The Orange-Senqu River Commission (ORASECOM)

Sharing the Water Resources of the Orange-Senqu River Basin

Botswana | Lesotho | Namibia | South Africa

Contract No.: P-Z1-EAZ-048/CS/01

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

ROADMAP FOR IWRMP OPERATIONALIZATION

Component II

Appendix B : Strategic Actions: Concept Notes

August 2024

FINAL REPORT

Report number: ORASECOM 013/2019

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

COMPONENT II

ROADMAP SUPPORTING REPORT

APPENDIX B

STRATEGIC ACTIONS : CONCEPT NOTES

Orange-Senqu River Commission (ORASECOM)

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Prepared by

in association with

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

COMPONENT II

ROADMAP SUPPORTING REPORT

APPENDIX B

STRATEGIC ACTIONS : CONCEPT NOTES

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APPROVALS

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Executive Secretary: ORASECOM Secretariat

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

[1] **Note: For any report not prepared and completed within 2019 revert back for revised numbering.**

Reports submitted	ORASECOM Report No.[1]
Pre-feasibility report Phase 2 Report Component lll	ORASECOM 015/2019
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

ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER

Strategic Actions

Summary of Proposed Key Strategic Actions

Proposed Key Strategic Actions

As part of the final deliverable from Component ll of this study a report has been written which describes a number of Key Strategic Actions and possible Road-Map for their implementation. The report provides details of potential Strategic Actions which support the road map and operational plan for ORASECOM to rollout the implementation thereof, over the coming years for activities under its direct operational responsibility. Following the completion of the first phase of the project, 17 possible strategic actions were identified by the project team which it considered could be included in future projects to be undertaken through ORASECOM.
The 17 Strategic Actions which were initially identified were discussed and through a lengthy selection process which is fully described in the relevant report a short-list of 9 key Strategic Actions were finally selected. identified and are discussed in detail in Sections 5 to 13 of the report. The 9 key Strategic Actions are listed below together with a preliminary estimate of the budget that will be required to complete the work. Each Strategic Action is presented individually in the form of a 2-page summary in the remainder of this spreadsheet in a format designed to allow funding partners to understand the scope of work and likely budget so that they can evaluate the potential for either normal loan funding or alternatively grant funding or even some combination of the two.

Key Strategic Actions Discussed in this Spreadsheet

SA1	Agreement and Implementation of Environmental Water Requirements.	($1m to $5m plus $1m per annum)
SA2	Improvement and Implementation of Monitoring and Information Management + Hydraulic Model	($5m +$1m per annum)
SA3	Development and Implementation of Guidelines for sharing.	($1m)
SA4	Synchronisation and Preparation of Future and Planned Developments	($1m)
SA5	Implementation and monitoring of WDM Activities	($1m)
SA6	Assurance of Supply and Economic Value of Water	($1m)
SA7	Water Disaster Management and Climate Adaptation	($2m to $3mil)
SA8	Capacity Building (3 year programme)	($2m + $2m every 3 years)
SA9	Hydrology Update and WQ Model Calibration	($5m)

ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER TRANSFER PROJECT	Strategic Action 1

Agreement and Implementation of Environmental Water Requirements

Project Description

The preliminary desired Environmental Water Requirements from an environmental point of view have already been determined in various previous studies undertaken over the past 30 years. System analyses showed that these Environmental Water Requirements, in particular those for Augrabies and downstream, including the Orange River estuary environmental requirements, significantly reduce the yield available from the resources (Gariep and Vanderkloof dams). These Environmental Water Requirements do not represent the final Environmental Water Requirements to be implemented and adhered to, according to the South African legislation. Another process must first be completed to find a balance between achieving the desired ecological state and the impact on the economy of the region. This balance needs to be agreed on by all role-players. Only then, can the final agreed Environmental Water Requirements be imposed on the system. These Environmental Water Requirements are then referred to as the Reserve and are published in the Government Gazette so that it can be lawfully implemented and enforced.

The reserve for the Orange River is currently unknown, and the old and outdated estuary environmental requirements determined as part of the Orange River Replanning Study (DWAF, 1996) is currently still released (287.5 million m3/a) from Vanderkloof Dam. Based on the latest Environmental Water Requirement studies carried out, a Preliminary Reserve for the Lower Orange was determined and approved by DWS RSA (DWS, 2017). The Preliminary Reserve used the latest Environmental Water Requirement estimations but were adjusted so that they do not impact negatively on the current Orange River Project (Gariep and Vanderkloof Dams) system yield.

The final agreed Reserve still needs to be determined and is expected to be somewhere between the preliminary Reserve requirements (average of ±533 million m3/a) and those of the preferred Environmental Water Requirement (average of ± 942 million m3/a) as defined by the environmentalists.

It is noted that ORASECOM has recently appointed a Service Provider to undertake certain work and investigations to establish the Environmental Water Requirements in the Orange/Senqu basin. It is therefore important to ensure that the proposed work envisaged for Strategic Action 1 will compliment the work being undertaken currently and should not duplicate or diverge from the existing efforts. In this regard, the current project has been split into several phases, the first of which is being undertaken by the Service Provider. The remaining phases have not yet been fully defined and no budget has been allocated to them.

The proposed tasks outlined under Strategic Action 1 will therefore form the basis for the future phases of the Environment assessments being undertaken by the Service Provider and will hopefully provide the necessary funding needed to complete the work that has already been envisaged by the team.

This assignment will be undertaken in the following Tasks:

- SA1.1: Inception Report (must include details of GAP Analysis being currently undertaken)
- SA1.2: Design an eFlow Monitoring Programme
- SA1.3: Prepare an eFlow Implementation Agreement for the Orange/Senqu basin
- SA1.4: Develop an Implementation Plan to prioritse sites for eFlows
- SA1.5: Develop a Management Plan for the Orange River Mouth

The cost of the study to establish the final agreed Environmental Water Requirements or Reserve to be implemented in the Orange River System is estimated to be between $1million and $5 million depending upon the scope of work that is agreed upon.

STRATEGIC ACTION

Strategic action being supported	Specific action

LEAD AND SUPPORTING ORGANISATIONS OR COUNTRIES

LEAD	RSA
Supporting 1	Namibia
Supporting 2	Lesotho
Supporting 3	
Supporting 4	

BUDGET REQUIREMENTS

More than 1 billion USD	
Between 50 million USD and 1 billion USD	
Between 1 million USD and 50 million USD	X
Less than 1 million USD	

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ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER TRANSFER PROJECT	Strategic Action 1

Agreement and Implementation of Environmental Water Requirements

1: Involvement of ORASECOM		2: Countries involved	
High	X	Botswana	
Significant		Lesotho	X
Medium		Namibia	X
Limited		South Africa	X
3: Priority		**4: Impact on Climate Resilience**	
High Priority	X	High	
Medium Priority		Medium	
Low Priority		Low to None	X
5:Funding Required		**6: Likley Loan Period**	
Normal Loan		1 to 5 Years	X
Loan and Donor		6 to 20 Years	
Donor Only	X	More than 20 Years	
7: Type of Job Creation		**8: Impact on possible Conflicts Between Basin States**	
Long term jobs		Positive	X
Only during construction		Neutral	
None	X	Negative	
9: Socio economic influence		**10: Influence on local communities**	
High	X	Positive	X
Medium		Neutral	
Low		Negative	
11: Yield contribution		**12: Contribution to alleviating water scarcity**	
Significant contribution		Significant contribution	
Moderate contribution		Moderate contribution	
Little or no contribution	X	Little or no contribution	X

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ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER TRANSFER PROJECT	Strategic Action 2

Improvement and Implementation of Monitoring and Information Management Systems

Project Description

Monitoring of hydrological and hydro-meteorological data is the responsibility of each country and departments already exist in the 4 basin states tasked with the collection and processing of such data and associated information. In the case of the Orange/Senqu River Basin it is important to co-ordinate the data collection and dissemination to avoid unnecessary duplication and try to ensure that the data are managed to the benefit of all basin states. While it is recognised that each country will wish to exercise its own preferences with regard to equipment and storage/processing procedures, it is important to try and develop a system whereby each country has access to all information in the Orange/Senqu River Basin. In this regard, ORASECOM can act in a facilitation role where it can direct and co-ordinate the efforts required to develop a comprehensive data-base for the basin as a whole that is freely available to the member states.

The key focus for Strategic Action 2 will concentrate on the Real-Time monitoring system and associated Hydraulic Model. This is considered one of the most important tasks mentioned as it can deliver very significant savings with a very short "pay-back" period from a financial viewpoint.

It will also be very useful to have a proper aerial survey of the Orange River, particularly from Van der Kloof Dam to the mouth. A 2-D hydraulic model will assist in disaster management during times of flooding as early warning, predicting flood levels and areas of inundation well ahead of the flood.

This assignment will be undertaken in the following Tasks:

- SA2.1: Inception Report
- SA2.2: Status Quo Assessment (previous studies, available data sets, model calibrations, details of all measured cross sections
- SA2.3: Collection and collation of river data (cross-sections, riparian vegetation, roughness, historical floods and drought routings etc.,)
- SA2.4: Liaison with local specialists involved with flood and low flow measurements including discussions and info collection from Farmers Associations and DWS/Namibian DWA and Eskom
- SA2.5: Assessment of gauging network (real time monitoring as well as needs for new equipment and new gauging stations
- SA2.6: Establish water balance components for each river section
- SA2.7: Set up and calibrate (high and low flows) hydraulic river model using an open source model such as HEC-RAS (or similar and approved by ORASECOM) – based on the historical flow records
- Task 8: Test new operating rules with and without the Noordoewer/Vioolsdrift Dam to improve efficiency of releases from Vanderkloof Dam and impact of changes to the Reserve at the River Mouth.
- Task 9: Initiate discussions with DWS and DWA Namibia in order to set up a Dashboard to interact with the model using the real-time data in order to transfer ownership and operation of the model to the custodian.
- Task 10: Improvement of monitoring networks basin-wide. (irrigation use, groundwater, water quality, surface water, Climate Mitigation Monitoring (evaporation, rainfall temp etc),

The cost of the proposed is estimated to be $5 million. It should be noted that this is a preliminary estimate at this stage which will be reviewed and refined during the finalization of the TOR for the study.

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STRATEGIC ACTION

Strategic action being supported	Specific action

LEAD AND SUPPORTING ORGANISATIONS OR COUNTRIES

LEAD	RSA
Supporting 1	Namibia
Supporting 2	
Supporting 3	
Supporting 4	

BUDGET REQUIREMENTS

More than 1 billion USD	
Between 50 million USD and 1 billion USD	
Between 1 million USD and 50 million USD	X
Less than 1 million USD	

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ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER TRANSFER PROJECT	Strategic Action 2

Improvement and Implementation of Monitoring and Information Management Systems

1: Involvement of ORASECOM		2: Countries involved	
High	X	Botswana	X
Significant		Lesotho	X
Medium		Namibia	X
Limited		South Africa	X
3: Priority		**4: Impact on Climate Resilience**	
High Priority	X	High	
Medium Priority		Medium	X
Low Priority		Low to None	
5:Funding Required		**6: Likley Loan Period**	
Normal Loan		1 to 5 Years	
Loan and Donor	X	6 to 20 Years	X
Donor Only		More than 20 Years	
7: Type of Job Creation		**8: Impact on possible Conflicts Between Basin States**	
Long term jobs	X	Positive	X
Only during construction		Neutral	
None		Negative	
9: Socio economic influence		**10: Influence on local communities**	
High		Positive	X
Medium		Neutral	
Low	X	Negative	
11: Yield contribution		**12: Contribution to alleviating water scarcity**	
Significant contribution		Significant contribution	X
Moderate contribution	X	Moderate contribution	X
Little or no contribution		Little or no contribution	

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ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER TRANSFER PROJECT	Strategic Action 3

Development and Implementation of Guidelines for Sharing of water resources

Project Description

Possible new dam developments have been proposed in the ORASECOM Basin Wide Investment Plan which will help to supply water to both users in the upstream areas as well as users in adjacent countries including Namibia, South Africa and Botswana. In view of the fact that the available yield from the Orange-Senqu basin is currently fully utilized, any new development abstracting or diverting water from the upper reaches of the basin will result in shortages lower down in the system. To address such shortages, any new development must therefore be accompanied by some form of augmentation development to restore the water balance and to protect all downstream users. When many of the previous dams were constructed in the Orange/Senqu basin, there was excess water available in the basin with the result that there was no need to mitigate for the reduced water available in the lower reaches of the Orange/Senqu river. In the past 10 to 20 years, however, the situation has changed, and any new developments must be identified and quantified to ensure that the water resources are shared in an equitable and reasonable manner.

For each possible future water resource development option, detailed analyses have been undertaken to assess both the maximum gross yield from the proposed project as well as the net yield from a systems context. It must be noted that the difference between the gross and net yields need not be released from the proposed development but must be addressed through some form of mitigation measures which can include, mitigation releases, a new dam lower in the system, the purchase of some existing water rights somewhere in the system, or the recovery of water losses etc. The solution must be carefully considered and evaluated properly in a systematic and pragmatic manner through proper debate and discussion between the four countries involved.

This assignment will be undertaken in the following Tasks:

- SA3.1: Inception Report
- SA3.2: Evaluation of existing legislation, conventions and protocols on water sharing to identify those factors and circumstances that must be taken into account for the utilization of an international watercourse in an equitable and reasonable manner;
- SA3.3: Identification of relevant factors to be evaluated for each potential development option identified in the Core Scenario Basin Wide Investment Plan
- SA3.4: Workshop the various development options and key factors using a Balanced Scorecard or Multi Criteria Analysis approach or similar.
- SA3.5: Summarise the results in a final report.

The cost of the proposed is estimated to be $1 million. It should be noted that this is a preliminary estimate at this stage which will be reviewed and refined during the finalization of the TOR for the study.

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STRATEGIC ACTION

Strategic action being supported	Specific action

LEAD AND SUPPORTING ORGANISATIONS OR COUNTRIES

LEAD	
Supporting 1	Botswana
Supporting 2	Lesotho
Supporting 3	Namibia
Supporting 4	South Africa

BUDGET REQUIREMENTS

More than 1 billion USD	
Between 50 million USD and 1 billion USD	
Between 1 million USD and 50 million USD	
Less than 1 million USD	X

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ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER TRANSFER PROJECT	Strategic Action 3

Development and Implementation of Guidelines for Sharing of water resources

1: Involvement of ORASECOM		2: Countries involved	
High	X	Botswana	X
Significant		Lesotho	X
Medium		Namibia	X
Limited		South Africa	X
3: Priority		**4: Impact on Climate Resilience**	
High Priority	X	High	
Medium Priority		Medium	X
Low Priority		Low to None	
5:Funding Required		**6: Likley Loan Period**	
Normal Loan		1 to 5 Years	X
Loan and Donor		6 to 20 Years	
Donor Only	X	More than 20 Years	
7: Type of Job Creation		**8: Impact on possible Conflicts Between Basin States**	
Long term jobs		Positive	X
Only during construction		Neutral	
None	X	Negative	
9: Socio economic influence		**10: Influence on local communities**	
High	X	Positive	X
Medium		Neutral	
Low		Negative	
11: Yield contribution		**12: Contribution to alleviating water scarcity**	
Significant contribution		Significant contribution	X
Moderate contribution		Moderate contribution	
Little or no contribution	X	Little or no contribution	

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ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER TRANSFER PROJECT	Strategic Action 4

Synchronisation and Preparation of Future and Planned Developments

Project Description

Based on a number of recent studies, it is clear that there are a large number of new and proposed future water resource developments in various parts of the Orange/Senqu River Basin. The proposed recent and near future developments include:

- A dam on the Makhaleng river in Lesotho and associated transfer scheme,
- A dam on the Lower Orange River at Noordoewer/Vioolsdrift.
- The Polihali Dam which is under construction in Lesotho;
- The recently completed Metolong Dam in Lesotho
- The recently completed Neckartal Dam in Namibia
- A dam on the upper Orange River in South Africa at Verbeeldingskraal
- The Hlotse Dam in Lesotho,
- The Ngoajane Dam in Lesotho
- Several possible hydro-power schemes in Lesotho.

In addition, the potential to supply water to Bloemfontein from a new dam in Lesotho appears to be a viable option that requires additional investigation. In the event that a new dam is commissioned on the Makhuleng River it will be necessary to complete a study to assess possible augmentation options to restore the yield to the Orange River Project.

All of these schemes are interlinked, as they are all utilising the same resource, namely the Senqu/Orange River. All of these schemes will therefore impact on each other to some degree, with some of the impacts being significant and others relatively small. Due to the associated impacts, it will not be possible to operate these schemes as stand-alone schemes, and they must therefore be operated and managed as part of the larger system. Results from the Core Scenario analyses already highlight that the operating rules used for each scheme, as well as operating rules between the schemes, significantly impact on the water supply to the different users, as well as to the overall optimal utilisation of the system as a whole.

It is therefore recommended that a study is commissioned to identify and harmonise the different development options to the benefit of the system as a whole.

This assignment will be undertaken in the following Tasks:

- SA4.1: Inception Report
- SA4.2: Status Quo Assessment
- SA4.3: Identification of Net and Gross Yields for each development option.
- SA4.4: An augmentation study to restore the water balance in the lower Orange River in the event of a new dam on the Makhuleng River.
- SA4.5: Identification and investigation of selected key operating rules
- SA4.6: Preliminary investigation of Legal Agreements (in conjunction with Strategic Action 3)
- SA4.7: Organise and manage workshop to discuss and refine selected key operating rules
- SA4.8: Identification of new monitoring points and gauging sites to facilitate possible new operating rules
- SA4.9: Undertake Annual Operating Analyses with representatives from the 4 Basin States (co-ordinate with possible existing study on this topic).

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STRATEGIC ACTION

Strategic action being supported	Specific action

LEAD AND SUPPORTING ORGANISATIONS OR COUNTRIES

LEAD	
Supporting 1	Botswana
Supporting 2	Lesotho
Supporting 3	Namibia
Supporting 4	South Africa

BUDGET REQUIREMENTS

More than 1 billion USD	
Between 50 million USD and 1 billion USD	
Between 1 million USD and 50 million USD	
Less than 1 million USD	X

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ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER TRANSFER PROJECT	Strategic Action 4

Synchronisation and Preparation of Future and Planned Developments

1: Involvement of ORASECOM		2: Countries involved	
High	X	Botswana	X
Significant		Lesotho	X
Medium		Namibia	X
Limited		South Africa	X
3: Priority		**4: Impact on Climate Resilience**	
High Priority	X	High	
Medium Priority		Medium	X
Low Priority		Low to None	
5:Funding Required		**6: Likley Loan Period**	
Normal Loan		1 to 5 Years	X
Loan and Donor		6 to 20 Years	
Donor Only	X	More than 20 Years	
7: Type of Job Creation		**8: Impact on possible Conflicts Between Basin States**	
Long term jobs		Positive	X
Only during construction		Neutral	
None	X	Negative	
9: Socio economic influence		**10: Influence on local communities**	
High		Positive	X
Medium	X	Neutral	
Low		Negative	
11: Yield contribution		**12: Contribution to alleviating water scarcity**	
Significant contribution		Significant contribution	
Moderate contribution	X	Moderate contribution	X
Little or no contribution	X	Little or no contribution	

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ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER TRANSFER PROJECT	Strategic Action 5

Implementation and monitoring of WDM Activities

Project Description

Water Conservation and Water Demand Management have been identified as important components of all future water resource assessments throughout the Orange /Senqu River Basin. The impact of WC/WDM can be very significant in many areas where water losses are known to be high and can sometimes be in the order of 30% to 50% of the total municipal water demand. Reducing such water losses is not easy and cannot be implemented overnight, but with proper support both financially and technically, it will be possible to achieve significant savings, which in turn will have a significant impact on the overall water balance in the Orange/Senqu River Basin. It has been shown in many cases that the cheapest solution to provision of "new" water resources is to identify and reduce existing water losses in large urban water supply systems. In many planning studies and reports, the reduction in water losses has already been factored into the future projected water demands. Results from the WRPM Core Scenario analyses have already highlighted that failure to successfully implement the anticipated WC/WDM interventions will result in significant deficits in water supply in the main water supply systems within the Orange/Senqu basin. This will include all users, irrigation, industry and urban.
A study is therefore recommended to set up a system to identify the key focus areas for WC/WDM throughout the Orange/Senqu River Basin and to ensure that the related actions are implemented successfully and maintained over time.

This assignment will be undertaken in the following Tasks:
- **SA5.1: Inception Report**
- **SA5.2: Status Quo Assessment (check what docs are already available in public domain)**
- **SA5.3: Identification and collection of data on real case studies**
- **SA5.4: Create a template report/framework for implementing and monitoring an agricultural WDM project**
- **SA5.5: Create a template report/framework for implementing and monitoring a Municipal/Industrial WDM project**
- **SA5.6: Develop an inventory of WC/WDM initiatives and prioritise them for implementation basinwide.**
- **SA5.7: Organise a conference in one of the basin states to discuss and disseminate info on WC/WDM with impacts of Climate Change.**
- **SA5.8: Selection of 2 Agricultural (SA and Namibia) and 4 Industrial/Municipal (one in each country) case studies for future monitoring and assessment**
- **SA5.9: Assess impacts of Climate change on future WC/WDM activities.**
- **SA5.10: Create monitoring and auditing dashboard**

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STRATEGIC ACTION

Strategic action being supported	Specific action

LEAD AND SUPPORTING ORGANISATIONS OR COUNTRIES

LEAD	
Supporting 1	Botswana
Supporting 2	Lesotho
Supporting 3	Namibia
Supporting 4	South Africa

BUDGET REQUIREMENTS

More than 1 billion USD	
Between 50 million USD and 1 billion USD	
Between 1 million USD and 50 million USD	
Less than 1 million USD	X

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ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER TRANSFER PROJECT	Strategic Action 5

Implementation and monitoring of WDM Activities

1: Involvement of ORASECOM		2: Countries involved	
High		Botswana	X
Significant	X	Lesotho	X
Medium		Namibia	X
Limited		South Africa	X
3: Priority		**4: Impact on Climate Resilience**	
High Priority		High	
Medium Priority	X	Medium	X
Low Priority		Low to None	
5:Funding Required		**6: Likley Loan Period**	
Normal Loan		1 to 5 Years	X
Loan and Donor		6 to 20 Years	
Donor Only	X	More than 20 Years	
7: Job Creation		**8: Impact on possible Conflicts Between Basin States**	
Long term jobs	X	Positive	X
Only during construction		Neutral	
None		Negative	
9: Socio economic influence		**10: Influence on local communities**	
High		Positive	X
Medium	X	Neutral	
Low		Negative	
11: Yield contribution		**12: Contribution to alleviating water scarcity**	
Significant contribution		Significant contribution	X
Moderate contribution	X	Moderate contribution	
Little or no contribution		Little or no contribution	

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ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER TRANSFER PROJECT	Strategic Action 6

Assurance of Supply and Economic Value of Water

Project Description

In most parts of the world the water resources in a river basin are distributed by simply allocation the available historical system yield to meet the various demands. Water is often utilised by the demand centres highest up in the river basin and those lower down in the system experience shortages during periods of drought. As the demands increase due to population growth the droughts become more severe exacerbated by the impacts of global warming and Claimet Change. The water supply situation in many river basins throughout the World is deteriorating and will continue to do so without proper agreements and management. The issue of assurance of supply is seldom discussed and rarely, if ever, taking into account when the available water resources are allocated. The problem is compounded in many parts of the world where the available water resources were estimated using outdated techniques which often leads to legal allocations that exceed the firm yields of the systems.

South Africa was one of the first countries in the world to develop and use risk-based water allocations based on the "assurance of supply" concepts developed by the USA, Canada, South Africa, and the UK during the 1980's and 1990's. These same techniques have been adopted by many countries around the world and in particular in the SADC region of Africa where they form the backbone of water planning and water resource management in Southern Africa. The system models are used to assess and allocate the available resources to the different users based not only on the historical firm yield of each system but also on the assurance of supply which is derived from the system models and the use of stochastically generated streamflow sequences. This approach to water management has proven itself to be very robust and a valuable tool for operation and managing some of the most complicated water resource systems in the world.

Despite the obvious benefits of the assurance of supply-based models available to the 4 basin states, it is currently clear that none of the basin states currently applies the assurance of supply on the same basis. The Basin States must therefore discuss this issue and agree on how the risk of failure of the water supply should be managed in a concise and pragmatic manner and to determine what level of assurance is affordable in each case so that the available water can be used optimally to the benefit of each country.

This assignment will be undertaken in the following Tasks:

- **SA6.1: Inception Report**
- **SA6.2: Status Quo Assessment**
- **SA6.3: Agree on a standard approach regarding assurance of supply (stand-alone schemes and integrated systems) throughout the Orange-Senqu basin**
- **SA6.4: Assess the economic impact of the Assurance of Supply (refer to WRC project)**
- **SA6.5: Provide training on the concepts of assurance of supply**
- **SA6.6: Agree on how restrictions will be determined and applied during drought periods**

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STRATEGIC ACTION

Strategic action being supported	Specific action

LEAD AND SUPPORTING ORGANISATIONS OR COUNTRIES

LEAD	
Supporting 1	Botswana
Supporting 2	Lesotho
Supporting 3	Namibia
Supporting 4	South Africa

BUDGET REQUIREMENTS

More than 1 billion USD	
Between 50 million USD and 1 billion USD	
Between 1 million USD and 50 million USD	
Less than 1 million USD	X

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ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER TRANSFER PROJECT	Strategic Action 6

Assurance of Supply and Economic Value of Water

1: Involvement of ORASECOM		2: Countries involved	
High	X	Botswana	X
Significant		Lesotho	X
Medium		Namibia	X
Limited		South Africa	X
3: Priority		**4: Impact on Climate Resilience**	
High Priority	X	High	X
Medium Priority		Medium	
Low Priority		Low to None	
5:Funding Required		**6: Likley Loan Period**	
Normal Loan		1 to 5 Years	X
Loan and Donor		6 to 20 Years	
Donor Only	X	More than 20 Years	
7: Job Creation		**8: Impact on possible Conflicts Between Basin States**	
Long term jobs		Positive	X
Only during construction		Neutral	
None	X	Negative	
9: Socio economic influence		**10: Influence on local communities**	
High	X	Positive	
Medium		Neutral	X
Low		Negative	
11: Yield contribution		**12: Contribution to alleviating water scarcity**	
Significant contribution	X	Significant contribution	X
Moderate contribution		Moderate contribution	
Little or no contribution		Little or no contribution	

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ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER TRANSFER PROJECT	Strategic Action 7

Water Disaster Management and Climate Adaptation

Project Description

In most integrated water supply systems, there are guidelines and operating rules in place to manage the overall water resource during drought events. Unfortunately, when a very severe drought does occur, it is often the case that the guidelines and operating rules are ignored as the water managers try to deal with specific problem areas and in such cases the whole allocation system can collapse with severe consequences. This issue arose recently in the Western Cape area where the City of Cape Town was within a few months of completely running out of water. Part of the problem was the fact that there were conflicting demands, between the irrigators and the municipality – both of which had their own allocations at specific levels of assurance as defined through many years of rigorous modelling. The agreed operating rules were in many cases not applied, and if a retrospective analysis is undertaken, it will show that the actual levels of assurance provided to the irrigators and the municipality during the drought were not as originally agreed.
It is therefore recommended that some form of mock drought disaster event is simulated involving participants from all four basin states to demonstrate exactly what will happen in the event of a severe drought. It will be less painful to identify the possible conflicts during a simulation exercise, rather than wait until the real event takes place and a new "day-zero" in the Orange/Senqu River Basin becomes a reality

This assignment will be undertaken in the following Tasks:
SA7.1: Inception Report - Status Quo Assessment for floods and droughts
SA7.2: Economic and social impacts of water supply failure
SA7.3: Co-operation between basin countries during times of disaster management
SA7.4: Compile a list of previous drought events from around the world that can be used to provide guidance to ORASECOM during the next severe drought
SA7.5: Workshop for potential extreme drought event
SA7.6: Develop a drought management plan for the basin

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STRATEGIC ACTION

Strategic action being supported	Specific action

LEAD AND SUPPORTING ORGANISATIONS OR COUNTRIES

LEAD	RSA
Supporting 1	Botswana
Supporting 2	Lesotho
Supporting 3	Namibia
Supporting 4	South Africa

BUDGET REQUIREMENTS

More than 1 billion USD	
Between 50 million USD and 1 billion USD	
Between 1 million USD and 50 million USD	X
Less than 1 million USD	

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ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER TRANSFER PROJECT	Strategic Action 7

Water Disaster Management and Climate Adaptation

1: Involvement of ORASECOM		2: Countries involved	
High	X	Botswana	X
Significant		Lesotho	X
Medium		Namibia	X
Limited		South Africa	X
3: Priority		**4: Impact on Climate Resilience**	
High Priority	X	High	X
Medium Priority		Medium	
Low Priority		Low to None	
5:Funding Required		**6: Likley Loan Period**	
Normal Loan		1 to 5 Years	X
Loan and Donor		6 to 20 Years	
Donor Only	X	More than 20 Years	
7: Type of Job Creation		**8: Impact on possible Conflicts Between Basin States**	
Long term jobs		Positive	X
Only during construction		Neutral	
None	X	Negative	
9: Socio economic influence		**10: Influence on local communities**	
High	X	Positive	X
Medium		Neutral	
Low		Negative	
11: Yield contribution		**12: Contribution to alleviating water scarcity**	
Significant contribution		Significant contribution	
Moderate contribution	X	Moderate contribution	X
Little or no contribution		Little or no contribution	

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ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER TRANSFER PROJECT	Strategic Action 8

Capacity Building

Project Description

In order to ensure transparency and to facilitate future co-operation between the four basin states, it is recommended that an annual meeting should take place to share the basic hydrological and water demand data and to discuss the training needs of each country with regard to the overall operation of the Orange-Senqu water resource system. The proposed project will help to:

- **Facilitate the sharing of information required to ensure the Integrated Water Resource Management Plan remains relevant;**
- **Evaluate the implication of new initiatives or plans and revised information (pertaining to the water balance) have on the Core Scenario and recommend reviews or updates of the Integrated Water Resource Management Plan;**
- **Discuss the implications of these changes and updates, the progress or lack in progress of individual system strategy implementation programmes, as well as that of the ORASECOM Integrated Water Resource Management Plan implementation programme, on the entire Orange-Senqu River System, as indicated or supported by Water Resources Planning Model scenario analyses (when required)**
- **Provide recommendations on possible adjustments to the Core Scenario and Integrated Water Resource Management Plan, as well as whether specific components/issues or problem areas require more in-depth investigation/study by specialised task groups;**
- **Keep the model up to date with the latest information, plans and implementation progress of existing strategies and or water resource plans, from all the basin states as well as the status regarding the ORASECOM Integrated Water Resource Management Plan implementation;**
- **Determine or table specific training/capacity building requirements.**

This assignment will be undertaken in the following Tasks:

SA8.1: Inception Report and Agreement on Training Modules to be developed
SA8.2: Design of Standard Video Training Module
SA8.3: Discussion and Refinement of Video Training Module Structure
SA8.4: Development of Remaining Video Training Modules
SA8.5: Development of Web site to host Training Modules
SA8.6: Development of supporting documentation to Support Video Training Modules

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STRATEGIC ACTION

Strategic action being supported	Specific action

LEAD AND SUPPORTING ORGANISATIONS OR COUNTRIES

LEAD	
Supporting 1	Botswana
Supporting 2	Lesotho
Supporting 3	Namibia
Supporting 4	South Africa

BUDGET REQUIREMENTS

More than 1 billion USD	
Between 50 million USD and 1 billion USD	
Between 1 million USD and 50 million USD	X
Less than 1 million USD	

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Capacity Building

1: Involvement of ORASECOM		2: Countries involved	
High	X	Botswana	X
Significant		Lesotho	X
Medium		Namibia	X
Limited		South Africa	X
3: Priority		**4: Impact on Climate Resilience**	
High Priority	X	High	
Medium Priority		Medium	X
Low Priority		Low to None	
5:Funding Required		**6: Likley Loan Period**	
Normal Loan		1 to 5 Years	X
Loan and Donor		6 to 20 Years	
Donor Only	X	More than 20 Years	
7: Type of Job Creation		**8: Impact on possible Conflicts Between Basin States**	
Long term jobs	X	Positive	X
Only during construction		Neutral	
None		Negative	
9: Socio economic influence		**10: Influence on local communities**	
High		Positive	
Medium	X	Neutral	X
Low	X	Negative	
11: Yield contribution		**12: Contribution to alleviating water scarcity**	
Significant contribution		Significant contribution	
Moderate contribution		Moderate contribution	X
Little or no contribution	X	Little or no contribution	

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ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER TRANSFER PROJECT	Strategic Action 9

Hydrology Update and Calibration of Water Quality Model

Project Description

The hydrological data sets used to manage the Orange-Senqu basin are currently based on observed flows covering the period 1920/21 to 2004/05 which provides 85 years of data. The hydrological data sets were last updated over 15 years ago and they can now be improved by adding the last 15 years of recorded rainfall and streamflow data. It is normal practice is to update the hydrology after 15 to 20 years or shortly after a severe drought has passed. During the last 16-year period some severe dry years have occurred over most parts of the basin and it is important to include such information to improve the accuracy of the water resource assessments. In addition it is very important to include all recent rainfall and streamflow data to ensure that trends and changes resulting from possible Climate Change can be identified as soon as possible. The updated hydrological records will then also be able to generate more realistic stochastic sequences which are used for modelling and planning purposes.
Work carried out as part of the climate change task of the current study suggests that the stochastic flow band was, in general, wide enough to capture the spread of expected flows and yield results obtained from the different climate change models. Capturing the latest rainfall and rainfall runoff characteristics will improve the capability of the stochastic models to provide realistic future streamflow and rainfall predictions used for future planning and operating analyses to account for possible changes due to climate change.

This assignment will be undertaken in the following Tasks:
•SA9.1: Inception Report and Status Quo Assessment of Hydrology, Water Quality, and Groundwater interaction (where appropriate).
•SA9.2: Update of Lesotho and Caledon Hydrology
•SA9.3: Update Upper and Middle Orange Hydrology plus Riet and Modder
•SA9.4: Update Lower Orange plus Namibia plus River Losses from Vanderkloof Dam, including water quality and groundwater interaction.
•SA9.5: Update of Vaal, Usutu, Komati and Tugela Hydrology, including water quality and groundwater interaction.
•SA9.6: Assessment of Eastern Cape System
•SA9.7: Validation and Verification of Hydrology using Stochastic Modelling.
•SA9.8: Assess possible inclusion of El Nino and La Nina in the stochastic projections to improve Climate Change modelling.
•SA9.9: Assessment of Climate Change models to investigate potential downscaling problems
•SA9.10: Assessment of Eutrophication and Salinity problems in Lower Vaal and Orange rivers.

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STRATEGIC ACTION

Strategic action being supported	Specific action

LEAD AND SUPPORTING ORGANISATIONS OR COUNTRIES

LEAD	
Supporting 1	Botswana
Supporting 2	Lesotho
Supporting 3	Namibia
Supporting 4	South Africa

BUDGET REQUIREMENTS

More than 1 billion USD	
Between 50 million USD and 1 billion USD	
Between 1 million USD and 50 million USD	X
Less than 1 million USD	

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ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER TRANSFER PROJECT	Strategic Action 9

Hydrology Update and Calibration of Water Quality Model

1: Involvement of ORASECOM		2: Countries involved	
High		Botswana	X
Significant		Lesotho	X
Medium	X	Namibia	X
Limited		South Africa	X
3: Priority		**4: Impact on Climate Resilience**	
High Priority		High	
Medium Priority	X	Medium	X
Low Priority		Low to None	
5:Funding Required		**6: Likley Loan Period**	
Normal Loan		1 to 5 Years	X
Loan and Donor		6 to 20 Years	
Donor Only	X	More than 20 Years	
7: Job Creation		**8: Impact on possible Conflicts Between Basin States**	
Long term jobs		Positive	X
Only during construction		Neutral	
None	X	Negative	
9: Socio economic influence		**10: Influence on local communities**	
High		Positive	
Medium		Neutral	X
Low	X	Negative	
11: Yield contribution		**12: Contribution to alleviating water scarcity**	
Significant contribution		Significant contribution	
Moderate contribution		Moderate contribution	X
Little or no contribution	X	Little or no contribution	

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