Report Number
P WMA 14/C520/00/0910/01

water affairs

Department:
Water Affairs
REPUBLIC OF SOUTH AFRICA

Water Reconciliation Strategy Study for the Large Bulk Water Supply Systems: Greater Bloemfontein Area

Final Inception Report

June 2009

aurecon

GHT CONSULTING SCIENTISTS

ILISO CONSULTING
ENGINEERS PROJECT MANAGERS

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water affairs
Department:
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REPUBLIC OF SOUTH AFRICA

Aurecon Project No: 402992

Water Reconciliation Strategy Study for the Large Bulk Water Supply Systems: Greater Bloemfontein Area

INCEPTION REPORT

FINAL

June 2009

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REPUBLIC OF SOUTH AFRICA

Directorate National Water Resource Planning

Water Reconciliation Strategy Study for the Large Bulk Water Supply Systems: Greater Bloemfontein Area

APPROVAL

Title	:	Inception Report
DWA Report no.	:	P WMA 14/C520/00/0910/01
Consultants	:	Aurecon in association with GHT Consulting Scientists and ILISO Consulting
Report status	:	Final
Date	:	June 2009

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This report is to be referred to in bibliographies as:

Department of Water Affairs, South Africa. 2012. *Inception Report for the Large Bulk Water Supply Systems of the Greater Bloemfontein Area.* Prepared by Aurecon in association with GHT Consulting Scientists and ILISO Consulting as part of the Water Reconciliation Strategy Study for the Large Bulk Water Supply Systems: Greater Bloemfontein Area. DWA Report No. P WMA 14/C520/00/0910/01.

Water Reconciliation Strategy Study for the Large Bulk Water Supply Systems: Greater Bloemfontein Area

Study Reports

Report Name	DWA Report Number	Aurecon Report Number
Inception	**P WMA 14/C520/00/0910/01**	**402992/6231**
Preliminary Reconciliation Strategy	P WMA 14/C520/00/0910/02	402992/6232
Interventions Report	P WMA 14/C520/00/0910/03	402992/6233
Water Quality Assessment	P WMA 14/C520/00/0910/04	402992/6234
Reconciliation Strategy	P WMA 14/C520/00/0910/05	402992/6235

ACKNOWLEDGEMENTS

P van Niekerk
J van Rooyen
J Rademeyer
D Ristic
F Fourie
J van Wyk
T Makombe
T Masike
P Pyke
P Herbst
B Mwaka
T Ntili
P Ramunenyiwa
LR Tloubatla
AG Visser
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ABBREVIATIONS

ACRONYMS

AEC	Alternate Ecological Category
CMA	Catchment Management Agency
DWA	Department of Water Affairs
EMFs	Environmental Management Frameworks
GIS	Geographic information systems
IDPs	Integrated Development Plans
NPVs	Net present value
O&M	Operation and maintenance
PSP	Professional Service Provider
REC	Recommended Ecological Category
RPST	Reconciliation Planning Support Tool
SDFs	Spatial Development Frameworks
ToR	Terms of Reference
URVs	Unit reference values
WC/WDM	Water conservation and water demand management
WMA	Water Management Area
WWTW	Wastewater Treatment Works
MLM	Mangaung Local Municipality

MEASUREMENTS

ha	Hectares
Mm^3/a	Million cubic meters per annum

1. INTRODUCTION

1.1 PURPOSE OF THE STUDY

The Department of Water Affairs (DWA) has initiated a Reconciliation Strategy Study in the Greater Bloemfontein area to explore supply and demand side interventions that can be implemented to meet anticipated future water requirements. Climate change, and its possible impacts on water resource availability, will also be brought into consideration.

The objective of the Reconciliation Strategy Study is to develop a strategy that will set out a course of action to ensure adequate and sustainable reconciliation of future water requirements in the Greater Bloemfontein Area for a horizon of at least 25 years. This study will:

1. Estimate future water requirements scenarios for the Greater Bloemfontein Area;
2. Investigate possible water conservation and water demand management (WC/WDM) interventions, groundwater interventions, re-use of treated effluent, and possible future surface water resource development options;
3. Investigate possible scenarios for reconciling the requirements for water with the available resources; and
4. Provide recommendations for development and implementation of interventions and necessary actions required.

Water resource planning cannot reply on the benefit of hindsight, and as such future water requirements scenarios need to be developed to ensure that sufficient water is provided to meet future water requirements. This in turn is a complex task of unravelling and understanding the range of parameters that affect future water requirements scenarios and the range of potential permutations. The Strategy will be designed to respond to potential future water requirement scenarios and will also take into account seasonal, short-, medium-, and long-term variations in climate. In order to facilitate a dynamic Strategy, regular review, supported by monitoring, will need to be undertaken. Ultimately the Strategy will be a living process, to be continuously improved as estimates of water requirements, water availability, and resource development options become more reliable during the 25-year (up to 2035) planning horizon.

1.2 DESCRIPTION OF THE STUDY AREA

The Greater Bloemfontein Supply System provides the majority of potable water requirements to the towns located within the study area, namely Bloemfontein, Thaba Nchu, Botshabelo, Wepenaar, Dewetsdorp, Reddersburg, and Edenburg. The future water requirements of the rural villages surrounding Thaba Nchu, which currently utilise groundwater, will also be taken into consideration in the strategy development. Agricultural water requirements will also form part of this study, as these water requirements may impact on the reconciliation of supply and requirement.

The study area has been divided into two areas, namely a ***Primary Study Area*** and a ***Secondary Study Area*** **(Figure 1.1).** The ***Primary Study Area*** includes the municipal boundary of Mangaung Local Municipality (MLM), all the towns identified within the Greater Bloemfontein Area, and main water resources. The ***Secondary Study Area*** includes the Caledon River, which is the main river system providing surface water to Bloem Water, and the quaternary catchments which drain into the Caledon River.

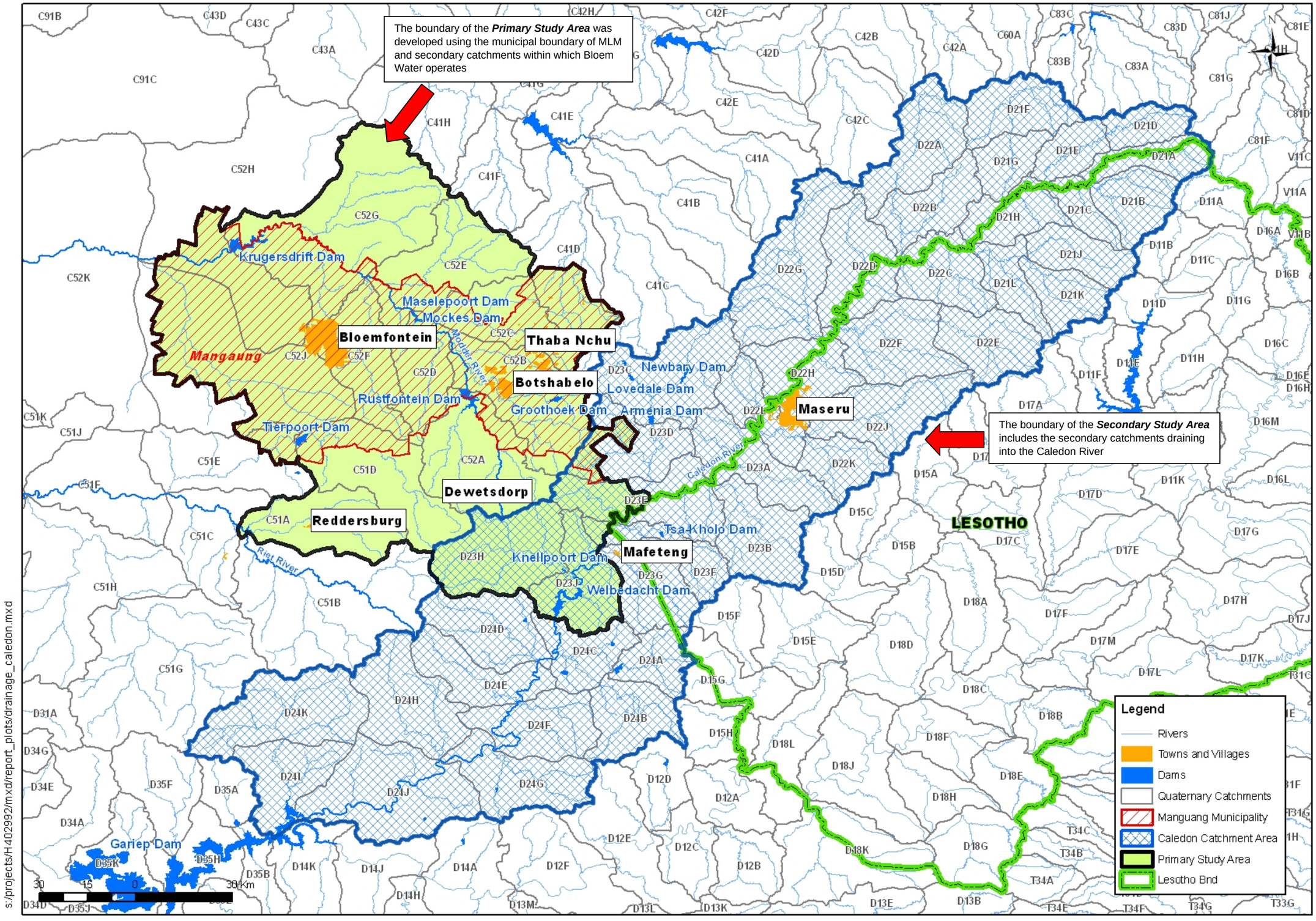


Figure 1.1: The Greater Bloemfontein Bulk Water Supply System (Primary Study Area) and the Caledon Catchment Area (Secondary Study Area)

1.3 OVERVIEW OF THE STUDY

This study will comprise of three phases, namely:

- ***Phase 1: Inception Phase***

The objective of the Inception Phase is to:

- Assemble and assimilate relevant information;
- Review and consider the study proposal and revise the programme and budget as applicable; and
- Prepare Inception Report clarifying the details of how the project will be undertaken.

- ***Phase 2: Development of Interim Strategy***

The objective of Phase 2 is to:

- Assess the acceptability of the various interventions identified in previous studies in terms of technical, financial, environmental, and social criteria;
- Ascertain which intervention or combinations thereof would warrant further investigations at reconnaissance or pre-feasibility level, and what aspects should be investigated in this study;
- Determine the future water requirements based on population growth;
- Proposed water resource planning scenarios to meet future water requirements; and
- Document the Interim Strategy.

- ***Phase 3: Refinement of Strategy and Scenario Planning***

The objective of Phase 3 is to:

- Evaluate in more detail the interventions which are most likely to be implemented to address future water requirements;
- Refine the future water resource scenarios;
- Develop a sequence of interventions which need to be implemented to meet the future water resource scenarios;
- Document the reconciliation process; and
- Report on the Reconciliation Strategy.

Each of these phases has a number of tasks which inform the subsequent phase. Some tasks also span across phases to allow for updating and refinement as more information becomes available.

Aurecon is the Lead Professional Service Provider for this study. Two independent specialist consultants have been contracted to Aurecon to assist with the study, namely ILISO Consulting (Pty) Ltd and GHT Consulting.

The tasks, budgets, and work programme for the study are detailed in this Inception Report.

1.4 DELIVERABLES

The main deliverables will be:

- Inception Report (March 2010)
- Interim Reconciliation Strategy Report (March 2010)
- Reconciliation Strategy Report (March 2011)
- Summary of Interventions Report (February 2011)
- Technical Report: Water Quality
- Administrative Reports

1.5 PROPOSED REVISIONS IN THIS INCEPTION REPORT

The following changes from the proposal have been included in this Inception Report:

- In the letter dated 19 October 2009, addressed to the Director General of the DWA, the Professional Service Provider (PSP) requested that the contract awarded to Ninham Shand (Pty) Ltd be transferred to Aurecon South Africa (Pty) Ltd (Registration No: 1977/003711/07).

- The programme has been revised and will now be completed in a 24-month period, as opposed to the original 36-month programme that was proposed.

- In response to the Department's request for the development of an Interim Strategy Report, an Interim Strategy Report has now been included as a deliverable for March 2010.

- In response to the changed methodology and the request to compile an Interim Strategy Report by March 2010, the budget, which was apportioned to each task, has been revised. The revised budget is presented in **Section 4**.

- The "*updating of the surface water hydrology*" task has been removed from the revised project methodology, as directed by the DWA.

- The "*review system operating rules*" task has been removed from the revised project methodology, as this will not influence the Reconciliation Stratgey.

1.6 STUDY PROGRAMME

The programme is based on the appointment being made in February 2009 and work commencing in March 2009. The study period is 36 months, however it is anticipated that the bulk of the work will be undertaken within the first 24 months. The proposed Study Programme to complete all the Tasks has been included in **Section 4.**

2. METHODOLOGY

The methodology and approach as detailed below will be followed in undertaking this technical study. **Figure 2.1** shows the schematic interrelationships between all the Tasks.

2.1 PHASE 1: INCEPTION PHASE

2.1.1 Task A: Inception Report

The project team will study the background documents, have discussions with relevant DWA representatives and draft the Inception Report in close co-operation with the Client. It will be based on this project proposal which will be expanded and modified where required to provide a clear and concise description of how the project will be undertaken, what deliverables will be produced, and in which sequence. It will provide detailed financial information (including: an updated manpower schedule, project budget, and cash flow projection) and a project programme. All items identified as possible problem areas and suggested additions to the project will be included in the Inception Report where appropriate.

The development of the Inception Report will be undertaken in parallel with Task 1 and Task 2 of Phase 2. Once Task 2 has been completed, the outcomes will inform the Inception Report. The Inception Report will therefore confirm the level of further study to be undertaken, and will also address the following:

- The extent of information gaps and the means to address them for the subsequent phases of the Study;
- A reassessment of the extent of work required, which may include a change in project methodology and approach, and the provision of motivations for any changes to the original Contract Amount; and
- Relevant feedback from the Preliminary Screening Workshop.

2.2 PHASE 2: DEVELOPMENT OF FIRST DRAFT RECONCILIATION STRATEGY

2.2.1 Task 1: Summary of Previous and Current Studies

Task 1.1: Assemble and Assimilate Information

The study team will obtain and study the range of relevant background documents from studies completed in the study area and also in areas adjacent to the study area which may impact on the planning for the Greater Bloemfontein Area. The following key sources of information have inter alia been identified as being important.

- The Orange River Development Project Re-Planning Study;
- The Internal Strategic Perspectives of the Upper Orange Water Management Area;
- The Water Resource Situation Assessment Studies;
- The Water Service Development Plans of the affected Water Service Authorities;
- The Water Conservation and Water Demand Management (WC/WDM) Strategies of the affected Water Service Authorities.

It should be noted that this is not a complete list. Additional sources of information will be referenced appropriately as they are identified during the course of the project.

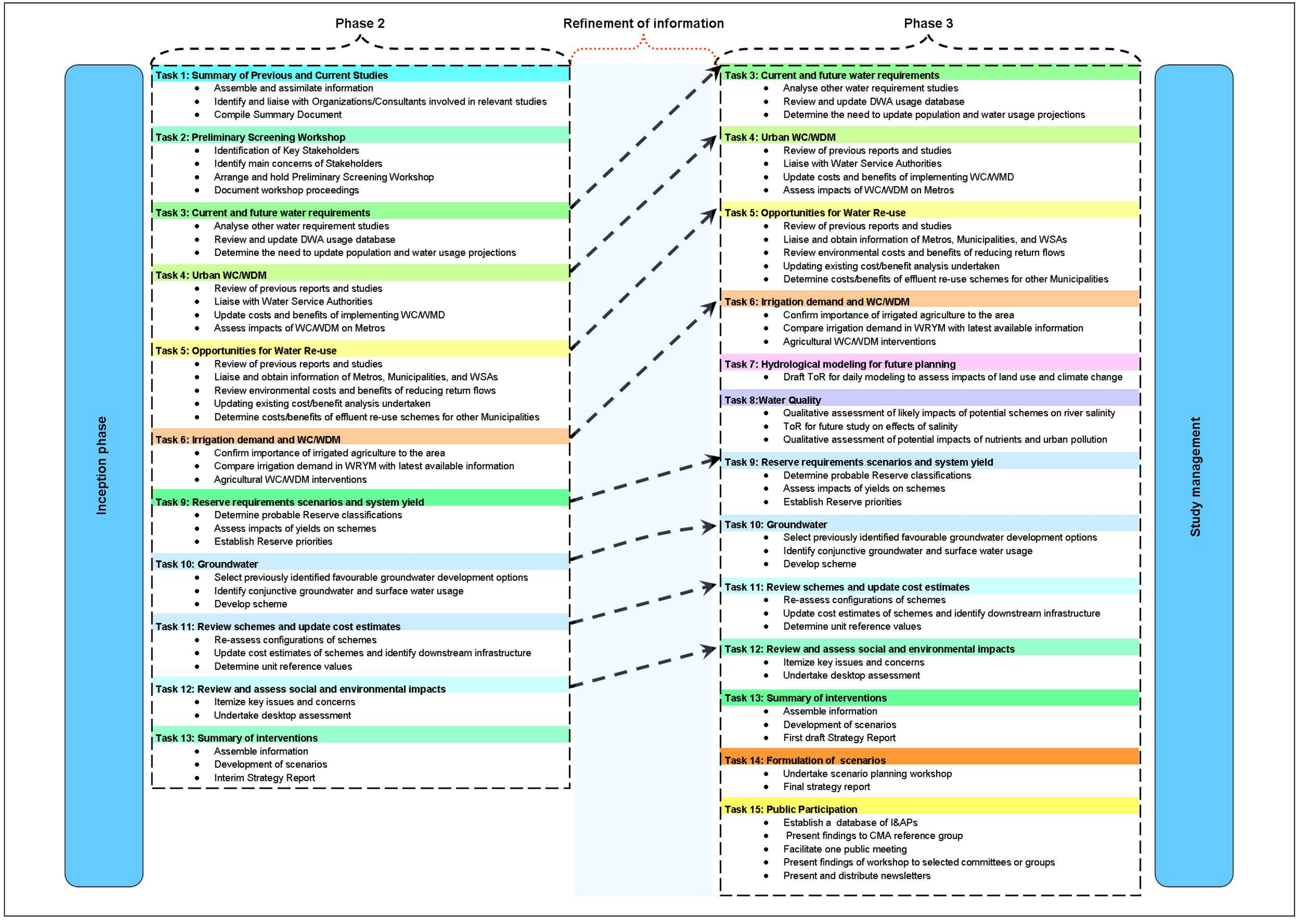


Figure 2.1: Study Methodology Programme

Task 1.2: Identify and Liaise with Organisations/Consultants Involved in Relevant Studies

The Study team will identify and liaise with all organisations and consultants which are currently engaged on studies in the Study Area. This will ensure that the most up to date and relevant information is utilised in preparing the Summary Document. It will be important to hold meetings with DWA Regional Office, Bloem Water, the Water Service Authorities in the area, and the Department of Agriculture, as these organisation will be able to inform the Study Team of the current studies and initiatives which are underway. A range of possible stakeholders has been identified, which will be updated regularly during the course of the project.

Task 1.3: Compile Summary Document

The Summary Document will include all information and its sources assembled in Task 1.1 and Task 1.2. The information will be based on existing and current reports and studies, contributions from DWA officials, Bloem Water officials and officials from Mangaung Municipality and other affected Water Service Authorities. It is anticipated that the Summary Document will contain information on the following aspects relating to the bulk systems supplying the Greater Bloemfontein Area:

- Historical and Projected water requirements for urban, irrigation and afforestation water usage
- Existing bulk water supply infrastructure

The Summary Document will not be a standalone report, but will serve rather as a source of information which will be used to inform the Interim Strategy Report and the Summary of Interventions Report.

2.2.2 Task 2: Preliminary Screening Workshop

Task 2.1: Identification of Key Stakeholders

Key stakeholders in the Study Area will be identified and will be invited to the Preliminary Screening Workshop. Key stakeholders will be identified in collaboration with the Study Management Team, including the DWA Regional Office.

Task 2.2: Identify Main Concerns of Stakeholders

It is important to identify the main concerns of Stakeholders prior to the Preliminary Screening Workshop being held. The main concerns will be identified from existing literature as well as from discussions with key stakeholders. In this way the Study team will capture the concerns of the Stakeholders and document concerns and issues raised in the Summary Document. Based on the Study Team's current knowledge of the area, it is anticipated that the following issues and concerns will be raised:

- The verification and validation of existing lawful use;
- Operational losses regarding releases from Vanderkloof Dam;
- Rules and procedures for operating the dams;
- Effluent Re-use;
- Diffuse Irrigation and small farm dams;
- Irrigation Return Flows – Return flows have a negative impact on streamflow water quality. Irrigation WC/WDM will reduce return flows and therefore also affect water quality;
- Implementation of the Reserve for the Orange River;
- The implementation of WC/WDM first to reduce current water usage;
- Water Conservation and Demand Management Plans for Water Service Authorities;
- Preparation of Water Management Plans for irrigated areas;
- Sedimentation – water in the Caledon River naturally carries a high sediment load. Sedimentation results in wear and tear on plant and equipment with the result that downtime increases and the reliability of supply is deteriorates in areas that have inadequate storage facilities (e.g. Bloemfontein);
- Age of bulk infrastructure - the bulk water supply pipeline supplying the Greater Bloemfontein Area is an ageing pre-stressed concrete pipeline;

- Limitations on the existing bulk water supply system and internal distribution system – due to the lack of bulk water storage capacity in the Mangaung area, network peaks will be transmitted to the bulk water supply infrastructure;
- Assurances of Supply for different classes of users.

Task 2.3: Arrange and Hold Preliminary Screening Workshop

A Workshop will be held in the Study Area to screen potential augmentation schemes. Workshop participants will be provided with a Workshop Starter Document prior to the workshop (referred to as the *Preliminary Screening Workshop Started Document*, dated October 2009). The primary purpose of the workshop will be to define the interventions which should be further investigated and to give guidance to the remainder of the study. The prioritization of interventions will be informed by the inputs from the broader client body, study team, and representatives of key authorities at the preliminary screening workshop.

The compilation of the *Preliminary Screening Workshop Started Document* was achieved through a number of tasks which informed the identification of interventions, namely:

- Task 3: Current and Future Water Requirements
- Task 4: Urban Water Conservation and Demand Management
- Task 5: Opportunities for Water Re-use
- Task 6: Irrigation Demand and WC/WDM
- Task 8: Water Quality
- Task 9: Reserve Requirement Scenarios and System Yield
- Task 10: Groundwater
- Task 11: Review Schemes and Update Cost Estimates
- Task 12: Review and Assess Social and Environmental Impacts

The Preliminary Screening Workshop is intended to present potential interventions in terms of timing, cost, and yield. Combinations of different interventions will also be considered to devise the set of best possible alternatives to meet the water requirements of the Great Bloemfontein Area. The objectives of the Preliminary Screening Workshop are to:

- Assess the acceptability of the various interventions identified in previous studies in terms of technical, financial, environmental, and social criteria;
- Ascertain which intervention or combinations thereof would warrant further investigations at reconnaissance or pre-feasibility level, and what aspects should be investigated in this study;
- Augment the existing information with specialist inputs from the DWA and other key stakeholders; and
- Identify any other issues/concerns of stakeholders which could impact on the reconciliation of supply and requirement.

The screening process and its outcomes will be recorded as part of the documentation of the Preliminary Screening Workshop which will make recommendations as to which interventions (and tasks) should be further investigated during the remainder of the Study.

Task 2.4: Document Workshop Proceedings

The screening process and preliminary screening workshop proceedings and outcomes will be recorded as part of the Workshop Document. This document will inform the Inception Report. The proceedings of the workshop will be compiled and distributed to all participants via email.

2.2.3 Task 3: Current and Future Water Requirements

Task 3.1: Analyse Other Water Requirement Studies

The Terms of Reference (ToR) is aimed at developing reconciliation strategies for the large bulk water supply systems serving the Greater Bloemfontein Area. The urban areas which have been identified as being supplied from the large bulk water supply systems are: the Mangaung/Bloemfontein Area, the Botshabelo / Thaba Nchu Area, Wepenaar, Dewetsdorp, Reddersburg and Edenburg. Discussions will be held with Bloem Water, Mangaung Municipality, as well as other Water Service Authorities (WSAs) to determine if studies undertaken by these institutions will be able to add value to the DWA Water usage database.

Other sources of information could include: the Water Service Development Plans of the Water Service Authorities, the Water Research Commission, the Council for Geoscience, CSIR reports and other DWA studies.

Task 3.2: Review and Update DWA Water Usage Database

The Water Services Assessment Model (WSAM) has been assumed to be the DWA water usage database that must be updated. The other DWA water use database is the WARMS database, This database consists of registered water use and is not updated with Census data. The primary source of information will be the census which was undertaken in 2001 as well as the large–scale community survey which was undertaken for all the Provinces at Municipal level. Existing demographic and socio-economic data which is available will be utilised to update DWA's water usage database.

The Study Team will review and update the existing DWA water usage database. It is understood that the WSAM is constantly updated with incoming information from community surveys. We have further understood that DWA undertakes a bi-annual revision of demographic statistics. The information contained in the WARMS database (i.e. all registered and/or licensed water use) will be compared against actual water use as per the census data, WSAM input data and the aforementioned community survey. The Study Team will also highlight areas were water use is taking place based on the planning tools (WSAM), WSDPs as well as the community survey data, but where the usage is not reflected in WARMS. Recommendations for further investigations will be made to DWA in this regard. (This will be based on existing information and will not include an actual detailed verification and validation exercise).

Future water demand projections will be made using the WSAM database. These future water demand projections will be compared to the future water requirement projections made by Bloem Water and Mangaung Municipality, as well as projections made by other smaller Water Service Authorities.

Task 3.3: Determine Need to Update Population and Water Usage Projections

The ToR requires that the Professional Service Provider (PSP) determines the need to update population and water usage projections made for the National Water Resource Strategy.

The population projections upon which the water demands in the National Water Resource Strategy (NWRS) were based, was derived from the 1995 Census data. Two future water requirement projections were made in the NWRS, namely a base scenario and a high scenario. The current water requirements and future water requirement projections made using the WSAM (Task 3.2) will be compared with the 2001 (interpolated) and 2025 projections made in the National Water Resource Strategy (September 2004). In addition, the current and future water requirement scenarios contained in the WSDPs of Mangaung Municipality and other Water Service Authorities will be compared to the WSAM projections and the NWRS projections. The findings will be discussed with the Study Management Committee and recommendations will be made to DWA on the need to update population and water usage projections made in the NWRS.

Water requirements of a Water Service Authority are influenced by:

- Increased responsibilities legislated for water service delivery;

- Consumer profiles and consumption patterns in the area of supply;
- Population growth trends, including the effects of HIV/AIDS;
- Urbanisation in and migration to or from the area of supply;
- Economic growth;
- Water tariffs and affordability.

The development of models to predict population growth is not an exact science and is based on an understanding of historic data and an evaluation of how the abovementioned impacts influence future water requirements. The uncertainty regarding the growth in future water requirements will be further explored and refined during Phase 3 to allow for the development of population growth curves which most accurately reflect potential growth scenarios. Essentially, the population growth curves will represent a "low", "medium", and "high" growth rate scenarios, which allows for the extrapolation of the future water requirements in urban and rural demand centres.

The results of Task 3 will be documented in the Interim Strategy Report and further refined in Phase 3 of the Strategy.

2.2.4 Task 4: Urban Water Conservation and Demand Management

The urban water requirements of the Mangaung area, namely the Bloemfontein, Botshabelo and Thaba Nchu, represents in excess of 90% of the total primary water requirement served by the large bulk water supply systems. In terms of the long-term reconciliation of supply and requirement, it therefore follows that any savings achieved through WC/WDM in these areas will have the most significant impact on the future water balance (the 80/20 principle). This Task will therefore primarily focus on the costs and benefits of implementing WC/WDM in these areas.

Task 4.1: Review of Previous Reports and Studies

All available literature on WC/WDM will be obtained from Bloem Water Board, and MLM and the other Water Service Authorities supplied by the large bulk water supply systems serving the Greater Bloemfontein Area and will be reviewed. The DWA Water Use Efficiency Directorate and DWA Regional Office will also be consulted about any other studies which have been undertaken.

Task 4.2: Liaise with Water Service Authorities

Based on the available literature, discussions will be held with representatives from all Water Service Authorities as well as Bloem Water. The discussions will focus on the following aspects:

- The existing and proposed WC/WDM strategies and programmes;
- Capital and operating budgets allocated to WC/WDM;
- Current and proposed initiatives and interventions which are being undertaken or planned to be undertaken by the Water Service Authorities and Bloem Water; and
- Actual and potential savings which have been/could be achieved through the implementation of WC/WDM.

Task 4.3: Update Costs and Benefits of Implementing WC/WDM

The team will update the costs and benefits based on the existing information available from Bloem Water, Mangaung Municipality and other Water Service Authorities. If this information is not available, the Study Team will try to quantify the costs and benefits through discussions and meeting with the Water Service Authorities. The team will discuss with MLM the potential implications of reduced effluent flows (as a result of the implementation of WC/WDM) to the waste water treatment works. The benefits of implementing WC/WDM are more far reaching than purely delaying future water resource development options. Implementing WC/WDM could also lead to delaying the implementation of bulk water supply infrastructure, water treatment plants and waste water treatment plants. The costs and benefits of these aspects will also be discussed with Mangaung Municipality and Bloem Water.

If suitable information is not available, an estimate of potential savings will be made at a high level, based on the difference between the bulk water supplied and the metered consumption to individual water users. An estimate will be made as to the extent of the potential costs and savings that can be achieved through the following WC/WDM strategies:

- Improved efficiency:
  - Efficient appliances, such as washing machines, toilet cisterns, etc
  - Low flow shower heads
  - Water efficient gardens
- Loss management:
  - Pressure management
  - Retrofitting and removal of wasteful devices
  - Improved management (sectorisation, metering, billing, legislation)
  - Mains replacement
  - Leak detection and repair

These topics will be discussed with all the relevant role players and adjusted during the course of the study as new information becomes available.

It should be noted that the determination of the potential costs and benefits of WC/WDM is one of the most critical aspects of the Study, as it will directly impact on the planning and implementation dates of future water resource supply schemes.

Task 4.4: Assess Impacts of WC/WDM on Metros

It is proposed that the Reconciliation Planning Support Tool (RPST) be used to graphically display the impact of implementing WC/WDM on the proposed water requirement curves of the Water Service Authorities (WSA) (to be determined in Task 3). The RPST will be able to quantify the potential saving per year and total accumulative savings by implementing an identified suite(s) of WC/WDM interventions. The ability of the Study Team to assess the impacts of implementing WC/WDM will be determined by the information available and the format of the available information.

There are fundamental differences between drought mitigation and WC/WDM interventions and one must not confuse water restrictions with water demand management. Water restrictions are planned punitive measures to reduce water demand in the short term and should be applied judiciously when circumstances such as droughts necessitate the implementation thereof. WC/WDM focuses on the sustained minimisation/ elimination of wastage and the optimal use of water over the medium to long-term, with nominal impact on the quality of life of the consumer and invariably with financial benefits accruing to the municipality concerned. The Study team will also comment on and assess the likely impact which the current and future WC/WDM interventions identified by MLM and other WSA will have on the WSAs' ability to restrict demands during periods of drought when water restrictions are imposed. The assessment will take account recent experiences when water restrictions were imposed. The Study Team will also draw on the knowledge gained when recent water restrictions were imposed on the City of Cape Town (in 2001 {10% restrictions} and again in 2004 {20% water restrictions}).

The outcome of this Task will feed directly into Phase 3, as WC/WDM is the key intervention which must be implemented prior to the development of new surface water and/or groundwater schemes.

The results of Task 4 will be documented in the Interim Strategy Report and further refined in Phase 3 of the Strategy.

2.2.5 Task 5: Opportunities for Water Re-use

Task 5.1: Review of Previous Reports and Studies
All previous reports and studies pertaining to the use of treated effluent undertaken by the WSAs, Bloem Water and DWA will be obtained from the relevant organisation and reviewed. It is anticipated that the Mangaung area discharges approximately 24 Mm^3/a of treated effluent into the Modder River. These flows supplement the base flow in the Modder River.

Task 5.2: Liaise and Obtain Information of Metros, Municipalities and WSAs
Due to the relative high number of households making use of water borne sewerage in the MLM, there are a number of Waste Water Treatment Works (WWTWs) in the Greater Bloemfontein Area. The two biggest WWTWs are the Bloemspruit WWTW, which discharges 56 Ml/d into the Bloemspruit, and the Botshabelo WWTW, which has a design capacity of 20 Ml/d.

Information on these WWTW and others will be obtained from MLM and other WSAs. The following information will inter alia be obtained: location of the WWTW, flow into the WWTW, flow leaving the WWTW, quality of treated effluent (domestic or industrial effluent), existing effluent re-use schemes, effluent re-use policies, and the price of treated effluent.

Task 5.3: Review Environmental Costs and Benefits of Reducing Return Flows
Available literature on the environmental benefits and lowering of costs to maintain rivers and vleis if effluent flows are reduced will be reviewed and will also be supplemented by expert opinion. Informed comment on these environmental benefits (including the re-instatement of seasonality of rivers) will be made.

Task 5.4: Update Existing Cost/Benefit Analyses Undertaken
Schemes previously identified by the Mangaung Municipality, Bloem Water and other Water Service Authorities will be reviewed and the cost and benefits of these schemes will be updated. A use of treated effluent to potable standards scheme, if not already considered will be conceptualised and costed. The updated costs and benefits of effluent re-use schemes previously identified and the potable schemes conceptualised will be able to inform the Formulation of Scenarios in Task 13.

Task 5.5: Determine Costs/Benefits of Effluent Re-use Schemes for Other Municipalities
Similarly to Task 5.4, the costs and benefits of other effluent re-use schemes identified by the other Water Service Authorities abstracting water from the large bulk water supply systems serving the Greater Bloemfontein Area will be reviewed and updated.

The results of Task 5 will be documented in the Interim Strategy Report and further refined in Phase 3 of the Strategy.

2.2.6 Task 6: Irrigation Demand and WC/WDM

Irrigation water represents approximately 80% of the water requirements in the Upper Orange Water Management Area (WMA). According to the Upper Orange WMA Internal Strategic Perspective (ISP), no new irrigation schemes are being planned and no meaningful change in the requirements for water by the irrigated agriculture in this WMA is foreseen, with the exception of 4 000 ha of irrigation, for which water has already been earmarked for resource poor farmers. In addition to the 4 000 ha earmarked for resource poor farmers in the Upper Orange WMA, the Orange River will also have to supply the water requirements for 4 000 ha of irrigated lands in the Lower Orange WMA and water requirements for 4 000 ha of irrigated lands in the Fish-Tsitsikama WMA. The ISP for Upper Orange WMA estimates that the water requirement for the additional 12 000 ha of irrigated land to be 113 million m^3/a.

Task 6.1: Confirm Importance of Irrigated Agriculture to the Area

The irrigation area in the Upper Orange River Catchment is estimated to be approximately 52 000 ha. If we accept that one job is generated per 30 ha of irrigation this amounts to 1 740 jobs. The social impact is much larger if you take four dependents on one job, it amounts to 6 960 people directly dependent on Agriculture. In addition there are also upstream and downstream related farming activities which contribute to the economy of the area.

During the study this information will be confirmed and extended to include irrigation not part of Water Users Associations or other management structures. The current rising in food prices also plays a role in the importance of irrigated agriculture.

Discussions will be held with the Department of Agriculture in the Free State in order to gather information and reports on the importance of irrigated agriculture in the area. By studying previous reports regarding Socio-Economic impact of the irrigation in the area the contribution to economic growth, employment and poverty reduction will be reported on.

Task 6.2: Compare Irrigation Demand in WRYM with Latest Available Information

All relevant information from the WARMS database will be plotted geographically using GIS and the irrigation demands will be grouped together to be able to make a direct comparison with the irrigation demands used in the WRYM and the WRPM. The information from the WARMS database will be supplemented by other water use information provided by DWA and affected Water Users Associations. The outcome of the comparison as well as any discrepancies found will be reported on.

Task 6.3: Agricultural WC/WDM Interventions

The following range of WC/WDM options for improving the efficiency of agricultural water use has been identified:

- River release management;
- Installation of more efficient irrigation practices;
- Improved flow of water through the canal system to reduce conveyance losses;
- Improved management of farm dams to reduce losses;
- Crop selection to reduce water requirements;
- Crop deficit irrigation;
- Implications of trading water use allocations; and
- Metering.

The abovementioned interventions will be evaluated to determine the potential costs and benefits of implementing agricultural WC/WDM options.

The results of Task 6 will be documented in the Interim Strategy Report and further refined in Phase 3 of the Strategy.

2.2.7 Task 9: Reserve Requirement Scenarios and System Yield

Task 9.1: Determine Probable Reserve Classifications

This task will include an evaluation of all current Reserve assessments, including the level at which the Reserve was assessed (i.e. Desktop, Rapid, Intermediate or Comprehensive), when it was assessed, whether a quality and quantity Reserve assessment was conducted, the status of the Reserve template (e.g. signed off, pending) and the validity of this assessment. Recommendations would have to be made for areas requiring Reserve assessments to be conducted at a higher level of detail. Data that are the most up-to-date and have the highest confidence level associated with them will therefore be identified and need to be incorporated into the study.

The following steps will essentially be conducted:

- Identify nodes for which Reserve data already exist
- Identify nodes where Reserve information is required in terms of water supply reconciliations
- Identify nodes to which existing Reserve data may be extrapolated (as required).

An intermediate level ecological Reserve was determined for the Riet/Modder catchment as part of the development of the catchment management strategy for the area. Ecological water requirements have not been determined for the catchment upstream of the Vanderkloof Dam and downstream of Lesotho – these are areas that may need focus, depending on water supply and other requirements or impacts. This area includes the Caledon River which is currently the main source supplying the Greater Bloemfontein Area.

The outcome of this Task would be an expert view of the most likely Reserve classifications for nodes where Reserve information is required in terms of water supply reconciliations. This task would be conducted in a participatory way liaising with DWA regional officers and consultants/researchers active in the area, and using desktop tools currently available, i.e. Present Ecological State and Reserve results, and Ecological Importance and Sensitivity assessments conducted at a desktop level in 1999/2000.

Task 9.2: Assess Impacts of Yields on Schemes

The ecological water requirements would need to be supplied not only for the ecosystems immediately downstream of the abstraction points (or dams as the case may be), but also for any other affected downstream ecosystems, including estuaries or wetlands. The Reserve task will therefore supply Recommended (REC) and Alternate Ecological Category (AEC) Reserve determinations for all nodes for input into the WRYM. The AEC provided will be based on the water supply development options proposed and the potential impact on the Ecological Reserve. The WRYM will be used to determine the impact of the most likely Reserve classifications as well as a higher and lower classification on the yields of the identified preferred surface water schemes. The Reserve requirements for groundwater schemes will be determined based on the latest thinking in DWA.

Task 9.3: Establish Reserve Priorities

Areas requiring Reserve assessments to be conducted at a higher level of detail (and higher confidence should data be available), will be identified and prioritized. Areas where integration between surface and groundwater will be required from a Reserve perspective, and tools available to conduct such tasks, will be identified.

The results of Task 9 will be documented in the Interim Strategy Report and further refined in Phase 3 of the Strategy.

2.2.8 Task 10: Groundwater

The Upper Orange WMA Overview Report indicated that the total groundwater use in the Upper Orange WMA was approximately 64 Mm^3/a. The registered volume from the WARMS database showed a volume of 98.3 Mm^3/a. The theoretical groundwater availability is estimated to be 1 020 Mm^3/a, which represents a significant volume.

Groundwater is used to supply the small towns in the WMA as either the sole source of supply or in combination with surface water resources. The Mangaung/Bloemfontein, Botshabelo and Thaba Nchu Areas are currently supplied from the Caledon/Modder System and do not rely upon groundwater as a source for primary water demand. Reddersburg and Edenburg draw water from the Caldeon/Modder System, but are also supplemented by groundwater supplies.

Task 10.1: Select Previously Identified Favourable Groundwater Development Options

In addition to Schedule 1 use, groundwater from the primary aquifers could be extensively utilized for irrigation. A clear distinction needs to be made between sectoral water being supplied either from groundwater or surface water. Discussions will be held with officials from DWA, the Department of Agriculture and other organisations who could provide information to the Study Team. All previously selected favourable groundwater options will be identified and documented. Other sources could include: topographical maps, geological and geohydrological maps, existing groundwater databases, existing hydro chemical databases, existing geohydrological reports and pollution monitoring reports.

Task 10.2: Identify Conjunctive Groundwater and Surface Water Usage

Utilising the information obtained in Task 10.1, the Study Team will identify options for conjunctive groundwater and surface water usage including aquifer recharge and storage. Note that recharge and storage values will not be generated but taken from available literature. If potential schemes do not exist for conjunctive groundwater and surface usage, a scheme(s) will be conceptualised at desk top level. The conceptual scheme will be costed as part of Task 10.3.

Task 10.3: Develop Schemes

Cost estimates of schemes will be prepared together with their main features including: yield, storage, water quality, cost, infrastructure cost, URV, Reserve requirements and environmental impacts.

The results of Task 10 will be documented in the Interim Strategy Report and further refined in Phase 3 of the Strategy.

2.2.9 Task 11: Review Schemes and Update Cost Estimates

Task 11.1: Reassess Configurations of Schemes

Those schemes which were identified by previous studies (See Task 1) and taken through the Preliminary Screening Workshop (Task 2) will be reassessed based on information contained in recent studies and based on the outcomes of Tasks 4 to 10 under the Bloem Recon Study. In particular it is anticipated that the outcome of Task 9, where the yields of the potential schemes are reassessed based on the most likely Reserve Classifications, could impact on the configuration of the Schemes. The capacity of the bulk water supply infrastructure serving the Greater Bloemfontein area will also be reassessed. Should additional bulk water supply infrastructure capacity be required it will be included as part of the revised configuration of the scheme.

Discussions will be held with the DWA Regional Office, Bloem Water and Mangaung Municipality in order to determine their future bulk water infrastructure requirements.

As more information becomes available, information presented in Task 11 will be updated and refined in Phase 3 of this Study.

Task 11.2: Update Cost Estimates of Schemes and Identified Downstream Infrastructure

The revised scheme configurations developed under Task 11.1 will be costed. The cost functions developed for the VAPS Study which are relevant for the current study would be reviewed and updated taking account of recent contract prices and any further escalation in costs. These cost functions will, where possible, also make provision for:

- Capital costs that would include the costs of construction, engineering, construction supervision and contingencies.
- Operating and maintenance costs.
- Electricity costs for pumping (including the anticipated higher than inflation increase in electricity costs) and the benefits of hydropower generation.

- Relocation of infrastructure (roads, power lines, telecommunication cables etc) would be included in the overall cost estimate (assuming that DWA would provide details of expropriation costs).

Task 11.3: Determine Unit Reference Values
Following Task 11.2, Unit Reference Values (URVs) will be calculated based on the Net Present Value (NPV) of the total cost of the identified schemes (including downstream bulk infrastructure required) divided by the NPV of the water delivered by the scheme (this will be based upon the assured yield provided by the option and the growth in water demands up to the assured yield). A URV spreadsheet will be developed which will allow different water requirement growth rates to be applied.

The results of Task 11 will be documented in the Interim Strategy Report and further refined in Phase 3 of the Strategy.

2.2.10 Task 12: Review and Assess Social and Environmental Impacts

The objective of this task is to undertake an environmental screening exercise for each of the schemes under investigation in order to:

- Summarise any key environmental or social issues that should be taken in account when considering and comparing option,
- Identify any environmental or social "fatal flaws" or "red flags" associated with any of the projects; and
- Identify environmental authorisations that will be required for any of the projects.

A fatal flaw would be an environmental or social negative impact that is not possible to mitigate and significant enough to prevent the scheme from being able to be implemented. A red flag issue would be a negative impact that although significant could be mitigated, but warrants special attention in the consideration of scheme alternatives.

The screening exercise will be undertaken in the context of the existing Integrated Development Plans (IDPs), Strategic Development Frameworks (SDFs) and any relevant Environmental Management Frameworks (EMFs).

The schemes being investigated can be divided into two categories:

- Schemes for which previous environmental assessments are available; and
- Schemes for which no environmental assessments have been undertaken.

Task 12.1: Itemise Key Issues and Concerns
The Environmental Assessments of schemes that have previously been studied will be obtained and reviewed with the aim of identifying whether any circumstances have changed. Key issues, red flag, fatal flaws and authorisation requirements will be identified and summarised.

Task 12.2: Undertake a Desktop Assessment
A site visit and environmental screening will be undertaken for schemes for which no environmental assessments are available. Provision has been made to consider two schemes in this category. Key issues, red flag, fatal flaws and authorisation requirements will be identified and summarised.

The results of Task 12 will be documented in the Interim Strategy Report and further refined in Phase 3 of the Strategy.

2.2.11 Task 13: Summary of Interventions

Task 13.1: Assemble Information

All the information gathered, updated and analysed during the course of undertaking all the required Tasks will be assembled together into a document. The document will inter alia contain the following information:

- The allocations to the urban users and irrigators taking assurances of supply into account as well as possible improvements to the existing and future operating rules (Task 6)
- Future urban and irrigation water demand scenarios (Task 3 and Task 6)
- Cost and benefits of implementing WC/WDM (Task 4)
- Opportunities for Water Re-use (Task 5)
- The potential impacts of the yield determination scenarios (most likely classification as well a higher and lower classification) (Task 9)
- Potential groundwater schemes(Task 10)
- Updated and revised water resource development options including:
    - Update yields (Task 9)
    - Updated Costs and URVs (Task 11)
    - Anticipated social and environmental impacts (Task 12)
    - Water Quality impacts (Task 8)

The Document will be prepared in a user friendly format which could be distributed to Stakeholders prior to the Final Screening Workshop. It is anticipated that the report prepared for the Preliminary Screening Workshop will be expanded upon to contain the information listed above. This document will also inform Task 14 where possible scenarios for prioritising the implementation of future reconciliation options will be undertaken.

All issues and concerns which have been raised by stakeholders in the Preliminary Screening workshop and which have been deemed to be important to the ongoing reconciliation of supply and requirement will be documented.

Task 13.2: Development of Scenarios

The Study Team will develop several scenarios to gain a broad understanding on the impact of a range of scenarios, such as the implementation of urban WC/WDM measures at different levels of effectiveness (50% and 100%).

Task 13.3: First Draft Strategy Report

The findings of the initial tasks undertaken in Phase 2 will be documented in the First draft Strategy Report, which will be submitted for review by March 2010.

The results of Task 13 will be documented in the Interim Strategy Report and further refined in Phase 3 of the Strategy.

2.3 PHASE 3: DEVELOPMENT OF THE RECONCILIATION STRATEGY

The following tasks undertaken in Phase 2 will be further refined in Phase 3:

- Task 3: Current and future water requirements
- Task 4: Urban WC/WDM
- Task 5: Opportunities for water re-use
- Task 6: Irrigation demand and WC/WDM
- Task 7: Hydrological modelling and future planning
- Task 9: Reserve requirements, scenarios and system yield
- Task 10: Groundwater

- Task 11: Review schemes and update cost estimates
- Task 12: Review and assess social and environmental impacts

2.3.1 Task 7: Hydrological Modelling for Future Planning

Task 7.1: Draft Terms of Reference for Daily Modelling to Assess Impacts Land Use and Climate Change

A Draft Terms of Reference for daily modelling to assess the impacts of land-use and climate change (and also for configuring and utilising the daily modelling for other catchments) will be prepared. It is envisaged that the ToR will be based on the need to determine daily flow records. From a quality perspective it is anticipated that the ToR will address the following issues:

- The severity of the salinity concerns in the catchment.
- The link between irrigation return flows and periods of high salinity
- The alignment of streamflow salinity with the requirements of downstream user e.g. industry of irrigators
- The contribution of dryland salinity to the total salinity load
- The probability of large scale land-use changes within the catchment

The climate change component of the ToR would consider forecasting models to determine possible increases in average daily temperatures and related evaporation.

2.3.2 Task 8: Water Quality

The quality of the water that is supplied to the Bloemfontein Area for domestic use is generally very good and ideally suited for human consumption. The sources for this water are currently also not under threat from development in the respective catchments, and the quality should not change significantly over the period (time horizon) that will be considered for this study.

However, previous studies have shown that the discharge of treated effluent does have a negative effect on water quality in the rivers and streams downstream of the major urban areas and larger towns. This can be expected to increase over time as the water use, and therefore the generation of waste water, increases. This aspect is expected to overshadow any effects that increased water abstraction may bring about.

Task 8.1: Qualitative Assessment of Likely Impacts of Potential Schemes on River Salinity

A study for the Modder/Riet River catchment was completed recently, during which the water quality in this area was analysed in some detail. The consultant has the datasets that were used for this exercise at his disposal, and can update them very easily. The same guidelines that were developed as part of that study will be used to assess the potential changes in water quality as a result of any potential schemes. Some additional work will be required on the Caledon and the Orange River.

The assessment will be based on a simple mass balance analysis, using flow and concentrations. The focus will be on salinity, but a qualitative assessment of other variables (mainly nutrients) will also be given.

Task 8.2: Terms of Reference for Future Study on Effects of Salinity

Based on the outcome of Task 8.2, it will be possible to determine whether or not a more detailed analysis of water quality is required. This will be based on determining if any changes in water quality can be expected, and if yes, whether or not these changes are significant (if a change in concentration does not affect the fitness for use, then that change is not significant). Should it become apparent that significant changes are likely to occur, a terms of reference for a more detailed follow-up study will be prepared.

Task 8.3: Qualitative Assessment of Potential Impacts of Nutrients and Urban Pollution

The catchment downstream of the Bloemfontein area, as well as downstream of some of the towns elsewhere in the study area, is already impacted by increased nutrient levels. At present the effect of this

has been small, due to the erratic run-off and also the fact that most of this water is intercepted and used for irrigation close to the point of discharge. However, this could change significantly when the Reserve for the aquatic ecosystem is implemented. Some of the problems can be mitigated successfully by upgrading the waste water treatment works, and an assessment in this regard will be made before a ToR for a possible follow-up study are developed.

The outcome of Task 8 will be documented in the Reconciliation Strategy Report.

2.3.3 Task 14: Formulation of Scenarios

The Study Team in consultation with the Study Management Team and possibly selected members of the Steering Committee will propose planning scenarios for the implementation of future reconciliation options. Examples of possible future planning scenarios which could be considered are:

- A planning scenario using a high and low water requirement for the Greater Bloemfontein Area;
- Planning scenarios assuming various levels of effectiveness of WC/WDM (benefits of implementing WC/WDM);
- Planning Scenarios assuming alternative Reserve classifications;
- Planning Scenarios assuming alternative water demand options (and the timing thereof) for the following potential water uses: transfers to the Upper Vaal WMA, transfers to the Fish to Tsitsikamma WMAs, development of irrigated agriculture in Namibia and in Lesotho;
- A planning scenario regarding the development of the 12 000 ha for resource poor farmers; and
- A planning scenario assuming a climate change scenario.

The Reconciliation Planning Support Tool (RPST) was developed to facilitate the selection process by comparing potential interventions with one another for a selected future water requirement scenario. Information contained in the RPST will include inter alia various water requirement scenarios, the current system yield, intervention programmes, intervention yields, financial parameters, and the MLM's WC/WDM Strategy implementation programme.

The RPST will be used to undertake the scenario planning process. The objective of the Scenario Planning Process is to identify, evaluate, and assess alternative groupings and phasing of interventions so as to determine the most appropriate combination of interventions that should be implemented to reconcile water supply and requirement in the Greater Bloemfontein Area, up to 2030. The objective is not to select one "favourable scenario" but to identify which interventions should be studied to allow consideration of a range of possible scenarios. This will allow the DWA, Bloem Water, Mangaung Municipality, and other stakeholders, the maximum amount of flexibility in making informed decisions on which interventions to implement. The outcome of the process will be a list of interventions that should be studied to pre-feasibility/feasibility level by specific dates, including timelines and the responsible organisations.

In addition to the planning scenarios, actions and possible future studies will be identified for all the substantive and relevant issues and concerns which were raised by stakeholders. These actions and studies required will also be presented to the Final Screening Workshop for discussion and consideration.

Task 14.1: Undertake Scenario Planning Workshop

It is anticipated that the stakeholders who attended the first Screening Workshop will attend the final Screening Workshop as well.

Prior to the final screening workshop a draft copy of the Report summarising the tasks undertaken as well as the various interventions (WC/WDM, surface water schemes, groundwater schemes and effluent re-use schemes) will be distributed to the stakeholders involved in the Final Screening Workshop. The above mentioned Report will also include future planning scenarios for the reconciliation of supply and requirement and for each of these scenarios will recommend implementation sequences for interventions.

The aim of the workshop will be select the most favourable future reconciliation options and also to prioritise future investigations. This will reduce uncertainties in planning and will enable definitive medium to long term reconciliation planning to be undertaken.

Provision has been made for a Dry Run/Planning Meeting prior to the workshop in Pretoria or Bloemfontein (whichever is most convenient for the client). It is however anticipated that the workshop will take place in Bloemfontein. Provision has been made for 30 people to attend the workshop.

Task 14.2: Final Strategy Report
The Reconciliation Strategy Report will be compiled based on the updated information provided in Phase 3, which includes:

- Updated information on interventions and bulk infrastructure costs will be updated where required;
- Updated future water requirements; and
- The agreed upon scenarios which provide the most realistic estimate of future water requirements and how these can be met.

2.3.4 Task 15: Public Participation

It must be noted that it has been assumed that the public participation process will be undertaken in English and Afrikaans. No provision for translation of public documentation into other official languages has been provided for.

Task 15.1: Establish a Database of Interested and Affected Parties
The study team will compile the public database for the study from existing databases and input from DWA staff and key stakeholders. Newspaper adverts will be placed in regional newspapers as well as local area newspapers which serve the areas directly affected by the schemes. Letters of notification will be sent to relevant authorities including Agriculture, Environment, Land Affairs, Tourism, Regional Development, Eskom and potentially affected municipalities. The study team will be responsible for the maintenance, verification and updating of the database for the duration of the Study. The Database will be given to the DWA Regional Office so that it can be used for the establishment of the CMA Reference Group.

Task 15.2: Present Finding to CMA Reference Group
The findings of each of the workshops (preliminary screening workshop and final screening workshop) will be presented to the CMA reference group. This proposal is based on the assumption that special meetings with the CMA Reference groups will have to be arranged for this purpose and provision has been made for 30 people to attend such meetings with the necessary refreshments being provided.

Task 15.3: Facilitate one Public Meeting
One public meeting will be held after the completion of the Final Screening Workshop (Task 14). The public meeting will be an information session aimed at providing information on the findings to the general public, and is not intended for the public to raise issues for consideration. Issues raised by the public will however be captured and documented.

The study team will compile advertisements to advertise the public meeting in the regional newspapers. Organisations and individuals listed on the project database will be invited to attend. The study team will be responsible for logistical and technical arrangements for the public meetings, and will facilitate the meeting. Presentations for the meetings will be prepared in English. Registers of attendance will be kept, minutes of meetings will be prepared and stakeholder feedback will be provided. Should translation of the presentations and minutes to any other official language be required, this will be accommodated, but has not been costed.

Task 15.4: Present Findings of Workshop to Selected Committees or Groups (Focus group Meetings)

Provision has been made for three additional Focus group Meetings to be arranged, attended and recorded at any stage of the project as may be required. The objective and format of these meetings may vary as required.

Task 15.5: Present and Distribute Newsletters

Two public newsletters will be developed and distributed to all stakeholders registered on the database. It is anticipated that the first Newsletter will be sent our after the Preliminary Screening Workshop and the second Newsletter approximately two weeks before the public meeting. The study team will be responsible for drafting the content, ensuring Client review and updating, and arranging for translation into Afrikaans. Copies or of the newsletter will be printed and distributed to stakeholders registered on the database. The final newsletter will present the Strategy to the public and role-players.

2.4 TASK 16: STUDY MANAGEMENT

General Project Management

The success of a project of this nature is dependent on sound technical input and proper project management and financial control. Ninham Shand is ISO 9001 certified and has approved quality management systems in place to run its projects. It is important to note that the study team will give advice and make recommendations but that the Client will make major decisions. Approval for such decisions will be obtained through the Client's nominated representative. In summary, the following tasks will be undertaken under project management:

- Co-ordination of technical aspects and preparation and issuing of progress reports in terms of the client's requirements;
- Budget preparation, monitoring and other administrative matters;
- Management and other intermediate meetings, including making all arrangements and keeping minutes;
- Ensuring review of specialist outputs; and,
- Reviewing of draft reports.
- Team meetings will be held to monitor progress and to provide guidance.

Mr JI Rademeyer of the DWA, Directorate of Water Resource Planning will act as the Client for the proposed study.

Study Management Committee Meetings

A Study Management Committee, chaired by the Study Manager of the Client, will oversee the overall day-to-day management of the Study. Progress meetings of the Study Management Committee will be held at approximately six-weekly intervals, to monitor progress and expenditure against programme and budget. These meetings will further offer opportunity to discuss and clarify issues that may arise and allow for opportunity to issue supplementary brief directives if necessary. In view of the broad scope of this study and its iterative nature of development, it is envisaged that these meetings will play a key role in defining the study requirements. Seventeen meetings have been allowed for. The study team will arrange all of these meetings, distribute all agendas and minutes, and undertake other related administrative tasks. The study team will keep an up-to-date record of all decisions taken in the process of the study.

Study Steering Committee Meetings

A Steering Committee, chaired by the Study Manager of the Client, will provide broad strategic guidance to the management of the Study. Progress meetings of the Steering Committee will be held at approximately six-monthly intervals. The records of decision from the Study Management Committee Meetings will be reviewed, amended and approved at these meetings. Five Steering Committee meetings have been allowed for.

The Study Team will arrange these meetings, distribute agendas and minutes, and undertake other administrative-related tasks. The Study Team will keep up-to-date records of all decisions taken in the process of the Study. The records will identify the issues raised, findings of investigations and decisions taken. The first meeting should take place prior to the first Preliminary Screening Workshop. It is anticipated that these meetings will be attended by representatives from the:

- Chief Directorate: Integrated Water Resource Planning;
- Directorate: National Water Resource Planning (the client);
- Directorate: Water Use Efficiency;
- Directorate: Options Analysis;
- Directorate: Water Resource Planning Systems;
- DWA Free State Regional Office;
- Bloem Water
- Representatives from Water Service Authorities (e.g. Bloemfontein)
- Water user associations
- Selected Non-government organisations; and the
- Study Team.

3. STUDY TEAM

The project team organogram for the study is included under **Appendix A** and shows the staff proposed for the key positions such as the study leadership, task leadership, and reviewer and specialist teams.

Peer Review

The Study team supports the concept of peer review. In order to get the maximum benefit from peer review it is essential that peer review happens not only at the end of the technical evaluation, but regularly throughout the technical evaluation, to be able to guide the study team. Dr Mike Shand, Professor André Görgens, Erik van der Berg, and Retha Stassen will provide initial strategic input and review key reports. They are well suited to this task and have expert knowledge in their fields and a good understanding of the development of Reconciliation Strategies.

Specialists

A number of specialists have been identified. Unlike the peer reviewers/advisors, these specialists will provide key input into the Study on specific issues. The specialists who have been identified are: Professor Gerrit Basson (Sedimentation), Nico Rossouw (Water Quality) and Alan Shelly (Conceptual Dam Design and Costing).

3.1 KEY PERSONNEL

The Organogram of the Study Team is shown in **Appendix A**. Brief descriptions of the key personnel are provided below.

Study Leadership

- **Koos Pretorius** (Aurecon): Study Director
- **Mike Killick** (Aurecon): Study Leader and Task Leader Scenario Planning

Task Leadership

- **Mike Killick** (Aurecon): Task Leader for **Task A**, **Task 1**, **Task 13**, and **Task 16** and Co-Task Leader for **Task 11**
- **Graeme Evers** (Aurecon): Task Leader for **Task 5** and Co-Task Leader for **Task 3** and **Task 11**
- **Terry Baker** (ILISO): Task Leader for **Task 2**, **Task 12**, **Task 14**, and **Task 15**
- **Henry Boning** (Aurecon): Task Leader for **Task 4**
- **Karen Versfeld** (Aurecon): Co-Task Leader for **Task 3**
- **Sarel de Wet** (Aurecon): Task Leader for **Task 6**
- **Verno Jonker** (Aurecon): Task Leader for **Task 7**
- **Dr Martin van Veelen** (ILISO): Task Leader for **Task 8**
- **Dirk Rudolph** (GHT): Task Leader for **Task 10**

Specialists

- **Nico Rossouw** (Aurecon) – **Water Quality Assessment**
- **Gerrit Basson** (Aurecon) – **Sedimentation**
- **Alan Shelly** (Aurecon) – **Dam Layout and Design**

4. STUDY PROGRAMME

The revised Study Programme is given in **Figure 4.1.**

TASK LEADER		PROGRAMME OF WORK	Development of Reconciliation Strategies for Large Bulk Water Supply Systems: Greater Bloemfontein Area — Month 1 (Feb-09) … 30 (Jul-11)
M. Killick	1	**TASK A: INCEPTION REPORT**	
		Task : Hold Inception Meeting	
		Task: Draft Inception Report	
M. Killick	2	**TASK 1: SUMMARY OF PREVIOUS AND CURRENT STUDIES**	
		Task : Summary Report	
T. Baker	3	**TASK 2: PRELIMINARY SCREENING WORKSHOP**	
		Task: Identification of Key Stakeholders	
		Task: Compile Screening Workshop Document	
		Task: Circulate Screening Workshop Document	
		Task: Preliminary Screening Workshop	
		Task: Document Worhshop Proceedings	
G. Evers / K. Versfeld	4	**TASK 3 : CURRENT AND FUTURE WATER REQUIREMENTS**	
H. Boning	5	**TASK 4 : URBAN WATER CONSERVATION AND DEMAND MANAGEMENT**	
G. Evers	6	**TASK 5 : OPPORTUNITIES FOR WATER RE-USE**	
S. de Wet	7	**TASK 6 : IRRIGATION DEMAND AND WC/WDM**	
V. Jonker	8	**TASK 7 : SURFACE WATER HYDROLOGY**	
M. van Veelen	9	**TASK 8 : WATER QUALITY**	
P. Scherman	10	**TASK 9 : RESERVE REQUIREMENT SCENARIOS AND SYSTEM YIELD**	
D. Rudolph	11	**TASK 10 : GROUNDWATER**	
M. Killick / G. Evers	12	**TASK 11 : REVIEW SCHEMES AND UPDATE COST ESTIMATES**	
T. Baker	13	**TASK 12 : REVIEW AND ASSESS SOCIAL AND ENVIRONMENTAL IMPACTS**	
M. Killick	14	**TASK 13 : ASSEMBLY OF INFORMATION AND FORMULATION OF SCENARIOS**	
		Task: Assemble information	
		Task: Determine Planning Scenarios	
		Task: Interim Draft Strategy	
		Task: Update Strategy	
		Task: Refine Strategy	
		Task: Final Strategy	
T. Baker	15	**TASK 14 : FINAL SCREENING WORKSHOP**	
		Task: Undertake Final Screening Workshop	
		Task: Document Final Screening Workshop	
T. Baker	16	**TASK 15 : PUBLIC PARTICIPATION**	
		Task: Establish a database of I&Aps	
		Task: Newspaper advertisement	
		Task: Letters of notification	
		Task: Present Finding to CMA Reference Group (x2)	To be decided at a later date
		Task: Facilitate one Public Meeting	
		Task: Present Findings of Workshop to selected Committees or Groups (x3)	To be decided at a later date
		Task: Present and Distribute Newsletters (x2)	
M. Killick	17	**TASK 16 : STUDY MANAGEMENT**	Date be decided at a later point
		Study Management	
		Steering Committee Meetings	

Deliverable
Proposed meeting date
Drafting of report
Continuous updating of database
Extent of work to be determined by the outcome of the First Draft Preliminary Strategy

Figure 4.1: Revised Study Programme

5. FINANCIAL PROPOSAL

5.1 PROFESSIONAL FEES

A breakdown of the costs associated with each main study task as presented in the original proposal is presented in **Table 5.1**.

Table 5.1: Professional Fees (2008 Rates)

Task	Cost Estimate (Rand)
Task A: Inception Report	R 79,485
Task 1: Summary of Previous and Current Studies	R 280,780
Task 2: Preliminary Screening Workshop	R 146,317
Task 3: Current and Future Water Requirements	R 123,181
Task 4: Urban Water Conservation and Demand Management	R 105,040
Task 5: Opportunities for Water Re-Use	R 128,580
Task 6: Irrigation Demand and WC/WDM	R 239,364
Task 7: Surface Water Hydrology	R 308,862
Task 8: Water Quality	R 100,569
Task 9: Reserve Requirement Scenarios and System Yield	R 125,432
Task 10: Groundwater	R 109,300
Task 11: Review Schemes and Update Cost Estimates	R 225,306
Task 12: Review and Assess Social and Environmental Impacts	R 120,960
Task 13: Assembly of Information and Formulation of Scenarios	R 144,337
Task 14: Final Screening Workshop	R 106,606
Task 15: Public Participation	R 351,659
Task 16: Study Management	R 836,366
Total Excluding VAT	**R 3,532,145**

The total costs associated with Project Management are contained in **Table 5.2**.

Table 5.2: Project Management Fees (Excluding VAT)

Project Management	Professional Fee Expenditure (R)
Study Management	R 296,290
Steering Committee	R 94,556
General Management	R 445,520
Total	**R 836,366**

5.2 DISBURSEMENTS

All external invoices will be recoverable at cost. Travel costs will be recovered at the rates advised by DWA. The estimated disbursements are as listed in **Table 5.3** below**.**

Table 5.3: Disbursements Cost Estimate (Travel Accommodation, Incidentals)

Item	Rate	Unit	Number	Total Cost
Travel	3.0	km	10000	R 30,200
Car Hire (Group A)	700	days	30	R 21,000
Flights (Economy) CPT–Bloem Return	3,500	No of flights	33	R 115,500
Accommodation	600	Nights	30	R 18,000
Translations				R 15,000
Newsletters				R 15,000
Preliminary Workshop Costs				R 21,000
Final Screening Workshop Costs				R 21,000
Public Management, Reference Group Management, Stakeholder Management				R 38,500
Establish and Maintain Stakeholder Database				R 12,000
Adverts and Notification Letters				R 6,500
Other Incidental Costs, Photo's, Maps, Parking Fees, Meals etc.	100	No	90	R 9,000
Total (Excl VAT)				**R 322,700**

5.3 INFRASTRUCTURE COSTS

An amount of R1 000 per month each is estimated for computer costs and for telephone and fax costs for the contract period, as shown in **Table 5.4**.

Table 5.4: Infrastructure Cost Estimate

Item	Details (Eg Unit Cost and Quantity Needed)	Total Cost
Printing & copying	3000 x R 4.66	R 13,980
Tel and fax	R 1000 / mth x 24	R 27,000
Hire of overhead projector	R 500 x 30	R 15,000
Courier service	R 150 x 50	R 7,500
Postage	Lump sum	R 1,500
Total Other Costs (Excl VAT)		**R 64,980**

5.4 ESCALATION

A value of R 531 902 has been allowed for escalation of 10% per annum based on the estimated cash flow.

5.5 SUB CONSULTANTS COSTS

The portion of fees allocated to each of the members in the Association is given in **Table 5.5** below.

Table 5.5: Breakdown of Costs within the Study Team

Company	Professional Fees	% of Total
Ninham Shand (Aurecon)	R 2,676,829	75.8%
ILISO Consulting	R 628,100	17.8%
GHT Consulting Scientists	R 227,216	6.4%
Total	**R 3,532,145**	**100%**

5.6 TOTAL COST

The estimated total cost of the study, excluding escalation, is shown in **Table 5.6**.

Table 5.6: Total Cost Estimate

Item	Cost Estimate (Rand)
Professional Fees	R 3,532,145
Disbursements and Infrastructure	R 387,680
Total excluding Taxes	R 3,919,825
VAT	R 548,775
Total Including VAT	**R 4,468,600**
Escalation	R 531,902
Total Including VAT	**R 5,000,502**

5.7 CASH FLOW SCHEDULE

The cash flow schedule for the study shown in **Table 5.7** is based on the study commencing in March 2009.

Table 5.7: Cash Flow Summary for Each Financial Year

Item	Cost Estimate (Rand)
2008/09 DWA Financial Year (no escalation)	R 284,285
2009/2010 DWA Financial Year (with Escalation)	R 3,037,360
2010/2011 DWA Financial Year (with Escalation)	R 1,678,857
Total Including VAT and Escalation	**R 5,000,502**

5.8 HDI PARTICIPATION

The division of professional fees based on HDI participation is shown in **Table 5.8** below.

Table 5.8: HDI Participation: Professional Fees

Task Description	Value of Work HDI	Value of Work NON HDI
Task A : Inception Report	R 3,980	R 75,505
Task 1: Summary of Previous and Current Studies	R 79,598	R 201,183
Task 2: Preliminary Screening Workshop	R 48,000	R 98,317
Task 3: Current and Future Water Requirements	R 104,874	R 18,307
Task 4: Urban Water Conservation and Demand Management	R -	R 105,040
Task 5: Opportunities for Water Re-Use	R 61,858	R 66,723
Task 6: Irrigation Demand and WC/WDM	R 10,560	R 228,804
Task 7: Surface Water Hydrology	R 264,246	R 44,616
Task 8: Water Quality	R 17,160	R 83,409
Task 9: Reserve Requirement Scenarios and System Yield	R 107,412	R 18,020
Task 10: Groundwater	R -	R 109,300
Task 11: Review Schemes and Update Cost Estimates	R 99,744	R 125,562
Task 12: Review and Assess Social and Environmental Impacts	R 104,000	R 16,960
Task 13: Assembly of Information and Formulation of Scenarios	R 43,332	R 101,005
Task 14: Final Screening Workshop	R 46,180	R 60,426
Task 15: Public Participation	R 174,000	R 177,659
Task 16: Study Management	R 72,800	R 763,566
	R 1,237,744	R 2,294,401

% HDI involvement	**35%**

5.9 HDI PARTICIPATION PER CATEGORY

HDI participation per category of person is shown in **Table 5.9**.

Table 5.9: HDI Participation Rate and Fees Earned per Category

Project Staff Category	Professional Fee Expenditure (R)	% of Total
Black male	R 272,222	7.7%
Black female	R 201,360	5.7%
White female	R 764,162	21.6%
Disabled person		0.0%
Sub-Total	**R 1,237,744**	**35.0%**
White male	R 2,294,401	65.0%
Total	**R 3,532,145**	**100%**

5.10 REVISED PROFESSIONAL FEE ALLOCATION

The original professional fee allocation (as per proposal), expenditure to date (end February 2010) and the anticipated expenditure for the remainder of the Study are shown in **Table 5.10**. Some of the task budgets have been revised based on discussions with DWA and the changes proposed in **Section 1.**5 of this Inception Report.

Table 5.10: Professional Fees (March 2009 Rates)

Task		Cost Estimate (Rand)	Expenditure to End Feb 2010 (Rand)	Anticipated Expenditure to End Mar 2011 (Rand)
Task A:	Inception Report	79,485	38,864	79,485
Task 1:	Summary of Previous and Current Studies	280,780	278,314	280,780
Task 2:	Preliminary Screening Workshop	146,317	149,718	146,317
Task 3:	Current and Future Water Requirements	123,181	110,221	173,181
Task 4:	Urban Water Conservation and Demand Management	105,040	29,910	105,040
Task 5:	Opportunities for Water Re-Use	128,580	114,420	128,580
Task 6:	Irrigation Demand and WC/WDM	239,364	58,800	139,364
Task 7:	Surface Water Hydrology	308,862	1,826	108,862
Task 8:	Water Quality	100,569	-	100,569
Task 9:	Reserve Requirement Scenarios and System Yield	125,432	49,002	125,432
Task 10:	Groundwater	109,300	81,355	109,300
Task 11:	Review Schemes and Update Cost Estimates	225,306	39,878	175,306
Task 12:	Review and Assess Social and Environmental Impacts	120,960	60,000	120,960
Task 13:	Assembly of Information and Formulation of Scenarios	144,337	19,863	444, 337
Task 14:	Final Screening Workshop	106,606	-	106,606
Task 15:	Public Participation	351,659	-	351,659
Task 16:	Study Management	836,366	152,601	836,366
Total Excluding VAT		**3,532,145**	**1,184,772**	**3,532,145**

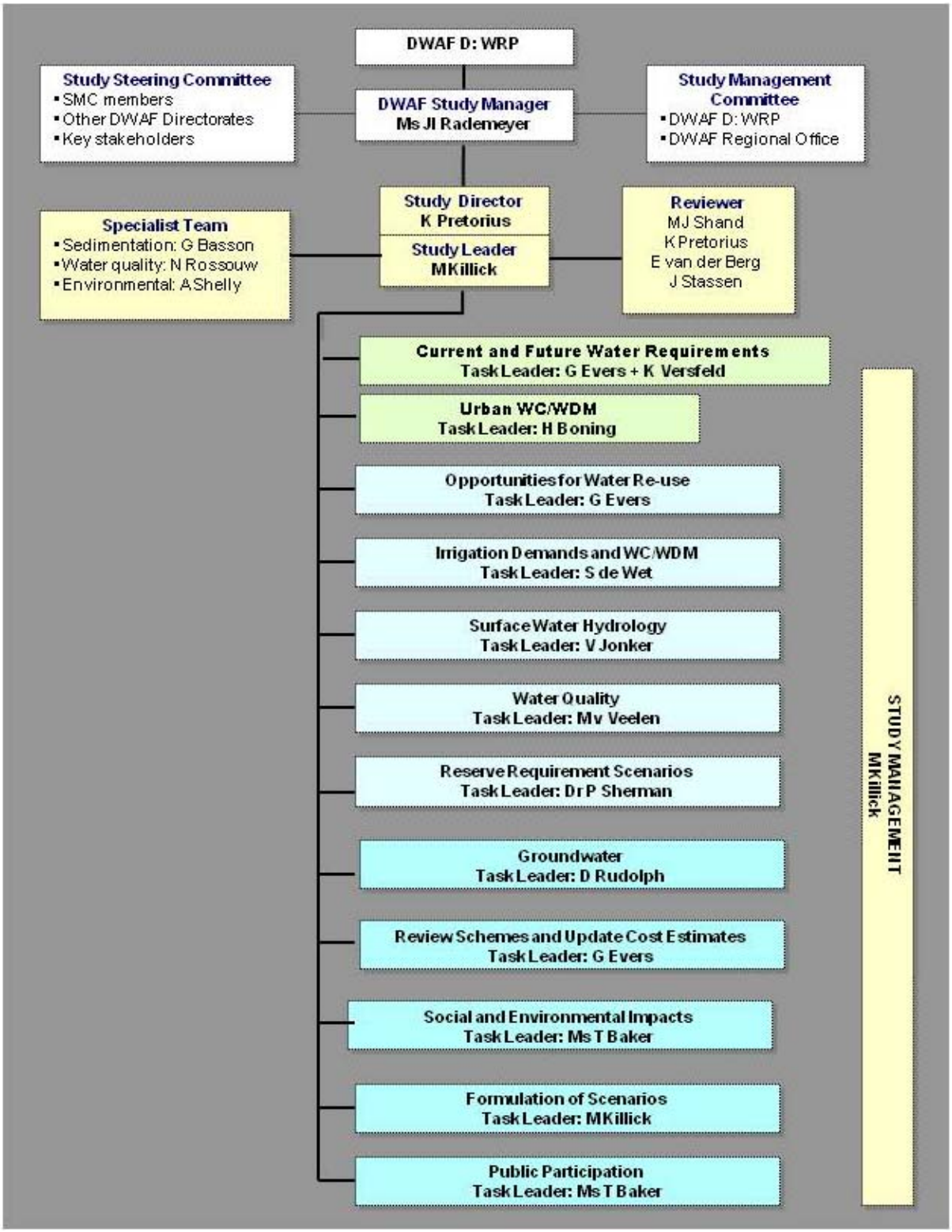
The revised cash flow allocation for the remained of the project is provided in **Table 5.11**.

Table 5.11: Revised Cash Flow Summary for the Remainder of the Project

Revised Cash Flow	Cost Estimate (Rand)
Invoiced to end of February 2010 (including VAT + escalation)	R 1,288,117.29
Expenditure to end of March 2011 (including VAT + escalation)	R 3,712,384.71
Total Including VAT and Escalation	**R 5,000,502.00**

Appendix A

Project Team Organogram


DWAF D: WRP
Study Steering Committee
▪ SMC members
▪ Other DWAF Directorates
▪ Key stakeholders
DWAF Study Manager
Ms JI Rademeyer
Study Management Committee
▪ DWAF D: WRP
▪ DWAF Regional Office
Study Director
K Pretorius
Study Leader
MKillick
Specialist Team
▪ Sedimentation: G Basson
▪ Water quality: N Rossouw
▪ Environmental: A Shelly
Reviewer
MJ Shand
K Pretorius
E van der Berg
J Stassen
Current and Future Water Requirements
Task Leader: G Evers + K Versfeld
Urban WC/WDM
Task Leader: H Boning
Opportunities for Water Re-use
Task Leader: G Evers
Irrigation Demands and WC/WDM
Task Leader: S de Wet
Surface Water Hydrology
Task Leader: V Jonker
Water Quality
Task Leader: Mv Veelen
Reserve Requirement Scenarios
Task Leader: Dr P Sherman
Groundwater
Task Leader: D Rudolph
Review Schemes and Update Cost Estimates
Task Leader: G Evers
Social and Environmental Impacts
Task Leader: Ms T Baker
Formulation of Scenarios
Task Leader: MKillick
Public Participation
Task Leader: Ms T Baker
STUDY MANAGEMENT
MKillick