



Botswana | Lesotho | Namibia | South Africa

The Orange-Senqu River Commission (ORASECOM)

Sharing the Water Resources of the Orange-Senqu River Basin

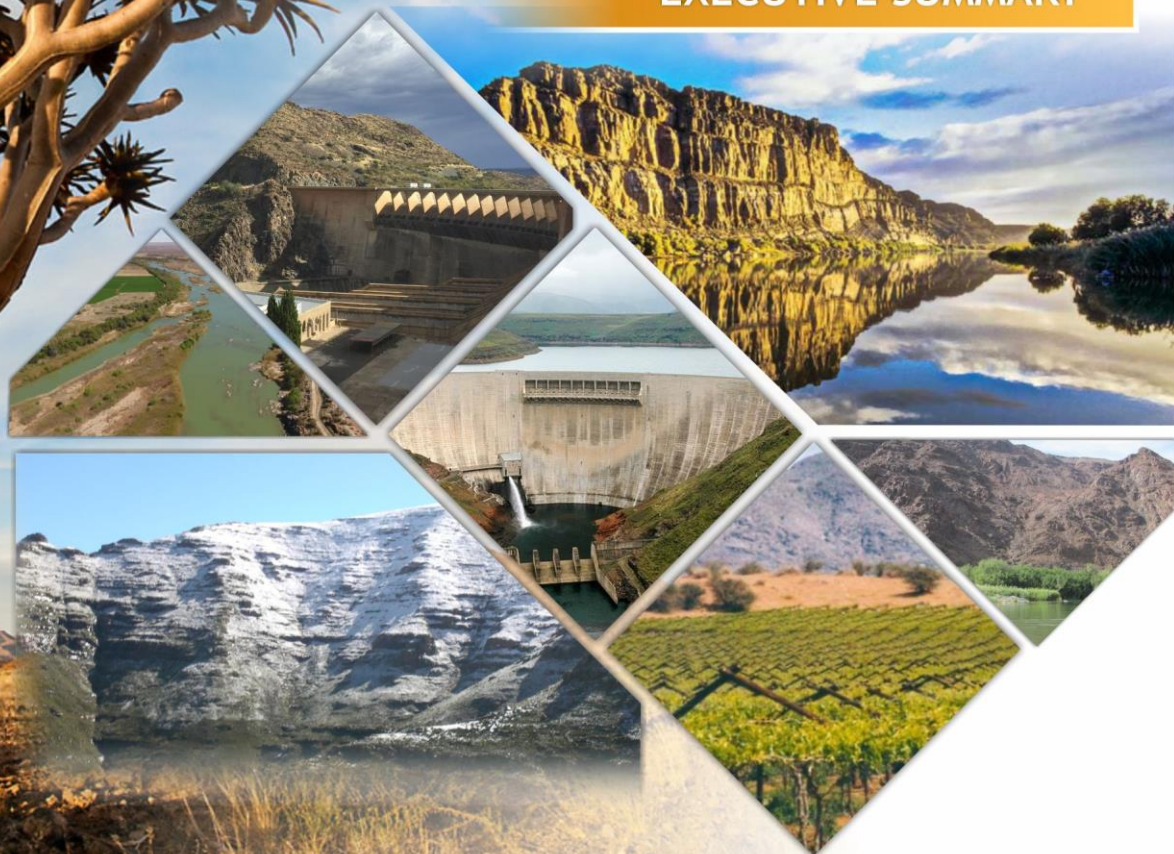
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Preparation of Climate Resilient Water Resources Investment Strategy & Plan and Lesotho-Botswana Water Transfer Multipurpose Transboundary Project

ROADMAP FOR IWRMP OPERATIONALIZATION

Component II

EXECUTIVE SUMMARY



August 2024
FINAL REPORT

Report number: ORASECOM 012A/2019

The Preparation of a Climate Resilient Water Resources Investment Strategy & Plan and the Lesotho-Botswana Water Transfer Multipurpose Transboundary project was commissioned by the Secretariat of the Orange-Senqu River Basin Commission (ORASECOM) with technical and financial support from the African Development Bank, NEDPAD-IPPF (Infrastructure Project Preparation Facility), the Stockholm International Water Institute (SIWI), the Climate Resilient Infrastructure Development Facility – UK Aid, and the Global Water Partnership-Southern Africa.



PREPARATION OF CLIMATE RESILIENT WATER RESOURCES INVESTMENT STRATEGY & PLAN AND LESOTHO-BOTSWANA WATER TRANSFER MULTIPURPOSE TRANSBOUNDARY PROJECT

COMPONENT II

ROADMAP FOR IWRMP OPERATIONALIZATION EXECUTIVE SUMMARY

Prepared for



Orange-Senqu River Commission (ORASECOM)

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**PREPARATION OF CLIMATE RESILIENT WATER
RESOURCES INVESTMENT STRATEGY & PLAN
AND LESOTHO-BOTSWANA WATER TRANSFER
MULTIPURPOSE TRANSBOUNDARY PROJECT**

COMPONENTS II

ROADMAP FOR IWRMP

OPERATIONALIZATION EXECUTIVE SUMMARY

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TABLE OF REPORTS

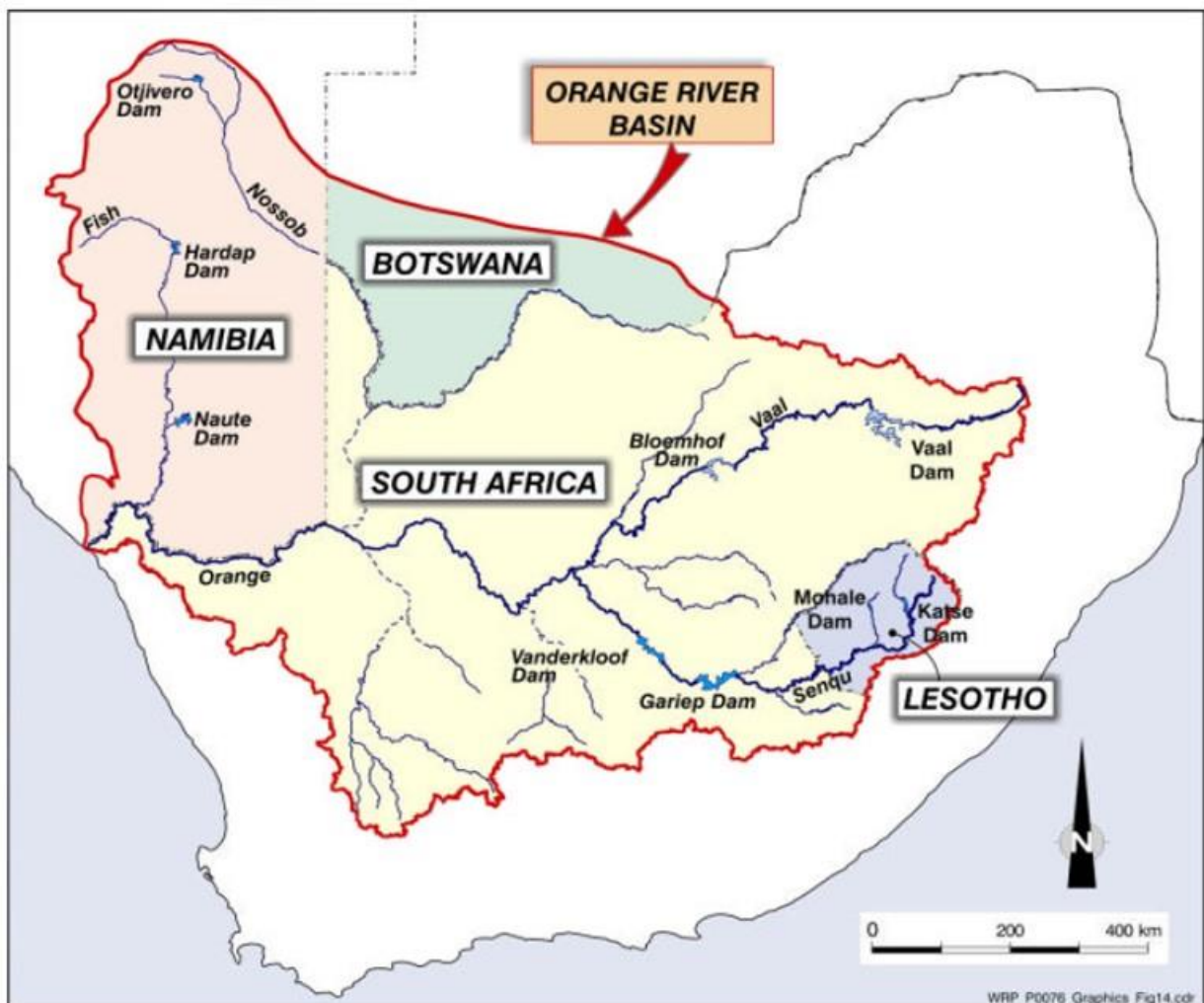
Reports submitted	ORASECOM Report No. ¹
Inception Report Components I and II	ORASECOM 010/2018
Inception Report Components III and IV	ORASECOM 011/2018
Preparation of climate resilient water resources investment strategy & plan Component I	
Core Scenario Update Report Component I	ORASECOM 003/2019
Core Scenario Supporting Report: Water Requirements and Return flows Component I	ORASECOM 004/2019
Core Scenario Supporting Report: Water Conservation, Water Demand management and Re-use Report Component I	ORASECOM 005/2019
Core Scenario Supporting Report: Ground Water Report Component I	ORASECOM 006/2019
Climate Change Report Component I	ORASECOM 007/2019
Review and assessment of existing policies, institutional arrangements and structures Component I	ORASECOM 008/2019
Optimized IWRMP Core Scenario economic approach Report Component I	ORASECOM 009/2019
Climate Resilient Water Resources Investment Plan Report Component I	ORASECOM 010/2019
System analysis Report Component I	ORASECOM 011/2019
Preparation of climate resilient water resources investment strategy & plan Component II	
Roadmap for IWRMP Operationalization Report Component II	ORASECOM 012/2019
Roadmap for IWRMP Operationalization Executive Summary	ORASECOM 012A/2019
Roadmap for IWRMP Operationalization: Appendix B Strategic Actions Concept Notes	ORASECOM 012B/2019
Roadmap for IWRMP Operationalization: Appendix C Core Scenario Concept Notes	ORASECOM 012C/2019
Climate Resilience Investment Plan (Brochure)	ORASECOM 012D/2019
Roadmap supporting Report: Strategic actions and TORs (Appendix A to Roadmap Report)	ORASECOM 013/2019
Lesotho-Botswana water transfer multipurpose transboundary project Component III Pre-feasibility Phase	
Pre-feasibility report Phase 1 Report Component III	ORASECOM 014/2019
Pre-feasibility report Phase 2 Report Component III	ORASECOM 015/2019

Reports submitted	ORASECOM Report No.¹
Report A Phase 2: Dam on the Makhaleng River	ORASECOM 015A/2019
Report B Phase2: Water Conveyance System	ORASECOM 015B/2019
Report C Phase 2: Environmental and Social Assessment	ORASECOM 015C/2019
Report D Makhaleng River Ecological Water Requirements	ORASECOM 015D/2019
Lesotho-Botswana water transfer multipurpose transboundary project Component IV - Feasibility Phase	
Feasibility Study Interim Report Component IV	ORASECOM 016/2019
Feasibility Study Report Component IV	ORASECOM 017/2019

EXECUTIVE SUMMARY

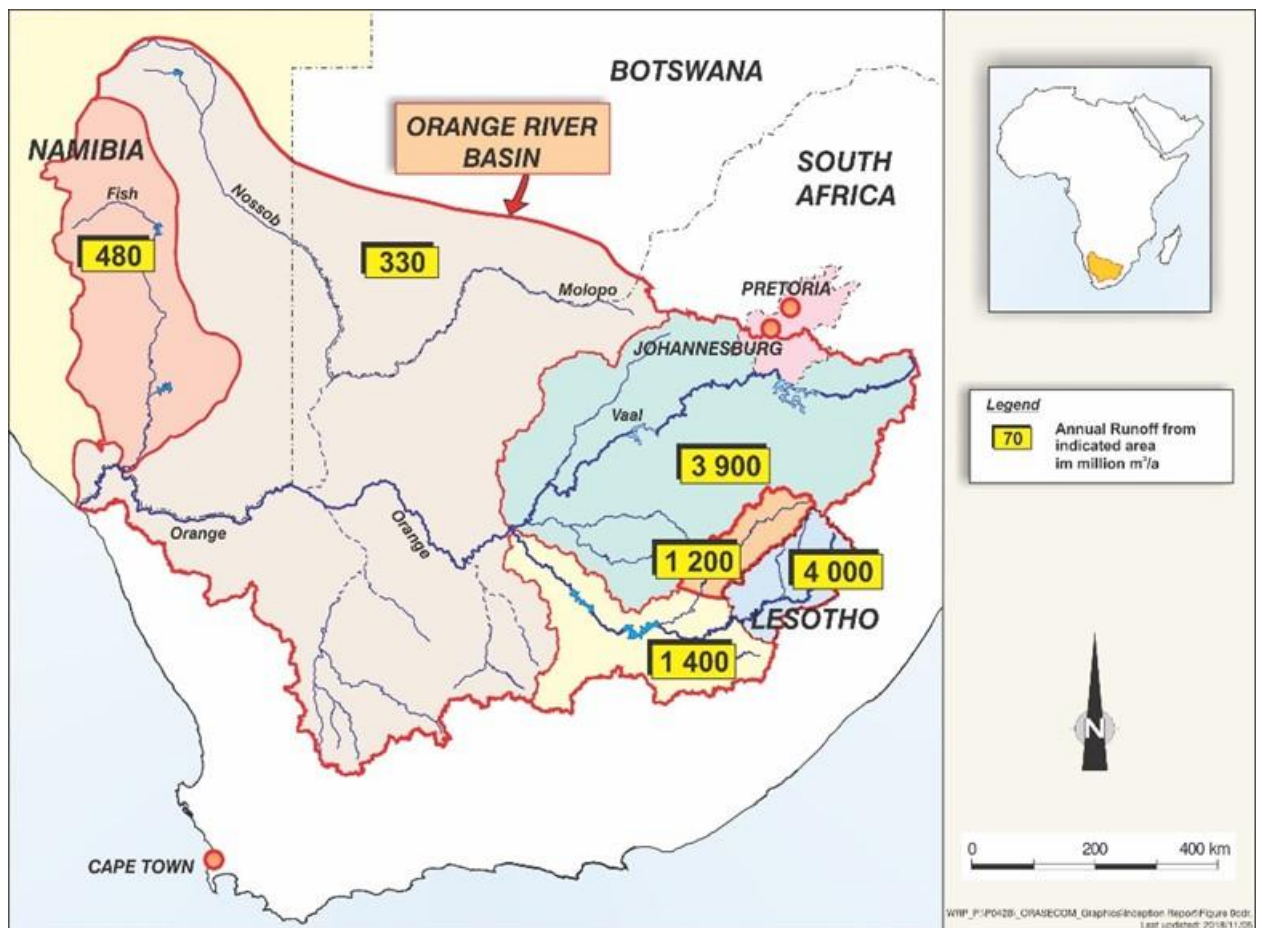
The Orange-Senqu River Basin

The Orange-Senqu River basin is one of the largest river basins south of the Zambezi with a catchment area of approximately 1 million km². It encompasses all of Lesotho, a significant portion of South Africa, Botswana and Namibia. The Orange-Senqu River originates in the Highlands of Lesotho and flows in a westerly direction for approximately 2,200 km to the west coast of South Africa and Namibia where it discharges into the Atlantic Ocean.



Water Resources of the Orange-Senqu River Basin

It has been estimated that the natural runoff of the Orange-Senqu River basin is in the order of 11,300 million m³/a, of which approximately 4,000 million m³/a originates in the Senqu basin in the Lesotho Highlands, 6,500 million m³/a from the Vaal and Upper Orange, with approximately 800 million m³/a from the Lower Orange and Fish River (Namibia).



The runoff values provided highlight the highly variable and uneven distribution of runoff from east to west in the basin and the various water demands have already reduced the actual runoff reaching the river mouth to less than half the natural runoff. The Natural Runoff figures refer to the runoff which would have occurred had there been no developments or impoundments in the catchment.

It is important to note that the current demands for water within the basin are basically in balance with the available yields from the many different dams and transfer schemes. As such, it is important to analyse all possible new dam developments to assess their impacts on existing downstream users and to provide additional yield where necessary to rebalance any shortages caused by the new development.

Climate Change

It is generally accepted that southern Africa will be highly impacted by climate change and various studies have been completed which indicate that Climate Change is likely to affect the water resources of the basin to some degree. It is agreed that the temperature and thus also the evaporation will increase throughout the basin. The rainfall is expected to reduce

especially in the lower areas to the west of the catchment although there is no clear indication of what will happen in the high laying wetter areas in Lesotho and to the East of the basin. This study therefore aims to enhance investment in transboundary water security and to develop resilience to climate change through strategic projects and actions, some of which are described in the Integrated Water Resource Development Plan.

The Republic of Botswana is an arid country with serious water constraints which will worsen with the expected effects of climate change. Botswana can expect to experience chronic water shortages in the near future unless a major new water source is developed. Gaborone has already experienced a serious drought which caused severe shortages in 2015 and 2016. Droughts are natural events which must be expected from time to time. It is clear, however, that they are becoming more frequent and more severe due to the impacts of Climate Change. The proposed Lesotho to Botswana Water Transfer Project is effectively a Water Resilience Project aimed at protecting the water supply to Southern Botswana by providing a reliable alternative water source to augment the existing local water resources as well as the supply from Northern Botswana through the North-South Carrier.

ORASECOM and the Integrated Water Resources Development Plan

Southern Africa has fifteen (15) transboundary watercourse systems of which thirteen exclusively stretch over the Southern African Development Community Member States. The Orange–Senqu is one of these thirteen transboundary watercourse systems. The Southern African Development Community member states embrace the ideals of utilizing the water resources of these transboundary watercourses for the regional economic integration and for the mutual benefit of riparian states. To enhance the objectives of integrated water resources development and management in the region, the Orange–Senqu River Basin Commission (ORASECOM) was established in November 2000.

ORASECOM was established by the Governments of the four States, namely, South Africa, Lesotho, Botswana and Namibia, for managing the transboundary water resources of the Orange-Senqu River basin and promoting its beneficial development for the socio-economic wellbeing and safeguarding the basin environment. This led to the development of a basin level Integrated Water Resources Management Plan adopted in February 2015 by the ORASECOM Member States. The Integrated Water Resources Development Plan provides a strategic transboundary water resources management framework and action areas and serves as a guiding and planning tool for achieving the long-term development goals in the basin. A key aspect of the transformative approach for strengthening cooperation has been identified

as the need for joint project implementation that provides a mutually inclusive transboundary benefit.

The Integrated Water Resources Development Plan recommends strategies and measures for promoting sustainable management of the water resources of the basin and defines strategic actions that will ensure and enhance water security, considering the long term socio-economic and environmental demands on the water resources of the basin.

The Orange-Senqu River basin is a highly complex and integrated water resource system, characterised by a high degree of regulation and major inter-basin transfers to manage the resource availability between the location of relatively abundant precipitation and the location of greatest water requirements. The infrastructure involves storage and transmission of water to demand centres that are in some cases located outside of the basin through intra and inter basin transfers. The largest interbasin transfer is the Lesotho Highlands Water Project which transfers approximately 800 million m³/annum water to South Africa through an 80km long transfer tunnel which runs through the Maluti Mountains.

Objective of this Study

The objective of this study is to assist ORASECOM and the riparian countries to implement various elements of the Integrated Water Resource Management Plan developed in 2015. The objective will be met through the following three processes:

- A Climate Resilient Investment Plan for the Orange-Senqu River Basin based on the updated Core Scenario. The Core Scenario is basically a detailed list of new water resource developments which have been planned by the 4 basin states to ensure that future water demands can be supplied into the future taking into account the possible impacts of Climate Change.
- A proposed Implementation Plan for a number (nine separate projects have been identified) of Key Strategic Actions selected from the updated Integrated Water Resource Management Plan. These proposed Strategic Actions are potential projects where ORASECOM will play a key role in the management and funding of the work.
- A Pre-feasibility level report for the Lesotho to Botswana Water Transfer Project, and a feasibility level report for a new dam on the Makhaleng River in Lesotho.

The study is divided into four components namely:

Component I

- Preparation of a Climate Resilient Investment Plan, based on the updated Water Resources Yield and Planning Model and the updated Core Scenario defined in the IWRM Plan of 2015.

Component II

- Operationalisation of the Integrated Water Resources Management Plan;

Component III

- A Pre-feasibility study of the Lesotho to Botswana Water Transfer Project;

Component IV

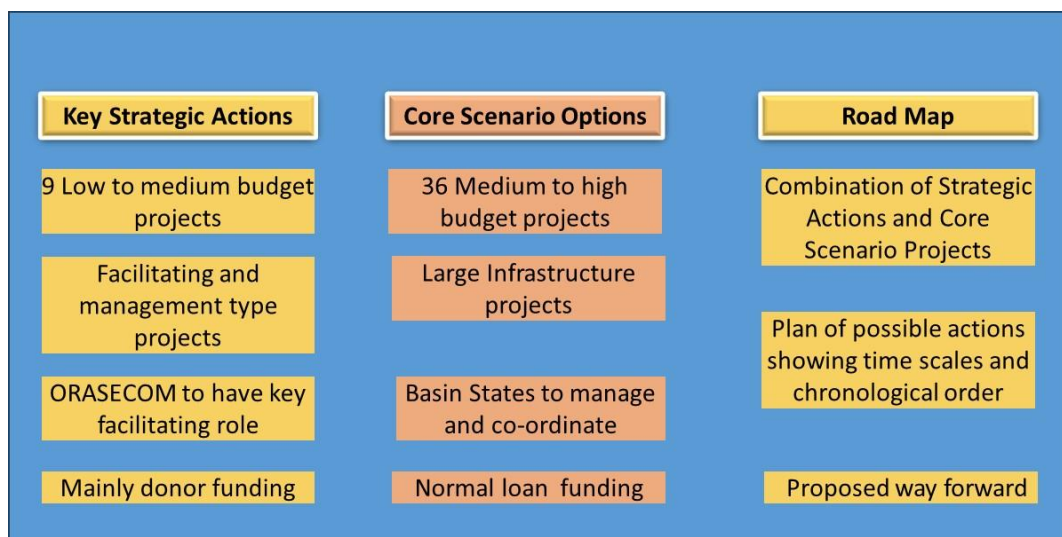
- A Feasibility Study of the Dam on Makhalleng River in Lesotho.

Future Water Resource Developments

As a result of the potential impacts of Climate Change and growing economies, the Governments of Botswana, Lesotho, Namibia and South Africa recently agreed to undertake a Pre-feasibility study on the Lesotho to Botswana Water Transfer scheme (L-BWT) aimed at developing new water infrastructure in Lesotho and through South Africa, to convey water from Lesotho to Botswana at the same time supplying various users in Lesotho and South Africa. This Pre-feasibility (Component III & IV of this study) led to the selection of a technical option which included a possible dam on the Makhalleng River in Lesotho and a water conveyance system to Botswana. It was envisaged that 186 million m³/a (162 million m³/a before losses) could be pumped to Botswana with additional supplies for consumers along the route in Lesotho and South Africa.

Following the completion of Components I & II of this study, a number of possible development options and supporting studies were identified. These have been split into two specific categories namely:

- Key Strategic Actions
- Core Scenario Infrastructure Projects



Key Strategic Actions

The nine Key Strategic Actions discussed in this report are listed below together with the approximate funding requirements for each action:

	Description	Capital Cost (\$m)	Running Costs (\$m/annum)
1	Agreement and Implementation of Environmental Water Requirements	\$1m to \$5m	\$1m per annum
2	Improvement and Implementation of Monitoring and Information Management	\$5m	\$1m per annum
3	Development and Implementation of Guidelines for sharing	\$1m	
4	Synchronisation and Preparation of Future and Planned Developments	\$1m	
5	Implementation and monitoring of WDM activities	\$1m	
6	Assurance of Supply and Economic Value of Water	\$1m	
7	Water Disaster Management – Climate Adaptation	\$2.0m to \$3.0m	
8	Capacity Building		\$2m in 3 years
9	Hydrology Update and WQ Model Calibration	\$3m	

Core Scenario Projects

The Orange Senqu River basin is one of the most complicated and integrated water resource systems in the world. It covers an area of over 1 million km² and includes:

- Over 80 large Dams/Reservoirs
- Over 270 small Dams/Reservoirs
- Over 1200 demand centres (cities, irrigation schemes, power stations etc)
- A system network of over 4 000 links (pipelines, tunnels, river sections etc)
- Over 300 individual naturalised streamflow sequences (monthly records for 90 years)
- Over 300 monthly rainfall records(monthly for 90 years)

In order to effectively manage such a large and complicated water resource system, it is necessary to continually monitor and update the various water demands as well as to plan and commission new water related infrastructure in the form of new dams, pipelines, tunnels etc. The proposed future schemes are discussed by the 4 basin states (Botswana, Lesotho, Namibia and South Africa) on a regular basis and the process is managed and facilitated through ORASECOM which has been created to ensure that all new developments are first discussed and agreed in principle to avoid possible problems in future.

The most likely future development scenario is referred to as the “Core Scenario” and it includes the current and likely future demands for all existing demand centres, as well as all existing water related infrastructure and possible future developments. The future developments include the projected water demands and possible new infrastructure as provided by each of the 4 basin states. Only projects that have been investigated to at least a pre-feasibility level, in that a basic costing has been done, have been included in the “Core Scenario”. When considering the detail provided for each possible future project, it is important to note the following:

- All cost estimates provided are estimated based on 2018 price levels unless otherwise stated.
- The cost estimates were all taken from various reports prepared by others.
- Some of these reports were only at a pre-feasibility level of detail while others were at a feasibility level with the result that some cost estimates are more accurate than others.
- The cost estimates quoted in the various reports were escalated to the 2018 price levels, using published government inflation figures.

Furthermore, in future, cost estimates and project viability would need to be verified through detailed feasibility and design level planning studies.

The 36 Core Scenario Projects have been presented in 9 clusters which are each discussed in this report. The nine clusters and related costs and yields are provided in the table below:

Cluster Name	Capital cost (\$ million)	Operational Cost (\$ million)	Yield impact (million m ³ /a)
1) Orange River Project + Noordoewer/Vioolsdrift Dam intervention options	2 096	6.9	724
2) Lesotho Botswana Water Transfer Scheme	2 856	45.3	162/334*
3) Lesotho Lowland developments	73	0.3	65
4) Integrated Vaal River System intervention options	1 723	84.4	522
5) Caledon to Greater Bloemfontein transfers	15	0.6	11
6) Greater Bloemfontein internal resource improvements	82	8.8	31
7) Gariep to Greater Bloemfontein transfer	226	12.1	43
8) Neckartal Scheme in Namibia	26	0.7	90
9) Integrated Water Management Options	337	67.2	308

Note: * 162 million m³/a refers to the net transfer volume (186 million m³/a including losses) and 334 million m³/a to the local yield of the dam which reduced to 308 million m³/a in feasibility phase due to repositioning of the dam.

Cluster 1: The Orange River Project + Noordoewer/Vioolsdrift Dam options

The Orange River Project refers to Gariep and Vanderkloof dams and their total supply area. These are the two largest storage dams in the Orange-Senqu basin. The gross storage of Gariep Dam is 4 905 million m³ and 3 107million m³ for Vanderkloof Dam. The yield available from this system is currently fully utilised and therefore no new demands can be supplied without adding some additional yield to the system through the construction of new dams/reservoirs or through the reduction of existing demands in some manner. Constructing any new dams upstream of the Orange River Project will reduce the yield available from the system and create water shortages to the existing users. Polihali Dam is currently under construction and will reduce the yield available from the Orange River Project by approximately 280 million m³/a. Some form of yield augmentation will therefore be required to offset the reduction in yield caused by Polihali Dam when it is finally completed and starts to transfer water to the industrial heartland of South Africa.

Several augmentation options have been identified by Department Water and Sanitation South Africa to rebalance the system and to allow for some further development along the Orange River. All these augmentation options form part of the Orange River Project + Noordoewer/Vioolsdrift Dam Cluster. Due to the significant impact of Polihali Dam on the Orange River Project it was included as part of this cluster. These options include:

- Utilise the lower-level storage in Vanderkloof Dam yield increase 137 million m³/a.
- Noordoewer/Vioolsdrift Dam along Namibia RSA border on the Lower Orange with an estimated yield of 280 million m³/a for a medium size dam. Final size of the dam is still to be determined and agreed on between Namibia and the RSA.
- Polihali Dam and transfer tunnel to Katse Dam forming part of the Lesotho Highlands developments. The local yield of 391 million m³/a. Construction recently started.
- Verbeeldingskraal Dam upstream of Gariep Dam with an estimated yield of 200 million m³/a.
- Real time monitoring and modelling, reducing operational requirements by approximately 80 million m³/a.

More details of the Orange River Project + Noordoewer/Vioolsdrift Dam Cluster are given in the main text of the report.

These include the investment cost of each of the schemes, the yield generated by the project and the Unit Reference Value for each scheme as well as for the Cluster of schemes.

Final sizes and related yield of these dams are still to be determined.

Cluster 2: The proposed Lesotho to Botswana Water Transfer Scheme

This project includes a 3 MAR dam (dam with a gross storage of three times the mean annual runoff generated from the catchment upstream of the dam) on the Makhalleng River. The scheme includes the 688 km pipeline (diameter from 2 200mm to 1 100mm) from Lesotho to Gaborone/Lobatse, which also supplies some towns in South Africa with water. There is a high possibility that water supply to Bloemfontein can be included as part of this transfer scheme. The pre-feasibility study for this transfer scheme was completed with the Feasibility study in progress at the time of writing this report (November 2023) and this scheme is discussed in more detail in various project reports as well as the “Road Map” Report. This dam has a local yield of 308 million m³/a (162 million m³/a before losses) will be transferred to users in Lesotho and the RSA, with the bulk of that transferred to Botswana.

Cluster 3: The Lesotho Lowlands Dams.

These dams comprise two proposed dams, supplying urban/rural demands and irrigation developments within Lesotho, namely:

- Hlotse Dam; and
- Ngoajane Dam.

The final size and yield from these two dams still need to be determined.

Cluster 4: The Integrated Vaal River System Intervention Options.

The Vaal River System Intervention Options include:

- Further phases of the transfer from the Thukela River;
- Utilising the Crocodile River Return Flows in Tshwane (Pretoria) to reduce the demand from the Vaal River via the Rand Water Board supply system; and
- Desalination and re-use of mine water effluent.

The proposed further phases of the Thukela River Water Transfer comprise two new dams at Jana on the main tributary of the Thukela River and the Mielietuin Dam on the Bushman's River (a tributary of the Thukela River) with new pipelines and pump stations linking these dams to the existing Thukela Water Transfer Scheme.

The proposed further phases will increase the yield of the Vaal River system, by approximately 522 million m³/a. This represents the net yield from the two dams after provisions were made for required yield loss due to mitigation releases for existing downstream users.

Key information on this water transfer scheme includes:

- The Jana Dam with the incremental yield of 396 million m³/a and the Mielietuin Dam with the incremental yield of 126 million m³/a.
- The Jana Dam with a gross storage of 2 652 million m³ and the Mielietuin Dam with a gross storage of 467 million m³.
- The dam wall height at full supply level for the Jana Dam is 186 m and for the Mielietuin Dam is 95 m.
- The total pumping head is high at about 580 m, requiring substantial electrical energy.
- The construction cost for the total scheme is estimated at \$1 184 million and the annual operations cost at \$9.1 million/a, at the 2018 development levels.

Cluster5: Caledon to Greater Bloemfontein Transfer

The intervention options to increase the water supply from the Caledon/Mohokare River include the following:

- Increase the total pump capacity at the Tienfontein Pump Station to 3.87 m³/s. Simultaneously increase the Novo transfer capacity to 2.2 m³/s. The Tienfontein pump station mainly abstracts water during the summer months because the flow rate in the river is generally too low in the winter months to pump. The Novo transfer system is used to transfer water from the Knellpoort Dam to the Rustfontein Dam. These capacity increases were recently completed, and the system is already in full operation.
- Increase the total pump capacity at Tienfontein pump station to 7 m³/s by 2040 or later.
- This option is expected to increase the system yield by 13.7 million m³/a.
- The capital cost for this option is estimated at \$9.5 million (2018).
- The operational cost is estimated at \$0.4 million/a (2018).

Cluster 6: Greater Bloemfontein Internal Resource Improvements

Most of the projects included under Cluster 6 were recommendations from the Mangaung Gariiep Augmentation Project (Mangaung, 2018), although there are similarities with the recommendations from the Greater Bloemfontein Reconciliation Strategy (DWS, 2012). Several components form part of Cluster 6 which include the following:

- Raise Mockes Dam – This component is designed to capture and store return flows for indirect re-use purposes, and to minimise spills from the dam. The yield benefit from the raising of the Mockes Dam on its own is very small.
- Increase the Maselspoort Water Treatment Works capacity to 130 Ml/d to be able to accommodate the increased volumes due to indirect re-use. This will include the upgrading of the plant to treat the low quality return flows up to potable standards.
- Indirect re-use of 16 million m³/a from the Bloemspruit Waste Water Treatment Works to be captured in Mockes Dam.
- Direct re-use of 11 million m³/a to be fed directly into the water supply system at the Maselspoort WTW downstream of the Mockes Dam.

Additional key information on the transfer scheme includes:

- The total system yield is increased by 30 million m³/a due to the combination of all improvements.
- The total capital cost for all components combined is \$ 86.2 million
- and the combined operational cost for all components was estimated at \$ 77.1 million/a

Cluster 7: Gariep to Greater Bloemfontein Transfer

The projects covered under Cluster 7 are recommendations from both the Greater Bloemfontein Reconciliation Strategy (DWS, 2012) and the Mangaung Gariep Augmentation Project (Mangaung, 2018). The SA Department of Water and Sanitation has, however, confirmed that an independent study has been commissioned to identify the best option from a national perspective. This study had not been completed at the time of writing this report (November 2023).

There are several possible route options for the transfer pipeline from Gariep Dam. For the purpose of this report, only one of the pipeline route options was selected, namely the clear water pipeline from Gariep Dam to a point near Bloemfontein. Based on the latter study, the transfer scheme will be constructed in two phases:

- Phase 1: Transfer capacity of 32 million m³/a by means of a pump station and pipeline.
- Phase 2: Inclusion of a booster pump station increasing the transfer capacity by another 11 million m³/a, to a total transfer capacity of 43 million m³/a.

Additional key information on the transfer scheme includes:

- Phase 1 capital cost estimated at \$200 million.
- Phase 1 operational cost estimated at \$9 million/a.
- Phase 2 capital cost estimated at \$ 26.3 million.
- Phase 2 operational expenditure estimated at \$ 3.1 million/a

The reader is also referred to cluster 2 where another option is listed that can be used to transfer water to the Greater Bloemfontein via the Lesotho-Botswana Water Transfer Scheme. Final decisions in this regard have however not been made.

Cluster 8: Neckartal Scheme

The Neckartal Dam located in the lower Fish River in Namibia was completed in 2018 and has been storing water since that time.

The main purpose of this dam is to supply water to a new irrigation development which has yet to be completed at the time of writing this report (November 2023). Water will be released from the dam directly into the river and abstracted downstream from a diversion weir. The water will be pumped to a high lying storage reservoir and gravity fed for irrigation. The releases from the dam into the river will take place via hydro-power turbines, which have already been installed.

The planning of the irrigation scheme is currently well behind schedule. The total irrigation requirement was estimated at 90 million m³/a. Based on the installed turbine capacities the volume that can be released through the turbines was determined as 100 million m³/a. The difference of 10 million m³/a could be used to support the Environmental Water Requirement downstream of the diversion weir.

Cluster 9: Integrated Water Management Options

The integrated water management options comprise several components which include the following:

- Removal of unlawful irrigation.
- Water Conservation and Water Demand Management within irrigation schemes.
- Water Conservation and Water Demand Management in the urban and industrial sectors.
- Increasing the area of water use permit/licence coverage.
- Improve assessments of aquifers (storage capacities, recharge rates, sustainable yields, and other characteristics).
- Manage salinity.
- Manage eutrophication.
- Management and control of alien and invasive species and problem pests.
- Set water quality objectives/standards.
- Consolidation of climate data and extreme event data at basin level.
- Identify priority water needs to support economic development at basin level.
- Set out guidelines and procedures to improve equitable utilisation and benefit-sharing at the basin level, and
- Harmonise policy, legal and institutional frameworks.

The primary integrated water management options are the Water Conservation and Water Demand Management in the irrigation sector and Water Conservation and Water Demand Management in the urban and industrial sectors. The reconciliation strategies prepared for the Integrated Vaal River System (DWAF, 2009), the Orange System (DWS, 2015) and the

Greater Mangaung (DWA, 2012) Water Supply systems all include Water Conservation and Water Demand Management as a high priority action needed to maintain a positive water balance in future years. In the Integrated Vaal River System Reconciliation Strategy, it was stated that savings from Water Conservation and Water Demand Management in the irrigation sector will not be available for other water users or water use sectors, but that the savings will be utilised by the existing farmers to extend their irrigation area or to improve their assurance of supply. This is regarded as the benefit and main motivation for irrigators to improve or change their irrigation systems to achieve higher irrigation efficiencies and free up water for further use and increased income. Therefore, this saving will not necessarily result in a reduction in water demand.

The Orange Reconciliation Strategy followed a similar approach regarding Water Conservation and Water Demand Management in the irrigation sector, with the main difference, that some of the savings can in future be used for purposes other than irrigation. The main reason for this is that along the Orange River fertile soil for irrigation is in some places limited, so that an increase of irrigation will not necessarily take place when more water is made available through Water Conservation and Water Demand Management. In such cases, the irrigators might be willing to sell some of the water to other users to obtain some benefit for their Water Conservation and Water Demand Management efforts. For the Orange system, it was estimated that approximately 5% of the current irrigation use can be saved to be utilised by other users. The remainder of the Water Conservation and Water Demand Management saving in the irrigation sector is expected to be utilised by the existing irrigators to increase their irrigation area. The 5% savings through Water Conservation and Water Demand Management in the irrigation sector in the Orange system was estimated at 73 million m³/a. It should be noted that savings in the irrigation sector can be significantly higher, but only the 5% is regarded to be the volume available for other use or to reduce the total water demand.

The capital expenditure to achieve a 5% saving on the Orange System irrigation demand was estimated at \$10.5 million with the operational expenditure at about \$ 0.11 million/a

It is expected that the largest savings from Water Conservation and Water Demand Management will be from the urban and industrial sectors.

Initial combined savings in the urban and industrial sectors due to Water Conservation and Water Demand Management were estimated at 240 million m³/a from the different reconciliation strategies. Water Conservation and Water Demand Management strategies were already implemented in most of these identified areas, and it is estimated that by 2018 total savings of approximately 85 million m³/a had already been achieved. Consequently, a further potential saving of 155 million m³/a can be saved.

To be able to save the 155 million m³/a in the urban/industrial sectors through Water Conservation and Water Demand Management, the expected capital expenditure was estimated at \$ 322 million with the operational expenditure at \$67.1 million/a

Funding Options

The proposed Lesotho-Botswana Transfer Project is one of the main elements of the current study and comprises a possible new dam on the Makhaleng River in Lesotho together with a almost 700km long pipeline from Lesotho to Botswana. The project has an expected cost of approximately \$3 billion at 2018 cost levels based on R18/\$ exchange rate. Approximately 10% of the overall project cost is associated with the construction of the dam while the remaining 90% is associated with the pipeline and pump stations. The project can include a small hydropower installation which will require a further \$60 million should this be included.

The funding requirements of the Lesotho to Botswana Water Transfer Project as well as many of the Core Scenario Projects are so large that they cannot be secured by any single member of the 4 basin states. The Lesotho to Botswana Water Transfer Project, in particular, will require funding from several countries as well as some form of grant funding and Government Guarantees to support the normal loan funding. This means that even with a Public Private Partnership option, the governments will still be required to underwrite the project.

If the Parties agree to proceed with the Project, it is recommended that State-Owned Entities such as the Lesotho Highlands Development Authority, Trans Caledon Tunnel Authority and the Water Utility Corporation of Botswana (possible together with Rand Water) be involved with the implementation of components of the scheme in the different countries.

It is clear that the water from the Lesotho to Botswana Water Transfer Project will be expensive when comparing the cost per m³ of water delivered to most other water supply projects in Southern Africa. The member countries must confirm as soon as possible whether or not water from the Lesotho to Botswana Water Transfer Project is affordable before they agree to continue with its implementation. The funding assessment by the Project Team is in general agreement with the findings from a parallel study recently undertaken by the Climate Resilience Infrastructure Development Fund which also highlighted the issue that lenders be reluctant to lend such large amounts of funding for such water infrastructure projects without the governments of the recipient states giving explicit guarantees for the loans. These funding conclusions apply to both the Lesotho to Botswana Water Transfer Project as well as the various associated water related projects discussed under the “Core Scenario Projects”.

Most standalone infrastructure investments (in the water sector) require a combination of developmental and commercial capital. While the Basin Member States may be able to fully fund components of the core scenario by issuing a bond, it is more likely that the Integrated

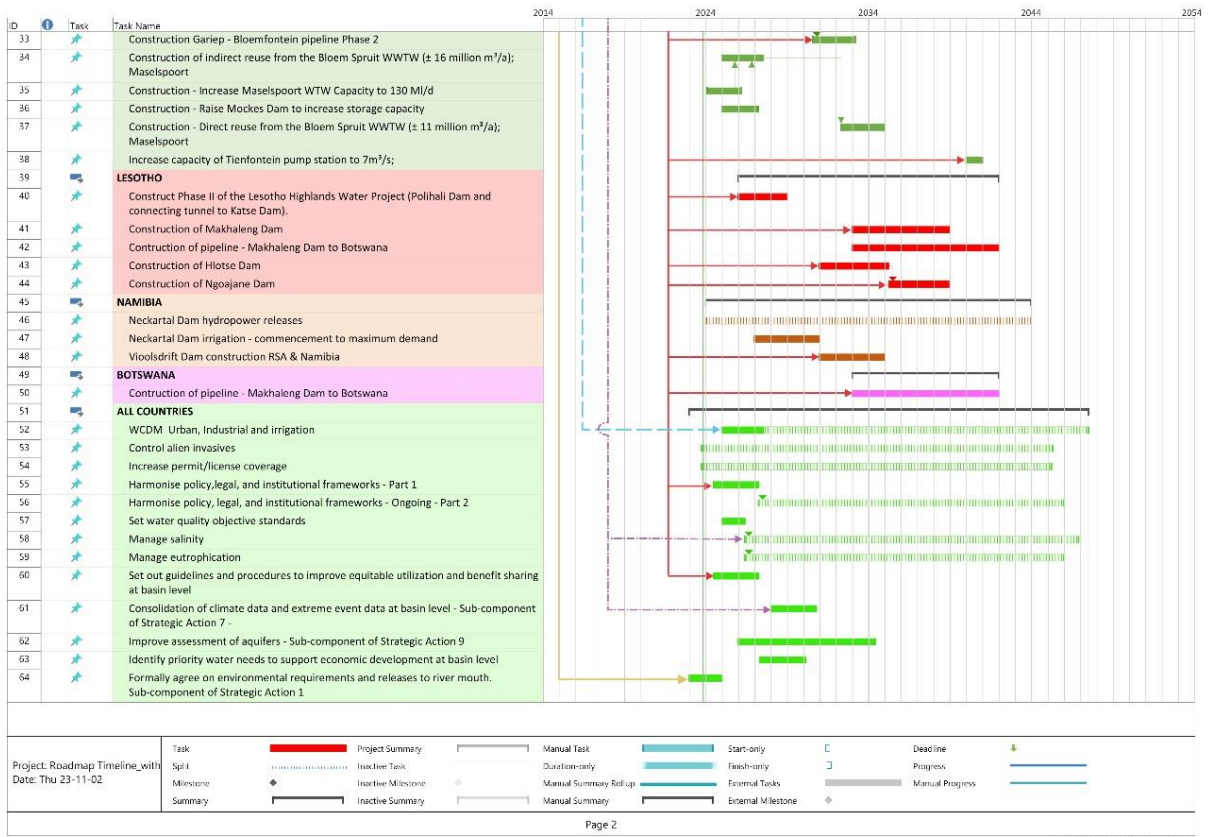
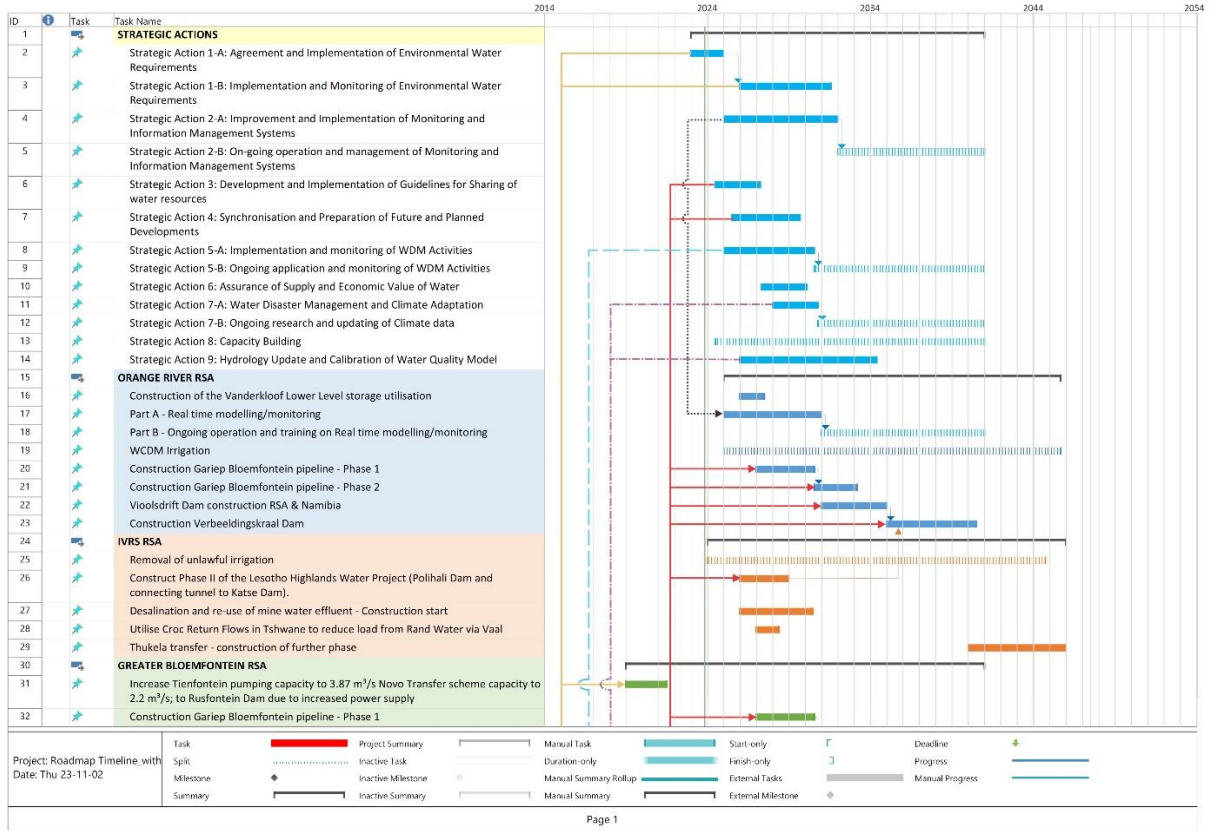
Water Resource Management Plan core scenario interventions will require a combination of funding sources.

The proposed projects must therefore meet the requirements of both developmental and commercial capital financiers in order to attract such investors. Furthermore, developmental capital and commercial capital are not seen as being mutually exclusive. Even for development capital governments and donors need to be convinced that the project will be able to recover the investment or become sustainable once the initial funding has been provided. On the other hand, commercial capital is increasingly taking into account the economic and social impacts of projects. This is particularly the case for infrastructure investments in Africa and other developing regions. Certain projects proposed in the Road Map are clearly Climate Resilience projects which are designed to supply water to address possible future shortages that are due to the impacts of Climate Change. Such projects may qualify to receive preferential terms or even significant grant funding from one of the various Global Climate Funds which have been established to support such projects in developing countries. This may help to create a viable project which would not be possible without some level of grant funding.

Road Map Report and Way Forward

Each Key Strategic Action and Core Scenario Project is discussed in detail in this “Road Map” report which aims to pull all the proposed projects together into a single coherent plan. Timelines and budgets for each project have been provided to assist possible funding partners to assess the various projects and determine if they wish to participate in them. A key aim of the “Road Map” Report is therefore to summarise the projects through a series of “Concept Notes” (**Appendix B** and **Appendix C**) which provide sufficient information for possible Funding Partners to understand the scope of the project and likely funding requirements without having to digest the many lengthy reports which contain the full detail of each project.

The proposed way forward involves the implementation of the various water related projects in a manner in which they can provide additional yield to users in the river basin without damaging the supply to existing demand centres. A proposed action plan has been developed which is presented in a series of figures (Road Map Timeline) which show the proposed commencement dates for each project together with the duration of each project. Where appropriate, the linkages with other projects have been included to highlight where specific projects are linked to each other to ensure that they are implemented in the correct sequence to minimise any water supply problems to existing users. A full description of the various projects and linkages is provided in the main report.



Conclusions and Recommendations

- Depending on the availability of funds, political drive and decisions taken, the actual growth of the water requirements, success rate of water conservation and water demand actions etc. the timing and implementation of the projects and key strategic actions will change in future. It is therefore recommended that the Road Map program be regarded as a live document and be updated on an annual basis.
- The Lesotho Botswana Transfer Scheme is expensive, and its financial viability needs to be checked in detail after the completion of the Feasibility Study of both the dam and conveyance system. Based on these financial and economic assessments the member countries will need to confirm if the water from the Lesotho to Botswana Water Transfer Project is indeed affordable to the recipient States and whether or not they agree to continue with its implementation.
- Polihali Dam, currently under construction, as well as the possible future dam on the Makhaleng River will impact significantly on the yield of existing downstream schemes. Based on current planning no compensation/mitigation releases will be made from these two dams to re-balance the existing downstream schemes. It is therefore important to introduce other intervention options to restore the water balance to the downstream system. The cost of these intervention options was not included in the costing of Polihali Dam or the proposed dam on the Makhaleng River. Considerable effort has already been undertaken by DWS RSA on possible options to re-balance the downstream system as result of the impact of Polihali Dam These options have been included in the Core Scenario Schemes and in some of the Key Strategic Actions.
- Some options have already been identified as part of this study to re-balance the impact that the dam on the Makhaleng River has on the existing downstream developments. A detailed reconciliation strategy study is, however, required to determine the most appropriate intervention option to re-balance the existing downstream systems. This proposed reconciliation study is referred to in Key Strategic Action no. 4.
- The Road map will provide guidance to ORASECOM and the four basin states to implement the Water Resources Investment Strategy and Plan, including the large number of development projects from the Core Scenario as well as the Key Strategic Actions.