be required between water users and water management institutions to ensure that water can be made available when it is needed."

To achieve this, the following reconciliation interventions were listed:

- water demand management
- water resource management
- managing groundwater resources
- re-use of water
- control of invasive alien vegetation
- re-allocation of water
- development of surface water resources
- inter-catchment transfers.

There is an important shift in emphasis towards addressing management systems, use, and requirements (the demand side) before seeking to provide more water (the supply side). The development of metropolitan reconciliation strategies (see section 10) has also brought life to co-operative planning as espoused in the NWRS. Each metropolitan strategy includes the establishment of a Strategy Steering Committee that, although without executive power, is able to ensure that member institutions (for example, City Councils, Water Boards, and DWA itself) fulfil commitments, and do their jobs as required both statutorily and in terms of the strategies.

What cannot be disputed is that water resources are limited, and that growth puts increasing strain on those resources. In seeking economic growth it is important not to lose sight of social needs, equity, and the ultimate reason for achieving economic growth, which is to create better lives for all. This increases the imperative for careful planning on the one hand, and efficient use on the other.

9 DWA'S INTERNAL STRATEGIC PERSPECTIVES (ISPS)

The Department's ISPs serve as water resource strategy and management tools for its Regional Offices. In the ISPs, the water resource situation was reviewed for each of the 19 Water Management Areas (WMAs), thus at a much finer level of detail than in the NWRS. Information was integrated into a framework allowing for useful strategic decisions to be taken, although further systems modelling is often required for specific situations. The function of the ISPs will be taken over by the Catchment Management Agencies, which are mandated to develop Catchment Management Strategies.

The ISPs pointed clearly to the need for water reconciliation strategies for all of the country's major metropolitan areas, these being the recognised engines of the economy but with growth trajectories determined in large measure by water availability. The Department's Directorate: National Water Resource Planning addressed this as a core planning activity, commissioning a series of reconciliation studies.

10 RECONCILIATION STRATEGIES FOR LARGE SYSTEMS AND METROPOLITAN AREAS

Water resource reconciliation strategy studies involve an assessment of the current availability, use, and future requirements for water and how these can be 'reconciled' through various strategies.

10.1 OBJECTIVES OF THE RECONCILIATION STUDIES

- to develop future water requirement scenarios for and with the users in the area
- to investigate all possible water resources and other interventions that could add to water availability
- to investigate all possible methods for reconciling the requirements for water with the available resources
- to provide recommendations for development and implementation of interventions and actions required
- to offer a system for continuous monitoring and updating of the strategies into the future.

The major reconciliation studies addressed thus far are listed below. These studies cover the primary growth areas identified in the NSDP, and outputs are summarised as part of Annexure 1. All studies are referenced in the Annexure.

10.2 COMPLETED STUDIES

- *Western Cape Water Supply System: Reconciliation Strategy Study* (2007), covers the City of Cape Town and certain Overberg, Boland, West Coast and Swartland towns, as well as irrigators along the Berg, Eerste and Riviersonderend rivers. A Strategy Steering Committee was established to oversee the implementation of the strategy. The strategy has already been updated (2009), the water situation is constantly being reviewed, WC/WDM is receiving serious attention and budget, and feasibility studies into both desalination and re-use will soon commence.
- *Reconciliation Strategy for the Amatole Bulk Water Supply System* (2008), which provides water for urban, rural and agricultural users in the catchments of the Buffalo and Nahoon rivers, including the Buffalo City Municipality, King William's Town, Bisho and Stutterheim. A Strategy Steering Committee was established to oversee both updating and implementation of the strategy. WC/WDM is receiving urgent attention.
- *Vaal River System: Large Bulk Water Supply Reconciliation Strategies* (2009). The Vaal River System supplies a vast area covering the Eastern Highveld of Mpumalanga, Gauteng, the North West goldfields around Klerksdorp, the Free State goldfields around Welkom and down to Kimberley in the Northern Cape. The Strategy Steering Committee is already attending to a number of actions, including unlawful water use, the implementation of WC/WDM, the re-use of mine water, as well as the implementation of Phase 2 of the Lesotho Highlands Water Project.
- *Crocodile (West) Reconciliation Strategy Study* (2009), covering the northern areas of Gauteng, the platinum mines and other developments around Rustenburg and Brits and further north to Thabazimbi. This study also covers the strategy for supplying the large-scale energy-related developments that are planned for the Waterberg coalfields in the vicinity of Lephalale. A Strategy Steering Committee will be constituted by August 2010.
- *Water Reconciliation Strategy Study for the KwaZulu-Natal Coastal Metropolitan Areas* (completed in March 2010). This covers the area from Pietermaritzburg to Durban (west to east) and from KwaDukuza (Stanger) in the north, to Amanzimtoti in the south. It includes the eThekwini Metropolitan area and the Msunduzi and iLembe Municipalities. A strategy maintenance project has been launched, a Strategy Steering Committee will be formed, and a System Operation Management Forum is to be launched by DWA.
- *Algoa Water Supply System:* This study will soon be completed (October 2010). The strategy has been developed in co-operation with all the major roleplayers, inter alia the Nelson Mandela Bay Municipality, the Gamtoos Irrigation Board and the Sundays River Water User Association. Drought conditions in the region have forced the fast-tracking of several recommended interventions.

10.3 STUDIES IN PROGRESS

- *A study for the Mangaung Municipality (Bloemfontein area)*, started in February 2009. Stage 1 of the strategy has been completed (February 2010). The final strategy should be completed by March 2011.
- *The Olifants River Water Reconciliation Study* will run over two years, from December 2009 to December 2011.
- A study for the *uMhlathuze Local Municipality*, which includes the town of Richards Bay, will start early in 2011.
- The *Development of a Reconciliation Strategy for the Luvuvhu and Letaba Water Supply System* is to be commissioned this year (2010).

10.4 A SYNTHESIS OF CONCLUSIONS FROM THE RECONCILIATION STUDIES

While more detailed results and findings from these reconciliation studies are discussed in Annexure 1, some important conclusions are synthesised below:

- Water use efficiency measures (Water Conservation and Water Demand Management) must be implemented as a matter of urgency. For many of the systems investigated no other measure can be implemented in time to prevent shortages over the medium term. If water is not used more efficiently, shortages will develop and water restrictions will become inevitable. There is still enough time to implement structured programmes to achieve greater efficiency, provided these are well managed and given political support.
- The re-use of water has been identified as a major potential source of water for coastal cities and is already a necessity in some inland areas. Return flows to the Vaal River from the upstream Gauteng metropolitan areas are increasing to the extent that, with downstream use quite stable, these flows will soon exceed uptake and thus be in surplus. A portion of these return flows have been identified as the best resource for the new power stations and a possible coal-to-liquid fuel plant on the Waterberg coalfield near Lephalale in the Limpopo province. The rest of the increase in return flows will have to be treated to potable standards and re-used in Gauteng.
- Desalination of seawater has been identified as a competitive option for all coastal urban centres. Feasibility studies will start in 2010 for the Cape Town and Durban areas in order to properly compare desalination to re-use and further surface water options when decisions have to be made by 2012. Various small desalination plants have been - or are in the process of being - implemented in the drought stricken areas of the Southern and Eastern Cape.
- Groundwater resources are of particular importance, not only for smaller towns, but also for larger cities, such as Cape Town and Nelson Mandela Bay Municipality.
- The further development of surface water resources and inter basin transfers will also play an important role in a number of areas.

The reconciliation studies have been very successful in achieving their objectives (see Annexure 1). They have succeeded in facilitating co-operative governance and the Department is receiving good co-operation from municipalities, provinces and other water management institutions. All strategies, on completion, are being taken forward by Strategy Steering Committees, comprising key stakeholders in each study area. These committees are being set up to oversee implementation of the strategy, monitor interventions and their impact, assess further planning studies, and make recommendations on the approaches taken. The Strategy Steering Committees are tasked to review the strategies annually, updating as required, whilst keeping as a minimum a moving 25-year planning horizon.

11 RECONCILIATION STRATEGIES FOR ALL OTHER TOWNS

The *'All Towns Reconciliation Strategy Study'* is a major planning thrust that commenced in June 2008, and extends the structured planning process to cover all towns in the country. Every town, village, or cluster of villages, is now being assessed in terms of water resource availability. Growth nodes highlighted in the NSDP offered an important first prioritisation of towns for early attention, although any town with obvious and immediate supply needs was also prioritised. The "All Towns" study commenced with a data collection phase, but is now producing final strategies for the first towns. A steady stream of strategies will now flow, until all towns and settlements are covered by the end of 2011. The 'All Towns' information and strategies give clear direction to municipal managers on the best sources of water supply, and on the development of implementation plans. In addition to informing the need, or otherwise, for bulk infrastructure provision, information from the All Towns study is essential for water resource planning to be properly taken into account in the WSDPs and IDPs.

Towns are being studied at different levels of detail, depending on the extent of the water resource problems and the difficulty of reaching a workable solution. Elements of each study include water requirements, resource management options, source development options (surface water, groundwater, return flows and re-use), and approaches to reconciling water requirements with supply. Implementing water conservation and water demand management is addressed as a key tool in reducing both losses and requirements. Additional elements addressed include water quality, and the state of water services infrastructure.

Where possible, Regional Bulk Infrastructure options for water services provision are being informed by these studies. Given funding constraints, and that bulk infrastructure can sometimes be avoided through the implementation of other reconciliation strategies, recommendations from the All Towns studies are proving very useful in a number of instances. Examples include Colesberg and Noupoort in the Northern Cape (where distribution losses were identified as the key reason for high consumption); a number of Free State towns (population and water use numbers revised downwards); Boshof and Dealesville in Free State (local groundwater options identified as alternative); and Greytown in KZN (investigating WC/WDM).

Key messages already coming through include:

- Most municipalities know neither their population, nor how much water they are using. It is therefore impossible for these municipalities to understand the nature and extent of their water losses
- Groundwater is highly suited to small town domestic supply, but this is often not recognised by Water Services Authorities
- Water Conservation and Water Demand Management is an essential tool in reducing both losses and requirements. Municipalities do not always understand the importance of WC/WDM. More support is needed
- Water Services Authorities are desperately short of the required funds and skills to address proper water resource management.

12 WATER SUPPLY TO THE ENERGY SECTOR

The energy sector is a strategic water consumer requiring maximum possible assurance of supply. For details on specific areas refer to Annexure 1.

The Department is working very closely with the large water users in the energy sector to ensure that existing power stations are supplied at maximum assurance (i.e. with little or no chance of failure), and that future power plants are planned for and designed in the light of the expected availability and cost of water. Long-term water resource availability also informs the National Planning Commission.

12.1 COAL-FIRED POWER STATIONS AND COAL-TO-LIQUID PLANTS

The bulk of Eskom's existing large coal-fired power stations are situated in the supply area of the Vaal River System and a complex pipeline infrastructure network provides these stations with water from a number of Departmental dams. When the bulk of these stations were built, Eskom used wet-cooled technology, with a typical large (3 600 MW) power station requiring 45 million m^3 of water per annum. Under pressure from the Department, with water no longer abundant, and with the high cost of providing water now better recognised, Eskom has moved over to dry-cooled systems. Dry-cooled stations cost more to build and operate and are not quite as energy efficient as wet-cooled stations, but use only about 10% of the water required by a wet-cooled station, and the country's water situation necessitated this. Eskom is constructing the Kusile 4 800 MW dry-cooled station near Kendal that will also be supplied from the Vaal River water supply area. Completion is targeted for 2013 and the water requirement has been factored into the Vaal River Reconciliation Strategy Study.

The large coal-to-liquid plants, Sasol 1 at Sasolburg and Sasol 2 and 3 at Secunda are also situated in the supply area of the Vaal River. Sasol 1 uses 20 million m^3 and Sasol 2 and 3 some 90 million m^3 of water per annum in the production of fuel and associated chemical products. The Vaal River Eastern Sub-system Augmentation Pipeline (VRESAP) augments the water supply to the Eskom power stations and Sasol 2 and 3 from the Vaal Dam. The delivery capacity of this scheme meets current demand projections.

The largest potential for the building of new coal-fired power stations is on the Waterberg coalfields near Lephalale in the Limpopo province. Eskom already has the dry-cooled 3 600 MW Matimba power station in this area and is building the dry-cooled 4 800 MW Medupi station. This may be followed by three or four more power stations. These new dry-cooled power stations are required to install a Flue Gas Desulphurisation process to scrub sulphur and will each use about 12 million m^3 of water per annum. Water for existing use in this area comes from the Mokolo Dam, for which supply infrastructure is to be upgraded by June 2013. Local sources will not be able to meet the requirements of the new power stations, even though dry-cooled, and additional water must be provided.

Sasol is also currently planning the Mafutha 1 and 2 coal-to-liquid fuel plants on the Waterberg coalfield. These plants would be of the same order as Sasol 2 and 3 at Secunda. They would share the water supply system planned for Eskom in this area. Even at increased levels of water use efficiency, as insisted upon by this Department, these plants require large quantities of water (80 million m^3 per annum) and this will put pressure on the water resources. This has been taken into account in strategy scenarios and feasibility studies.

Current planning is aimed at bringing water from the Crocodile West River - where the growing return flows from the northern urban and industrial areas of Gauteng serve as an important source – to the Waterberg coalfields. Impacts on the Reserve and flows to the Limpopo must be considered. The Crocodile West reconciliation strategy study shows that this return flow may not be sufficient, and additional water may have to be pumped from treatment works south of Johannesburg. A feasibility study is currently being done on the pipelines, pumping stations and reservoirs that will be required for these transfers. Planning is in close cooperation with Eskom and Sasol and the Crocodile West supply scheme to Lephalale is expected to be operational in 2015.

12.2 HYDROPOWER

There is very little opportunity for large-scale hydropower generation in South Africa. Hydropower generation was part of the design of Gariep and Vanderkloof Dams, and used to generate peaking power. Gariep has a generating capacity of 360MW but power can only be generated from normal flow releases to the river, and scheduled releases to downstream users. The Collywobbles Dam on the Mbashe River, along with Ncora Dam, First Falls and Second Falls, all in the Eastern Cape, are used only for grid stabilisation. Hydropower has been considered as part of development options on the Mzimvubu but no schemes have proved economic.

It is possible to install small plants at a number of existing dams to utilise normal releases to downstream users. There is interest from the private sector in several developments, which would take the form of public: private partnerships.

12.3 PUMPED STORAGE

Existing pumped storage schemes in South Africa are Cape Town's Steenbras scheme (180 MW), the Palmiet scheme (also near Cape Town, 400 MW), and the Drakensberg scheme (Free State / KZN, 1000 MW). These are non-water-consumptive schemes aimed at meeting peak power demands.

The Ingula Drakensberg scheme (1000 MW near Ladysmith, KZN) is scheduled for completion in 2012.

In the Olifants catchment, the Department will be supplying water from the De Hoop Dam - now under construction near Steelpoort in the Limpopo Province - for the operation of Eskom's proposed Tubatse pumped storage hydropower scheme (1520 MW), when this is built.

12.4 NUCLEAR POWER

Nuclear power generation needs as much water for cooling as is required by coal-fired power stations. Nuclear generators can be wet-cooled or dry-cooled, and water can be used in a 'once-through' process, or cooled and re-circulated. The choice of cooling technology affects the volumes of water involved, just as for coal-fired stations. The location of coal-fired stations is bound to the source of coal, whilst nuclear stations are not tied to their energy source - and in South Africa the decision has been to site nuclear stations along the coast where seawater can be used for cooling, so that the availability of freshwater resources is not an issue. South Africa's only existing nuclear power station (Koeberg) generates 1800 MW.

12.5 SOLAR POWER

The generation of solar power on a large scale requires a thermal process involving the generation of steam to drive turbines. This process also requires cooling, with the water demand being at least the equivalent of a dry-cooled coal-fired power station. Like coal, solar power stations are bound to the energy source, in this case the hottest and usually driest environments. Planning the supply of Orange River water to possible solar thermal power stations in the vicinity of Upington is being undertaken.

Solar photovoltaics do not require water, but the technology is only suited to the small-scale user.

12.6 WIND ENERGY

Generation of power from wind does not require any water.

12.7 BIOFUELS

Government policy has set a target of 10 000 GWh of energy to be produced from renewable sources by 2013. The Department of Water Affairs has indicated that there should be no irrigated cropping for biofuels. This would include sugar beet and sugarcane production for bioethanol. Tree crops for biofuels require to be assessed as Stream Flow Reduction Activities. The actual processing of biofuels requires relatively little water.

13 WATER SUPPLY TO THE AGRICULTURAL SECTOR

13.1 IRRIGATED AGRICULTURE

Agriculture, in particular irrigation, is the country's biggest water user – with 60% of the available water resources of the country used by this sector. This is largely a result of government policies in a past era of agrarian development that encouraged water use by agriculture through the construction of Government funded irrigation schemes.

South Africa has moved into a far more diversified and modern economy and the agricultural sector's (agriculture, fishing and forestry) direct contribution to the GDP in 2007 was only 2,4% although, with secondary linkages, its importance is far greater. Certainly, the state of the South African economy is strongly influenced by the state of the agricultural sector and the country continues to have a very important role in regional food production.

Opportunities for new "green-fields" irrigation projects are few and far between, not only due to scarcity of water resources, but also to the fact that almost all locations with good soils, favourable climate and available markets have already been developed. As the scarcity and value of water increases, there is an increasing trend towards water use efficiency, the production of higher value crops, and the migration (through water trading) from the irrigation sector to other, higher value, sectors. When trading water, the increased economic gain from water diverted to other sectors has to be balanced with the strategic implications of reduced irrigated food and crop production nationally. As custodian of the nation's water resources and in the furtherance of growth and development, the Department continues to support viable irrigation projects but will also facilitate agreed improvements in the allocation of the water resource asset base.

Presently, the activities of the Department include only one large new irrigation project - the proposed Lower Sundays River (Barclay Bridge) scheme, close to the Lower Sundays Irrigation Area and the Nelson Mandela Bay Municipality. This is for emerging farmers. The investigation into this scheme is being conducted in conjunction with the Department of Agriculture, Eastern Cape.

The Directorate recently (2007-2010) investigated the potential of the Mzimvubu River and its tributaries to supply water for irrigation and other development. The results are not promising for large-scale irrigation schemes due to the limitations posed by the topography, soils, and climate; one exception is an estimated 1200 ha with suitable soils and available water in the upper Mzimvubu catchment at Ongeluksnek. Apart from run-of-river use, additional irrigation opportunities are most likely to be smaller schemes along the riverbanks, supplied from smaller dams on tributaries. The possibility of a medium-sized multi-purpose dam on the Tsitsa River was identified and will be investigated further. There is, in contrast, potential for dryland agricultural development on a large scale. These opportunities will be investigated in detail by the Eastern Cape Department of Agriculture. There is also significant forestry opportunity in the Mzimvubu catchment, and impacts on water resources are being investigated alongside agricultural development.

13.2 WATER USE EFFICIENCY IN AGRICULTURE

Efficiencies can be targeted both in terms of distribution networks (leaky pipelines and canals) and application (choice of crops and technologies employed).

There are a number of implications related to efficiency in irrigation:

- Efficient distribution and application of water means that there will be less return flow to rivers (as a rule calculated as 10% of the total agricultural allocation; this water is often re-allocated, either to agriculture again, or to other sectors).
- Water use efficiency is seen as an important way of reducing overall use by the sector whilst maintaining production - typically when compulsory licensing for water allocation reform is implemented. The water clawed back in this way can be made available to other users. Highly efficient users may be more vulnerable to compulsory licensing, as they will not be able to rely on water use efficiency to compensate for a reduced allocation.
- Limitations on the resource allocation, and the cost of water, are strong incentives for efficiency. There are at present no restrictions on users expanding irrigated areas based on water saved through more efficient use, and the irrigation sector can expand through its more efficient use of water. Efficient users can also trade the water saved, or accept a reduced allocation and put water back into the system.

These feedback loops are important in water balance calculations, choices regarding trading or optimising use, and to the regulator when implementing compulsory licensing.

13.3 REVITALISATION OF AGRICULTURAL IRRIGATION SCHEMES

A large number of dams were constructed in the former homelands as part of subsidised irrigation schemes. The withdrawal of subsidies in 1996, the loss of state support and the closure of many of the state enterprises established to run these schemes has resulted in the collapse of many schemes, with very significant volumes of water going unused. It has been the policy of the Department of Water Affairs to ensure that water allocated to these irrigation schemes remains available for agricultural use, and efforts have been made to revitalise underutilised schemes. Until recently, efforts at revitalization were modelled on the original philosophy of modernisation although this has shown minimal success over the last four decades. New initiatives, guided by the Water Research Commission, now support a range of development pathways for schemes. These include different support models for individual farmers (some part-time on small plots, others full-time on sizeable farms) as well as different ways of implementing the increasingly contested commercial 'partnerships', which have been based on consolidation of the whole scheme into a single block leased to the commercial sector.

These more diverse approaches have been shown to provide a much greater chance of success because they meet the widely differing needs, levels of interest, and capability of scheme participants, rather than the application of one approach to all schemes and all farmers. In some instances it may, however, be sensible to make unused water available either for rural or urban domestic use or to meet other economic user demands (e.g. industrial, mining, forestry). In all such considerations the DWA will confer with the national and provincial Departments of Agriculture.

13.4 VIRTUAL WATER – GROWING CROPS ELSEWHERE

At issue here are questions of water security, food security, and food self-sufficiency. *Water security* requires the country to have sufficient water to meet its essential services at all times – for energy generation, urban and domestic needs, and provision for livelihoods, mining, and essential industries. For *food security* the country must be able either to provide or to buy in all essential foodstuffs. *Food self-sufficiency* means being able to produce internally all the basic needs of the country. As a country with very limited agricultural potential, South Africa has the economic strength to buy in many foodstuffs and has

long chosen the route of food security. At the same time, there is a strong desire for self-reliance, with the capacity to grow, at the very least, essential foodstuffs, such as maize and wheat. It is also notable that a significant portion of the irrigated crop is currently exported in the form of citrus, deciduous fruits, grapes and wines.

An assessment of rain-fed crop production potential in South Africa's neighbouring countries - a report recently (2010) completed for the Department of Water Affairs - has noted that the Southern African countries (Zimbabwe, Zambia, Malawi and Mozambique) have 26,6 million hectares of currently undeveloped agricultural land with a climate suited to the production of rain-fed food crops. Importing locally (SADC) grown food would have the effect of releasing large volumes of water for alternative uses, without necessarily compromising food security.

14 WATER AND FORESTRY

Plantation forestry is an important water user, and is regulated as a 'stream flow reduction activity' or SFRA. The country has 1.34 million hectares of plantation using an estimated 1 400 million m^3 of water per annum, although only a third of this water would be available to other users without additional storage. The industry is able to meet most of the country's solid and processed wood requirements at present, also earning a significant export income, and is an important job creator in rural areas.

There have been a number of recent studies to assess the extent of remaining potential land and water for further afforestation. The Forestry Sector Transformation Charter has a target of 100 000 hectares over the next 10 years, mostly in the Eastern Cape and southern KwaZulu-Natal. It appears that there is sufficient water to support this. There are also opportunities to trade water out of agriculture and into forestry, and *vice versa*. The guiding criteria for such trades should be water use efficiency determined through a weighting of social, environmental, and economic cost and benefit.

15 SOCIO-ECONOMIC BENEFITS OF LARGE WATER RESOURCE DEVELOPMENT PROJECTS

Investments in new water resource projects - such as dams, bulk water pipelines, pumping stations and reservoirs - can bring significant benefits to local communities in what are often otherwise economically depressed areas.

During the planning phase, as well as during the actual implementation phase of any water project, there is close consultation with local and provincial government to identify additional opportunities that would enhance local economies and improve the quality of livelihoods in the vicinity of the project. These may, for example, relate to local tender opportunities, the construction of housing, and the routing of roads.

Major construction projects boost the local economy - bringing hundreds of jobs, skills development, and downstream spin-offs to the commercial and service sectors. Roads, electricity supply, communications and other infrastructure are established during the construction and remain after the completion of the project to service the local communities. The water bodies themselves generate tourism opportunities and create other jobs once construction is complete. The bulk of the employment is, however, temporary as the maintenance and operation of the project provide only limited permanent job opportunities.

The social benefits of construction projects are easier to demonstrate than the social costs, which can include community dislocation and disruption, risks to health, and loss of ecological services. Without taking social costing into account, and depending on transfer distances, the development of new dams could still provide water at an engineering cost lower than desalination or re-use projects, but the nature of future developments should be decided only after all costs are factored into the equation.

16 CLIMATE CHANGE

The planning of water resources requires the consideration of many uncertainties, including the extent and nature of future requirements, and knowledge of both rainfall and runoff; this knowledge improves as the historical record grows. Climate change increases this uncertainty, with trends becoming the most important feature to be distilled from historical records.

Climate change is an accepted global reality but in South Africa the impact is not yet obvious. The long-term predictions are for a drier western half of the country and for far more variability, with more extreme events, to the east. Temperatures are expected to rise, and thus also evaporative losses. The Department and the Strategy Steering Committees need to consider these long-term predictions in all planning, keeping an eye on trends and adapting as required. There is growing concern that the shrinking rainfall and flow gauging networks are no longer sufficient to accurately detect these trends.

In the reconciliation strategies for the metropolitan areas the possible impacts of climate change on available water are included in scenarios for the future to ensure that augmentation options are considered timeously. Mitigation measures can then be introduced as their necessity becomes evident. An example would be the predicted drying of the West Coast and the effect this would have on the water supply to Cape Town. A reduction in system yield of 2.5% per annum due to climate change has already been planned as a "worst case" scenario for the Western Cape and this has the effect of significantly bringing forward augmentation intervention dates, with desalination becoming a more pressing option.

Climate change brings an added uncertainty, but with impacts that can be mitigated. The relatively gradual nature of climate change allows time for well-considered adaptation measures. It is vital that the monitoring of rainfall and runoff be continued rigorously, and the hydrological monitoring network improved to ensure that the actual effects of climate change are measured accurately and brought as quickly as possible into the analysis of resources. The Water Research Commission is now supporting research to define the needs for information and measurement, and the actions that will be required.

17 INTERNATIONAL RIVERS

South Africa shares four major river systems with neighbouring countries. Some cross boundaries (trans-boundary rivers), whilst others serve as the international border (contiguous rivers). These are:

- The Orange/Senqu system - shared with Lesotho (trans-boundary) and Namibia (contiguous)
- The Limpopo River - shared with Botswana and Zimbabwe (contiguous) and Mozambique (trans-boundary)
- The Incomati system - shared with Swaziland and Mozambique (trans-boundary)
- The Usutu/Pongola-Maputo system - shared with Mozambique and Swaziland (trans-boundary).

The *Revised Protocol on Shared Watercourses in the Southern African Development Community* provides the framework for the management of these rivers, whilst the National Water Act gives international requirements a priority that is second only to basic human needs and the ecological Reserve.

Growth and development are goals for the sub-region and international obligations must be kept in mind when considering how South Africa chooses to use water from shared rivers. A discussion on existing

international agreements regarding these rivers is included as Annexure 2 - International River Systems.

18 MEETING THE CHALLENGES FACING THE WATER SECTOR

(i) Managing with limited water resources

Every authority, sector and individual needs to recognise South Africa's water resource limitations. Alternative sources will have to be embraced - with groundwater, desalination, and the re-use of water playing an increasing role in the future.

Significant opportunity can be unlocked by increasing the use of groundwater, especially in supplying the domestic needs of towns and villages countrywide. A National Groundwater Strategy is currently being compiled.

Water Conservation and Water Demand Management is critical: losing less between source and user, primarily through infrastructure maintenance, and using less through increased efficiencies. Implementation of these measures is unavoidable and urgent. In recognition of the importance of this function, the Department is strengthening its capacities in WC/WDM.

The re-use of water is also growing in importance as a strategy, and critical in areas where freshwater sources are reaching their limits. Most water can be purified back to potable standards, or used by industry or irrigation.

Desalination is an important remediation technology, typically for the secondary processing of acid mine drainage and municipal effluents for re-use. Desalination of seawater can now be realistically offered as a strategy to boost coastal supplies offering an alternative to other source development options. South Africa needs to build expertise and experience in this field.

Catchment rehabilitation, the clearing of invasive alien plants, and rainwater harvesting are all activities to optimise rainfall in the form of utilisable yield – both at catchment and at household level.

Provided actions arising from water balance reconciliation strategies are implemented as planned, the country's major metropolitan areas are water secure for the immediate future. The next phase of the Lesotho Highlands Project has been approved, and further utilisation of the Thukela is a longer-term prospect.

(ii) Getting to grips with the real cost of water

Water is going to get more and more expensive and cost will increasingly define the location of activities requiring water. Water may be moved from a less efficient to a more efficient use, traded from low value to high value use, or switched from a high consumption use to a less demanding requirement. Irrigated agriculture has historically been supplied with water at low cost and will be deeply affected by its changing value. The production of food crops through rain-fed agriculture elsewhere in Southern Africa will become a regional food security strategy of increasing importance. Both resource availability and cost signals must be clear to development planners.

The relative costs of future supply schemes are currently being analysed (see section 5 above).

(iii) Providing for the needs of the environment

The National Water Act demands that the environmental standards of rivers be upheld to secure the sustainability of water resources. This water requirement must therefore be factored into all water resource planning and development initiatives. Addressing current deficits in terms of the environment will require that water must either be taken from existing users, or provided from newly developed resources. There are social, economic, and ecological implications in this, and implementing the Reserve is going to be an increasingly difficult socio-economic balancing act.

(iv) Managing water quality

Water quality deterioration from agricultural, industrial, mining and settlement pollution may be the country's most serious threat to water resources. The decanting of mine-polluted groundwater into surface will have to get focused attention. Re-use of this water suggests an opportunity to solve a supply as well as a quality problem.

The Department is undertaking a national assessment of the water quality of water resources for all Water Management Areas and will compare status and consider trends against national resource water quality objectives. Strategies and solutions to problems identified will be adopted accordingly.

(v) Ensuring skills

Technical and management skills in the water sector are essential in both local and national government, with sufficient technically trained staff employed by all water management authorities, if the country is to remain water secure.

(vi) Keeping long planning horizons

Neither the Department nor the country can afford to slip on the 25-year planning horizon currently held, and must retain the skill and capacity that will allow the identification and implementation of necessary measures in good time.

(vii) The situation must be monitored and information updated

With rapid growth, increasing water requirements, changing expectations, and a changing climate, the measurement and monitoring of the water resource situation become all the more important. Hydrological and climate monitoring networks must be maintained and improved. A Water Research Commission study is reviewing new technologies.

(viii) Adaptive planning is essential

Water resource planning is structured but flexible, with the Department guided by national policies, plans and programmes. Rapid growth, and particularly urbanisation, has required rapid adaptation to secure supplies to a mixed and growing economy and meeting the needs of all people. Adaptable reconciliation strategies have been developed, and will ensure water for the large metropolitan areas - but only if implemented in time.

(ix) Forward planning – Strategy Steering Committees

Water security requires continuous forward planning. The Department has great faith in the Strategy Steering Committees now being set up to oversee the implementation, and regular updating, of the reconciliation strategies developed for the metropolitan areas. Comprising key roleplayers - typically Local Government, DWA, relevant Provincial Departments, Water Boards, Agri SA, and others - these Strategy Steering Committees also offer the cooperative space in which to debate the implications of, and approaches to, implementing the ecological Reserve pertaining to local resource supply system. These Committees are essential to the vitality and sustainability of their strategic plans, and are already proving their capacity to facilitate action. A way needs to be found to extend this very useful model to the smaller towns.

19 KEEPING A LONG TERM VIEW

South Africa has enough water to stay in business. There is no looming disaster and no cause for panic, but a number of steps must be taken to avoid the serious and otherwise imminent risk of shortages in many areas. These include:

- Significant investment in Water Conservation and Water Demand Management at national level, with an understanding and adoption of the process at local level, and implementation of strategies countrywide.
- Investment in groundwater exploration and use.
- Concerted input into managing water quality, and especially acid mine drainage and the pollution of rivers through under-performing wastewater treatment works.
- Investment in new technologies – both desalination and water re-use.
- A focus on management at all levels, which requires creating and supporting the capacity needed to manage water to a high level of efficiency.
- Maintaining a long-term planning horizon - monitoring and managing the situation in recognition of long lead times.

What will happen beyond the 25-year planning horizon? South Africa's developed and populous zones will be increasingly affected by the challenges of water availability, and the cost of supplying the required water. Patterns of use will have to change.

A view of the future suggests that the re-use of all water will be the norm. Desalination technologies may be able to provide enough water to the coastal cities, but desalinated seawater will not be affordable inland. Industries will lead the way by relocating towards cheaper water sources and people will follow. Water may become too valuable to continue using it for the irrigation schemes nurtured in the past, and it may be necessary to shift some of this agricultural production north of the country's borders. If it is to grow as a populous industrial nation South Africa may have to rely on importing 'virtual water' from elsewhere in Southern Africa, through the food produced there.

Innovative thinking is required if South Africa is to adapt to the realities of a water-scarce country.

20 REFERENCE AND SOURCE DOCUMENTS

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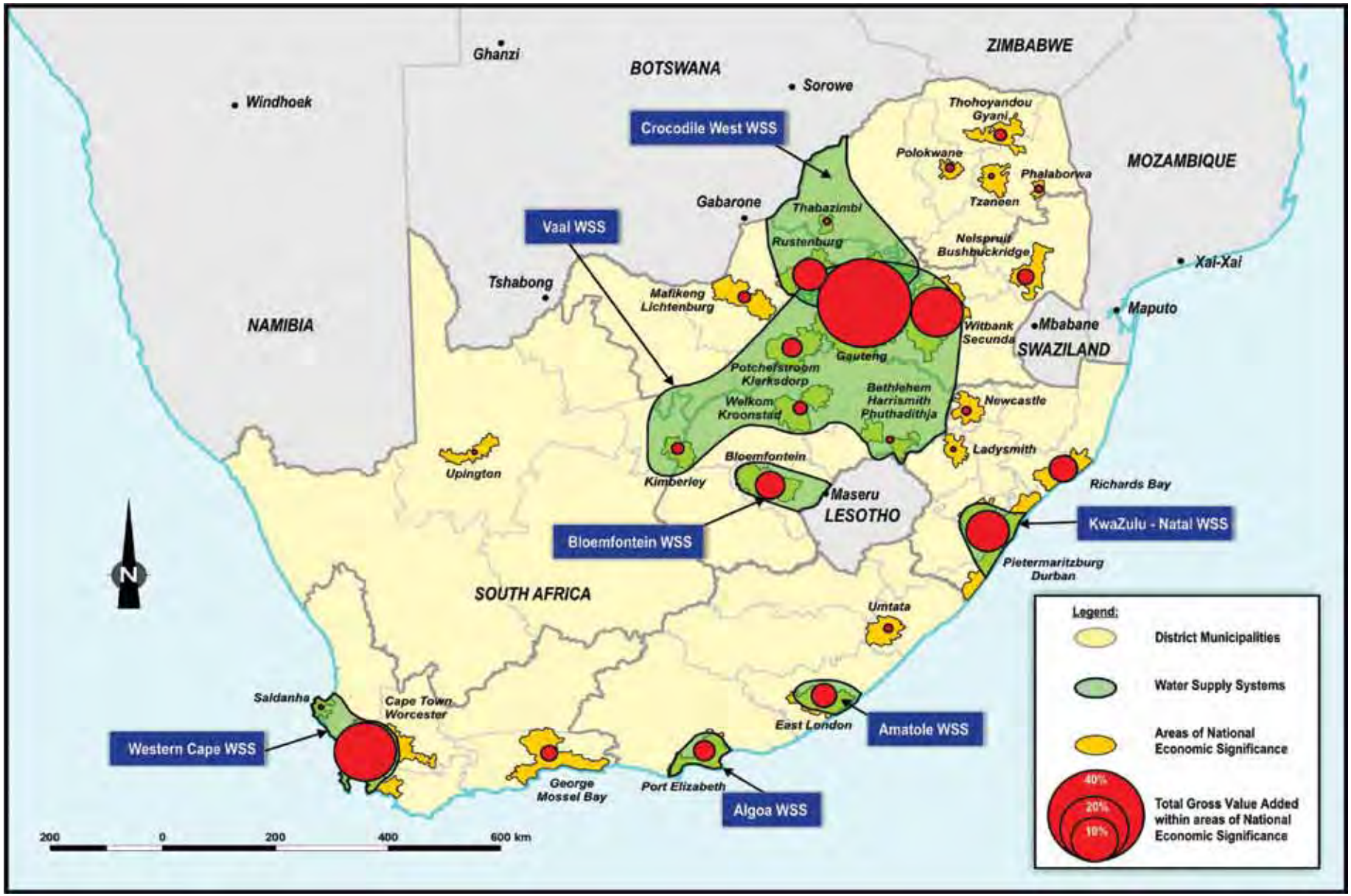


Map 1: Areas of key economic significance in the 2006 NSDP, in relation to existing water supply systems

TABLE 1: SOCIO-ECONOMIC STATISTICS PER AREA OF NATIONAL ECONOMIC SIGNIFICANCE: POPULATION, PEOPLE LIVING BELOW MLL, GVA

Areas of national economic significance*	Population 2004	% of the national population	Number of people living below MLL	People living below MLL as % of national total	People living below MLL as % of total po;ulation of area	Total GVA (2004 current prices)	% of the national GVA in the sector	Area (ha)
Gauteng area	10 213 353	21.79	3 063 809	12.99	30.00	490 744 655	40.20	2 127 579
Cape Town-Worcester area	3 721 716	7.94	858 963	3.64	23.08	163 495 507	13.39	1 216 472
Durban-Pietermaritzburg area	4 413 552	9.42	1 890 637	8.02	42.84	54 446 520	4.46	965 931
Witbank-Secunda area	784 758	1.67	306 396	1.30	39.04	37 469 744	3.07	1 117 593
Port Elizabeth area	1 207 810	2.58	480 998	2.04	39.82	36 430 221	2.98	369 910
Rustenburg area	699 655	1.49	244 480	1.04	34.94	18 415 605	1.51	721 143
Richards Bay area	601 670	1.28	333 334	1.41	55.40	18 075 814	1.48	379 812
Bloemfontein area	693 674	1.48	278 878	1.18	40.20	13 191 447	1.08	483 919
East London area	924 197	1.97	527 563	2.24	57.08	11 817 841	0.97	415 980
Potchefstroom-Klerksdorp area	549 652	1.17	290 756	1.23	52.90	11 778 519	0.96	505 684
George-Mossel Bay area	353 433	0.75	77 670	0.33	21.98	11 092 286	0.91	705 769
Nelspruit-Bosbokrand area	674 925	1.44	358 819	1.52	53.16	9 260 182	0.76	360 588
Welkom-Kroonstad area	623 521	1.33	306 523	1.30	49.16	7 459 578	0.61	492 570
Kimberley area	241 726	0.52	106 411	0.45	44.02	6 545 526	0.54	223 947
Mafikeng-Lichtenburg area	324 249	0.69	192 285	0.82	59.30	6 378 218	0.52	444 121
Thohoyandou-Giyani area	737 084	1.57	500 875	2.12	67.95	5 833 019	0.48	333 959
Polokwane area	302 964	0.65	222 581	0.94	73.47	5 437 431	0.45	224 152
Newcastle area	424 109	0.90	234 916	1.00	55.39	5 386 913	0.44	224 777
Umtata area	423 260	0.90	311 670	1.32	73.64	4 611 628	0.38	271 509
Phalaborwa area	112 579	0.24	46 468	0.20	41.28	4 246 170	0.35	73 391
Thabazimbi area	41 110	0.09	11 619	0.05	28.26	4 152 555	0.34	75 392
Bethlehem-Harrismith-Phuthadithjaba area	476 447	1.02	300 634	1.27	63.10	3 754 672	0.31	282 537
Tzaneen area	420 361	0.90	271 413	1.15	64.57	3 208 898	0.26	223 680
Saldanha area	59 416	0.13	6 276	0.03	10.56	2 675 482	0.22	85 789
Upington area	122 252	0.26	45 215	0.19	36.99	2 327 693	0.19	230 126
Ladysmith area	198 014	0.42	114 122	0.48	57.63	2 277 061	0.19	165 713
Total	29 345 487	62.62	12 548 811	53.21	42.76	940 513 197	77.04	12 722 056
RSA Total	46 864 884	100.00	23 584 394	100.00	100.00	1 220 888 209	100.00	122 079 198

* The areas listed in the Table are not administrative regions. These areas should be read as broader functional economic regions
(Source: NSDP 2006)

Annexure 1: The Water Resource Situation in the 26 Priority Economic Growth Areas Identified in the NSDP

A NOTE ON RECONCILIATION STUDIES AND STRATEGIES FOR LARGE SYSTEMS AND METROPOLITAN AREAS

This document addresses the water resource situation in each of the 26 priority economic growth areas identified in the National Spatial Development Plan of 2006 (NSDP, Office of the President, 2006). The Department of Water Affairs has undertaken reconciliation strategy studies for all of the country's major metropolitan areas and some of the large river systems supporting key development zones. These studies cover the most important key areas, and the information and resultant strategies provide an up-to date situation assessment of water resources in these NSDP areas.

1.0 RECONCILIATION STRATEGY STUDIES

Water balance reconciliation strategies that seek to reconcile future water requirements with available resources over the next 25 years have recently been developed for:

- The Vaal River System
- The Crocodile (West) River System
- The KwaZulu-Natal Coastal Metropolitan Water Supply System
- The Western Cape Water Supply System
- The Algoa Water Supply System
- The Amatole Bulk Water Supply System
- The Greater Bloemfontein Water Supply System

Studies are also underway to cover the Richards Bay area, the Olifants River System, and the Letaba-Luvuvhu System. There is also a study covering the water resource situation for all other towns and villages in the country.

These water balance reconciliation studies address:

- Future water requirement scenarios
- Water resources - i.e. sources of supply
- Other 'interventions' that could reduce demand or add to water availability
- Ways of reconciling the requirements for water with the available resources
- The possible impact of climate change
- Strategy development
- The monitoring and updating of these strategies.

2.0 STRATEGY STEERING COMMITTEES

All Metropolitan and System strategies have included the establishment of Strategy Steering Committees made up of key roleplayers to oversee implementation, and to keep the strategies updated and relevant as the future unfolds – whilst maintaining a 25-year planning horizon.

FUNCTIONS OF THE STRATEGY STEERING COMMITTEES

- monitor the implementation of strategy recommendations
- monitor the growth in water requirements in the System against the available supply
- make recommendations on further strategies and studies needed to ensure the continued reconciliation of water availability and requirements
- make recommendations to the decision makers on which interventions to implement, and
- update the strategy as and when necessary.

These Committees are essential to the vitality and sustainability of their strategic plans, and are already proving their capacity to facilitate action.

REFERENCES

Office of the Presidency (2006). National Spatial Development Perspective (NSDP). Spatial Guidelines for Infrastructure Investment and Development. Republic of South Africa, 2006.

Planning Studies and Water Resource Reconciliation Reports can be accessed on the DWA website http://www.dwa.gov.za/documents/ Under "All Categories" go to Other: Integrated Water Resource Planning - WMA Documents and search under the relevant Water Management Area. DWA's Internal Strategic Perspectives for all WMAs can also be found here. For studies on the Vaal Catchment go to www.dwa.gov.za/Projects/VaalWRMS/

Should difficulty be experienced in accessing these Planning Reports, please contact Mrs Patricia Viljoen, at viljoenp@dwa.gov.za, with your request.

A1.1 GAUTENG (VAAL AND CROCODILE WEST WATER SUPPLY SYSTEMS)

The Gauteng area includes all the metropolitan and local municipalities in the Gauteng province.

There are two key planning studies of relevance to the Gauteng area:

(i) Vaal River System Large Bulk Water Supply Reconciliation Strategy Study

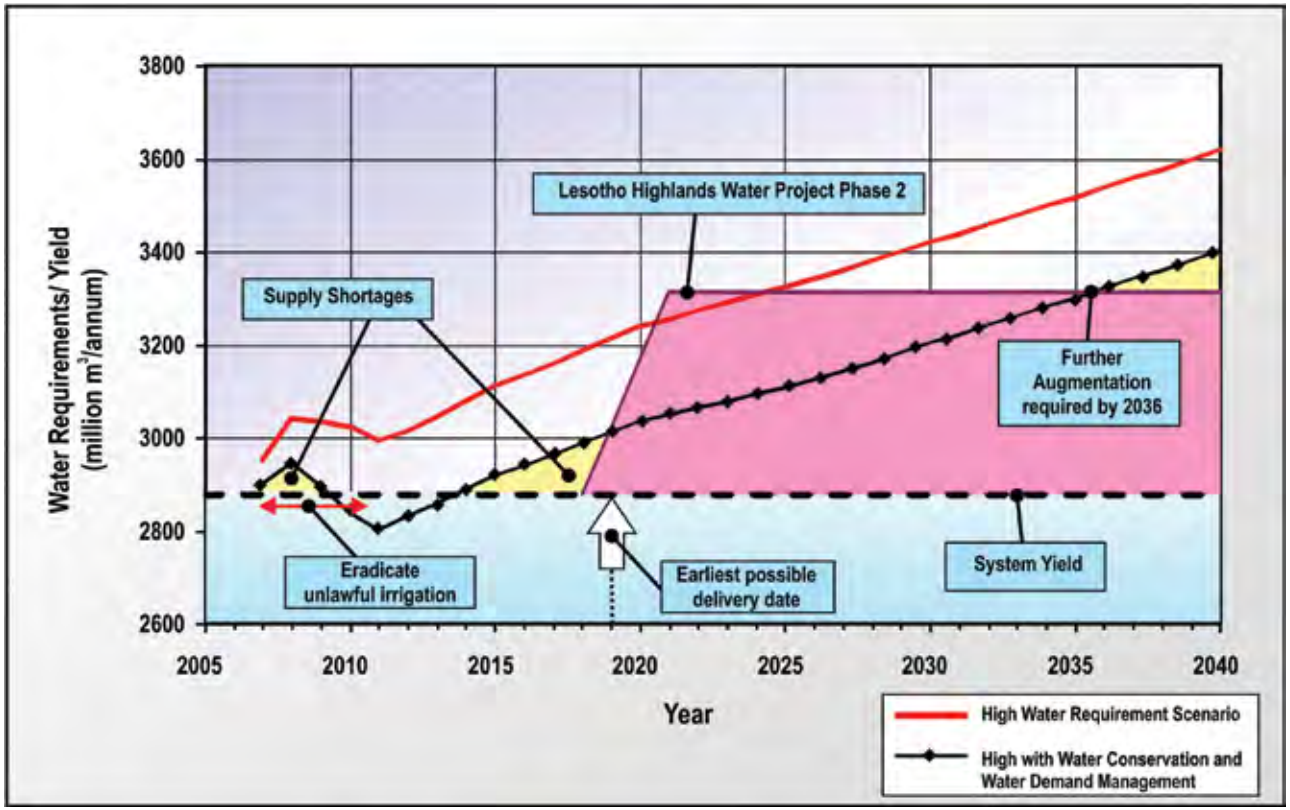
(ii) Development of a Reconciliation Strategy for the Crocodile (West) Water Supply System

A1.1.1 THE VAAL RIVER WATER SUPPLY SYSTEM

AREA OF SUPPLY

The Gauteng area receives the bulk of its water from what has become known as the Integrated Vaal River System (Vaal River System). The area supplied by the Vaal River System stretches far beyond the catchment boundaries of the Vaal River and includes most of Gauteng, Eskom's power-stations and Sasol's petro-chemical plants on the Mpumalanga Highveld, the North-West and Free State goldfields, iron and manganese mines in the Northern Cape, Kimberley, several small towns along the main course of the river, as well as irrigation all along the main stem of the river and the large Vaalharts Irrigation Scheme. Supplying this huge area is achieved through a very complex water supply system of reservoirs, pumping schemes, diversion weirs, canals, pipelines and inter-basin water transfer schemes. The system will soon be extended to also supply water to the developments on the Waterberg coalfields near the town of Lephalale (see Crocodile West River Water Supply System, A1.1.2 below). The Vaal River System meets the water resource needs of 60% of the national economy and serves 45%, or 20 million, of the people in the country. Some overlap with the Crocodile West River Water Supply System is included in this accounting.

An important characteristic of the Vaal River System is that a substantial quantity of water is transferred in from the Thukela, the Usutu and the Senqu (in Lesotho) rivers. The Vaal River serves as conduit to transfer water to the Upper, Middle, and Lower Vaal Water Management Areas (WMAs). Significant water transfers out of the Upper Vaal WMA occur through the distribution system of Rand Water to urban and industrial users in the Crocodile West and Marico WMA. Water is also transferred to the Olifants WMA, mainly to supply the power stations in this region



Vaal River System: Water balance reconciliation

PLANNING FOR THE FUTURE

The recently completed *Vaal River System Large Bulk Water Supply Reconciliation Strategy* study investigated future use, all the resource options, and sought to develop a strategy to ensure future water supplies to all users of the Vaal River System.

The Vaal River System Reconciliation Strategy identified five core actions to ensure that sufficient water is available to users:

- Apply all the necessary resources to eradicate extensive unlawful water use, as a national priority, by 2011.
- Implement water conservation and water demand management measures to reduce losses and reduce the urban demand by at least 15% by 2014.
- Undertake a feasibility study into the re-use of water, with first priority being water from gold mines.
- Implement the Vaal River Integrated Water Quality Management Strategy. This has a focus on salinity, eutrophication, microbiological pollution, and institutional challenges.
- Implement Phase 2 of the Lesotho Highlands Water Project.

Water quality is a very important aspect of the management of the Vaal River System and must be fully integrated with the management (distribution and use) of quantity. To this end the development of an *Integrated Water Quality Management Plan Study for the Vaal River System* study was conducted parallel to the Reconciliation Strategy study. A third very important study, *Potential Savings through Water Conservation / Water Demand Management (WC/WDM) in the Upper*

and Middle Vaal Water Management Areas, was undertaken at the same time to assess prospects for the reduction of demand through various measures.

THE WATER BALANCE - 2010 TO 2040

The accompanying graph shows two water requirement scenarios, one with and the other without the implementation of further water conservation and demand management measures. The projections assume high population growth in Gauteng, but also that the unlawful irrigation water use in the Vaal Catchment is completely eliminated by 2011.

Although measures are being implemented to eliminate unlawful water use, the project could struggle to meet its target of eradicating all unlawful irrigation by 2011. This is due to human resources constraints but is being addressed.

A water conservation and water demand management project has been initiated in Gauteng in order to save 15% of all water used, and all municipalities are involved. The main challenge is funding. The Department's Directorate: Water Use Efficiency and the Gauteng Regional Office are in the process of setting up a Steering Committee and a Project Management Unit that will drive 'Project 15%'.

Even with 'Project 15%' fully effective, the system will experience shortages by the year 2014 and additional augmentation is essential. Recognising this, the implementation of Phase 2 of the Lesotho Highlands Water Project was approved by Cabinet in December 2008. Nevertheless, the earliest possible delivery from Phase 2 is in 2019. This scheme should provide sufficient water until 2035.

The shortages between 2014 and 2019 (yellow-shaded area) could be alleviated through the re-use of water. The re-use strategy includes both the re-use of acid mine drainage and treated sewage effluent - with the initial focus on the treatment of mine water. A pre-feasibility study has commenced to assess options for the re-use of effluent.

The deficit after 2035 can either be supplied through additional water resource developments in the Thukela River System, or by another project on the Orange River.

A Comprehensive Reserve determination study is currently being undertaken for the Vaal River – to be completed by September 2010. The results of the study will be presented to the Strategy Steering Committee for consideration as its implementation may have significant implications on the approach to reconciliation.

IMPLEMENTATION: STRATEGY STEERING COMMITTEE

A Strategy Steering Committee was established In July 2009 to oversee the monitoring and implementation of the Reconciliation Strategy. The Committee consists of key stakeholders representing the Provincial Departments, Department of Agriculture, Metropolitan Municipalities, Salga, Water Boards, Eskom, Sasol, Agri-SA and the Chamber of Mines.

REFERENCES

Vaal River System Large Bulk Water Supply Reconciliation Strategy. Reports P RSA C000/00/4406/01 to /08

Vaal River System Large Bulk Water Supply Reconciliation Strategy: Executive Summary. Report No P RSA C000/00/4406/09

Integrated Water Quality Management Plan Study for the Vaal River System. Reports P RSA C000/00/2305/1 to /7

Potential Savings through Water Conservation / Water Demand Management (WC/WDM) in the Upper and Middle Vaal Water Management Areas. Report No. P RSA C000/00/4405/02

A1.1.2 THE CROCODILE WEST RIVER WATER SUPPLY SYSTEM

AREA OF SUPPLY

The Crocodile West River catchment extends northwards from the catchment divide in central Johannesburg to the Limpopo River. It is characterised by the sprawling urban and industrial areas of northern Johannesburg and Pretoria, extensive irrigation downstream of Hartebeespoort Dam, and large mining developments north of the Magaliesberg. The Crocodile River has thus been very heavily influenced by human activity. Noting significant overlap with the Vaal River System, the Crocodile West River Water Supply System serves a population of about 5.5 million, with over 20% of the National GDP generated in the Crocodile River catchment.

SOURCES OF WATER

The water resources that naturally occur in the Crocodile catchment have been fully developed and utilised. Supplies to northern Johannesburg, Midrand, Tshwane and environs, are transferred in from the Vaal River via the Rand Water distribution network. This represents over 45% of the total water use in the Crocodile catchment, and results in large volumes of return flow (primarily effluent discharges) from what was originally Vaal River water, being discharged into the Crocodile River and its tributaries. This, in turn, constitutes an important source of water for users downstream.

PLANNING FOR THE FUTURE

A water resources study entitled *"Development of a Reconciliation Strategy for the Crocodile West Water Supply System"*, was completed in 2009. The broad strategy for the management of water resources with respect to the Crocodile River System is summarized below:

- Water for urban and industrial use in the area south of the Magaliesberg should continue to be supplied predominantly from the Vaal River system via Rand Water. Water for irrigation and rural users should be supplied from local sources.
- The bulk of the water available in the area north of the Magaliesberg consists of a combination of local surface resources and return flows. The growth in water requirements in this area will be supplied from the growth in return flows from northern Gauteng, whilst some rural users should continue to be supplied from groundwater.
- Large quantities of water need to be transferred to the rapidly developing Lephalale area to augment the local resources. Water for these transfers can mostly be sourced from the Crocodile River by using the surpluses available from return flows in the catchment, but further augmentation from the Vaal River system may also be needed.

WATER BALANCE AND RECONCILIATION

The graph accompanying this text presents the water balance for the whole Crocodile West River catchment for a scenario with high population growth and medium water demand management. The areas that are supplied from the Vaal River are excluded, but the graph includes return flows into the catchment. The future high water requirements expected from the Lephalale area have been added to the graph.

The graph shows that a large proportion of the resource is already made up of return flows from northern Gauteng, even allowing for the fact that success of medium intensity water conservation and demand management would reduce the return flow volume.

In this scenario it can be seen that the future growth in water requirements in the Crocodile catchment could be met from the growth in return flows. The graph actually shows a growing surplus as the return flows from northern Gauteng increase faster than the requirements of users in the catchment. However, with the addition of expected high demand at Lephalale (topmost curve on the graph) the return flows in the Crocodile West River will no longer be sufficient to meet requirements, and an additional direct transfer from the Vaal River System will be required.

The graph shows only one scenario, whilst there are many possible permutations examined in the Reconciliation Strategy. So, for example, the return flows could be higher and the Lephalale demands could be significantly lower – in which case the return flows would be sufficient.

IMPLEMENTATION: STRATEGY STEERING COMMITTEE

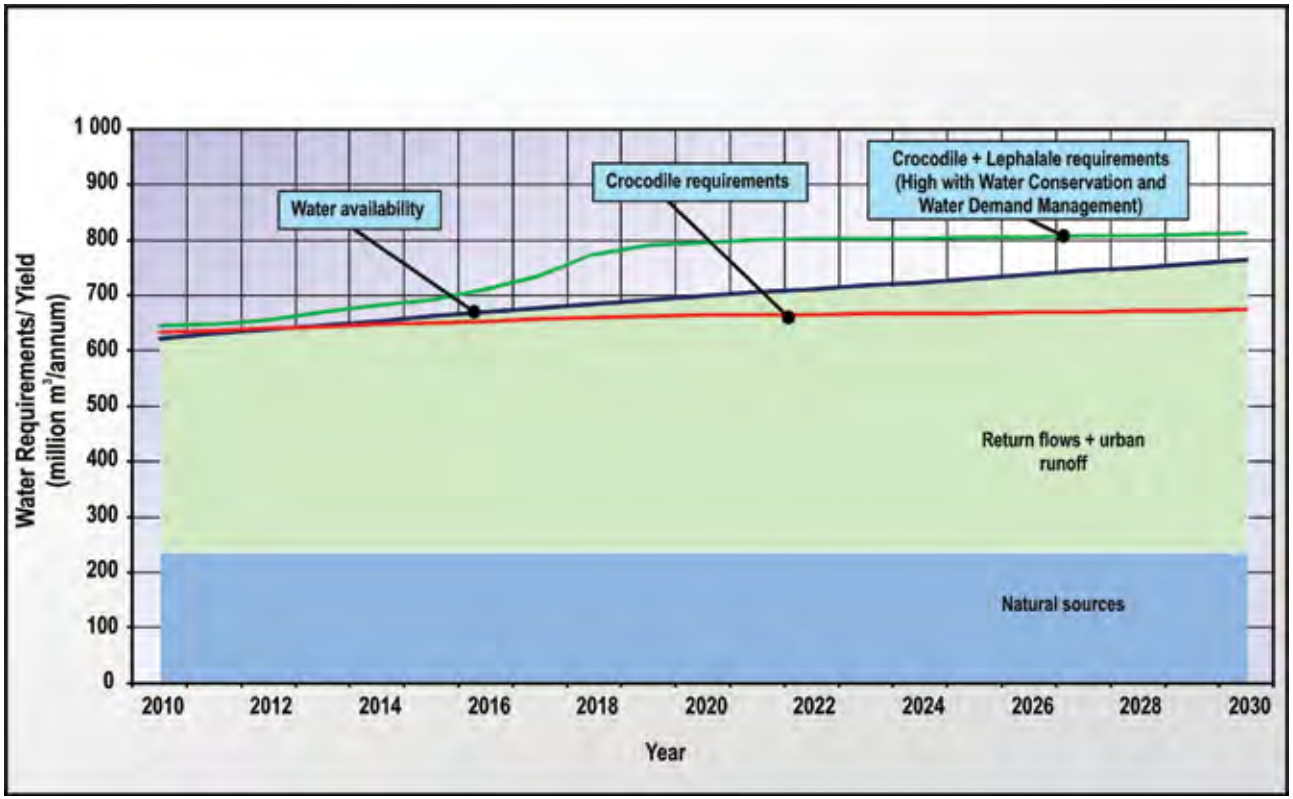
A Strategy Steering Committee comprising key roleplayers and decision-makers, will be constituted in July 2010. This committee will closely monitor the growth in return flows, and will have regular discussions with developers in the Lephalale area (Eskom, Sasol, others) regarding requirements, to enable detailed and timeous adjustments to the Strategy and decisions on further augmentation needs.

REFERENCES

The Development of a Reconciliation Strategy for the Crocodile West Water Supply System. Report No. P WMA 03/000/00/3608

The Development of a Reconciliation Strategy for the Crocodile West Water Supply System: Executive Summary. Report No. P WMA 03/000/00/3909

Vaal River System Large Bulk Water Supply Reconciliation Strategy: Executive Summary. Report No P RSA C000/00/4406/09



The Crocodile West River catchment: Water balance with medium demand management in place

A1.2 CAPE TOWN-WORCESTER

A1.2.1 WORCESTER-ROBERTSON AREA

Water supply strategies for the Worcester-Robertson area are contained in the Breede River Basin Study, completed by the Department in 2003. Enough water has been allocated for urban and industrial uses from the Brandvlei Dam, and with the Municipality's own resources there are adequate resources to meet the requirements well into the future. The rest of Brandvlei Dam's water is used for irrigation. The Breede-Overberg Catchment Management Agency was established in 2008, and is in the process of developing its catchment management strategy.

A1.2.2 THE WESTERN CAPE WATER SUPPLY SYSTEM AREA

AREA OF SUPPLY

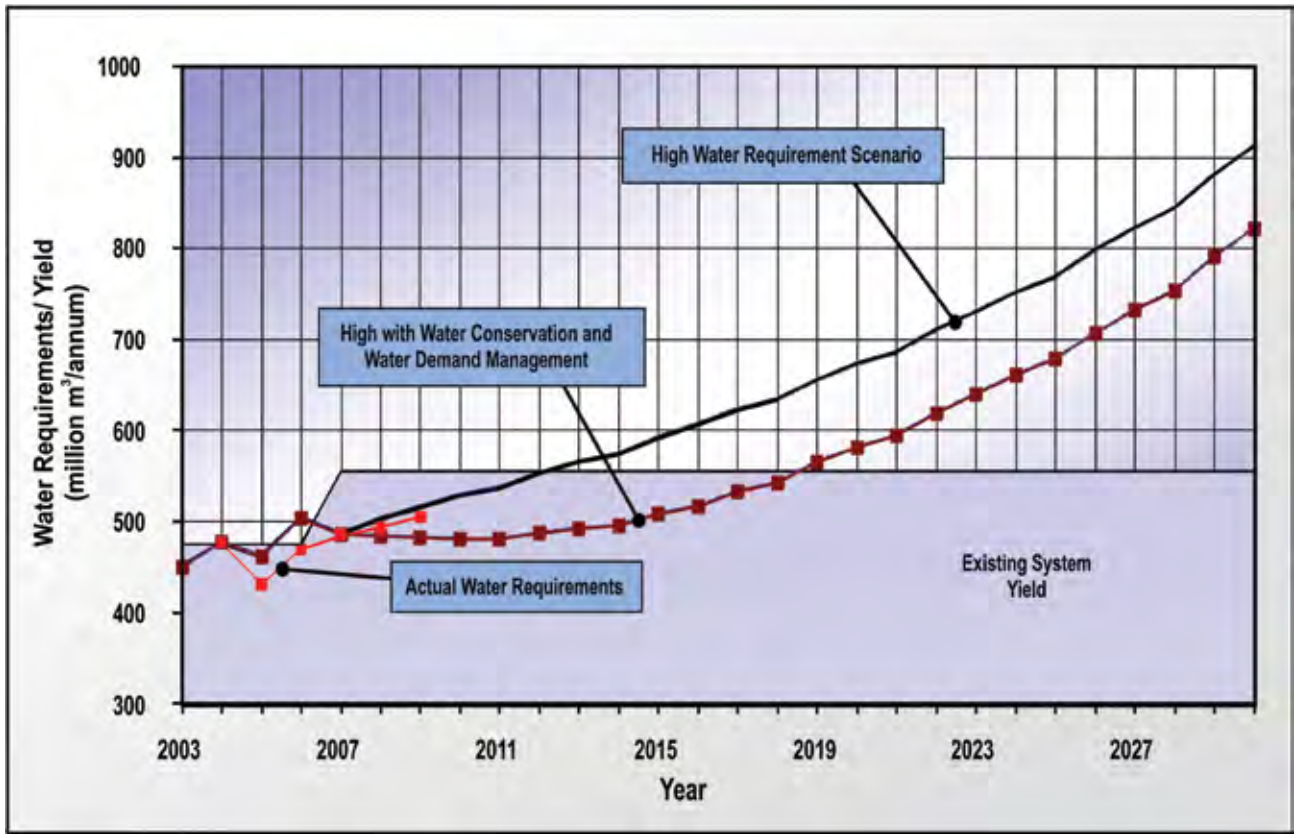
The Western Cape Water Supply System (WCWSS) serves more than 3.2 million people and provides water to the City of Cape Town (CCT) and certain Overberg, Boland, West Coast (including Saldanha) and Swartland towns, as well as to irrigators along the Berg, Eerste and Riviersonderend rivers. The main storage dams are the Theewaterskloof, Voëlvlei, Berg River, Wemmershoek and the Upper and Lower Steenbras dams. The area generates approximately 14% of the national GDP.

PLANNING FOR THE WESTERN CAPE SUPPLY SYSTEM

The *Western Cape Water Supply System Reconciliation Strategy* was completed in 2007. The strategy had as its aim to reconcile future water requirements with supply for a 25-year planning horizon, and to provide a framework for decision-making.

STRATEGY STEERING COMMITTEE

A Strategy Steering Committee was formed in September 2007. This Committee has representatives from all provincial government departments involved in water resources management, organized agriculture, the Breede-Overberg CMA, the City of Cape Town, relevant District and Local Municipalities, and the DWA regional and national offices. The Strategy Steering Committee actively monitors implementation of the strategy by all roleplayers.



Western Cape Water Supply System: Water availability and requirements scenario

The Strategy Steering Committee updated the strategy in 2009 on the strength of additional information that had become available since the original strategy was developed. This updated situation and strategy is discussed below.

WATER REQUIREMENTS AND AVAILABILITY

The accompanying graph shows the current system yield and the expected growth in 'high water requirement' until 2030. This water requirement is shown both with and without the successful implementation of the water conservation and water demand management measures (WC/WDM) that were approved in the 2007 Strategy.

The graph shows that without water conservation and demand management the system will already be in deficit by 2013. With successful implementation of water conservation measures, however, the next augmentation scheme will need to first supply water by 2019.

SUPPLY INTERVENTIONS TO MEET FUTURE NEEDS

Any of the following intervention options could be implemented in time for the expected deficit in 2019:

(i) Surface water schemes

- Voëlvlei Dam augmentation (and further phases)
- Further phases of the Palmiet Transfer Scheme.

The Department is undertaking feasibility studies on the surface water options.

(ii) Groundwater

There has been successful exploration work on the Table Mountain Group Aquifer. The site for a pilot wellfield will be recommended and implementation should start in the second half of 2010. Large-scale implementation will only be considered after completion of the feasibility phase.

(iii) Desalination of seawater

Desalination of seawater is a long-term augmentation option, depending on cost and the availability of sustainable energy supplies. A full-scale feasibility study, which includes the implementation of a pilot desalination plant, is planned to start in July 2010

(iv) Re-use of water

The Strategy Steering Committee commissioned a high-level assessment of the potential for water re-use. This was completed in 2009 and, based on the conclusions and recommendations, the City of Cape Town will be launching a feasibility study, planned to start in the last quarter of 2010.

The results of current feasibility studies will be used by the Strategy Steering Committee to make a recommendation by September 2012 on which of these priority options to implement in order to provide water by 2019. The other interventions will follow as requirements grow.

THE IMPORTANCE OF SUCCESSFUL IMPLEMENTATION OF WC/WDM

The City of Cape Town has provided for, and is implementing, a 10-year water conservation and demand management strategy. However, as is shown in the graph, the actual water requirements are currently higher than the planned figure, putting success with implementation of the strategy programme, and its critical targets, into question. The reasons for this are being investigated and will be reported to the Strategy Steering Committee in September 2010.

Some of the above supply options could be fast tracked to yield additional water by 2017 - but this would require additional cost, effort and risk. The successful implementation of water conservation and water demand management is thus crucial to ensure that sufficient water is supplied, and the Strategy Steering Committee will work with the City to achieve this.

FURTHER WATER RESOURCE ISSUES

WATER QUALITY

The Western Cape has naturally high quality water, with little turbidity or sediment. Salinity is an issue in the Lower Berg River and Breede River catchments due to the geology and irrigation return flows.

The continued spilling of poorly treated effluent, and the uncontrolled polluted runoff from dense settlements into the Berg River and the other smaller tributaries, pose a serious threat to the export of agricultural produce. The Paarl Municipality is busy with a major upgrade of its WWTW, which should result in improvements to the water quality in the Berg River.

WATER USE BY AGRICULTURE

Most water used in the WCWSS area is already being imported from neighbouring catchments at considerable cost, and there can be no further allocations for irrigation development.

CLIMATE CHANGE

Climate change is a major threat to Western Cape water resources and the Strategy Steering Committee has requested that both the DWA and the City of Cape Town improve their monitoring networks to track impacts. Interventions to augment water supplies can be fast-tracked should any drastic and unexpected changes in climate start to manifest. A specialist task team will monitor climate change globally and locally.

INVASIVE ALIEN PLANTS

The removal of invasive alien plants is an important intervention to increase water availability in the Western Cape. Many rivers and mountain catchment areas are densely invaded, especially with pine and black wattle. The Strategy Steering Committee will work together with Working for Water (WfW) in planning the control and removal of invasive alien plants, prioritising the clearing of areas that would maximize water resource benefits.

UPDATING THE RECONCILIATION STRATEGY

The Western Cape Water Supply System Reconciliation Strategy will be re-assessed by the Strategy Steering Committee in September 2010, and adjusted if required.

REFERENCES

The Western Cape Water Supply System Reconciliation Strategy Study. Report no P WMA 19/000/00/0507

The Western Cape Water Supply System Reconciliation Strategy Study: Executive Summary. Report no P WMA19/000/00/0509

The Western Cape Water Supply System – Strategy Steering Committee status report, December 2009

A1.3 DURBAN-PIETERMARITZBURG (KZN COASTAL METROPOLITAN WATER SUPPLY SYSTEM)

AREA OF SUPPLY

The KZN Coastal Metropolitan Area stretches from Pietermaritzburg in the west to Durban in the east, and from Kwadukuza in the north to Amanzimtoti in the south. It includes the eThekwini Metropolitan and Msunduzi and Illembe municipalities. Main stakeholders are the municipalities, Umgeni Water, and the Department of Water Affairs. The area is supplied by two independent systems: Msunduzi and most of eThekwini is supplied by the Mgeni System, with the northern fringe of eThekwini and the KZN north coast supplied by the Mdloti System. These two supply systems meet the water resource needs of 9,4% (about 4.5 million) of the country's population, with the area generating 12,0 % of the national economy.

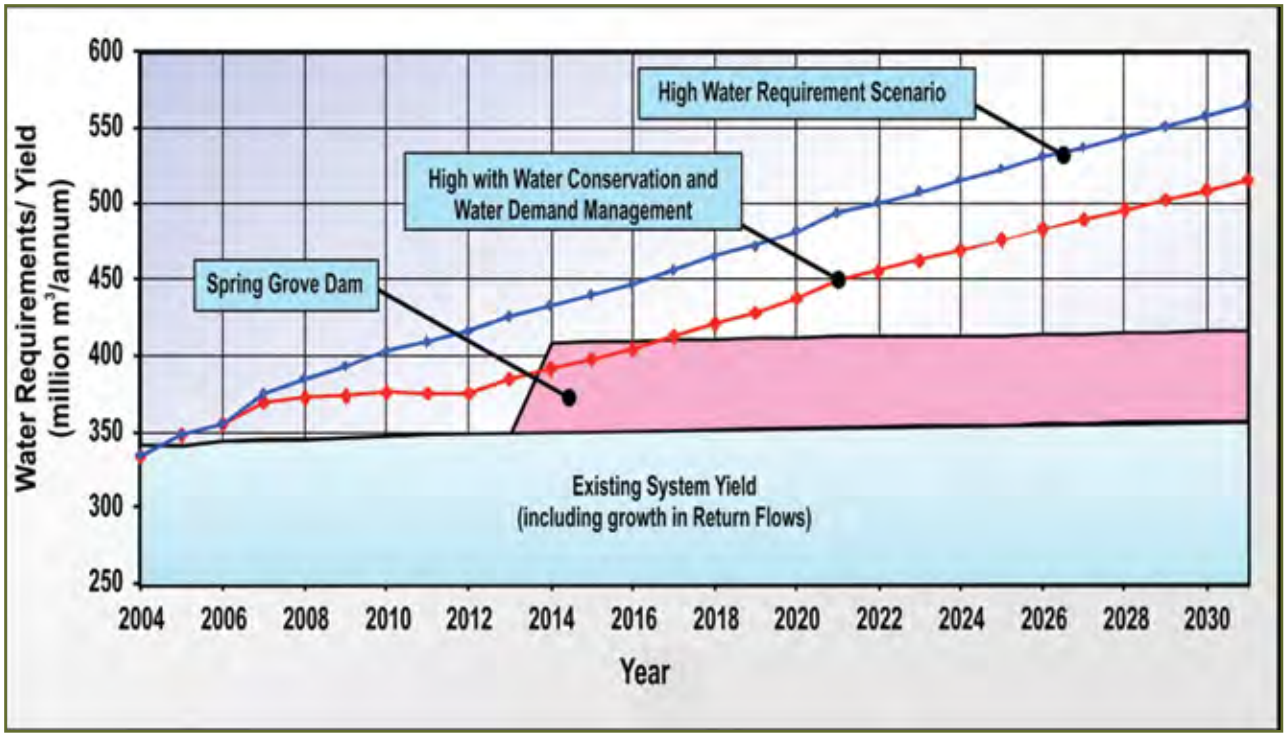
WATER RESOURCE PLANNING

A *Water Reconciliation Strategy Study for the KwaZulu-Natal Coastal Metropolitan Areas* was completed in March 2010. Various options to manage water demand and to extend the resource have been examined. These include water conservation and water demand management, rainwater harvesting, re-use of water, desalination, dam construction and transfers of water. A combination of these intervention options will be needed over the long term.

Both the large Mgeni and the much smaller Mdloti systems are currently in deficit, with requirements in excess of assured supply. Good rains over the last few years have masked this deficit. The expected future increase in water requirements is a consequence of planned improvements in water services, along with the needs of proposed housing developments.

MEETING REQUIREMENTS IN THE MGENI SYSTEM

- The effective implementation of water conservation and water demand management measures is critical to reconciling the water balance. The reconciliation strategy recommended an intensive water conservation and demand management programme to reduce water requirements. eThekwini, by far the largest water user, is implementing this recommendation, but there remains scope for improvement. Msunduzi and Illembe municipalities, with current water losses around 30%, are expected to follow suit.
- The strategy recommended that the Spring Grove Dam on the Mooi River be built to supplement the Mgeni System. Construction is due to begin and this dam should deliver water in 2013. This will keep the system in a positive balance until 2016. Successful water conservation and demand management will halve, but not fully reduce, the supply deficit before Spring Grove Dam is completed. Water restrictions may therefore be required if below-average rainfall is received during the next three years.
- The re-use of water through the treatment of effluent from several wastewater treatment plants will make approximately 60 million m^3/a available to supply urban use. This can be implemented by 2016 and will be sufficient to supply the system until 2023. eThekwini is currently undertaking a study to confirm the feasibility of this option.
- Feasibility studies will be undertaken to assess supply options after 2023. A decision on which option to implement will have to be made by 2016. Options include:
  - A dam on the Mkomazi with a transfer into the Mgeni System
  - The desalination of seawater
  - Further use of treated effluent.



Mgeni System: Reconciliation of water supply and demand

MEETING WATER REQUIREMENTS IN THE MDLOTI SYSTEM

- The deficit in the Mdloti System will be met in 2012 by increasing the storage of Hazelmere Dam through the addition of crest gates. This will increase the yield of the dam from 18 million m^3/a to 28 million m^3/a.
- Further augmentation from the Thukela River is in a pre-design stage, with first water delivery anticipated in 2015.
- Re-use of KwaMashu effluent is planned after 2016.
- In the long term (after 2020) the water resource of the Mvoti River will have to be developed.

The effect of climate change on water availability cannot be accurately quantified at this stage, but current models do not indicate a reduction of rainfall in this area, although it may be more variable. This will be closely monitored.

Insufficient water is available to immediately implement the full ecological Reserve. Allocations to the Reserve will have to be made progressively as new supplies are developed.

IMPLEMENTATION: STRATEGY STEERING COMMITTEE

A strategy maintenance project has been launched, a Strategy Steering Committee will be formed, and a System Operation Management Forum is to be launched by DWA in the second half of 2010.

REFERENCES

A Water Reconciliation Strategy Study for the KwaZulu-Natal Coastal Metropolitan Areas. Executive Summary: Report no. P WMA 11/000/00/1107. DWA, November 2009.

A1.4 WITBANK-SECUNDA

AREA OF SUPPLY

The Witbank-Secunda area includes Middelburg. The area comprises the Local Municipalities of Emalahleni (Witbank), Steve Tshwete (Middelburg), Lekwa and Govan Mbeki. This area contains a large number of coal mines and Eskom power stations across the region, and Sasol Synfuels at Secunda. Witbank and Middelburg fall in the upper Olifants River catchment (Olifants WMA) and Secunda in the Vaal River Catchment (Upper Vaal WMA).

Water supply to Eskom power stations is provided from the Vaal River system (see A1.1) and is also discussed in Section 12 of the main report.

SOURCES OF SUPPLY

(i) The Vaal River System

The Secunda urban area is supplied with water by Rand Water (Vaal River System). Sasol Synfuels is located near Secunda and supplied with raw water by pipeline from the Grootdraai Dam, a sub-system of the Vaal River System.

A pipeline to supply some of the water requirements of Sasol and Eskom power stations in this area directly from the Vaal Dam, augmenting the supplies from Grootdraai Dam, was recently completed. Future growth in this area will be supplied from the Vaal River System. (The Vaal River system is described in depth under the Gauteng area in paragraph A1.1).

Although the main stem of the Vaal River above Grootdraai Dam is not highly modified at present, its water quality and ecological functioning could be threatened by the planned expansion of coal mining in the catchment of the dam. Resource Water Quality Objectives (RWQOs) were set at strategic points along the main stem of the Vaal and its tributaries as part of the development of an *Integrated Water Quality Management Plan for the Vaal River System* study (refer to the Gauteng area under paragraph A1.1). The challenge will be to ensure that these objectives are achieved through proper monitoring and source control.

(ii) The Olifants River System

Water quality in the Olifants River is affected by coal mining in the area, and in particular acid water decanting from existing and defunct mines. Decant from defunct mines is especially difficult to deal with as there are no longer active mining interests to hold responsible, and the problem is left for government to handle. DWA recently completed a study for the upper and middle Olifants River Catchment entitled *"Upper and Middle Olifants River Catchment: The development of an Integrated Water Resources Management Plan".* The main product of this study is a water quality strategy aimed at managing this part of the catchment in a structured way, with the main actions as follows:

- Setting Resource Water Quality Objectives (RWQO)
- Manage salinity
- Manage nutrients
- Implement waste discharge charge system (WDCS).

The industrial and domestic water requirements of the Emalahleni Municipality (Witbank) are supplied from the Witbank Dam on the upper Olifants River. The water in this dam is fully allocated and shortages are being experienced. Eskom is also experiencing shortages as the water supplied to Duvha power station via the Witbank Dam is not suitable for use in the cooling towers without very costly treatment to reduce the high level of sulphates, which would damage the concrete structures. A direct supply to Duvha from the Vaal River System is now being considered.

(iii) The re-use of water

The mining areas of many of the collieries have grown to such an extent that they are generating more water than the mines need for their own operations. This excess water (groundwater ingress), the poor quality of the water, and the lack of assimilative capacity in the Olifants River to accept discharges of mine water, has led to the implementation of water treatment facilities. Collaboration amongst the mines has led to the construction of the 25 ML/d (9.1 million m^3/a) Emalahleni Mine Water Reclamation Plant. The mine water is treated to potable standard and supplied to Emalahleni Municipality under contract. The plant has been constructed in modules so that treatment capacity can be added to accommodate further water from adjacent mines, ensuring enough water to Emalahleni for the future

A similar plant is being built in the vicinity of Hendrina, and will supply potable water to the town.

The water requirements of Steve Tshwete LM will exceed the 50-year yield of the Middelburg dam by 2012 and investigations are underway to also supply this town with treated water.

REFERENCES

Vaal River System Large Bulk Water Supply Reconciliation Strategy: Executive Summary. Report No P RSA C000/00/4406/09

Integrated Water Quality Management Plan Study for the Vaal River System. Reports P RSA C000/00/2305/1 to /7

Integrated Water Resources Management Plan for the Upper and Middle Olifants Catchments. Report No. PWMA 04/000/00/7007

A1.5 PORT ELIZABETH (THE ALGOA WATER SUPPLY SYSTEM)

AREA OF SUPPLY

The Algoa Water Supply System provides water to the Nelson Mandela Bay Municipality (NMBM), the Gamtoos Irrigation Board, and to several smaller towns in the Kouga Municipality. The needs of 1 million people are met by the system, and the area generates approximately 2.5% of the national GDP. A *Water Reconciliation Strategy* will be completed for the Algoa System in September 2010.

EXISTING WATER SOURCES

Approximately 70% of the area's potable water requirements are provided by local supplies: the Kouga and Loerie dams, the Churchill and Impofu dams, Groendal Dam, and several small dams and springs. The remaining 30% of the requirements are supplied from the Orange River via the Fish-Sundays scheme and the existing NMBM Nooitgedagt Scheme. These schemes together supply about 159 million m^3/a.

CURRENT AND FUTURE WATER REQUIREMENTS

The total water requirements from the system were 158 million m^3/a in 2009, with about 65% supplied for urban and industrial use and 30% for irrigation.

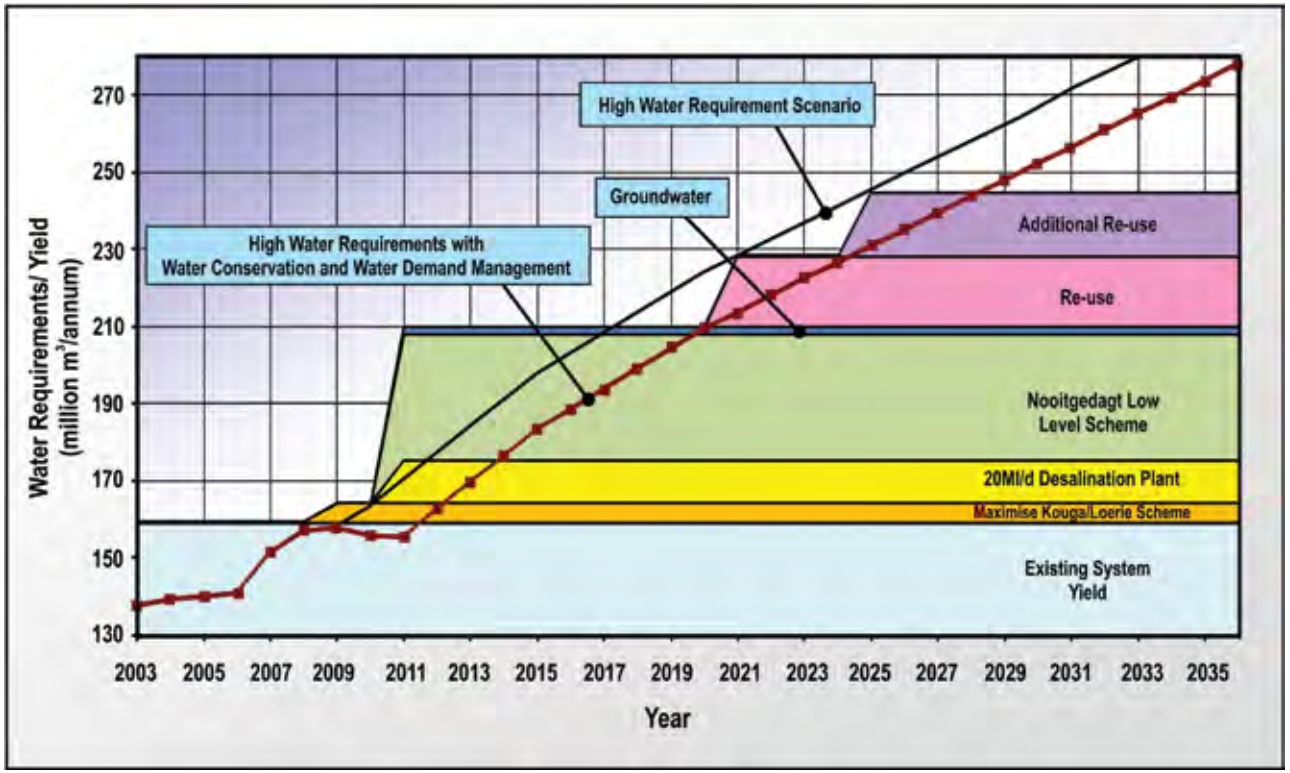
The water requirements of the urban and industrial sectors of NMBM, the Coega Industrial Development Zone (IDZ), and of the coastal towns, can be expected to increase. In the Reconciliation Strategy, 'high growth' and 'low growth' water requirement scenarios have been used for planning purposes. The water requirements of the agricultural sector have, however, been kept constant as allocations are not expected to increase.

The anticipated situation until 2030 is shown in the accompanying graph.

The two rising curves in the graph show the high growth water requirement scenario, with and without water conservation and water demand management.

RECONCILIATION STRATEGY AND NMBM DROUGHT EMERGENCY MEASURES

The Reconciliation Strategy identified a number of interventions and implementation scenarios. Recommendations to ensure that there will be enough water to meet the anticipated growth in requirements include:



Algoa Water Supply System - Water availability and requirements

(i) increasing the yield of the Kouga/Loerie Scheme by optimising operations

(ii) the implementation of water conservation and demand management measures, and

(iii) the early construction of the Nooitgedagt Low Level Scheme (with additional water from the Orange River), for which the EIA and design have already been completed.

Due to the current severe drought situation a 30 Ml/d desalination plant and various small groundwater developments will also be implemented.

The water provided through these measures is shown in the graph. The orange, yellow, green and blue areas of the graph represent water added to the system through the improved operation of the Loerie Dam, the implementation of a seawater desalination plant, the Nooitgedagt Low Level Scheme, and the addition of a groundwater scheme. Treated effluent from both the Coega and Fish Water Flats Waste Water Treatment Works will be available to supply the industrial requirements of the Coega IDZ after 2020. This re-use of water will reduce the demand on other sources.

This graph does not show the effect of the current drought, and it may appear that the new Nooitgedagt Low Level Scheme is implemented unnecessarily early. However, on account of the current low levels of the supply dams, the uncertainty of the immediate success of Water Conservation and Water Demand Management, and the possible impact of climate change, the decision was made to implement all these measures as soon as possible.

FUTURE INTERVENTIONS

It is anticipated that the implementation of the measures listed above, including the Coega IDZ re-use of effluent, will meet the area's water requirements until 2028. Thereafter additional interventions will be required.

The reconciliation strategy recommends studies of the following interventions in preparation for the selection and implementation of future supply options:

- Re-use of effluent (various configurations)
- Desalination of seawater in the Coega IDZ and of irrigation return flows in the lower Sundays River
- Development of further groundwater resources
- A new dam on the Kouga River, or the raising of the existing dam.

IMPLEMENTATION: STRATEGY STEERING COMMITTEE

A Strategy Steering Committee, comprising the main stakeholders in the study area that are actively involved in water resources, will be responsible for the Strategy implementation. It is anticipated that the first meeting will be held in November 2010.

REFERENCES

Water Reconciliation Strategy Study for the Algoa Water Supply Area. Report No WMA 15/M00/00/1510.

A1.6 RUSTENBURG

This area falls under the Bojanala District Municipality.

Strong growth in mining activity has a direct impact on the growth in water requirements, both to supply the mines as well as the resultant growth in the urban areas. As described under section A1.1 (Gauteng Area) Rustenburg is supplied from the south with potable water from the Vaal River brought by Rand Water, and from the north with water from the Crocodile and Elands rivers brought by Magalies Water. Recommendations from the *Crocodile (West) River: Development of a Reconciliation Strategy for the Bulk Water Supply System* study are outlined in Section A1.1.

A large and growing resource in this area is the re-useable effluent from the Gauteng area (originally from water supplied from the Vaal River System) that is discharged into the Crocodile River and its tributaries. This is then available for use in the Rustenburg, Thabazimbi and Lephalale areas. More use can also be made of local groundwater sources, particularly by mines where groundwater ingress is often found to be a problem.

REFERENCES

The Development of a Reconciliation Strategy for the Crocodile West Water Supply System: Executive Summary. Report No. P WMA 03/000/00/3909

A1.7 RICHARDS BAY

Richards Bay is the economic centre of the uMhlathuze Local Municipality, comprising Empangeni, Ngwelezana, Nseleni, Esikhawini and a number of rural villages. It is a national strategic economic hub.

The Mhlathuze River, together with coastal freshwater lakes in the area, provides water for the Richards Bay / Empangeni industrial area. A water transfer scheme from the Thukela River is used to supplement the supply in the Goedertrouw Dam on the Mhlathuze River, and provides for the high level of assurance of supply demanded by Richards Bay industries. This transfer scheme is not fully utilized, and was also designed for an increase in capacity.

The Mfolozi River north of Richards Bay is relatively undeveloped and could be further developed as a source of water for Richards Bay. This would be a significant undertaking and there are a number of complex considerations, including the need for greater inflow into Lake St Lucia, and water shortages in Mtubatuba, which already draws on the Mfolozi.

A Water Reconciliation Strategy Study for Richards Bay and surrounding areas is to start early in 2011. The resource is currently sufficient, but Richards Bay industrial users require a very high assurance of supply and there is the possibility of new industrial users taking up opportunities in Richards Bay. The objective of the study is to identify and develop a strategy for intervention options to meet possible requirements up to 2035. This study has been prioritized due to the strategic importance of the area.

Options include increasing the capacity of the existing water transfer scheme from the Thukela River, a development on the Mfolozi River, and desalination. This is in addition to Water Conservation and Demand Management, more use of groundwater, the re-use of water, and water trading.

A1.8 BLOEMFONTEIN (GREATER BLOEMFONTEIN WATER SUPPLY SYSTEM)

AREA OF SUPPLY

The Greater Bloemfontein Water Supply System provides most of the water required by the towns located within the Mangaung Local Municipality, namely Bloemfontein, Thaba Nchu, Botshabelo, Dewetsdorp, Reddersburg, Wepener, Edenburg and Excelsior. The system serves a population of approximately 750 000, with the area generating 1.5% of the national GDP.

A WATER RESOURCE RECONCILIATION STRATEGY

The Department of Water Affairs initiated a planning study for this supply area, *Development of Reconciliation Strategies for Large Bulk Water Supply Systems: Greater Bloemfontein Area.* A draft strategy report was completed in March 2010, with the final report due in March 2011. The study is guided by a Steering Committee comprising key local roleplayers in water resource management and use. Two of the key role-players are Mangaung Municipality and Bloem Water.

CURRENT AND FUTURE WATER REQUIREMENTS

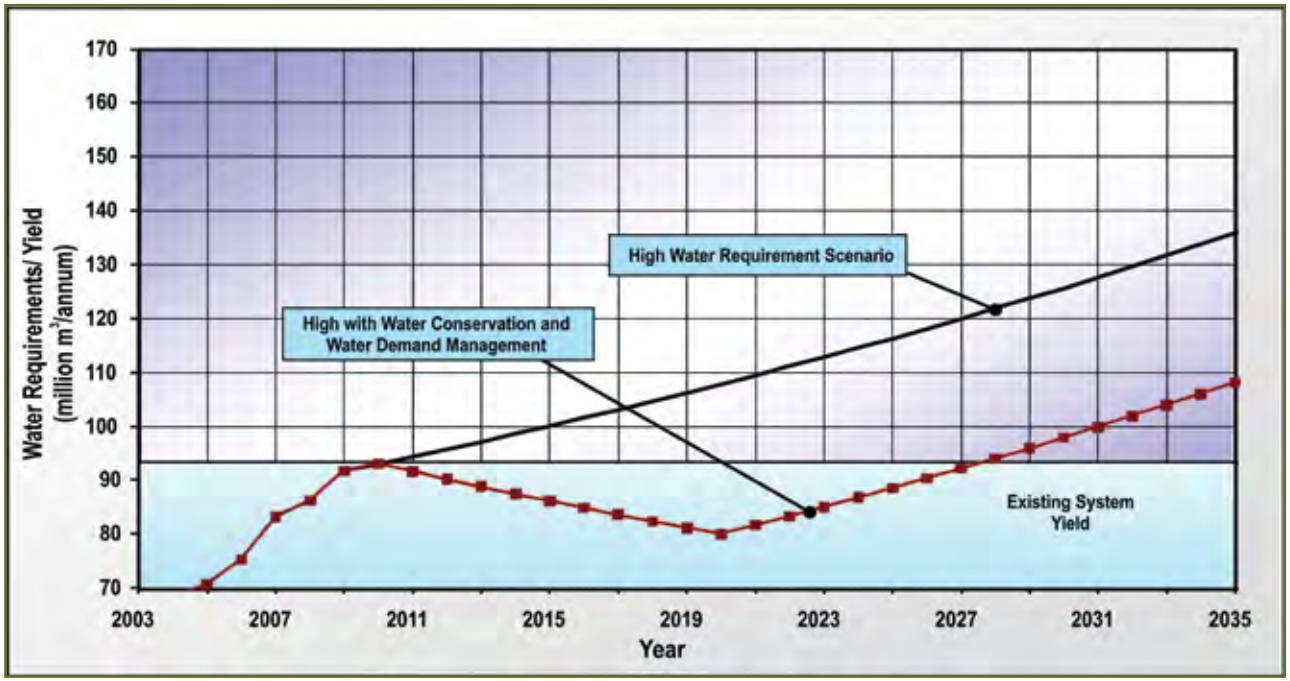
To meet current urban water requirements, water is supplied from local resources and transferred from the Caledon River via several transfer schemes: (1) the Caledon – Bloemfontein transfer which supplies water from Welbedacht Dam, (2) the Maselspoort Scheme, which supplies water from Maselspoort Weir, and (3) the Novo Transfer Scheme which supplies water from the Knellpoort Dam.

Agricultural water requirements were not included in the water balance as water is supplied from different resources, such as groundwater and return flows from the wastewater treatment works.

In 2009, the total urban/industrial water requirement was 92 million m^3/a. The existing system yield from surface water resources, at 93 million m^3/a, at present balances requirements.

The accompanying graph is used to explain the future situation:

The graph shows that if the requirements continue to increase according to the high growth scenario and without implementing any water conservation and demand management measures, the yield will be exceeded in 2010. Bulk losses are known to be in the order of 12%, and reticulation losses are estimated at 40%. If the full estimated realistic savings are achieved through water conservation and demand management, and the very high volumes of water loss reduced, the current system could supply demands until 2028. Should only 50% of the identified water savings be achieved then supply augmentation would be required by 2021.



Greater Bloemfontein Supply System: Water balance reconciliation

BALANCING REQUIREMENTS: RECONCILIATION STRATEGIES

The first strategy is thus to immediately and urgently implement water conservation and water demand management measures in this area.

Depending on the level of success of these measures, additional supplies will be required somewhere between 2021 and 2028. The options recommended for feasibility studies are the following:

- Increase the capacity of the Novo Pump Station
- Increase the capacity of Tienfontein Pump Station with a further increase in capacity of Novo Pump Station.

All interventions entail further infrastructure development to the Novo Transfer Scheme. These interventions were selected as having the lowest cost, with limited additional infrastructure.

Large-scale groundwater development is not considered as a viable supply option for the Greater Bloemfontein Area, due to the high social and economic impacts on the surrounding farms which rely on groundwater. Local groundwater schemes will be assessed as a source of water for the smaller towns.

Severe siltation in the Caledon River has led to a high level of sedimentation in the Welbedacht Dam and this places significant strain on the Welbedacht water treatment works and on Tienfontein Pump Station. Bloem Water have undertaken to investigate the problem and its amelioration.

Water re-use remains an option as a future source of water for the Greater Bloemfontein Area.

IMPLEMENTATION: STRATEGY STEERING COMMITTEE

On completion of the reconciliation strategy study, the Study Steering Committee will be transformed into a Strategy Steering Committee with the long-term responsibility of ensuring that the strategy is both implemented and regularly updated to maintain its relevance, keeping a 25-year time horizon.

REFERENCES

Bloemfontein Reconciliation Strategy Study: Summary Report. DWA Report No. P WMA 14/C520/00/0910/4. April 2010.

A1.9 EAST LONDON (THE AMATOLE WATER SUPPLY SYSTEM)

AREA OF SUPPLY

The system supplies water to the Buffalo City Municipality (BCM), incorporating East London, King William's Town and Bisho, along with a small portion of the Amathole District Municipality area (Stutterheim and its immediate surrounds).

There are six major dams on the Kubusi, Buffalo, and Nahoon rivers. The system serves 820 000 people, 1.5% of the national economy, and the water requirements of 1 000 ha of scheduled irrigation.

PLANNING FOR THE AMATOLE REGION

A Reconciliation Strategy for the Amatole Bulk Water Supply System was completed in March 2008.

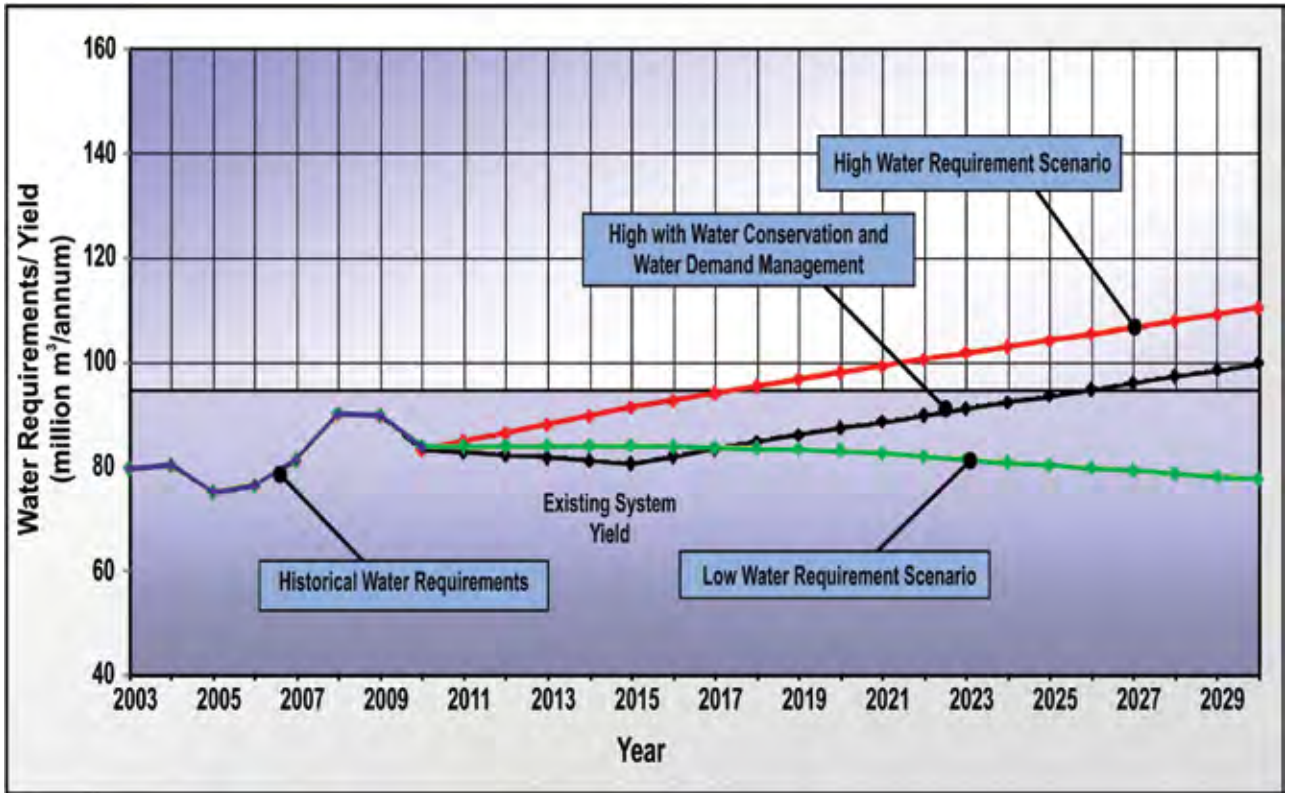
CURRENT AND FUTURE WATER REQUIREMENTS

The Amatole Bulk Water Supply System has an annual yield of 95 million m^3. Substantial water savings have been achieved through recent improvements by the Buffalo City Municipality to the Umzonyana Water Treatment Works, and the actual water requirement in 2010 has been reduced to 84 million m^3.

The Amatole System Strategy provides high and low growth water requirement scenarios, as reflected in the accompanying graph. The high growth scenario, which is used in planning, is shown with and without the successful implementation of further Water Conservation and Water Demand Management (WC/WDM) measures. Without these measures the system water requirements will exceed the available yield in 2018 and increase to 110 million m^3 by 2030.

The anticipated deficit under high growth would require additional augmentation interventions to be in place by 2018. However, with the effective implementation of WC/WDM measures any deficit should be delayed until 2026 and the total requirement limited to 100 million m^3 in 2030. If necessary, water re-use, desalination to provide for outlying coastal resorts, rainwater harvesting, and the clearing of invasive alien plants have been identified as interventions for implementation before additional surface water schemes should be developed.

Under the low growth scenario there is virtually no change to the current water requirements of 84 million m^3 until 2020, with use then steadily declining to 77 million m^3 by 2030. The existing system yield is sufficient to meet these requirements, although attention should still be paid to implementing water conservation and demand management, and other proposed system operational improvements.



The Amatole System: Water availability and requirements under different growth scenarios

The very divergent high and low growth scenarios are a result of high uncertainty regarding migration patterns and the impact of HIV/Aids in the region. While close monitoring of actual growth is imperative to allow for adaptation, these scenarios point to the value of using existing infrastructure and available water optimally, before investing in costly augmentation schemes that may not be required.

The implementation of the ecological Reserve for existing schemes will have a significant impact on available water, bringing augmentation dates forward and this needs to be managed under the Reconciliation Strategy.

IMPLEMENTING THE STRATEGY

Key recommendations of the Strategy and progress with implementation:

- *Operate the Amatole System as an integrated system to maximise yield*

  An 'Annual Operating Analysis' study (2009-2011) will assist the Amatole System Operations Co-ordination Committee in making operational decisions.
- *Complete bypass works on the Wriggleswade Dam/ Yellowwoods River link*
- The link will improve efficiency in the operation of the system.
- *Implement water conservation and water demand management measures*

- This will delay and perhaps even obviate costly augmentation schemes.

  A comprehensive strategy is still required for the Buffalo City Municipality, the main water user in the system.
- *Re-use of water from the System*
- The Buffalo City Municipality plans to incorporate water re-use facilities into designs for new regional wastewater treatment works at Reeston and Zwelitsha. Re-use potential to be investigated for other existing works.
- Augment system yields through new surface water supply schemes Prospective schemes have been identified but the current water resource situation suggests first optimising existing resources.

IMPLEMENTATION: STRATEGY STEERING COMMITTEE

A Strategy Steering Committee comprising representatives of all key stakeholders was constituted in March 2009. The Committee is responsible to oversee implementation of the Strategy and to keep it updated, determining if and when the next augmentation intervention will be required.

REFERENCES

Development of a Reconciliation Strategy for the Amatole Bulk Water Supply System, March 2008. Report no P WMA 12/R00/00/2608.

A1.10 POTCHEFSTROOM-KLERKSDORP

This area comprises the Potchefstroom and the Matlosana Local Municipalities.

The Klerksdorp area is being supplied from the Vaal River System and the future growth in use will be supplied from there. The Department supplies raw water in bulk from the Vaal River System to Mid-Vaal Water. Mid-Vaal Water purifies the water and supplies it to the local authorities and other users in its supply area. Mid-Vaal Water has also started procedures to utilise dewatered mine water.

The Potchefstroom area is being supplied from the Mooi River. When that resource is fully utilised, Potchefstroom could also be supplied from the Vaal River, either directly or possibly by Mid-Vaal Water.

The Vaal River System is described in more detail under the Gauteng area in paragraph A1.1.

REFERENCES

Vaal River System Large Bulk Water Supply Reconciliation Strategy: Executive Summary. Report No P RSA C000/00/4406/09

A1.11 GEORGE-MOSSEL BAY

PLANNING STUDIES

The Outeniqua Coast Water Situation Strategy Study was completed in March 2008.

MANAGING DEMAND

The main finding from this study, after updating the hydrology for the area and taking the ecological Reserve into consideration, is that water supplies should be adequate, but that the high seasonal influx of tourists into the coastal resorts places huge pressure on the local municipalities to supply peak water requirements. Peak demand coincides with the dry summer months and can bring about seasonal deficits because of the lack of adequate storage.

Water reconciliation strategies were developed for each of the major towns, i.e. Mossel Bay, George and Knysna, all falling under the Eden District Municipality. George Local Municipality has appointed consultants to investigate augmentation schemes and they are considering either the raising of the Garden Route Dam or building a new dam on the Malgas River. Knysna Local Municipality is investigating increasing abstraction from existing run-of-river schemes and increasing storage facilities. Mossel Bay Local Municipality's immediate urgent water needs that cannot be supplied by their own resources will be met by an increased allocation from the Department's Wolwedans Dam. Various interventions have been identified to augment Mossel Bay's future water supplies, such as implementing water efficiency measures that will reduce the requirements, raising the Klipheuwel Dam, supplying PetroSA with suitably treated effluent for some of their process water, and developing groundwater resources to meet the requirements of the communities to the west of the town.

2010 DROUGHT INTERVENTIONS

The current drought reflects that, even with the most careful and conservative planning, water shortages can still be experienced and emergency measures have been required to supplement supplies through the Eden District Municipality in 2010. The following measures are being implemented:

- Mossel Bay: A Reverse Osmosis plant will be used to treat sewage for industrial use by PetroSA. Mossel Bay will get part of PetroSA's allocation of fresh water from Wolwedans Dam in exchange. This plant was commissioned in June 2010.

- George: The municipality has drilled very successfully for groundwater, and is now equipping three boreholes that will deliver 3.5 Ml/day (1.2 million m^3/a). The municipality is also installing a Reverse Osmosis plant that will treat effluent to a standard suitable for discharge into the Garden Route Dam. This was commissioned in mid-August 2010.
- Knysna: The municipality has installed a seawater desalination plant in Sedgefield that became operational in April. A further seawater desalination plant is now planned on the Knysna Lagoon.

A Strategy Steering Committee has not yet been established to keep strategy implementation under review.

REFERENCES

Outeniqua Coast Water Situation Study, 15 December 2007. Report no P WMA 16/000/00/0407

A1.12 NELSPRUIT-BOSBOKRAND

This area includes the Mbombela and Bushbuckridge Local Municipalities.

The Nelspruit area, which falls under the Mbombela Local Municipality, gets its water from the Crocodile River. This system is already stressed and Nelspruit/ Kanyamazane is at the limit of its water allocation. Initial surveys indicate that there is large scope for improvements in water use efficiency in the area, and this should be the first action taken by the Mbombela Municipality to overcome its water shortage.

A comprehensive Water Allocation Reform programme for the Inkomati Water Management Area is underway and a Catchment Management Strategy is being prepared by the Inkomati Catchment Management Agency. With rivers already very heavily utilised and severely stressed a suite of actions and activities will be required to bring the Crocodile River System back into balance. In addition to the essential need for stringent water conservation and demand management measures, additional water can be expected to come from the use of groundwater, re-use of water, rainwater harvesting, water trading, and some possible water resource development.

The Bosbokrand area was originally largely dependent on water from the Sand River and on boreholes. The Sand River is over-utilized and the Inyaka Dam was built in the adjacent Mariti River (a tributary of the Sabie) to augment the water supply to Bosbokrand. Forestry plantations in the upper Sand River catchment were also removed with the objective of increasing yield. Water losses are extremely high, particularly in the Hoxane area. The completion of Inyaka Dam made an additional 20 million m^3 of water available. This meets current requirements but, given the current levels of water loss, this is only because of the lack of bulk infrastructure to distribute the water to many areas. The network to distribute this water is progressively being expanded and unless losses are addressed, Inyaka alone will not be able to meet future requirements. A further option to secure domestic supplies is to revive the use of boreholes, which were previously the source for most communities, for conjunctive use with Inyaka dam supplies. The management of water use, and water use efficiencies, will also have to be implemented in the agricultural sector.

A1.13 WELKOM-KROONSTAD

This area is included in the Matjhabeng and Moqhaka Local Municipalities.

WELKOM/VIRGINIA

The Welkom/ Virginia area is supplied from the Vaal River System and any future growth in use will be supplied from there. The Department supplies raw water in bulk from the Vaal River System to Sedibeng Water. Sedibeng Water purifies the water and supplies it to the local authorities and other users in its supply area. Preliminary investigations show that there are substantial potential water use savings that can be achieved by implementing Water Conservation and Water Demand Management measures.

The Vaal River System is described in greater detail under the Gauteng area in paragraph A1.1.

KROONSTAD

Kroonstad sources its water from the Vals River. There are frequent water supply problems and it is not clear whether this is a management problem or a resource problem. In the absence of adequate metering a water balance cannot be compiled, but indications are that there are high levels of wastage. The town needs to improve on its water metering, must plan and implement Water Conservation and Demand Management, and must undertake a detailed yield analysis of its dams. Once this is done, and if it is demonstrated that there is indeed a resource problem, a feasibility study should be undertaken to determine the most suitable option to augment the water resources in the area.

REFERENCES

Vaal River System Large Bulk Water Supply Reconciliation Strategy: Executive Summary. Report No P RSA C000/00/4406/09

A1.14 KIMBERLEY

Kimberley is part of the Sol Plaatjie Local Municipality.

Kimberley is being supplied from the Vaal River System and the future growth in use will be supplied from there.

Although Kimberley is not experiencing a water resource shortfall, the 'All Towns Reconciliation Study' (see section 11 in the main document) makes it clear that the Municipality should implement WC/WDM so as to cut the level of water wastage, which in turn reduces pressure on the whole system.

The Vaal River System is described in depth under the Gauteng area in Annexure A1.1.

REFERENCES

Vaal River System Large Bulk Water Supply Reconciliation Strategy: Executive Summary. Report No P RSA C000/00/4406/09

A1.15 MAFIKENG-LICHTENBURG

This area is included in the Mafikeng and Ditsobotla Local Municipalities.

Botshabelo Water supplies Mafikeng with potable water. The current sources of supply are the Grootfontein and Molopo springs, supplemented by Setumo Dam, which is hardly utilised because of water quality problems emanating from urban/ industrial return flows. Mafikeng town has a high per capita consumption indicating inefficient utilisation. The implementation of Water Conservation and Water Demand Management (WC/WDM) measures is essential.

A study in close liaison with the North West Province is about to start with the development of a water reconciliation strategy for the Mafikeng area. One of the options that will be investigated is to supply this area from the Vaal River System. Some of the smaller towns along the route may then also be supplied from the Vaal River System. Vaal System water will however be very costly and this will only be provided if WC/WDM and the search for groundwater do not relieve the pressure on resources.

Groundwater from the local water-rich dolomitic formations is the source of water for Lichtenburg and should be sufficient for the future if carefully managed.

A1.16 THOHOYANDOU-GIYANI

This area is included in the Thulamela and the Greater Giyani Local Municipalities.

Thohoyandou is supplied with water from the Vondo Dam. Water shortages were being experienced from time to time, but the recently completed Nandoni Dam was built to alleviate this problem. The water purification works at Nandoni Dam is under construction, with Phase 1 completed but not yet commissioned. Nandoni Dam will be able to supply sufficient water to Thohoyandou well into the future.

Water to Giyani is supplied by the Middle Letaba Dam. This dam also supplies water to the Waterval/ Elim/ Vleyfontein area situated close to Louis Trichardt in the Luvuvhu River catchment, upstream of the Albasini Dam. The demand for water from the Middle Letaba Dam exceeds the yield. There is, however, a lot of wastage that can be reduced in the Giyani area, and once the water purification works at Nandoni Dam have been completed this dam will be used for Waterval/ Elim/ Vleyfontein, taking some of the pressure off the Middle Letaba Dam and easing the supply to Giyani. The area under irrigation from the Middle Letaba Dam may also have to be substantially reduced to improve domestic supplies. Investigations have shown that the construction of additional storage on the Little and Middle Letaba Rivers would add very little to the system yield and is therefore not economically feasible.

Due to high use and poor rainfall the water level in the Middle Letaba dam has dropped to between 6 to 11% each year over the past three years. The Department, together with the Local Authorities and Water User Authorities, are implementing actions to prevent a serious immediate crisis, stabilise the situation, and prevent future occurrences of this nature. DWA gazetted water use restrictions in May 2009, Water Conservation and Water Demand Management measures are being implemented by Lepelle Northern Water, and DWA is planning to provide both funding (R10m) and technical capacity, to rehabilitate a number of existing boreholes.

Consideration may have to be given to the linking of further parts of the present Middle Letaba Dam supply area to Nandoni Dam. DWA is commissioning the Development of a Reconciliation Strategy for the Luvuvhu and Letaba Water Supply System, covering the entire Luvuvhu and Letaba Water Management Area in Limpopo Province. This is expected to start this year (2010). The first phase of this study includes updating of the hydrology and setting up water resources models for the entire WMA. Further key objectives are to provide a strategy that facilitates integrated operation of resources, and pays particular attention to the optimal utilisation of groundwater.

A1.17 POLOKWANE

Polokwane Local Municipality is currently supplied by Lepelle Northern Water from the Dap Naudé and Ebenezer dams on the Great Letaba River and from the Flag Boshielo Dam on the Olifants River. Water is also supplied to Polokwane from the sand aquifer in the Sand River, which is being recharged with return flows from the Polokwane wastewater treatment works.

The De Hoop Dam is currently under construction on the Steelpoort River, a tributary of the Olifants River. The dam should be completed during 2012, with partial impoundment planned to start in the spring of 2010. A pipeline will be constructed from the De Hoop Dam along the Middle Olifants River to the Olifantspoort Water Treatment Works near Lebowakgomo, from where potable water will be supplied to Polokwane by Lepelle Northern Water. Water for existing and new platinum mines along the eastern limb of the Bushveld Igneous Complex will also be supplied from this pipeline. Another pipeline from the De Hoop Dam will supply water for domestic use to the Nebo Plateau. It is envisaged that the Department will supply water from the De Hoop Dam for the operation of Eskom's proposed hydropower pumped-storage scheme in the proximity of the De Hoop Dam. This is a non-consumptive use.

Mokopane is currently supplied with water from the Doorndraai Dam and groundwater from the Planknek well field. Potgietersrus Platinum mine gets purified wastewater from the Polokwane wastewater treatment works by means of a pipeline specifically constructed for this purpose.

It is expected that new mines will be established in the Mokopane area and it is also expected that Mokopane will grow significantly. Provision has been made for this allocation from Flag Boshielo Dam, and a pipeline is planned from Flag Boshielo to supply the required water.

There are, however, strong indications that the growth in the water requirements of this area and others that are also supplied by the Olifants River system will, soon after the completion of the De Hoop Dam, further increase and exceed the availability of water from the supply system. There is therefore an urgent need for additional new resources to augment the supply, as well as for management actions that can bring future water requirements into line with available resources.

The Department is now embarking on a strategic level study, *Development of a Reconciliation Strategy for the Olifants River Water Supply System,* to determine all the possible options to ensure a continuing supply of water for the growth and development of this important part of the country. This study is similar to the other major metro and system studies already undertaken or underway. The options that will be investigated are, inter alia, the more efficient use of water, the transfer of water allocations from existing users to new use through trading, the building of another dam, transfer of water from adjacent catchments, as well as further exploration of groundwater. This will aimed at addressing the future requirements of all users that could potentially be supplied from the Olifants River system.

The DWA will develop these water resource strategies in an open process and will fully involve the public. The first order water resource strategies will be available by the middle of 2010. A Strategy Steering Committee will be appointed to monitor implementation.

A1.18 NEWCASTLE

Water for the Newcastle area comes from the Buffalo River (Thukela System) and the Ntshingwayo Dam in this river. The Ntshingwayo Dam is not fully utilized and Newcastle thus has enough water for the foreseeable future. There is potential for further dam development close to Newcastle, should more water be required for industrial development.

A1.19 UMTATA

This area is included in the King Sabata Dalindyebo Local Municipality.

Mthatha has been identified for urban renewal in the Mzimvubu Development Project, a Presidential Icon Project driven by the Eastern Cape Provincial Government and supported by the Department. As water losses and wastage in the town are unacceptably high, and the water quality of effluent from the WWTW discharged to the Mthatha River is very poor, a water conservation and demand management strategy needs to be developed and implemented urgently.

The water situation for the town of Mthatha was investigated in the Mtata Basin Study, completed by the Department in 2001. The Internal Strategic Perspective for the Mzimvubu to Mbashe area used the information assembled in that study.

The relatively large Mtata Dam can supply much more water than the Mthatha area can use for its growth and development in the foreseeable future. In the meantime water from the dam is used non-consumptively for hydro-power generation.

A1.20 PHALABORWA

This area is included in the Ba-Phalaborwa Local Municipality.

Phalaborwa is currently supplied with water by Lepelle Northern Water using allocations from the Blydepoort Dam (Blyde River, a tributary of the Olifants) from the Olifants River itself, abstracted at the Phalaborwa Barrage. The Phalaborwa Mining Company has changed its mining methods and has moved from an opencast to an underground operation. This requires less water and the mine has changed the water management on its premises and is recycling its process water. The mine also has a zero-effluent policy that is strictly applied.

Whilst surplus water is currently available for development in the Phalaborwa area the likely increase in the water requirements of this area needs to be investigated. This investigation is to be covered by the Olifants Reconciliation Strategy Study, discussed under A1.17 Polokwane.

A1.21 THABAZIMBI AND LEPHALALE

The Thabazimbi area, along with mines south of Thabazimbi, is supplied by Magalies Water from the Vaalkop Dam. Lephalale is expected to grow significantly as the centre of new coal mining and power generation activity. Sasol is also investigating the possibility of establishing a coal-to-liquid fuel plant in the area and this would require 80 million m^3 of water per annum.

Treated effluent released into rivers will serve as the source of water for further mining and urban requirements. As noted in more detail in Section A1.1, the Crocodile (West) River reconciliation study shows that enough water will be available to supply water to Magalies Water for the growth in the mining sector as well as for domestic purposes in the Thabazimbi and Lephalale area.

See also Section 12 “Water Supply to the Energy Sector” in the main body of this document.

REFERENCES

The Development of a Reconciliation Strategy for the Crocodile West Water Supply System: Executive Summary. Report No. P WMA 03/000/00/3909

A1.22 BETHLEHEM-HARRISMITH-PHUTHADITHJABA

This area is included in the Dihlabeng and Maluti a Puhofung Local Municipalities.

Bethlehem has developed local sources but is now being supported from the Lesotho Highlands Water Project where water released from the tunnel flows past the town. With such a seeming abundance of water available the challenge will be to ensure that water is used efficiently.

Harrismith gets water from local dams on the Wilge River with support from the Sterkfontein Dam, where water transferred from the Thukela River to the Vaal River System is stored. Water use efficiency will also have to get special attention in Harrismith.

Phuthaditjhaba has local resources in the Fika Patso and Metsi Matso dams. These dams can no longer cope with the current water requirements. A project has commenced through the Regional Bulk Infrastructure Grant, to create capacity in the Greater Harrismith area water supply system to accommodate future residential and industrial developments in Phuthaditjhaba. This area will then also effectively be supplied from the Sterkfontein Dam.

A1.23 TZANEEN

The Greater Tzaneen Local Municipality is supplied from the Tzaneen and Ebenezer dams on the Great Letaba River. Allocations from both these sources are fully utilised.

In 2006 a post-feasibility bridging study was initiated to facilitate decision-making and preparation for implementation of the Groot Letaba River Water Development Project (GLeWaP). The aims of this project are to improve water supplies to communities in the Southern part of the Mopani District (which includes Tzaneen); to improve the water availability for the ecological system in the Groot Letaba River; to enable the establishment of resource poor farmers, and to stabilize commercial irrigation. The building of the Nwamitwa Dam and the raising of Tzaneen Dam, both on the Groot Letaba River, were at first proposed but further analyses have shown that the availability of water from these developments is substantially less than previously estimated, and further hydrological analyses will be necessary to support appropriate planning and development. Groundwater utilisation needs to be managed on a regional scale to ensure optimal use. The findings of the current study underscore that the potential for further water resource development in the Limpopo Province is very limited and the available water resources must be utilised very efficiently, with losses managed to a minimum.

DWA is currently commissioning the *Development of a Reconciliation Strategy for the Luvuvhu and Letaba Water Supply System*, covering the entire Luvuvhu and Letaba Water Management Area in Limpopo Province. This is expected to start this year (2010). The first phase of this study includes updating of the hydrology and setting up water resources models for the entire WMA. Further key objectives are to provide a strategy that facilitates integrated operation of resources, and pays particular attention to the optimal utilisation of groundwater.

REFERENCES

Groot Letaba River Development Project (GLeWap) Post Feasibility Bridging Studies. Technical study module: Main Report P WMA 02/810/00/0608/1

A1.24 SALDANHA

The Saldanha area is mainly supplied with water from the Misverstand Dam, which forms the lower part of the Western Cape Water Supply System. Future supplies were considered in the Western Cape Reconciliation Strategy Study (see Cape Town area under A1.2).

The Department initiated a study for the West Coast District Municipality in 2002 after concerns were raised about the reliability of water supplies, as water requirements were growing at 10% per annum. The main recommendation from the study was that enough water could be tapped from the Misverstand Dam through more effective operation of the existing pumping station. It is the Department's view that there is enough water and sufficient capacity available in the infrastructure to supply the additional water required in the medium term. The West Coast DM has however recently commissioned a further feasibility study on the need for additional augmentation of supply resources. Output from this study will be moderated by the Department.

In July 2008 a project was started whereby the feasibility of artificially recharging the Langebaan Road Aquifer using surplus winter runoff from the Berg River, for abstraction in the dry summer months, is being investigated. The results from this study are expected this year (2010).

REFERENCES

The Western Cape Water Supply System Reconciliation Strategy Study, Report no P WMA 19/000/00/0507

A1.25 UPINGTON

This area is included in the //Khara Hais Local Municipality.

Upington receives its water from the Orange River and the future growth in use will be supplied from there. The Department is also looking at the use of water to supply the requirements of a possible solar thermal power station, should plans for solar power generation in this area materialise (see section 12 in the main report).

A1.26 LADYSMITH

This area is included in the Emnambithi-Ladysmith Local Municipality.

The Ladysmith area gets its water from the Spioenkop Dam in the Upper Thukela River and from a pump station lower down in the river. The pump station and associated pipeline can be upgraded if more water is required.

There is surplus water available in the Upper Thukela River that can readily be diverted to Ladysmith.

Annexure 2: International River Systems

1 THE INCOMATI AND MAPUTO RIVER SYSTEMS

The Incomati and Maputo River Systems are dealt with together because the international cooperation institution the Tripartite Permanent Technical Committee (TPTC) deals with them in this way. Mozambique, Swaziland and South Africa share these river systems. In South Africa the Incomati system consists of the Sabie, Crocodile and Komati Rivers and the Maputo system consists of the Usutu and Pongola Rivers.

The most recent Agreement that guides countries in water use is the Interim IncoMaputo Agreement (IIMA) signed in 2002. Various joint studies are currently being undertaken by the three countries to facilitate implementation of the Agreement. Studies already initiated are:

- Water supply to the city of Maputo
- Information exchange
- Disaster management
- Operating rules
- Stakeholder participation
- Integrated Water Resource Management

In the Incomati system the Sabie River has recently been determined to be in balance, the Komati River is fully allocated, and the Crocodile River is over-allocated. South Africa does not always meet the cross border flow requirements set for the Komati and Crocodile Rivers. In the Catchment Management Strategy of the Inkomati CMA attention will have to be given to adjusting water use back to agreed levels in the Crocodile River. The city of Maputo will soon be unable to meet water demands, with the Incomati system, for practical reasons, a preferred target of Mozambique for additional water for Maputo. Mozambique has also initiated procedures to complete the Corumana Dam in the Sabie River just downstream of the border with South Africa. Completion will entail raising the water level by installing crest gates, thereby inundating a small area in the Kruger National Park.

In the Maputo system the Usutu River is more or less in balance in South Africa, and the Pongola River is not fully utilized yet, although all the surplus water in the system has been earmarked for use. Mozambique is sensitive about environmental releases from Pongolapoort Dam as it inconveniences people living and farming on river banks, but there are no other major water issues between the three countries at present.

2 THE LIMPOPO

The 1700 km mainstem of the Limpopo forms parts of the border between South Africa and Botswana, and the entire border between South Africa and Zimbabwe, before entering the Indian Ocean through Mozambique

With regard to sharing of the Limpopo, formal cooperation between South Africa and Botswana started in 1967 and a number of bilateral agreements were signed. A Joint Permanent Technical Committee (JPTC) was established in 1983 to make recommendations on matters of common interest. In 1988, an agreement was reached on the transfer of water from the Molatedi Dam on the Marico in South Africa to Botswana for domestic use. But the most notable outcome of the JPTC framework was the Joint Upper Limpopo Basin Study (JULBS) in 1991, a pre-feasibility study to determine and evaluate the most successful and cost effective method of regulating the main stream. The study concluded that anticipated dam projects on the main river were not viable for both technical and economic reasons. South Africa and Botswana signed an Agreement on Cross Border Water Supply on 17 July 2008, and the JPTC has started discussions to implement this agreement.

In 1986, Limpopo Basin States (South Africa, Botswana, Zimbabwe and Mozambique) signed a multilateral agreement establishing a Limpopo Basin Permanent Technical Committee (LBPTC) to advise on issues regarding the river. This committee did not function for ten years but was re-activated in 1995. It was agreed to undertake a joint hydrological study of the Limpopo mainstem, and the establishment of a Limpopo River Commission (LRC) was proposed. Little progress was made due to disagreements between Basin States over the status of the LRC and water sharing.

In 1996 South Africa and Mozambique established a Joint Water Commission (JWC), with advisory functions on technical matters relating to their common rivers, including the Limpopo. In 2003 the Limpopo co-basin states formed the Limpopo Watercourse Commission (LIMCOM) to serve as the forum for the Limpopo basin countries, responsible for the management of the water resources of the Limpopo River. This Commission (still awaiting Zimbabwe ratification) will replace the Limpopo Basin Permanent Technical Committee.

South Africa dominates the basin in terms of land occupation and runoff contribution. No dams have been built on the Limpopo main stem. However, many major dam projects have been implemented on its various tributaries. 45 large dams, 29 in South Africa, were built mainly for irrigation, domestic and industrial water supply, hydropower generation, and as flood mitigation structures. South Africa, the major user of the river, is economically dependent on it, and demands are increasing. The Limpopo also supplies Eastern Botswana, and large irrigation schemes in southern Mozambique. There are few attractive development options left in Zimbabwe, where resources have been developed to the river's potential. There are substantial but poorly quantified flows in the Limpopo River, used primarily by irrigators in the Limpopo WMA. The assumption is therefore made that development along the Limpopo River has expanded to the limit of sustainability and that the water resource balances out the water use. The water requirement in South Africa is estimated at 80 million m3/a from the main stem of the Limpopo River. The registered water use indicates that 49 million m3/a of the water abstractions from the Limpopo are from groundwater (i.e. from the alluvial aquifer) while the remaining 31 million m3/a are from surface flow, although the distinction between these two may not always be clear. The main stem of the Limpopo is, at best, in balance. Concerns have however been raised that over-exploitation of the alluvial aquifer on the South African side of the river would have long lasting negative impacts on the quantity and quality of the water.

South Africa's overall approach towards the main stem of the Limpopo is to disallow any further water use licences from the river and from the alluvial aquifer, at least until the system is much better understood than is currently the case. One of LIMCOM's first tasks is to oversee a Joint Basin Study of the Limpopo River, and the development of a water use agreement for the Limpopo Basin to allow better management of the river and prevent over-utilisation. LIMCOM commissioned a Scoping Study (1st Phase of the Joint Limpopo River Basin Study) at the end of 2008. This was aimed at gathering information, assessing information gaps, defining the level of investigation and providing the work content for the detailed main study. Scoping work was completed at the end of 2009 and arrangements are now being put in place to start the comprehensive phase 2 study.

3 THE ORANGE RIVER

Four countries - Botswana, Namibia, Lesotho and South Africa - are co-basin states of the Orange (or Senqu in Lesotho) River, if the ephemeral, endoreic, Molopo-Nossob River system is included. The latter three countries are riparian to the main stem, as well as to tributary rivers such as the Vaal (South Africa), Caledon (Lesotho and South Africa), and Fish (Namibia) that contribute to the flow of the main stem river.

A number of bi-lateral agreements preceded the multi-lateral agreement that created the Orange-Senqu Commission (ORASECOM) in 2000. The most important of these were:

- Agreement between South Africa and Botswana establishing a Joint Permanent Technical Committee JPTC in 1983
- Treaty on the Lesotho Highlands Water Project (LHWP) between South Africa and Lesotho in 1986
- Agreement on the establishment of a Permanent Water Commission (PWC) between South Africa and Namibia in 1992

In addition to the bi-lateral cooperation, the establishment of the ORASECOM provided the four countries the opportunity for cooperation on basin-wide issues. For this purpose the Commission embarked on a number of projects, many of which are still in progress. These projects are coordinated by the ORASECOM Secretariat and sub-committees of the Commission.

The Orange System is of critical importance to South Africa: The Vaal sub-system, augmented from the upper Orange (Senqu) by the LHWP, supplies water to the economic heartland of South Africa; the total Gross Value Added is in excess of R800 billion, or 40% of that of the country. It also supplies water to the thermal power stations on the Highveld; some 29600 MW, or 67% of South Africa's installed electricity generating capacity. In addition irrigation schemes covering large areas along the Vaal, middle and lower Orange Rivers, account for 60% of South Africa's total water use in the basin. Some 15 million people, or more that 30% of the nation, are dependent on secure water supplies from the basin.

Over the last century South Africa has invested heavily to secure the water resources of the basin. Many large dams were built, such as the Vaal, Bloemhof and Grootdraai Dams on the Vaal River, Gariep and Vanderkloof Dams on the Orange River, and the Katse and Mohale Dams on Lesotho, as well as long conveyance infrastructure; tunnels, pipelines and canals.

Namibia invested mainly in irrigation schemes on the Fish River in southern Namibia, for which purpose the Hardap and Naute Dams were built. Some irrigation is taking place on the Namibian side of the Orange River itself. Namibia has indicated its intention to increase irrigation development along the Orange as well as the Fish Rivers.

Lesotho's water requirements, largely for domestic and stock-watering purposes, are met from streams and fountains. Botswana has similar types of demand in its sparsely populated part of the basin, with boreholes the main source of water.

Present demands on the Orange System (dominated by South Africa) are broadly in balance with supply. Any further demand will have to be met by either increasing the supply (by building more storage) or improving the management of the existing uses. Increasing the supply will be expensive and is likely to be viable only for municipal industrial purposes as has been evidenced by the recent decision by South Africa and Lesotho to build the Polihali Dam as a next phase of the LHWP. In South Africa this will be accompanied by a concerted water demand management action, and projects to recycle water.

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