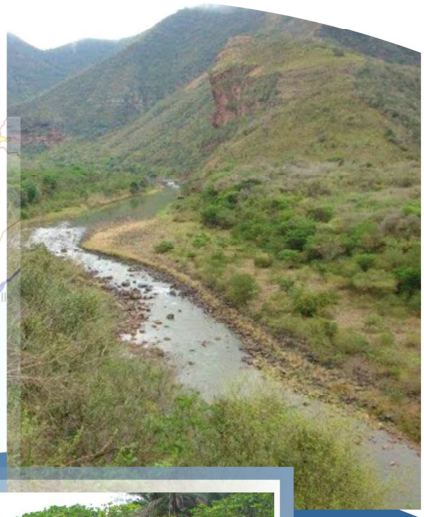
REPORT NUMBER: RDM/WMA11/00/CON/CLA/0116

CLASSIFICATION OF WATER RESOURCES AND DETERMINATION OF THE COMPREHENSIVE RESERVE AND RESOURCE QUALITY OBJECTIVES IN THE MVOTI TO UMZIMKULU WATER MANAGEMENT AREA

PROJECT NUMBER: WP 10679

CLOSING REPORT

JANUARY 2016



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Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

RfA21_2015

CLASSIFICATION OF WATER RESOURCES AND DETERMINATION OF THE COMPREHENSIVE RESERVE AND RESOURCE QUALITY OBJECTIVES IN THE MVOTI TO UMZIMKULU WATER MANAGEMENT AREA

CLOSING REPORT

Report Number: RDM/WMA11/00/CON/CLA/0116

January 2016

REFERENCE
This report is to be referred to in bibliographies as:
Department of Water and Sanitation, South Africa, April 2016. Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: Closing Report. Prepared by: Rivers for Africa eFlows Consulting (Pty) Ltd. DWS Report: RDM/WMA11/00/CON/CLA/0116.

DOCUMENT INDEX

Index Number	DWS Report Number	Report Title
1	Report Number: RDM/WMA11/00/CON/CLA/0112	Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: **Inception Report**
2	Report Number: RDM/WMA11/00/CON/CLA/0113	Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: **Status Quo assessment, IUA delineation and Biophysical Node identification**
3	Report Number: RDM/WMA11/00/CON/CLA/0213	Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: **River Resource Units and EWR sites**
4	Report Number: RDM/WMA11/00/CON/CLA/0313	Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: **Desktop Estuary EcoClassification and EWR**
5	**Rivers EWR report volumes**	
5.1	Report Number: RDM/WMA11/00/CON/CLA/0114	Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: **Volume 1: EWR estimates of the River Desktop Biophysical Nodes**
5.2	Report Number: RDM/WMA11/00/CON/CLA/0214	Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: **Volume 2: EcoClassification and EWR assessment on the Mtamvuna, Lovu, uMngeni, Karkloof and uMnsunduze Rivers**
5.3	Report Number: RDM/WMA11/00/CON/CLA/0314	Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: **Volume 3: EcoClassification and EWR assessment on the uMkhomazi, uMngeni and Mvoti Rivers**
6	Report Number: RDM/WMA11/00/CON/CLA/0212	Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: **BHNR**
7	Report Number: RDM/WMA11/00/CON/CLA/0414	Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: **Water Resource Analysis Report**
8	**Operational Scenario and Management Class report volumes**	
8.1	Report Number: RDM/WMA11/00/CON/CLA/0514	Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: **Volume 1: Supporting Information on the Determination of Water Resource Classes – River Ecological Consequences of Operational Scenarios**
8.2	Report Number: RDM/WMA11/00/CON/CLA/0614	Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: **Volume 2a: Supporting Information on the Determination of Water Resource Classes – Mvoti (U4) Estuary EWR and Ecological Consequences of Operational Scenarios**

Index Number	DWS Report Number	Report Title
	Report Number: RDM/WMA11/00/CON/CLA/0614	Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: **Volume 2b: Supporting Information on the Determination of Water Resource Classes – uMkhomazi (U1) Estuary EWR and Ecological Consequences of Operational Scenarios**
	Report Number: RDM/WMA11/00/CON/CLA/0614	Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: **Volume 2c: Supporting Information on the Determination of Water Resource Classes –Mhlali (U30E) Estuary EWR and Ecological Consequences of Operational Scenarios**
	Report Number: RDM/WMA11/00/CON/CLA/0115	Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: **Volume 2d: Supporting Information on the Determination of Water Resource Classes –Ecological Consequences of Estuaries in T4, U2, U3, U5, U6, U7 and U8 of Operational Scenarios**
8.3	Report Number: RDM/WMA11/00/CON/CLA/0714	Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: **Volume 3 Supporting Information on the Determination of Water Resource Classes – Estuary specialist appendices (electronic information only)**
8.4	Report Number: RDM/WMA11/00/CON/CLA/0814	Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: **Volume 4: Supporting Information on the Determination of Water Resource Classes - Economic Consequences of Operational Scenarios**
8.5	Report Number: RDM/WMA11/00/CON/CLA/0914	Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: **Volume 5: Supporting Information on the Determination of Water Resource Classes - Ecosystem Services Consequences of Operational Scenarios**
8.6	Report Number: RDM/WMA11/00/CON/CLA/1014	Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: **Volume 6: Supporting Information on the Determination of Water Resource Classes – User Water Quality Consequences of Operational Scenarios**
8.7	Report Number: RDM/WMA11/00/CON/CLA/1114	Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: **Volume 7a: Recommended Water Resource Classes for the uMkhomazi (U1) and Mvoti (U4) River Systems**
	Report Number: RDM/WMA11/00/CON/CLA/0215	Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: **Volume 7b: Recommended Water Resource Classes for the T4, T5, U2, U3, U5, U6, U7 and U8 secondary catchments**
9	**Resource Quality Objectives report volumes**	
9.1	Report Number: RDM/WMA11/00/CON/CLA/0315	Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: **Volume 1: River RQOs**

Index Number	DWS Report Number	Report Title
9.2	Report Number: RDM/WMA11/00/CON/CLA/0415	Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: **Volume 2: Wetland RQOs**
9.3	Report Number: RDM/WMA11/00/CON/CLA/0515	Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: **Volume 3: Groundwater RQOs**
9.4	Report Number: RDM/WMA11/00/CON/CLA/0615	Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: **Volume 4: Estuary RQOs**
10	Report Number: RDM/WMA11/00/CON/CLA/0715	Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: **Implementation Report**
11	Report Number: RDM/WMA11/00/CON/CLA/0815	Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: **Main Report**
12	**Report Number: RDM/WMA11/00/CON/CLA/0116**	**Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: Closing Report**

DEPARTMENT OF WATER AND SANITATION

CHIEF DIRECTORATE: WATER ECOSYSTEMS

CLASSIFICATION OF WATER RESOURCES AND DETERMINATION OF THE COMPREHENSIVE RESERVE AND RESOURCE QUALITY OBJECTIVES IN THE MVOTI TO UMZIMKULU WATER MANAGEMENT AREA

CLOSING REPORT

Approved for RFA by:

……	***……***
Delana Louw	Date
Project Manager	

DEPARTMENT OF WATER AND SANITATION (DWS)
Approved for DWS by:

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REPORT SCHEDULE

Version	Date
First draft	March 2016
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EXECUTIVE SUMMARY

PURPOSE OF THE STUDY

The Chief Directorate: Water Ecosystems (CD: WE) of the Department of Water and Sanitation (DWS) commissioned a study during 2012 for the provision of professional services to undertake the Comprehensive Reserve, classify all significant water resources and determine the Resource Quality Objectives (RQOs) in the Mvoti to Umzimkulu Water Management Area (WMA) (now known as the Pongola to Mzimkulu WMA). Rivers for Africa eFlows Consulting was appointed as the Professional Service Provider (PSP) to undertake this study over a 36 month period from July 2012. This period was extended to June 2016.

PURPOSE OF THIS REPORT

This report forms the final deliverable of the study and serves as a feedback on final deliverables, milestones, stakeholder participation, training, challenges and lessons learnt through the undertaking of the Mvoti to Umzimkulu Classification study. Recommendations are made which can be considered in the review of the Water Resources Classification System (WRCS) Guidelines.

STUDY APROACH WITHIN THE CONTEXT OF THE WRCS

According to the Terms of Reference (TOR) the main aim of this study was to:

- Determine the comprehensive Reserve (and other lower levels of the Reserve where necessary) in the study area, using acceptable methods and compiling Reserve templates that address the environmental flows and ecosystem health of significant water resources.
- Co-ordinate the implementation of the WRCS in order to classify all significant water resources in the study area; and
- Determine RQOs using the DWS procedures.

To ensure integration of the above-mentioned processes, Reserve determination documentation for Rivers (DWAF, 1999b; Kleynhans and Louw, 2007; DWAF, 2008a) and Estuaries (DWAF, 2008b) as well as the seven step procedure for determining the water resource class (DWAF, 2007a) and for RQO and the associated guideline documentation (DWA, 2011b) were consulted by key specialists in the study team. Based on this information an integrated project plan and approach for this study was formulated. Due to the significant overlap within these three processes, the project plan focussed on designing an integrated process and steps. Furthermore, the lessons learnt during pilot studies on the WRCS (the Vaal River) (DWA, 2012a) were incorporated into the design of this integrated process.

The integrated process is provided in Figure 1.1 and forms the basis of the scope of this study. The scope of the study was therefore designed around the INTEGRATED STEPS and not the individual process steps

Integrated study steps

Step	Description
1	Delineate the units of analysis and Resource Units (RUs), and describe the status quo of the water resource(s).
2	Initiate stakeholder process and catchment visioning.
3	Quantify the Ecological Water Requirements (EWR) and changes in non-water quality ecosystem goods, services and attributes (EGSA).
4	Identify and evaluate scenarios within the Integrated Water Resource Management process.
5	Evaluate the scenarios with stakeholders and determine Water Resource Classes.
6	Develop draft RQOs and numerical limits.
7	Gazette and implement the class configuration and RQOs.

MILESTONES: DELIVERABLES AND REPORTS

The study was structured and broken down into various tasks and sub-tasks listed in Table 2.1, Section 2.1 with associated deliverables and reports which were the milestones of the study project listed in Table 2.2, Section 2.1. Twenty six formal study reports were compiled as part of the study. The purpose of each report and a description of the key results included in each report are provided in Section 2.2.

FINANCIAL SUMMARY

The budget for this study including the Variation Order (VO) for time, disbursements, escalation and VAT was R12 795 467 (twelve million seven hundred and ninety five thousand, four hundred and sixty seven rand only).

An extension to the end June 2016 was requested to accommodate the supplementary stakeholder engagement in the form of enhanced technical working sessions, additional PSC and expanded alternative scenario evacuation (outlined below). It was requested that the contract amount be increased by R1 178 124 VAT included (a total of 10.1% of the initial contract amount).

Additional budget and time on the study was needed to address the following additional work that was not part of the original approved Project Plan:

- Undertake enhanced stakeholder engagement on detail technical aspects that were requested by stakeholders at a Project Steering Committee (PSC) meeting. This would be in the form of enhanced Technical Task Team work sessions to capacitate key stakeholders.
- Address information gaps that only became known when stakeholders put forward their long term development plans as scenarios for evaluation in the study.
- Provision for additional professional services by the study team to assist DWS to address comments during the 60 day gazetting period (it was anticipated that based on the current high intensity interest from stakeholders that there could be numerous comments requiring responses as well as possible further engagement events).

TRAINING AND CAPACITY BUIDING

The Mvoti to Umzimkulu Classification study was identified by both DWS and the PSP as a unique opportunity to train DWS personnel on Reserve and Classification procedures, and further build on previous training exposure. The primary aim of this component was to build the capacity of water resource managers attached to the study, both those in the regional offices (DWS regional) and the head office of DWS in Pretoria. Task D8 was identified as the Mentorship and Capacity Building task during the Inception Phase of the study. Input from DWS, and experience from

previous Classification studies, were critical in designing the programme. Capacity building and training was conducted at the following levels:

- Mentorship programme
- Specialist workshops
- Capacity building programme

STAKEHOLDER PARTICIPATION

The stakeholder engagement process followed has provided sufficient opportunities for stakeholders to become involved in the process. Stakeholders received information through a variety of avenues in different languages. The process has taken place over a long enough period to provide sufficient time for stakeholders to contribute. The stakeholder process was transparent; stakeholders had access to all technical documents and project team members to clarify matters of concern.

Based on the inputs received during the stakeholder engagement process, the following conclusions may be drawn:

- Due to the need of improved water resources management in the study area, the project attracted massive stakeholder interest. This was evident through good representation of sectors and organisations at all PSC meetings as well as at the broader stakeholder meetings.
- A comprehensive database has been compiled during the study and Public Participation consists of key representatives from all sectors and organisations within the study area. This database will be handed over to DWS to facilitate continuity with stakeholder engagement activities in the study area.
- There were however concerns about the lack of representation from the Department of Mineral Resources (DMR) throughout the process. Although they were invited to meetings, they did not attend any of the scheduled meetings. Stakeholders raised a number of illegal mining issues which require a regulatory effort and action from DMR's side.
- Interested and Affected Parties (I&APs) were afforded sufficient opportunities to engage meaningfully during the study. Stakeholders also utilised the communication channels and opportunities which were provided to them.
- Issues and concerns identified were recorded and considered, where possible, during the study. These issues are captured in the IRR, which will be a living document until the gazetting process has been concluded.
- Meetings held were informative and project updates which were provided through BID's ensured that stakeholders were kept updated of the project progress.

Overall, the levels of stakeholder participation throughout the study have been encouraging and stakeholders are thanked for their inputs in the process. It is, therefore, recommended that communication with stakeholders is maintained to achieve the desired improvement in managing water resources in the Mvoti to Umzimkulu catchments.

ISSUES, CHALLENGES AND LESSONS LEARNT

Section 6 includes comments and broad recommendations to be considered in the review of the Water Resource Classification System (WRCS) Guidelines. These recommendations originate from the practical experiences gained by applying the guidelines during the execution of the Mvoti to Umzimkulu Classification Study and encapsulate the lessons learnt during the classification process.

BENEFIT TO CLIENT

- The objectives of the study have been achieved within the stipulated budget and timeframe.
- The WRCS have been successfully implemented according to the gazetted steps.
- A robust stakeholder engagement process was followed throughout the study with broad based and diverging contributions from various sectors interested in the management of the water resources.
- Buy-in with sector and stakeholder groups has generally been achieved.
- Department personnel have derived adequate benefit from the capacity building programme and activities undertaken and are in a position to maximise their involvement in future Classification studies.
- Linkages and alignment with other studies and initiatives have been achieved (Reconciliation, Groundwater Reserve study, etc.).

RECOMMENDATIONS

The following recommendations are made:

- It is highly recommended to have reconciliation studies run parallel with classification studies.
- Validated water use data is a prerequisite for high confidence classification outcomes.
- Long term monitoring is critical. Without the necessary investment before the study, high confidence results cannot be provided regardless of how much time and effort goes into field investigations.
- Operationalisation and monitoring of the Class and RQOs are required in order to implement proposed recommendations and exercise compliance control.
- It is recommended that the members of the PSC be valued as stakeholders of the department who have already been capacitated to a certain degree. They have already received and have participated in the process and should be kept informed of the next steps.
- Where legislative mandate conflicts arise it is recommended that the relevant departments be identified upfront and additional high level authority meeting be held to ensure conflict resolution before detail public participation, e.g. coastal catchments with a joint mandate on waste disposal shared by DEA and DWS or the TEC of priority systems for conservation planning.
- It is recommended that Ms Thwala be provided with additional opportunities to work with Classification projects and PSP teams, as to further build on the experience gained during this Classification study.
- Specialist scientists within DWS need to play a much stronger role in advising and guiding PSPs, and therefore steering components of studies so that DWS goals and objectives are met. This is particularly important for the water quality task. This kind of assistance from DWS would also be helpful in terms of meeting stakeholder goals within time and budget constraints. Due to the emphasis on stakeholder participation, PSPs can get into a position where they are “over” producing in an effort to satisfy stakeholders. As it is impossible to satisfy everyone all of the time, technical guidance is needed from DWS to ensure that DWS goals are kept in perspective.
- The integration of water quality down a river and into the estuary (in catchments containing both), is not clearly considered in the Classification guideline documents.
- Water quality models for evaluating consequences of scenarios are still not available for variables other than Total Dissolved Salts. This means that water quality consequences cannot be evaluated at the same level of confidence as other components.
- Methods determining the Reserve for wetlands need to be improved and expanded on and it should consider how scenario consequences will be evaluated. At present major water

development scenarios that impact wetlands which are not river related have not occurred, but this may well happen in future studies.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS AND ABBREVIATIONS

BHNR	Basic Human Needs Reserve
BID	Background Information Document
CBA	Cost-Benefit Analysis
CD: WE	Chief Directorate: Water Ecosystems
CERM	Comprehensive Ecological Reserve Methodology
DAFF	Department of Agriculture Forestry and Fisheries
DEA	Department of Environmental Affairs
DMR	Department of Mineral Resources
DWA	Department Water Affairs (Name change from DWAF applicable after April 2009)
DWAF	Department Water Affairs and Forestry
DWS	Department Water and Sanitation (Name change from DWA applicable after May 2014)
EC	Ecological Category
EcoSpecs	Ecological Specifications
EGSA	Ecosystem Goods, Services and Attributes
EIS	Recommended Ecological Category
EWR	Ecological Water Requirement
GIS	Geographic Information System
GRDM	Groundwater Resource Directed Measures
IERM	Intermediate Ecological Reserve Methodology
I&APs	Interested and Affected Parties
IRR	Issues and Response Register
IUA	Integrated Unit of Analysis
MRU	Management Resource Units
NFEPA	National Freshwater Ecosystem Priority Areas
NRU	Natural Resource Units
NWA	National Water Act
NWRC	National Water Resource Classification
NWRS	National Water Resource Strategy
PES	Present Ecological State
PSC	Project Steering Committee
PSP	Professional Service Provider
RDM	Resource Directed Measures
RDRM	Revised Desktop Reserve Model
REC	Recommended Ecological Category
RERM	Rapid Ecological Reserve Methodology
RQO	Resource Quality Objective
RU	Resource Unit
SANBI	South African National Biodiversity Institute
SCI	Socio-Cultural Importance
SQ	Sub Quaternary reach
SPATSIM	Spatial and Time Series Information Modelling
TEACHA	Tool for Ecological Aquatic Chemical Habitat Assessment
TEC	Target Ecological Category
TOR	Terms of Reference
TPC	Thresholds of Potential Concern
TTG	Technical Task Group
TWG	Technical Working Group
VO	Variation Order

WARMS	Water Use Authorisation and Registration Management System
WMA	Water Management Area
WQ	Water quality
WRCS	Water Resources Classification System
WRPM	Water Resource Planning Model
WRYM	Water Resource Yield Model

1 INTRODUCTION

1.1 OVERVIEW OF THE STUDY

The Chief Directorate: Water Ecosystems (CD: WE) of the Department of Water and Sanitation (DWS) commissioned a study during 2012 for the provision of professional services to undertake the Comprehensive Reserve, classify all significant water resources and determine the Resource Quality Objectives (RQOs) in the Mvoti to Umzimkulu Water Management Area (WMA) (now known as the Pongola to Mzimkulu WMA). These are required to ensure that the desired condition of the water resources, and conversely, the degree to which they can be utilised is maintained and adequately managed within the economic, social and ecological goals of the water users (DWA, 2011a). Regulations for the establishment of the Water Resource Classification System (WRCS) were published as Regulation 810 in Government Gazette 33541 dated 17 September 2010 and associated guidelines published in 2011 (DWA, 2011b). The National Water Act (NWA) (Act No 36 of 1998) specifies that once the Water Resource Classes has been gazetted, all significant water resources need to be classified.

Rivers for Africa eFlows Consulting was appointed as the Professional Service Provider (PSP) to undertake this study over a 36 month period from July 2012. This period was extended to June 2016. Over this period, a comprehensive Reserve (and other lower levels of the Reserve where necessary) where undertaken in the study area and the Water Resource Classes for all significant water resources have been set in a participatory approach with stakeholders of the Mvoti to Umzimkulu WMA. After setting of the Water Resource Classes for the demarcated Integrated Units of Analysis (IUAs), the RQOs were determined to give effect to the set Water Resource Classes. The process to gazette both the Water Resource Classes and RQOs are underway.

1.1.1 Reserve determination

The TOR indicated a Comprehensive level of Reserve assessment. It was assumed that this implied comprehensive in terms of the coverage of study area and did not refer to the Comprehensive Ecological Reserve Methodology (CERM). Due to the size of the study area different levels of Reserve and Classification was applied in different rivers within WMA 11. Of the 12 EWR sites selected in the study area, five sites were assessed using the Rapid Ecological Reserve Methodology (RERM) (Level III) (DWAF, 1999) and extended to achieve higher confidence by adding a flood component. The remaining seven EWR sites were assessed using the Intermediate Ecological Reserve Methodology (IERM) (DWAF, 1999). Associated with the RERM and IERM is the EcoClassification process at different levels.

EcoClassification refers to the determination and categorisation of the Present Ecological State (PES) (health or integrity) of various biophysical attributes of rivers compared to the natural (or close to natural) reference condition. The purpose of EcoClassification is to gain insight into the causes and sources of the deviation of the PES of biophysical attributes from the reference condition. This provides the information needed to derive desirable and attainable future ecological objectives for the river. The EcoClassification process also supports a scenario-based approach where a range of ecological endpoints has to be considered.

The Ecological Importance and Sensitivity (EIS) of the EWR sites were also determined using a model which estimates and classifies the EIS of the streams in a catchment by considering a number of components surmised to be indicative of these characteristics.

The Recommended Ecological Category (REC) is a recommendation from an ecological viewpoint which is considered within the decision-making process in the National Water Resource Classification System (NWRCS). This recommendation is based on either maintenance of the PES or an improvement there-of. Improvements are only considered if the EIS is HIGH or VERY HIGH. The guidelines to derive the REC based on the level of the PES and the EIS as indicated in Table 1.1. Note that in all cases the restoration potential and practicalities of ecological attainability of recommendations that require improvements are considered.

Table 1.1 Guideline for REC determination

PES	EIS	REC	Comment
A, A/B, B	High or Very High	A, A/B, B	The PES will be maintained as it is already in a good condition that will support the high EIS.
B/C	High or Very High	B	As this condition is close to a B, marginal improvement may be required as a B is sufficient to support the high EIS.
C	High or Very High	B	Attempts should be made to improve by a Category.
C/D	High or Very High	B/C	Attempts should be made to improve by a Category.
D	High or Very High	C	Attempts should be made to improve by a Category.
D/E, E, E/F, F	n/a	D	Any Category below a D should (if restoration potential still exists) be improved to at least a D to ensure a minimum level of sustainability. This is irrespective of the EIS. It is unlikely though that it would be practical to improve an F river to a D without considerable investment, effort and possibly physical rehabilitation of the river.

1.1.2 Water Resources Classification

The WRCS, which is required by the National Water Act (Act 36 of1998), provides a set of guidelines and a seven step procedure for determining different classes of water resources (DWAF, 2007). The classification of water resources in the Mvoti to Umzimkulu WMA has been conducted in terms of the prescribed steps as outlined in the DWS guidelines as best suited to circumstances and conditions that have prevailed. The WRCS prescribes a consultative process to classify water resources (Classification Process) to help facilitate a balance between the protection and use of the nation's water resources.

1.1.3 Resource Quality Objectives

The National Water Resource Strategy (NWRS) stipulates that "Resource Quality Objectives might describe, among other things, the quantity, pattern and timing of instream flow; water quality; the character and condition of riparian habitat, and the characteristics and condition of the aquatic biota". RQOs are numerical and/or descriptive statements about the biological, chemical and physical attributes that characterise a resource for the level of protection defined by its Class.

The determination of RQOs has been conducted in terms of the prescribed seven step procedure as outlined in DWA (2011b). Habitat and Biota RQOs (referred to as Ecological Specifications (EcoSpecs) and Thresholds of Potential Concern (TPCs)) were defined according to the approach outlined in DWA (2010).

1.2 STUDY AREA

The study area encompasses a total catchment area of approximately 27,000 km^2 and is situated within Kwazulu-Natal. A small portion of the Mtamvuna River and the upper and lower segments of the Umzimkulu River straddle the Eastern Cape, close to the Mzimvubu and Keiskamma WMA in the south (DWA, 2011a).

The WMA extends from the town of Zinkwazi, in the north to Port Edward and on the south along the KwaZulu-Natal coastline and envelopes the inland towns of Underberg and Greytown also incorporating the Drakensberg escarpment. The WMA spans across the primary catchment "U" and incorporates the secondary drainage areas of T40 (Mtamvuna River in Port Shepstone) and T52 (Umzimkulu River). Ninety quaternary catchments constitute the water management area and the major rivers draining this WMA include the Mvoti, uMngeni, uMkhomazi, Umzimkulu and Mtamvuna (DWA, 2011a).

Two large river systems, the Umzimkulu and uMkhomazi rise in the Drakensberg. Two medium-sized river systems the uMngeni and Mvoti rise in the Natal Midlands and have been largely modified by human activities, mainly intensive agriculture, forestry and urban settlements. Several smaller river systems (e.g. Mzumbe, uMdloti, uThongathi, Fafa, and Lovu Rivers) are also present within the WMA (DWAF, 2004). Several parallel rivers arise in the escarpment and discharges into the Indian Ocean and the water courses in the study area display a prominent southeasterly flow direction (DWA, 2011a). The WMA is very rugged and very steep slopes characterise the river valleys in the inland areas for all rivers and moderate slopes are found but comprise only 3% of the area of the WMA (DWAF, 2004).

Of the 64 estuaries occurring in the WMA, 30% (19 estuaries) have significant flow related pressures on them, while 78% (50 estuaries) are under significant water quality pressure. More than 90% (58 estuaries) have undergone significant habitat destruction. All of the estuaries could benefit from some remedial actions and more proactive management of the main vectors of change.

Twenty four sub-quaternary catchments have large Freshwater Ecosystem Priority Areas (FEPA) wetlands that are dependent on the mainstem rivers or large tributaries within the Mvoti Water Management Area. Of the large wetlands identified in the WMA, four priority wetland systems have been identified:

- The Ntsikeni wetland, a RAMSAR site within -quaternary catchment T51H-04846.
- The uMngeni sponge, a RAMSAR site within -quaternary catchment U20A-04253.
- The Swamp, a priority KZN Ezemvelo wetland monitoring site located on the Pholela River within sub-quaternary catchment T51E-04478; and
- The Mvoti Vlei, a priority KZN Ezemvelo wetland monitoring site located on the Mvoti River within sub-quaternary catchment U40A- 03869.

Groundwater resources vary since the geology consists of a diverse assemblage of rock types and structural environments, ranging from highly metamorphosed rocks of the natal Metamorphic Province, to sedimentary deposits of The Natal Group and Karoo SuperGroup, and alluvial and coastal deposits of Quaternary age. Faulting has resulted in a complex geological setting in the coastal region. The geology results in a aquifers being of a fractured nature in the Natal group and Dwyka tillites, fractured and weathered in the Karoo Supergroup (excluding the Dwyka tillites), and Natal Metamorphic Province, and primary in the Alluvial and Coastal deposits.

The study area is illustrated in Figure 1.1.

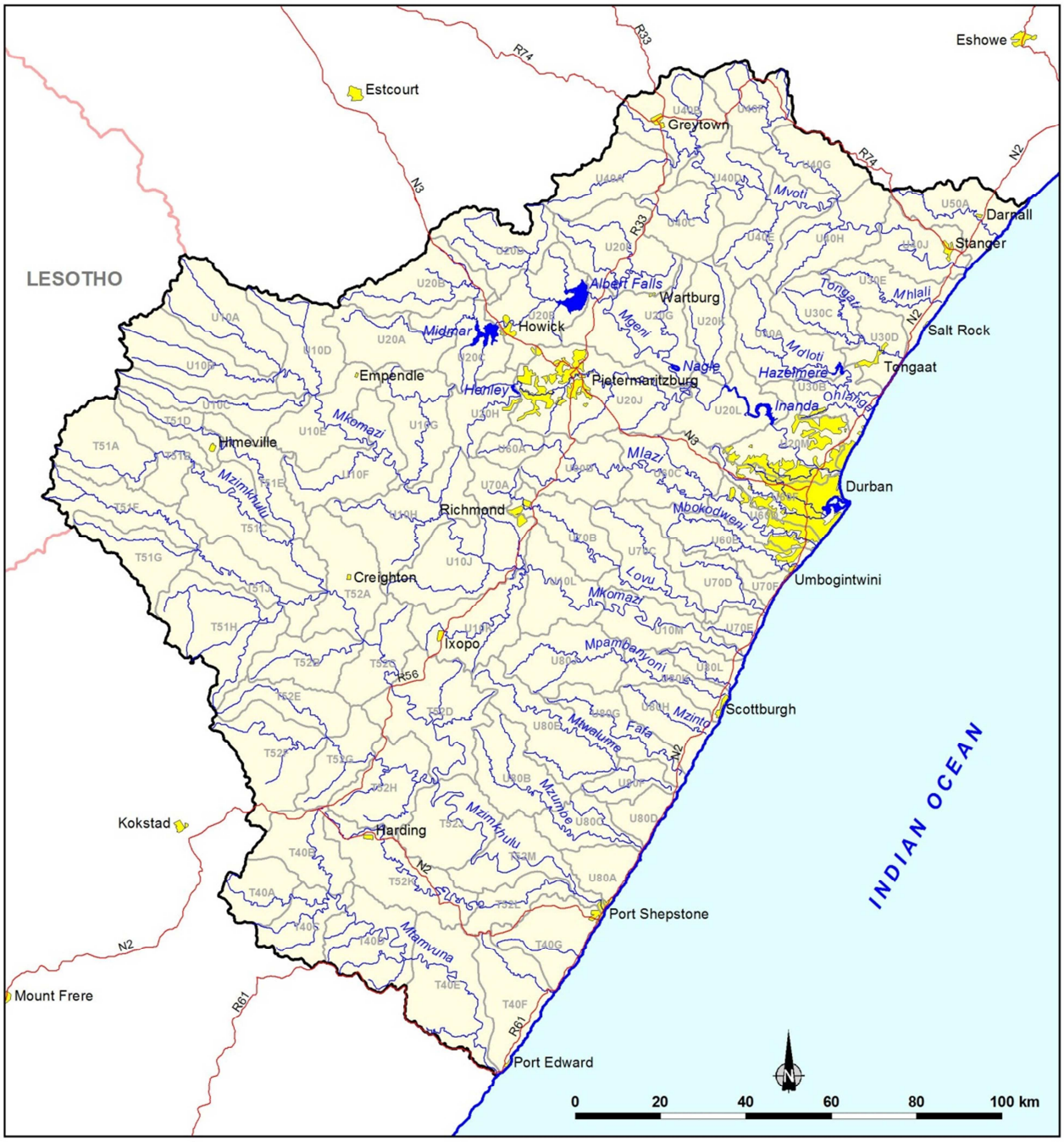

Figure 1.1 The Mvoti to Umzimkulu Water Management Area - WMA 11

1.3 BACKGROUND TO STUDY APPROACH WITHIN THE CONTEXT OF THE WRCS

Significant resources within the study area were classified as Rivers, Estuaries, Wetlands and Groundwater.

According to the Terms of Reference (TOR) the main aim of this study was to:

- Determine the comprehensive Reserve (and other lower levels of the Reserve where necessary) in the study area, using acceptable methods and compiling Reserve templates that address the environmental flows and ecosystem health of significant water resources.
- Co-ordinate the implementation of the WRCS in order to classify all significant water resources in the study area; and
- Determine RQOs using the DWS procedures.

To ensure integration of the above-mentioned processes, Reserve determination documentation for Rivers (DWAF, 1999b; Kleynhans and Louw, 2007; DWAF, 2008a) and Estuaries (DWAF, 2008b) as well as the seven step procedure for determining the water resource class (DWAF, 2007a) and for RQO and the associated guideline documentation (DWA, 2011b) were consulted by key specialists in the study team. Based on this information an integrated project plan and approach for this study was formulated. Due to the significant overlap within these three processes, the project plan focussed on designing an integrated process and steps. Furthermore, the lessons learnt during pilot studies on the WRCS (the Vaal River) (DWA, 2012a) were incorporated into the design of this integrated process.

The integrated process is provided in Figure 1.1 and forms the basis of the scope of this study. The scope of the study was therefore designed around the INTEGRATED STEPS and not the individual process steps (Table 1.2).

Table 1.2 Integrated study steps

Step	Description
1	Delineate the units of analysis and Resource Units, and describe the status quo of the water resource(s).
2	Initiation of stakeholder process and catchment visioning.
3	Quantify the Ecological Water Requirements and changes in non-water quality ecosystem.
4	Identification and evaluation of scenarios within the Integrated Water Resource Management process.
5	Evaluate the scenarios with stakeholders and determine Water Resource Classes.
6	Develop draft RQOs and numerical limits.
7	Gazette and implement the class configuration and RQOs.

1.4 PURPOSE AND OUTLINE OF THIS REPORT

This report forms the final deliverable of the study and serves as a feedback on final deliverables, milestones, stakeholder participation, training, challenges and lessons learnt through the undertaking of the Mvoti to Umzimkulu Classification study. Recommendations are made which can be considered in the review of the WRCS Guidelines.

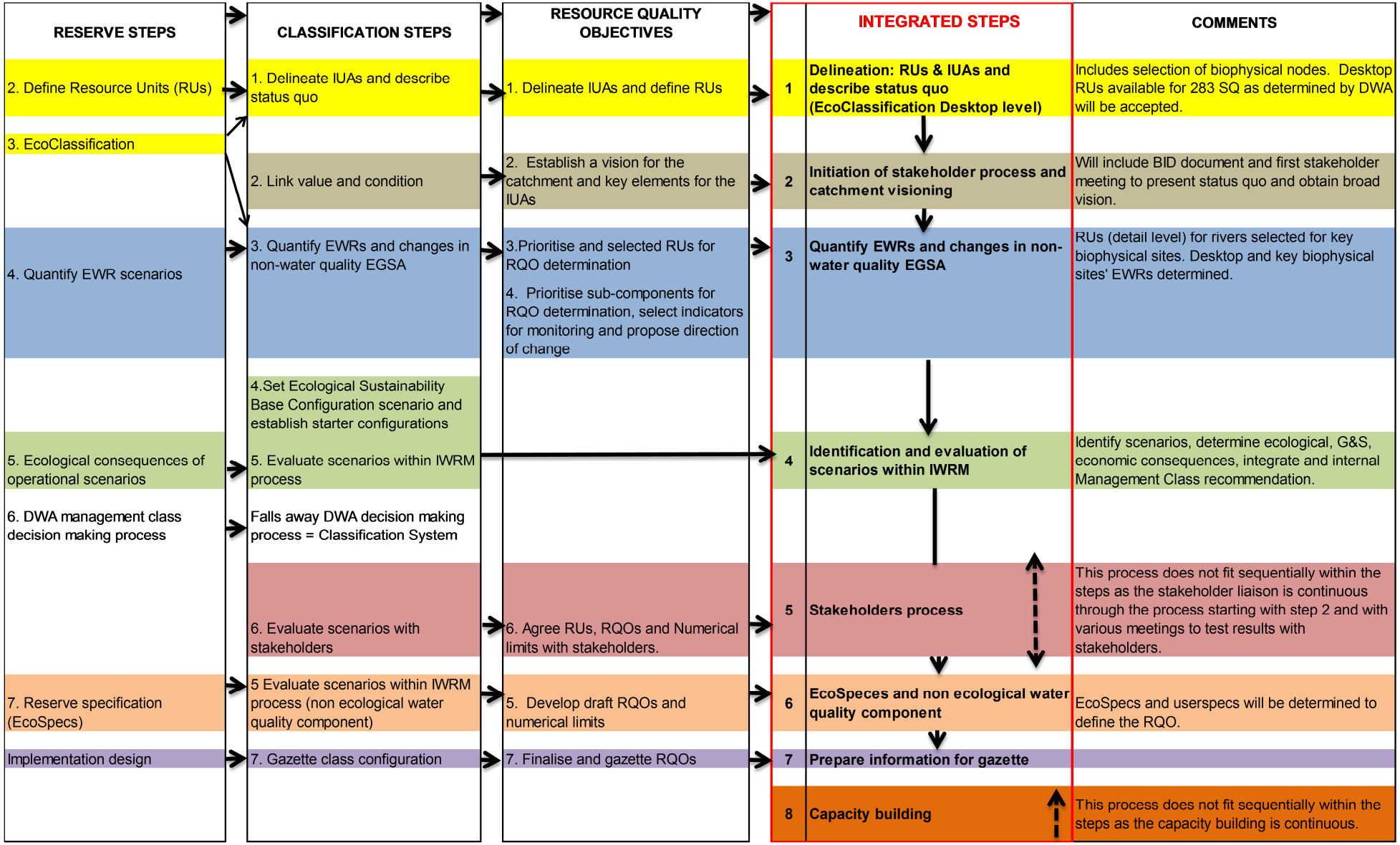

Figure 1.2 Integrated project plan derived from the Reserve and Classification

1.5 REPORT STRUCTURE

The report outline is provided below.

Chapter 1: Introduction
This Chapter.

Chapter 2: Milestones: Deliverables and Reports
This section provides a summary of the Study tasks as well as the deliverables and reports produced during the study.

Chapter 3: Financial Summary
A summary of the financial aspects of the project is provided.

Chapter 4: Stakeholder Participation
A brief description of the stakeholder programme and deliverables are provided.

Chapter 5: Training
The training programme is discussed.

Chapter 6: Issues, Challenges and Lessons Learnt
The chapter provides comments and broad recommendations to be considered in the review of the WRCS Guidelines.

Chapter 7: Benefit to the Client
The benefits of the study are listed in this section of the report.

Chapter 8: Recommendations and Conclusion
Recommendations are provided for future studies.

Chapter 9: References

Chapter 10: Appendix A: Mentorship Programme
The mentorship programme which included one-on-one mentorship opportunities at a number of specialist workshops is provided.

Chapter 11: Appendix B: Mentorship in Economics
The mentorship programme for one-on-one mentorship in Economics is provided.

Chapter 12: Appendix C: Programme of specialist workshops
The specialist workshop programme followed during the Study is provided in this section.

Chapter 13: Appendix D: Workshop Agendas and Attendance Lists
Three training sessions were held during the study. The agendas and attendance registers are provided.

Chapter 14: Appendix E: Report Comments
Comments provided by the Client are listed.

2 MILESTONES: DELIVERABLES AND REPORTS

2.1 DELIVERABLES

The study was structured and broken down into various tasks and sub-tasks (Table 2.1) with associated deliverables and reports which were the milestones of the study project (Table 2.2). All references to deliverables are preceded with a 'D' and reports with an 'R' in the tables below. Q refers to the yearly quarter of three months, i.e. Q1-12 would refer to the first quarter in 2012 which covers April, May and June.

Table 2.1 Tasks and sub-tasks proposed for this study

TASK A: PROJECT MANAGEMENT
A1 Project Management Committee Meetings (Progress meetings)
A2 Technical team management and coordination
A3 Project steering committees
A4 Financial management
TASK B: PROJECT INCEPTION (PLANNING AND PROCESS INTEGRATION)
Task B1: Design Project plan
Task B2: Inception report
Task B3: Mobilisation of study team
TASK C: WATER RESOURCE INFORMATION AND DATA GATHERING
TASK D: DETERMINATION OF THE MANAGEMENT CLASS
TASK D1: DELINEATE IUAs, RUs & DESCRIBE STATUS QUO (ECOCLASSIFICATION - DESKTOP LEVEL)
Task D1.1: Water resources component
Task D1.2: Economic Component
Task D1.3: EGSA component
Task D1.4: Water quality status quo
Task D1.5: Wetlands status quo
Task D1.6: Estuaries
Task D1.7: Rivers
Task D1.8: Integration to define IUAs
Task D1.9: Identification of river biophysical nodes and level of assessment
Task D1.10: Status Quo Report
TASK D2: INITIATION OF THE STAKEHOLDER PROCESS AND CATCHMENT VISIONING
Task D2.1: Stakeholder identification and database management
Task D2.2: Project Announcement: BID, advertisement, personalized letter
Task D2.3: Issues and response report
Task D2.4: Newsletters
TASK D3: STEP 3 - QUANTIFY EWRs AND CHANGES IN NON-WATER QUALITY EGSAs
Task D3.1: RU determination for rivers requirement more detail Reserve assessment
Task D3.2: EWR site selection - Prelim
Task D3.3: EWR survey (Intermediate and Rapid)
Task D3.4: Analysis of data: EcoClassification for rivers
Task D3.5: Hydrology analysis
Task D3.6: Hydraulic high flow survey and modelling
Task D3.7: Intermediate Specialist meeting
Task D3.8: Rapid assessment and Desktop
Task D3.9: Hydrological modelling (including groundwater) at desktop biophysical nodes
Task D3.10: EWRs for desktop biophysical nodes (rivers)
Task D3.11: Consequences of EGSA at sites where the REC is an improvement of the PES

Task D3.12: Rivers EWR report
Task D3.13: Estuarine desktop assessment
Task D3.14: Field surveys for estuaries requiring more detailed approaches
Task D3.15: Analysis of estuarine data
Task D3.16: Basic Human Needs Reserve
TASK D4: IDENTIFICATION AND EVALUATION OF OPERATIONAL SCENARIOS TO IDENTIFY CONSEQUENCES
Task D4.1: Defining operational scenarios
Task D4.2: River Ecological Consequences
Task D4.3: Estuaries: Ecological Consequences - Intermediate estuaries
Task D4.3.1: Specialist EWR Workshop
Task D4.3.2: Estuary EWR Report
Task D4.4: Economic consequences
Task D4.5: EGSA consequences
Task D4.6: Water quality consequences
Task D4.7: Integration of consequences to provide preliminary MCs
TASK D5: PUBLIC MEETINGS
TASK D6: RESOURCE QUALITY OBJECTIVES (RQO)
Task D6.1: EcoSpecs and TPCs: Rivers and Wetlands
Task D6.2: Non-ecological water quality
Task D6.3: Groundwater RQOs
TASK D7: PREPARING INFORMATION FOR GAZETTING (TEMPLATES)
TASK D8: CAPACITY BUILDING
Task D8.1: Training 1: Introduction and integration
Task D8.2: Training 2: Status quo
Task D8.3: Training 3: Management Classes
TASK D9: MAIN INTEGRATED REPORT

Table 2.2 Milestones: Deliverables and reports

Deliverables and Reports		Date	Task	Q
D4	Appointment: Sub-consultants	Sep 12	B3	Q2-12
R 1	Inception report	Sep 12	B2	Q2-12
D1	PMC meeting	Oct 12	A1	Q3-12
D5	Water resource info tables (hydrology and Reserve)	Oct 12	C	Q3-12
D6	Water Resource Use Importance (WRUI)	Dec 12	D1.1	Q3-12
D10	Wetlands identification of PES, EIS and hot spots	Dec 12	D1.5	Q3-12
R 6	BHNR report	Dec 12	D3.16	Q3-12
D6	Water resources zones	Jan 13	D1.1	Q4-13
D7	Economic zones	Jan 13	D1.2	Q4-13
D14	BID (DWS)	Jan 13	D2.2	Q4-12
D8	EGSA component: Delineation, description and SCI	Jan 13	D1.3	Q4-13
D9	Water quality status quo	Jan 13	D1.4	Q4-13
D11	Status quo and ecological zones based on PESEIS information	Feb 13	D1.7	Q4-13
D32	Training session 1: Introduction and integration	Feb 13	D8	Q4-12
D13	Identification of river biophysical nodes for level of assessment.	Feb 13	D1.9	Q4-13
D15b	Advertisement	Feb 13	D2.2	Q4-13
D15c	Personalised Invitation Letter	Feb 13	D2.2	Q4-13
D1	PMC meeting	Feb 13	A1	Q4-13
D12	IUAs selected and mapped	Mar 13	D1.8	Q4-13
D2	PCS meeting	Mar 13	A3	Q4-13
R 2	Status quo assessment, IUA delineation and identification of	Apr 13	D1.10	Q1-13

Deliverables and Reports		Date	Task	Q
	biophysical nodes and level of EWR assessment.			
D33	Training session 2: Status Quo	May 13	D8	Q1-13
R 3	RU and EWR site report	Jun 13	D3.1	Q1-13
R 4	Desktop estuary EcoClassification and EWR report	Jun 13	D3.13	Q1-13
D16	Preliminary EWR sites selected	Jun 13	D3.2	Q1-13
D1	PMC meeting	Jun 13	A1	Q1-13
D25a	Estuary field visit	May-Aug 13	D3.14	Q2-13
D25b	River field visit	Aug 13	D3.3	Q2-13
D21	EWR results for Rapid EWRs	Nov 13	D3.8	Q3-13
D22	Systems model including desktop biophysical nodes	Nov 13	D3.5	Q3-13
D1	PMC meeting	Nov 13	A1	Q3-13
D2	PCS meeting	Nov 13	A3	Q3-13
D26	Wetland RQO: Contribution to EcoSpecs and TPCs	Dec 13	D6.1	Q3-13
D27	Prelim Estuarine templates	Dec 13	D4.3	Q3-13
D24	EGSA related to REC (if improved from PES)	Dec 13	D3.11	Q3-13
D34	Training session 3a: Water quality	Dec 13	D8	Q4-15
R5.2	Volume 2: EcoClassification and EWR assessment at the Rapid III level	Jan 14	D3.12	Q4-14
D17	High flow hydraulic calibration	Feb 14	D3.6	Q4-14
D23	EWR results for all desktop biophysical nodes	Feb 14	D3.10	Q4-14
D1	PMC meeting	Mar 14	A1	Q4-14
R 5.1	Volume 1: EWR estimates of the Desktop Biophysical Nodes	Mar 14	D3.12	Q4-14
D18	Preliminary EcoStatus models	May 14	D3.4	Q1-14
D19	Hydraulic modelling results	May 14	D3.6	Q1-14
D20	EWR results for Intermediate and Comprehensive EWRs	Jun 14	D3.7	Q1-14
R 5.3	Volume 3: EcoClassification and EWR assessment at the Comprehensive and Intermediate levels	Jul 14	D3.12	Q2-14
	Yield modelling results for river		D4.1	Q2-14
D1	PMC meeting	Jul 14	A1	Q2-14
D28	Operational scenarios defined	Aug 14	D4.1	Q2-14
D2	PCS meeting	Aug 14	A3	Q2-14
	River ecological consequences		D4.2	Q2-14
	Yield modelling results for , socio-economics			
	Yield modelling results for estuary		D4.1	Q2-14
R 7	Water Resource Analysis report	Oct-14	D4.1	
D29	Estuaries: Specialist EWR Workshop	Oct-14	D4.3.1	Q3-14
R 8.1	Volume 1: River ecological consequences	Nov-14	D4.2	Q3-14
R 8.2	Volume 2: Estuary ecological consequences	Nov-14	D4.3.2	Q3-14
R 8.4	Volume 4: Economic consequences	Nov-14	D4.4	Q3-14
R 8.5	Volume 5: EGSA consequences	Nov-14	D4.5	Q3-14
D1	PMC meeting	Nov-14	A1	Q3-14
D2	PSC meeting	Nov-14	A3	Q4-15
R 8.3	Volume 3: Estuary ecological consequences (sp appendices)	Dec-14	D4.3.2	Q3-14
	Integration of consequences to recommend MC	Dec-14	D4.3.2	Q3-14
R 8.7	Volume 7: Integration of consequences to recommend MC	Feb-15	D4.7	Q3-14
D26	Wetland RQOs: Contribution to EcoSpecs and TPCs	Dec-14	D6.1	Q3-14
D15f	News Letter	Jan-15	D5	Q4-15
D15e	Progress Feedback Letters	Jan-15	D5	Q4-15
D1	PMC meeting	Feb-15	A1	Q4-15
R 8.6	Water quality consequences	Feb-15	D4.5	Q4-15
R 9.2	Volume 2: Wetlands	Mar-15	D6.2	Q4-15

Deliverables and Reports		Date	Task	Q
D34	Training session 3b: Management Classes	Feb-15	D8	Q4-15
D2	PSC meeting	Mar	A3	Q4-15
R 9.1	Volume 1: Rivers EcoSpecs and TPCs	Mar	D6.1	Q4-15
R 9.3	Volume 3: Groundwater	Mar-15	D6	Q4-15
	Definition of waste water scenarios (all estuaries)	Mar-15	D4.8	Q4-15
	Modelled waste water scenarios available	Apr-15	D4.8	Q1-15
	Socio economic consequences of waste water scenarios	May-15	D4.4	Q1-15
	EcoSystem Services consequences of waste water scenarios	June-15	D4.5	Q1-15
	Estuary Technical Task Group meeting	May-15	D2.4	Q1-15
	Estuary consequences of waste water scenarios	Jun-15	D4.8	Q1-15
	Preliminary ranking of waste water scenarios and MC available	Jun-15	D4.9	Q1-15
D1	PMC meeting	Jul-15	A1	Q4-16
R 9.4	Volume 4: RQOs for estuaries	Jul-15	D6	Q2-15
	Consequences of Sc on Southern, Central and Northern Cluster IUAs	Jul-15	D4.8	Q2-15
	Integration of Consequences to recommend MC for all excl. U1 and U4.	Jul-15	D4.9	Q2-15
9	Stakeholder involvement	Apr 15	D5	Q1-15
R 10	Implementation Report	Aug-15	D9	Q2-15
R 11	Main Report	Aug-15	D9	Q2-15
D31	Templates	Aug-15	D7	Q2-15
D2	PCS meeting	Aug-15	A3	Q2-15
D1	PMC meeting	Sep-15	A1	Q2-15
D30	Public Meetings	15-Oct	D5	Q3-15
D15d	Stakeholder Issues and responses	16-Jan	D5	Q4-16
R 12	Close out report	16-Jan	D9	Q4-16
D35	Electronic Data CD	Jan-16	D9	Q4-16

2.2 TECHNICAL STUDY REPORTS

Twenty six formal study reports were compiled as part of the study. These reports are listed below together with a description of the key results included in each.

2.2.1 Report 1: Inception Report (DWA, 2012b)

Report reference: Department of Water Affairs, South Africa. September 2012. Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: Inception Report. Prepared by: Rivers for Africa eFlows Consulting (Pty) Ltd. DWA Report: RDM/WMA11/00/CON/CLA/0112.

Purpose of report: To define the extent of work to be undertaken and the associated costs based on the proposed methodology and availability of information, as well as initial evaluations that was carried out after the submission of the Proposal.

Key information:

- Summary of tasks, deliverables and costs.
- Study program.
- Description of study risks and uncertainties.

Reports 2 - 4 documents Step 1 of the integrated study steps (Table 1.1): Delineate the Units of Analysis (IUAs) and Resource Units (RUs), and describe the status quo of the water resource(s) within the study area.

2.2.2 Report 2: Status quo assessment, Integrated Unit of Analysis delineation and biophysical node identification (DWA, 2013a)

Report reference: Department of Water Affairs, South Africa, July 2013. Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: Status quo assessment, IUA delineation and biophysical node identification. Prepared by: Rivers for Africa eFlows Consulting (Pty) Ltd. DWA Report: RDM/WMA11/00/CON/CLA/0113.

Purpose of report: The report defines the current status of the water resources in the study area in terms of the water resource systems, the ecological characteristics, the socio-economic conditions and the community well-being.

Key information:

- Description of the status quo of the water resources within each of the IUAs in terms of the following aspects:
  - Water resource infrastructure and availability.
  - Groundwater resources.
  - Ecological status.
  - Water quality issues and impacts.
  - Socio-economic conditions (including framework for impact assessment); and
  - Goods and services (communities and their well-being).
- Description of delineated IUAs.
- Information on selected biophysical nodes for which EWRs were assessed including the level of assessment.
- Identification of riverine Hotspots in the study area.

2.2.3 Report 3: River Resource Units and EWR sites (DWA, 2013b)

Report reference: Department of Water Affairs, South Africa, July 2013. Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: Resource Units and EWR sites. Prepared by: Rivers for Africa eFlows Consulting (Pty) Ltd. DWA Report: RDM/WMA11/00/CON/CLA/0213.

Purpose of report: The document focuses on the delineation of river Resource Units (RUs).

Key information:

- Information used to define the river RUs.
- Description of the Natural Resource Units (NRU) and Management Resource Units (MRU) of rivers selected for detailed Ecological Water Requirement (EWR) assessment.
- Information is provided on the key river biophysical nodes, i.e. the Rapid and Intermediate Reserve level EWR sites.

2.2.4 Report 4: Desktop Estuary EcoClassification and Ecological Water Requirement (DWA, 2013c)

Report reference: Department of Water Affairs, South Africa, June 2013. Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu WMA: Desktop Estuary EcoClassification and Ecological Water Requirement. Prepared by: Rivers for Africa eFlows Consulting (Pty) Ltd. DWA Report: RDM/WMA11/00/CON/CLA/0313.

Purpose of report: The report describes and documents the status quo of the 64 estuaries occurring within the study area. The information serves as a strategic tool that will guide current and future monitoring requirements, and ultimately EWR determinations.

Key information:

- Detailed findings on the Present Ecological State (PES) of the estuaries in the study area as well as the national and regional conservation and biodiversity importance of the estuaries.
- The REC for the individual estuarine systems based on their ecological importance.
- Socio-Cultural Importance (SCI) of the individual estuaries in the region based on their ritual use, aesthetic value, resource dependence, recreational use and historical/cultural value.
- Water Resource Use Importance of the individual estuaries in the region, by considering their current water balance of the catchment contributing to river flow, operational purposes, future development and water use, and river and dam water quality.
- Identification of priority estuaries or Hotspots in the study area.
- Summary of remedial actions required to improve the condition of individual estuarine systems as well the monitoring requirements to improve confidence in future studies.

Report 5 - 7 documents Step 3 of the integrated study steps (Table 1.1) for the riverine component: Quantify the Ecological Water Requirements and changes in non-ecological water quality ecosystem[1]. Step 3 entails the application of different levels of Reserve assessment and Classification within the study area. Report 5 consists of three volumes outlined in Section 2.2.5 to 2.2.7.

2.2.5 Report 5.1: Volume 1 - EWR estimates of the River Desktop Biophysical Nodes (DWA, 2014a)

Report reference: Department of Water Affairs, South Africa, March, 2014. Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: Volume 1: EWR estimates of the River Desktop Biophysical Nodes. Prepared by: Rivers for Africa eFlows Consulting (Pty) Ltd. Authored by Birkhead AL, Louw MD. DWA Report: RDM/WMA11/00/CON/CLA/0114.

Purpose of report: The report documents the quantification of the EWR at 158 desktop biophysical nodes in the study area. A desktop biophysical node represents a point at the end of the Sub Quaternary reach (SQ) for all SQs which do not contain key biophysical nodes (EWR sites) and require desktop EWR estimates.

Key information:

- Locality and RUs of the desktop biophysical nodes.
- Desktop EcoClassification results for desktop biophysical nodes.
- Estimated EWRs at all desktop biophysical nodes, excluding those that fall in its totality in conservation areas.

[1] Users, i.e. water quality related to users or role players other than ecology, for example: Domestic Use, Agriculture - Stock Watering, Agriculture – Irrigation, Industrial - Category 3 and Recreation - Intermediate Contact. UserSpecs are defined.

2.2.6 Report 5.2: Volume 2 - EcoClassification and EWR assessment on the Mtamvuna, Lovu, uMngeni, Karkloof and uMnsunduze Rivers (DWA, 2014b)

Report reference: Department of Water Affairs, South Africa, May 2014. Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: Volume 2: EcoClassification and EWR assessment on the Mtamvuna, Lovu, uMngeni, Karkloof and uMnsunduze Rivers. Prepared by: Rivers for Africa eFlows Consulting (Pty) Ltd. DWA Report: RDM/WMA11/00/CON/CLA/0214.

Purpose of report: The EcoClassification results and the EWR assessment at five of the twelve identified EWR sites in the study area, using the Rapid Ecological Reserve Methodology (Level III), are provided. The method was expanded to include the determination of floods which are normally not part of a Rapid assessment.

Key information:

- EcoClassification results for each of the five EWR sites.
- Results of different EWR scenarios, with respect to low and high flows for the respective EWR sites.
- Water quality and diatom assessment results.
- Revised Desktop Reserve Model (RDRM) (Hughes *et al.,* 2014) output files.

2.2.7 Report 5.3: Volume 3 - EcoClassification and EWR assessment on the uMkhomazi, uMngeni and Mvoti Rivers (DWS, 2014a)

Report reference: Department of Water and Sanitation, South Africa, July 2014. Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: Volume 3: EcoClassification and EWR assessment on the uMkhomazi, uMngeni and Mvoti Rivers. Prepared by: Rivers for Africa eFlows Consulting (Pty) Ltd. DWS Report: RDM/WMA11/00/CON/CLA/0314.

Purpose of report: The EcoClassification results and the EWR assessment at seven of the twelve identified EWR sites in the study area, using the Intermediate Ecological Reserve Methodology, are provided.

Key information:

- EcoClassification results for each of the seven EWR sites.
- Results of different EWR scenarios, with respect to low and high flows for the respective EWR sites.
- Water quality and diatom assessment results.
- Revised Desktop Reserve Model (RDRM) (Hughes *et al.,* 2014) output files.

2.2.8 Report 6: Basic Human Needs Reserve (BHNR) Report (DWA, 2012c)

Report reference: Department of Water Affairs, South Africa, September 2012. Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area. Basic Human Needs Reserve (BHNR) Report. Prepared by Greg Huggins (Nomad Consulting) for Rivers for Africa eFlows Consulting (Pty) Ltd. DWA Report: RDM/WMA11/00/CON/CLA/0212.

Purpose of report: The results of the BHNR assessment, which determines the prescribed minimum quantity and quality of water to remain in the water resource to enable the supply of

water, according to Schedule 1 of the NWA, to support households, i.e. informal households, to support life, personal hygiene and other subsistence use, are provided.

Key information:

- Total qualifying and non-qualifying population by quaternary catchment.
- Projected qualifying population size for years 2011, 2016 and 2021.
- Projected Basic Human Resources Needs including 25 and 50 litre criteria for selected years.

2.2.9 Report 7: Water Resource Analysis Report (DWS, 2014b)

Report reference: Department of Water and Sanitation, South Africa, October 2014. Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: Water Resource Analysis Report. Prepared by: Rivers for Africa eFlows Consulting (Pty) Ltd. Authored by WRP Consulting Engineers. DWS Report: RDM/WMA11/00/CON/CLA/0414.

Purpose of report: This report provides information on the hydrological database, decision support systems and basic assumptions used for the Water Resource Analyses undertaken as part of this study. The results of the Water Resource Analyses documented in this report informed the EWR quantification and integrated water resource management processes.

Key information:

- A summary of data and information available for the assessment of the different water resource systems.
- Summary and description of IUAs and desktop biophysical nodes.
- Outline of the various methodologies adopted during the Water Resource Analysis task.
- Description of each water resource catchment as well as the base data used for the assessment of Natural and Present Day flow results.
- Summary of the ecological quantification results for the respective EWR sites and background to the determination of EWR structures included in the Water Resource Yield Model (WRYM) and the Water Resource Planning Model (WRPM).
- Description, summary and discussion of operational scenarios, as defined for four of the main river systems in the study area.
- The structure adopted for the provision of electronic data resulting from this study.
- Relevant maps and EWR structures are provided for relevant EWR sites.

Report 8.1 – 8.7 documents Step 4 of the integrated study steps (Table 1.1): Identification and evaluation of scenarios within the Integrated Water Resource Management process. The objective of this step was to provide the scenario analysis, assumptions and results and document the consequences of the scenarios for various components which are provided as seven report volumes under Report 8 (Section 2.2.10 - 2.2.20). All the report volumes are supporting information that feeds into Report 8.7, which integrates all this information to derive Water Resource Classes for the various scenarios. This step is closely linked to Step 5 of the integrated study steps where the scenarios are tested with stakeholders and the draft Water Resource Classes are determined.

2.2.10 Report 8.1: Volume 1 - Supporting Information on the Determination of Water Resource Classes – River Ecological Consequences of Operational Scenarios (DWS, 2014c)

Report reference: Department of Water and Sanitation, South Africa, September 2014. Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: Volume 1: Supporting Information on the Determination of Water Resource Classes – River Ecological Consequences of Operational Scenarios. Prepared by: Rivers for Africa eFlows Consulting (Pty) Ltd. DWS Report: RDM/WMA11/00/CON/CLA/0514.

Purpose of report: This report describes and documents the river ecological consequences of the operational scenarios at the key biophysical nodes (EWR sites) by evaluating and determining the impact on the Ecological Category (EC).

Key information:

- Detailed consequences of the operational scenarios on the various ecological components.
- Summary of the ecological consequences of the operational scenarios.
- Inundation levels of riparian vegetation indicators under different flow regimes.

2.2.11 Report 8.2: Volume 2a - Supporting Information on the Determination of Water Resource Classes – Mvoti (U4) Estuary EWR and Ecological Consequences of Operational Scenarios (DWS, 2014d)

Report reference: Department of Water and Sanitation, South Africa, April 2015. Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu WMA: Volume 2a: Supporting Information on the Determination of Water Resource Classes – Mvoti (U4) Estuary EWR and Ecological Consequences of Operational Scenarios. Prepared by CSIR for Rivers for Africa eFlows Consulting PTY Ltd. DWS Report: RDM/WMA11/00/CON/CLA/0614.

Purpose of report: This report describes and documents the Mvoti Estuary ecological consequences of the operational scenarios by evaluating and determining the impact on the Ecological Category (EC).

Key information:

- Hydrological characteristics, catchment characteristics, land-use, as well as human pressures affecting the Mvoti Estuary are provided.
- Estuary delineation, which includes geographical boundaries, zoning and typical abiotic states adopted for the estuary.
- Baseline ecological and health assessment results.
- PES and REC of the estuary, summary of the overall confidence of the study and the degree to which non-flow factors have contributed to the degradation of the system.
- Ecological consequences of various future flow scenarios, and the EC for each scenario.
- Recommendations on the EWR for the estuary, including the recommended Resource Quality Objectives (RQOs - ecological specifications).
- Recommended monitoring requirements to improve the confidence of the EWR assessment.

2.2.12 Report 8.2: Volume 2b - Supporting Information on the Determination of Water Resource Classes – uMkhomazi (U1) Estuary EWR and Ecological Consequences of Operational Scenarios (DWS, 2014e)

Report reference: Department of Water and Sanitation, South Africa, December 2014. Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu WMA: Volume 2b: Supporting Information on the Determination of Water Resource Classes – uMkhomazi (U1) Estuary EWR and Ecological Consequences of Operational Scenarios. Prepared by MER for Rivers for Africa eFlows Consulting PTY Ltd. DWS Report: RDM/WMA11/00/CON/CLA/0614.

Purpose of report: This report describes and documents the EWR and scenario consequences for the uMkhomazi estuary.

Key information:

- Hydrological characteristics, catchment characteristics, land-use, as well as human pressures affecting the uMkhomazi Estuary are provided.
- Estuary delineation, which includes geographical boundaries, zoning and typical abiotic states adopted for the estuary.
- Baseline ecological and health assessment results.
- PES and REC of the estuary, summary of the overall confidence of the study and the degree to which non-flow factors have contributed to the degradation of the system.
- Ecological consequences of various future flow scenarios, and the EC for each scenario.
- Recommendations on the EWR for the estuary, including the recommended RQOs (ecological specifications).
- Recommended monitoring requirements to improve the confidence of the EWR assessment.

2.2.13 Report 8.2: Volume 2c - Supporting Information on the Determination of Water Resource Classes –Mhlali (U30E) Estuary EWR and Ecological Consequences of Operational Scenarios (DWS, 2014f)

Report reference: Department of Water and Sanitation, South Africa, April 2015. Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu WMA: Volume 2c: Supporting Information on the Determination of Water Resource Classes –Mhlali (U30E) Estuary EWR and Ecological Consequences of Operational Scenarios Prepared by: CSIR for Rivers for Africa eFlows Consulting PTY Ltd. DWS Report: RDM/WMA11/00/CON/CLA/0614.

Purpose of report: This report describes and documents the EWR and scenario consequences for the Mhlali estuary.

Key information:

- Hydrological characteristics, catchment characteristics, land-use, as well as human pressures affecting the Mhlali Estuary are provided.
- Estuary delineation, which includes geographical boundaries, zoning and typical abiotic states adopted for the estuary.
- Baseline ecological and health assessment results.
- PES and REC of the estuary, summary of the overall confidence of the study and the degree to which non-flow factors have contributed to the degradation of the system.
- Ecological consequences of various future flow scenarios, and the EC for each scenario.

- Recommendations on the EWR for the estuary, including the recommended RQOs (ecological specifications).
- Recommended monitoring requirements to improve the confidence of the EWR assessment.

2.2.14 Report 8.2: Volume 2d - Supporting Information on the Determination of Water Resource Classes – Ecological Consequences on Estuaries in T4, U2, U3, U5, U6, U7 and U8 of operational scenarios (DWS, 2015a)

Report reference: Department of Water and Sanitation, South Africa, September 2015. Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu WMA Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu WMA: Volume 2d: Supporting Information on the Determination of Water Resource Classes – Ecological Consequences on Estuaries in T4, U2, U3, U5, U6, U7 and U8 of operational scenarios. Prepared by: CSIR for Rivers for Africa eFlows Consulting PTY Ltd. DWS Report: RDM/WMA11/00/CON/CLA/0115.

Purpose of report: This report describes and documents the ecological consequences of a range of waste water management options on various estuaries.

Key information:

- Overview of Classification process and confidence of the study.
- Background information on the pressures affecting the estuaries.
- Description of operational scenarios.
- Desktop assessment results of the Southern and Northern Clusters, indicating the ecological consequences of the various future scenarios and the ECs associated with each of these.
- Detailed assessments of the Central Cluster scenario evaluation process and the estuaries responses to the scenarios.
- Summary of the overall findings of the study and the integration into the catchment scale operational scenario assessment.

2.2.15 Report 8.3: Volume 3 - Volume 3 Supporting Information on the Determination of Water Resource Classes – Estuary specialist appendices (DWS, 2014g)

Report reference: Department of Water and Sanitation, South Africa, September 2015. Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: Volume 3 Supporting Information on the Determination of Water Resource Classes – Estuary specialist appendices. DWS Report: RDM/WMA11/00/CON/CLA/0714.

Purpose of report: This report describes and documents the specialist appendices associated with Report 8.2: Volume 1 – 3. This report is only provided electronically.

Key information:

- Abiotic components including hydrology, hydrodynamics water quality and physical habitats for estuaries assessed in the study area.
- Abiotic components including microalgae, macrophytes, invertebrates, fish and birds for estuaries assessed in the study area.
- Scenario analysis results of abiotic and biotic components of estuaries assessed in the study area.

- Summary of the overall findings of the study and the integration into the catchment scale operational scenario assessment.

2.2.16 Report 8.4: Volume 4 - Supporting Information on the Determination of Water Resource Classes - Economic Consequences of Operational Scenarios (DWS, 2014h)

Report reference: Department of Water and Sanitation, South Africa, October, 2014. Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: Volume 4: Economic Consequences. Prepared by: Rivers for Africa eFlows Consulting (Pty) Ltd. Authored by Conningarth Economists. DWS Report: RDM/WMA11/00/CON/CLA/0814.

Purpose of this report: This report describes and documents the economic consequences of the operational scenarios in the Mvoti, uMngeni, Lovu and uMkhomazi catchments.

Key information:

- Results of the different operational scenarios for each of the catchments are presented in terms of the total discounted Gross Domestic Product, employment values and the Unit Reference Values.

2.2.17 Report 8.5: Volume 5 - Supporting Information on the Determination of Water Resource Classes - Ecosystem Services Consequences of Operational Scenarios (DWS, 2014i)

Report reference: Department of Water and Sanitation, South Africa, November, 2014. Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: Volume 5: Supporting information on the determination of Water Resource Classes: Ecosystem Services consequences of operational scenarios. Prepared by: Rivers for Africa eFlows Consulting (Pty) Ltd. Authored by Greg Huggins. DWS Report: RDM/WMA11/00/CON/CLA/0914.

Purpose of this report: This report describes and documents the consequences of the operational scenarios on Ecosystem Services in the Mvoti, uMngeni, Lovu and uMkhomazi catchments.

Key information:

- Results of the different operational scenarios for each of the catchments in terms of the Ecosystem Services values.

2.2.18 Report 8.6: Volume 6 - Supporting Information on the Determination of Water Resource Classes – User Water Quality Consequences of Operational Scenarios (DWS, 2015b)

Report reference: Department of Water and Sanitation, South Africa, March 2015. Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: Volume 6: Supporting Information on the Determination of Water Resource Classes – User Water Quality Consequences of Operational Scenarios. Prepared by: Rivers for Africa eFlows Consulting (Pty) Ltd. Authored by Scherman, P-A. DWS Report: RDM/WMA11/00/CON/CLA/1014.

Purpose of this report: This report presents the approach undertaken to include user water quality into the consequences evaluation and the results of this assessment.

Key information:

- Outline of the general approach to the consequences assessment for user water quality.
- Outline the Data collection process and results per step.
- Results of the consequences assessment.

2.2.19 Report 8.7: Volume 7a - Recommended Water Resource Classes for the uMkhomazi (U1) and Mvoti (U4) River systems (DWS, 2014j)

Report reference: Department of Water and Sanitation, South Africa, September 2014. Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: Volume 7a: Recommended Water Resource Classes for the uMkhomazi (U1) and Mvoti (U4) River systems. Prepared by: Rivers for Africa eFlows Consulting (Pty) Ltd. Authored by Pieter van Rooyen, Delana Louw, William Mullins, Greg Huggins, Lara van Niekerk. DWS Report: RDM/WMA11/00/CON/CLA/1114.

Purpose of this report: To recommended operational scenarios and preliminary Water Resource Classes for stakeholder evaluation for U1 and U4 catchments.

Key information:

- Overview of the scenario evaluation process. Ecology, Ecosystem Services and the Economic benefits are compared when determining the degree of achieving the appropriate balance between ecological objectives the socio-economic benefits and this chapter provides an expanded description of how the metric for each of the three components were derived.
- Economic, ecological (riverine and estuarine) and Ecosystem Services consequences.
- Description of obtaining integrated multi-criteria results.
- Water Resource Classes and catchment configuration results.

2.2.20 Report 8.7: Volume 7b - Recommended Water Resource Classes for the uMkhomazi (U1) and Mvoti (U4) River systems (DWS, 2015c)

Report reference: Department of Water and Sanitation, South Africa, September 2015. Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: Volume 7b: Recommended Water Resource Classes for the T4, T5, U2, U3, U5, U6, U7 and U8 secondary catchments. Prepared by: Rivers for Africa eFlows Consulting (Pty) Ltd. Authored by Pieter van Rooyen, Delana Louw, William Mullins, Greg Huggins, Lara van Niekerk. DWS Report: RDM/WMA11/00/CON/CLA/0215.

Purpose of this report: To recommended operational scenarios and preliminary Water Resource Classes for stakeholder evaluation for the relevant secondary catchments.

Key information:

- Overview of the scenario evaluation process. Ecology, Ecosystem Services and the Economic benefits are compared when determining the degree of achieving the appropriate balance between ecological objectives the socio-economic benefits and this chapter provides an expanded description of how the metric for each of the three components were derived.
- Economic, ecological (riverine and estuarine) and Ecosystem Services consequences.

- Description of obtaining integrated multi-criteria results.
- Water Resource Classes and catchment configuration results.

Report 9.1 – 9.4 documents Step 6 of the integrated study steps (Table 1.1): Develop draft RQOs and numerical limits. This step is closely linked to the next step where the class configuration and RQOs are gazetted and implemented. The information generated during Step 1, 3, 4 and 5 forms the basis of the RQOs. The results of Step 6 are documented in four report volumes under Report 9 (Section 2.21 - 2.24).

2.2.21 Report 9.1: Volume 1 - River Resource Quality Objectives (DWS, 2015d)

Report reference: Department of Water and Sanitation, South Africa, April 2015. Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: Volume 1: River Resource Quality Objectives. Prepared by: Rivers for Africa eFlows Consulting (Pty) Ltd. DWS Report: RDM/WMA11/00/CON/CLA/0315.

Purpose of this report: Provide a summary of the narrative and numerical RQOs for rivers of the Mvoti to Umzimkulu WMA.

Key information:

- An overview of the important RUs in the study area.
- Outline of the various multi-disciplinary methodologies adopted during this task.
- RQOs of the various components per IUA which include hydrology RQOs (expressed in terms of flow at biophysical nodes and EWR sites) and RQOs for river habitat, biota and water quality.

2.2.22 Report 9.2: Volume 2 - Wetland Resource Quality Objectives (DWS, 2015e)

Report reference: Department of Water and Sanitation, South Africa, July 2015. Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: Volume 2: Wetland Resource Quality Objectives. Prepared by: Rivers for Africa eFlows Consulting (Pty) Ltd. Authored by Rountree, M. DWS Report: RDM/WMA11/00/CON/CLA/0415.

Purpose of this report: Provide a summary of RQOs for wetlands of the Mvoti to Umzimkulu WMA.

Key information:

- Wetland RQOs.

2.2.23 Report 9.3: Volume 3 - Groundwater Resource Quality Objectives (DWS, 2015f)

Report reference: Department of Water and Sanitation, South Africa, March 2015. Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: Volume 3: Groundwater Resource Quality Objectives. Prepared by: Rivers for Africa eFlows Consulting (Pty) Ltd. Authored by Karim Sami. DWS Report: RDM/WMA11/00/CON/CLA/0515.

Purpose of this report: The purpose of this document is to provide a summary of the narrative and numerical RQOs for Groundwater per IUA in the Mvoti to Umzimkulu WMA.

Key information:

- Groundwater RQOs.
- Priority monitoring areas for water level and abstraction.
- Priority monitoring areas where baseflow reduction occurs.

2.2.24 Report 9.4: Volume 4 - Estuary Resource Quality Objectives (DWS, 2015g)

Report reference: Department of Water and Sanitation, South Africa, September 2015. Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: Volume 4: Estuary Resource Quality Objectives. Prepared by: Van Niekerk, Adams, Taljaard, Weerts. DWS Report: RDM/WMA11/00/CON/CLA/0615.

Purpose of this report: The purpose of this document is to provide a summary of the narrative and numerical RQOs for estuaries in the Mvoti to Umzimkulu WMA.

Key information:

- Outline of the various multi-disciplinary methodologies adopted during this task.
- Overview of the various indicator Components and overarching approach.
- RQOs of the individual estuaries in the study area.

Report 10 documents Step 6 and 7 of the integrated study steps (Table 1.1): Develop draft RQOs and numerical limits and Gazette and implement the class configuration and RQOs.

2.2.25 Report 10: Implementation Report (DWS, 2015h)

Report reference: Department of Water and Sanitation, South Africa, September 2015. Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: Implementation report. Prepared by: Rivers for Africa eFlows Consulting (Pty) Ltd. Authored by Pieter van Rooyen, Delana Louw, Patsy Scherman, Lara van Niekerk, Susan Taljaard, Shael Koekemoer, Piet Kotze, James Mackenzie, Karim Sami. DWS Report: RDM/WMA11/00/CON/CLA/0715.

Purpose of this report: The report focuses on describing the principles of an implementation plan as part of National Water Resource Classification (NWRC), the actions required as well as a timeline for the implementation of the RQOs. Monitoring to measure whether the RQOs are being achieved is also provided.

Key information:

- A generic implementation plan is presented and applied for the study area. The different components of the plan are provided, the linkages as well as a proposed conceptual timeline for the applications of the actions included in the Implementation Plan.
- The hydrological and groundwater and estuarine hydrodynamic requirements for the study area are presented.
- The water quality monitoring programme linked to two different levels of monitoring detail is presented.
- The principles of a monitoring programme that measures the ECs as signed off as part of the Water Resource Class. Biological monitoring programme specific to high priority estuaries is provided.

2.2.26 Report 11: Main Report (DWS, 2015i)

Report reference: Department of Water and Sanitation, South Africa, October 2015. Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: Main Report. Prepared by: Rivers for Africa eFlows Consulting (Pty) Ltd. DWS Report: RDM/WMA11/00/CON/CLA/0815.

Purpose of this report: Summary of the technical outcomes of the study.

Key information:

- **Status Quo:** Summary of the current status of the water resources in the study area in terms of the water resource systems, the ecological characteristics, the socio-economic conditions and the community well-being based on various multi-disciplinary methodologies adopted during this task of the project.
- **Integrated Units of Analysis:** Summary of the delineation of IUAs in order to establish broader-scale units for assessing the socio-economic implications of different catchment configuration scenarios and to report on ecological conditions at a sub-quaternary scale.
- **Hotspot Identification:** Outlines hotspots which are river reaches with a high Integrated Environmental Importance and could be under threat due to its importance for water resource use. The areas would require detailed investigations if development was being considered.
- **River Ecological Water Requirements:** EcoClassification and EWR determination at various biophysical nodes in the river systems of the Study Area. This chapter summarises the EWRs set during the step 3 of the integrated water resource management process.
- **Estuarine Ecological Water Requirements:** EcoClassification results of the uMkhomazi, Mvoti and Mhlali Estuaries.
- **Description of Scenarios:** Results of the Water Resource Analyses and identification and description of the various operational scenarios that were evaluated during the study.
- **Ecological Scenario Consequences:** Presentation of the consequences of the various scenarios for the various components which include rivers, estuaries, economic and ecosystem services as well as non-ecological water quality.
- **Water Resource Classes:** The recommended Water Resource Classes among the scenarios are presented and includes conclusions and recommendations.
- **Resource Quality Objectives:** The RQOs of the various components per IUA. RQOs are provided for hydrology of Rivers expressed in terms of flow at biophysical nodes and EWR sites, river habitat, biota and water quality. RQOs of Estuaries for water quality, geomorphology, vegetation, invertebrates, fish and birds, respectively are provided for the uMkhomazi and Mvoti Estuaries.
- **Groundwater Resource Quality Objectives:** The delineation of Groundwater Units is outlined and the process followed to develop groundwater RQOs is also provided. A summary of the criteria used for identifying groundwater priority areas and groundwater RQOs are included.
- **Implementation Considerations:** The principles and aspects to consider for implementing the NWRCS including the actions needed as well as a timeline to give effect to the RQOs are described. Monitoring to measure whether the RQOs are being achieved is also provided.
- **Catchment visioning:** These visions were documented in the form of narrative descriptions and captured for the twelve delineated IUAs and provided as an Appendix.

2.2.27 Report 12: Closing Report (DWS, 2015j)

This report.

3 FINANCIAL SUMMARY

3.1 BUDGET

The budget for this study including the Variation Order (VO) for time, disbursements, escalation and VAT was R12 795 467 (twelve million seven hundred and ninety five thousand, four hundred and sixty seven rand only). The cash flow projection is provided in Figure 3.1 and a summary of the monthly cash flow is provided in Table 3.2. Note that the cash flow projection is based on the total budget including VAT and including escalation.

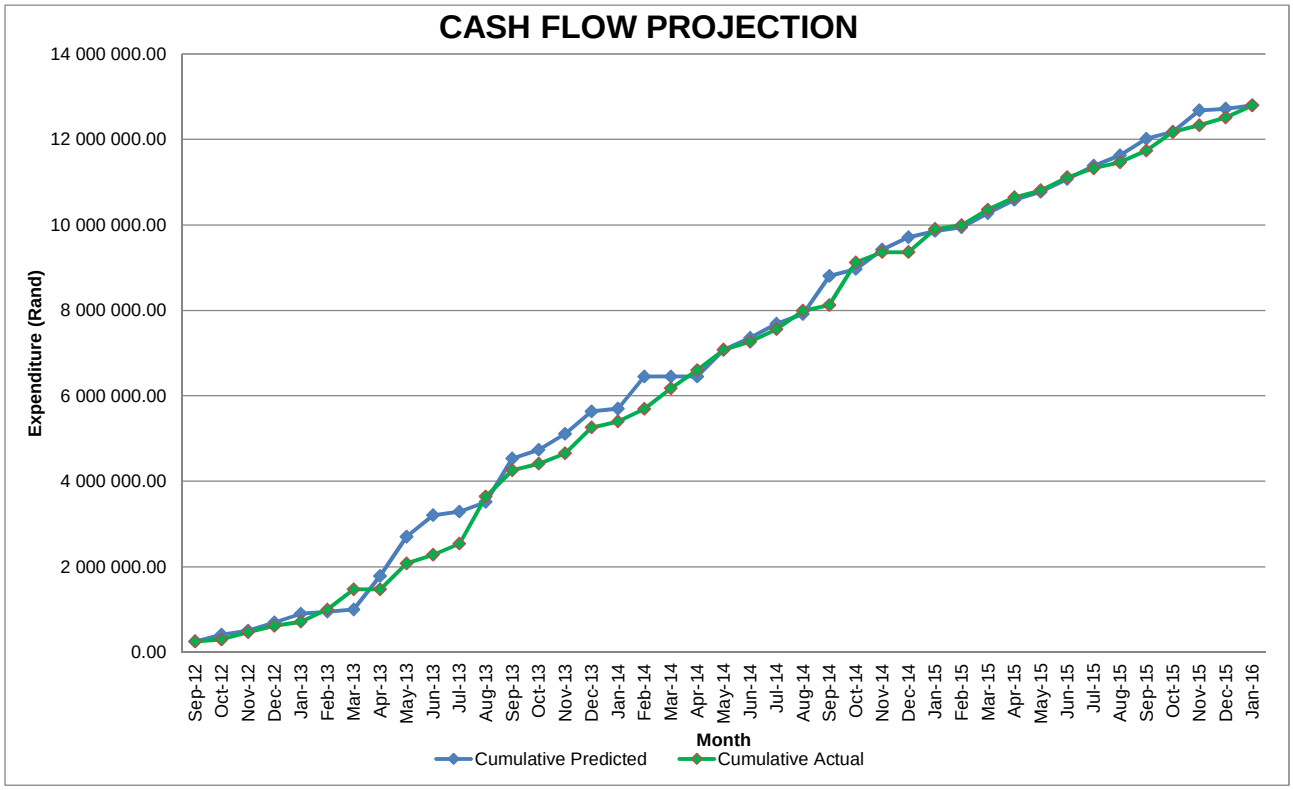

Figure 3.1 Cash flow projection

Table 3.1 Summary of monthly cash flow

Monthly Cash Flow				
Month	**Predicted per Month**	**Cumulative Predicted**	**Actual per Month**	**Cumulative Actual**
Sep-12	248 900.85	248 900.85	255 816.00	255 816.00
Oct-12	160 269.23	409 170.08	42 868.00	298 684.00
Nov-12	97 641.09	506 811.17	169 602.32	468 286.32
Dec-12	189 341.63	696 152.80	149 058.80	617 345.12
Jan-13	204 189.29	900 342.09	95 296.50	712 641.62
Feb-13	46 863.99	947 206.08	287 758.95	1 000 400.57
Mar-13	52 799.98	1 000 006.06	470 527.63	1 470 928.20
Apr-13	782 639.06	1 782 645.11	0.00	1 470 928.20
May-13	922 169.97	2 704 815.08	607 686.42	2 078 614.62
Jun-13	500 649.10	3 205 464.18	200 491.17	2 279 105.79
Jul-13	82 948.88	3 288 413.06	259 055.73	2 538 161.52
Aug-13	227 386.88	3 515 799.95	1 103 723.59	3 641 885.11
Sep-13	1 017 617.87	4 533 471.82	616 827.61	4 258 712.72
Oct-13	203 819.32	4 737 291.14	152 304.00	4 411 016.72

Monthly Cash Flow				
Month	**Predicted per Month**	**Cumulative Predicted**	**Actual per Month**	**Cumulative Actual**
Nov-13	371 844.98	5 109 136.12	243 230.40	4 654 247.12
Dec-13	523 863.02	5 632 999.14	604 776.40	5 259 023.52
Jan-14	67 216.88	5 700 216.02	142 394.32	5 401 417.84
Feb-14	750 687.92	6 450 903.94	292 210.69	5 693 628.53
Mar-14	0.00	6 450 903.94	480 578.68	6 174 207.21
Apr-14	0.00	6 450 903.94	426 496.80	6 600 704.01
May-14	629 518.88	7 080 422.82	471 800.02	7 072 504.03
Jun-14	274 887.43	7 355 310.25	193 294.32	7 265 798.35
Jul-14	330 540.00	7 685 850.25	294 600.00	7 560 398.35
Aug-14	227 700.00	7 913 550.25	430 659.24	7 991 057.59
Sep-14	889 790.88	8 803 341.13	134 235.20	8 125 292.79
Oct-14	162 450.00	8 965 791.13	995 689.43	9 120 982.22
Nov-14	455 671.73	9 421 462.86	241 802.85	9 362 785.07
Dec-14	291 500.00	9 712 962.86	0.00	9 362 785.07
Jan-15	144 100.00	9 857 062.86	538 996.17	9 901 781.24
Feb-15	87 153.00	9 944 215.86	94 343.00	9 996 124.24
Mar-15	332 994.00	10 277 209.86	361 506.43	10 357 630.67
Apr-15	309 302.52	10 586 512.38	287 107.46	10 644 738.13
May-15	189 240.00	10 775 752.38	162 761.62	10 807 499.75
Jun-15	295 831.14	11 071 583.52	305 960.46	11 113 460.21
Jul-15	310 310.28	11 381 893.80	211 008.92	11 324 469.13
Aug-15	247 269.42	11 629 163.22	141 561.56	11 466 030.69
Sep-15	386 807.70	12 015 970.92	274 567.24	11 740 597.93
Oct-15	161 025.00	12 176 995.92	431 939.90	12 172 537.83
Nov-15	500 829.04	12 677 824.96	158 961.60	12 331 499.43
Dec-15	41 384.96	12 719 209.93	182 474.17	12 513 973.60
Jan-16	76 266.00	12 795 475.93	281 493.29	12 795 466.89

3.2 VARIATION ORDER

An extension to the end June 2016 was requested to accommodate the supplementary stakeholder engagement in the form of enhanced technical working sessions, additional PSC meeting and expanded alternative scenario evaluation (outlined below). It is requested that the contract amount be increased by R1 178 124 VAT included (a total of 10.1% of the initial contract amount).

Additional budget and time on the study was needed to address the following additional work that was not part of the original approved Project Plan:

A: Undertake enhanced stakeholder engagement on detail technical aspects that were requested by stakeholders at a Project Steering Committee (PSC) meeting. This would be in the form of extended Technical Work Group sessions to capacitate key stakeholders on the following:

- Multi-criteria analysis approach and how it is applied to assist stakeholders to evaluate scenarios towards making recommendation as to the appropriate Water Resource Classes.
- Presentation of details on the hydrological information that were applied in the EWR assessment.

- Clarification of the different levels of estuary assessment - Desktop, Rapid, Intermediate and Comprehensive levels and associated confidence ratings as well as details on data that was available during this study and used to do the required estuarine assessments.
- Discussion regarding some of the recent technical refinements in the Estuary EWR methods and the consequences for this study.

Additional budget was required to prepare presentation material as well as arrange and facilitate four enhanced technical workshops that were not included in the accepted Project Proposal. Additional time was required to schedule the work sessions in-between the technical work plan activities.

B: Address information gaps that only became known when stakeholders put forward their long term development plans as scenarios for evaluation in the study. This required the following:

- Additional time to collect, collate and verify information for the analysis of scenarios relating to anticipated developments in the Ugu and Illembe municipal areas.
- Additional budget to formulate and evaluate supplementary scenarios from above-mentioned developments for comparison purposes.
- Additional budget and time, to expand the configuration of the multi-criteria analysis model to cater for the complex assortment of the stakeholders' scenarios coupled to the complexity of 62 discrete catchments with as many estuaries in the study area.

C: Provision for additional professional services by the study team to assist DWS to address comments received during the 60 day gazetting period (it was anticipated that based on the current high intensity interest from stakeholders that there could be numerous comments requiring responses as well as possible further engagement events).

4 STAKEHOLDER PARTICIPATION

This Chapter describes the stakeholder involvement process that was followed for the duration of the study. It is the final deliverable of the stakeholder engagement component and provides summary feedback on activities undertaken for Mvoti to Umzimkulu Classification Study.

A focused stakeholder engagement process was undertaken that was aligned to the technical steps of the study. A wide and extensive stakeholder database was setup and updated on a continuous basis. Stakeholders representing specific sectors of society (e.g. industry, agriculture, conservation, water, etc.) were identified and requested to serve on a Project Steering Committee (PSC) for the 3-year period. Six (6) PSC meetings and five (5) Technical Working Group (TWG) meetings were held during the course of the study. In order to provide feedback to the broader public, two (2) stakeholder meetings were held in the study area towards the end of the study.

Stakeholders were updated regularly on the status of the project. This was mainly done through the distribution of Background Information Documents (BID). These documents provided progress and update on technical activities and they served as a useful reference document at all PSC meetings.

An Issues and Response Report was compiled and updated continually throughout the two-year period of the implementation of the project and submitted to DWS upon agreed intervals. This was uploaded on the DWS website for access to all stakeholders on a periodic basis to all stakeholders to keep them informed of the issues and concerns of fellow stakeholders. Technical reports and all stakeholder engagement materials were published on the DWS web site and stakeholders were requested to review and comment on these documents.

4.1 STAKEHOLDER IDENTIFICATION AND DATABASE MANAGEMENT

The identification of stakeholders was done at the beginning of the project (in collaboration with the DWS) and as assisted by stakeholders in the study area. Stakeholders were identified by using existing databases, e.g. Catchment Management Forums. Telephonic, email inquiries and stakeholder referrals also supported the establishment of a comprehensive database. Stakeholders who were identified and invited to participate in the process were representative of a wide variety of interests and affected sectors of society in the study area.

Stakeholders' details were captured on a Microsoft Access database, an electronic database management software programme that categorises every mailing to stakeholders, thereby providing an on-going record of communication. This was updated on an on-going basis. In addition, comments and contributions received from stakeholders were recorded, linking each comment to the relevant stakeholder. At the time of compiling this report, the database contained **1 227** stakeholders across a range of sectors and spheres of government as shown in Table 4.1.

Table 4.1 Sectors of society represented by Interested and Affected Parties (I&APs) on the direct mailing list

Sectors of Society
National Government
Provincial Government
Local Government (local and district municipalities)
Agriculture (landowners, unions, farmer associations)
Tourism (tourism associations, landowners)
Conservation Authorities (provincial bodies)
Water Service Authorities
Residents and Ratepayers Associations
Local residents
Environmental groups
Statutory and regulatory groups
Public enterprises, utilities and agencies
Organised business
Landowners
Private sector (business, industries and irrigation)
Industry
Media
Educational organisations and institutions
Civil society
Academics and consultants

The project database was regularly updated as more information became available and as stakeholder information changed. This database was maintained and updated during the duration of the study. The database will be provided electronically due to its size.

Stakeholders received all project documentation and special efforts were made to encourage their attendance at the PSC meetings, as well as submission of their comments in writing. In addition to capturing stakeholder details, the database was also used to record stakeholder interactions, including what and when information was distributed to or received from stakeholders and which stakeholders attended each meeting.

4.2 PROJECT ANNOUNCEMENT

The study was widely announced with an invitation to I&APs to register and to actively participate in the study. There were two categories of interest groups in the Mvoti to Umzimkulu catchments, namely **general members of the public** and **key stakeholders**. The stakeholder engagement team adopted the following methodology in ensuring that both groups receive equal opportunities during the early stages of the study as described in Table 4.2.

Table 4.2 List of documents used to notify and invite stakeholders

No	General Public	Key Stakeholders
a	Printed media advertisements in English and Zulu were placed in regional and local newspapers, for the project announcement, as indicated in Table 4.3.	
b	Public members responding to the advertisements were sent an introductory letter which provided brief background and study objectives.	Key Stakeholders were contacted telephonically and informed of the study and the process.
c	Background Information Document (BID) was provided to all members of the public who expressed interest in the study.	A BID accompanied the invitation letter.
d	Members of the public who were representing a particular sector or interest group were informed of the opportunity to serve on the PSC.	Key Stakeholders were informed of the establishment of the PSC and called to serve on the committee.
e	A letter of invitation was then distributed to identified interest groups in the study area requesting them to nominate representatives to serve on the PSC.	A PSC nomination form was circulated to stakeholders who expressed interest or were keen to make a nomination on behalf of their organisation and/or sector.
f	A letter inviting identified stakeholders and nominees to serve in the PSC was circulated to relevant and interested sectors within the study area.	
g	To ensure that stakeholders fully understood the role of the PSC, TOR for the PSC were provided to all organisations who expressed interest in participating.	
h	Stakeholders who expressed interest in the PSC were then invited to the inaugural PSC meeting held on 19 March 2013 in the Project Catchment.	

Table 4.3 Advertisements – Study Announcement

Date	Newspapers	Distribution	Frequency	Languages
11 March 2013	Isolezwe	Regional	Daily	Zulu
11 March 2013	Natal Witness	Regional	Daily	English

4.3 PREPARATIONS FOR THE ESTABLISHMENT OF PSC

This process ran parallel with the project announcement phase. Communication with stakeholders to prepare for the establishment of the PSC was undertaken through the following activities:

- Distribution of an introductory letter which explained the need for the project, the context of the study which illustrated the extent of the study area. In addition, information was provided on aspects such as where additional information can be obtained and the contact details of the Public Participation team. This letter also invited nominees to the first PSC meeting.
- The letter was accompanied by a comment sheet which enabled interested and affected people and organisations to:
  - Register as a stakeholder,
  - Express interest in participating in the PSC,
  - Provide comments, and/or
  - Nominate additional stakeholders.
- BID 1 was compiled and distributed to all stakeholders on the database. This BID contained the description of the project, an explanation of all the components of the study, the need for Public Participation and the contact details of both the Public Participation and technical teams, for ongoing communication during the study.

4.4 PROJECT STEERING COMMITTEE MEETINGS

4.4.1 Establishment of PSC

- The PSC was established at the first meeting held on **19 March 2013** at the Durban Jewish Centre.
- The PSC was established as a result of a process of nomination which started during the project announcement phase, January 2013. The TOR was also discussed and adopted at the inaugural PSC meeting held on 19 March 2013.
- The Terms of Reference which clarified the role of PSC members were adopted by all members who were in attendance.

The **purpose** of establishing the **PSC** was to provide a structured platform for the public to give inputs into the study and share information with other stakeholders in the study area. The PSC consisted of members from various organisations and sectors, striving for balanced representation to achieve equal view points and inputs from stakeholders within the study area.

4.4.2 Format of PSC meetings

A focused stakeholder engagement process was undertaken throughout, as such all PSC meetings were aligned to specific deliverables and technical steps of the study.

The **role of the PSC** was to guide the study during all stages as it unfolded and to provide sectoral inputs and review technical reports.

Since its establishment, PSC members have actively participated and made valuable contributions to the study. Table 4.4 provides detail of all PSC meetings that were held during the course of the study.

Table 4.4 Details of PSC Meetings

Meeting	Date	Objectives of the Meeting
PSC 1	19 March 2013 at 09h00 Durban Jewish Centre	▪ Formalisation of the establishment of PSC. ▪ Introduction of the Classification and RQO processes. ▪ Presentation of *status quo* evaluation. ▪ Selection of the IUAs. ▪ Set catchment visioning.
PSC 2	26 November 2013 at 09h00 Durban Country Club	▪ Re-cap on the status of the study and report on progress of the study. ▪ Present and discuss the following: o Desktop Eco Classification and EWR recommendations for estuaries. o River Resource Units and EWR sites. o Rapid EWR assessment at 5 EWR sites. o Demonstration of the determination of the Water Resource Class with specific emphasis on socio-economics.
PSC 3	18 June 2014 at 09h00 Durban Botanic Gardens	▪ To provide the project outcomes: Water Resource Classes, RQOs and the Reserve. ▪ The specific objectives / focus were to consult with stakeholders on proposed Water Resource Classes, and on groundwater and estuary RQOs.
PSC 4	26 November 2014 at 09h00 Durban Botanic Gardens	▪ Recap on the status of the study and report on progress. ▪ Mvoti and Mkomazi River systems: o Presentation of the consequences on the river, estuary, ecosystem services, water quality and economy of the

Meeting	Date	Objectives of the Meeting
		identified operational scenarios. o Presentation and discussion on the resulting system ranking of the consequences and draft Water Resource Classes.
PSC 5	24 March 2015 at 09h00 Durban Botanic Gardens	Recap on the status of the study and report on progress with a focus on the following: ▪ To present and test waste water management scenarios and obtain agreement from stakeholders on the range of scenarios that will be evaluated. ▪ Present the River and Wetland RQOs.
PSC 6	16 September 2015 at 09h00 Durban Botanic Gardens	This was the final PSC meeting with an overall purpose of providing the project outcomes: Water Resource Classes, RQOs and the Reserve. The specific objectives were to: ▪ To consult with stakeholders on the proposed Water Resource Classes. ▪ To consult with stakeholders on the proposed groundwater and estuary RQOs.

4.5 INFORMATION MADE AVAILABLE TO STAKEHOLDERS

Stakeholders were regularly updated on the status of the project via the distribution of BIDs, which took the form of a newsletter. The purpose of information documents was to communicate progress made on the study and to provide them with a summary overview of study information. BIDs were circulated electronically prior to PSC meetings and assisted PSC members to engage meaningfully during the discussions. Hard copies of BIDs were also provided at the meetings.

Table 4.5 Summary of Information distributed in relation to each PSC meeting

No	Circulation Date	Information Document
1	24 January 2013 (in preparation for PSC Meeting 1: 19 March 2013)	▪ BID 1. ▪ Visioning Information Pack (including 29 IUAs). ▪ Visioning Questionnaire. ▪ Mvoti Umzimkulu Visioning Approach. ▪ Classification of water resources - List of acronyms. ▪ Meeting Agenda.
2	08 November 2013 (in preparation for PSC Meeting 2: 26 November 2013)	▪ BID 2. ▪ Meeting Agenda. ▪ PSC Meeting 1 Minutes.
3	02 June 2014 (in preparation for PSC Meeting 3: 18 June 2014)	▪ BID 3. ▪ PSC Meeting 2 Minutes. ▪ Meeting Agenda. ▪ Description of Operational Scenarios (discussion document).
4	04 September 2014	Progress Update Letter.
5	13 November 2014 (in preparation for PSC Meeting 5: 26 November 2014)	▪ BID4 ▪ PSC Meeting 3 Minutes. ▪ Meeting Agenda. ▪ Scenario Matrix Hand out. ▪ uMkhomazi and Mvoti River Systems Synthesis Document.
6	19 March 2015 (in preparation for PSC Meeting 6: 24 March 2015)	▪ BID 5. ▪ PSC Meeting 4 Minutes. ▪ Meeting Agenda. ▪ Draft RQOs for Mvoti to Umzimkulu Catchments.
7	04 September 2015 (in preparation for PSC Meeting 7: 16 September 2015)	▪ BID 6. ▪ PSC Meeting 5 Minutes. ▪ Meeting Agenda.

4.6 TECHNICAL WORKING GROUP SESSIONS

Five (5) Technical Working Group (TWG) Sessions were held with stakeholders to discuss different topics to clarify or expand on previous discussions held that was needed to equip stakeholders with information and provide DWS with essential information. Table 4.5 illustrate the various disciplines discussed.

Similarly, as for PSC meetings, invitation letters and proposed agenda were distributed to members providing them with sufficient information about the status of the project, the purpose of the technical session and what was expected of them. Following the meetings, minutes of meetings were compiled and circulated to attendees for their information, review and comment.

Table 4.6 Details of TWG sessions held during the duration of the study

Meeting	Date and Time	Focus of Meeting
TWG Session 1 Durban Botanic Gardens	03 October 2014 09h00	Scenario Evaluation, Multi Criteria Analysis Method and Priority RQOs for the Mvoti (U4) and uMkhomazi (U1) River Systems.
TWG Session 2 CSIR, Durban Office	15 October 2014 10h00	▪ Presented an overview of the methods employed to produce the hydrological information that was applied in the EWR assessments. ▪ Clarified the different levels of estuary assessment - Desktop, Rapid, Intermediate and Comprehensive and their minimum data requirements and links to confidence. ▪ Discussed the available data for the estuaries of the catchment. ▪ Summarised the existing Reserves for estuaries in the catchment at the level they were done as well as the implications to Classification. ▪ Discussed some of the recent refinements in the Estuary EWR methods and the consequences for this study.
TWG Session 3 Durban Botanic Gardens	26 November 2014 14h00	The focus of the meeting was on gathering information for setting up river RQOs and obtaining specialist stakeholder input with reference to: ▪ Confirming/checking the priority river RUs for RQO determination. ▪ Identifying the priority indicator components (ecological and user water quality) to be addressed at each priority river RU.
TWG Session 4 Durban Botanic Gardens	22 January 2015 13h30	Presented and discussed the Waste Water Management scenarios which would be analysed, to determine the ecological and socio-economic impacts on the estuaries.
TWG Session 5 CSIR, Durban Office	18 May 2015 11h30	**Estuarine TWG** ▪ Addressed issues pertaining to RQOs on all estuaries where RQOs were not undertaken in recent and historic Reserve studies. The PES and identified pressures was presented which helped identify the indicator components, for which RQOs were required. The work undertaken as part of the Desktop Estuary report was used as the basis. ▪ Update the existing information based on pressures and impacts on estuaries and to ensure that local knowledge was incorporated in preparation for scenarios analysis and RQO determination.

4.7 FOCUS GROUP MEETINGS

Where there was a significant common interest around a particular issue or geographic area, meetings were held with these interest groups. Many of these meetings were upon request of the

Stakeholders. Comments raised at these meetings were captured in the Issues and Response Register (IRR).

4.8 ONE-ON-ONE INTERACTIONS

One-on-one interactions were held with individuals and representatives of relevant stakeholder groups, e.g. Duzi Umngeni Conservation Trust, Catchment Management Forums. These interactions were particularly useful in dealing with key issues raised during the study.

4.9 COLLABORATING WITH EXISTING STRUCTURES IN THE STUDY AREA

As part of information dissemination and ensuring that many stakeholders are aware of the study, including opportunities for participation, existing structures such as Catchment Management Forums (CMFs) were utilised as platforms for information sharing. The actual engagement of the CMFs was not a direct responsibility of the stakeholder consultation team; however, all comments and issues raised at the CMF meetings were fed into the IRR, which was regularly updated by both the DWS team and the stakeholder engagement team.

There were also active environmental groups, e.g. Coastwatch, Duzi Umngeni Conservation Trust in the study area which, from time-to-time invited the technical team to present the study to their constituencies. As such, these organizations were used as platforms for sharing information and to create awareness of the classification process.

4.10 ISSUES AND RESPONSES REGISTER

All comments raised and submitted by stakeholders during this process were captured in the IRR. At the time of compilation of this report, the IRR contained approximately 474 written comments, which were a combination of individual written submissions and verbal comments raised at the following:

- PSC Meetings.
- TWG Sessions.
- Focus Group Meetings.
- One-on-one interactions, and
- Comments that arose from the reports circulated for comment.

4.11 BROADER STAKEHOLDER MEETINGS

Towards the end of the study, broader stakeholder meetings were arranged. To reach a wider audience and community, advertisements were placed in newspapers as shown in Table 4.7.

Table 4.7 Advertising of broader stakeholder meetings

Date	Newspapers	Distribution	Frequency	Languages
12 October 2015	Isolezwe	Regional	Daily	Zulu
12 October 2015	Daily	Regional	Daily	English

These meetings were held in strategic locations within the study area as shown in Table 4.8.

Table 4.8 Details of broader stakeholder meetings

Area	Date	Venue	Time
Pietermaritzburg	21 October 2015	University of KwaZulu-Natal Pietermaritzburg Campus - Council Chambers	10h00 – 14h00
Durban	22 October 2015	Durban Botanic Gardens, 70 John Zikhali Road	10h00 – 14h00

For both Stakeholder Meetings 1 and 2, invitation letters and a proposed agenda were distributed to members providing them with sufficient information about the status of the project, the purpose of the meeting and what was expected of them. Following the meetings, minutes of meetings were compiled and comments incorporated into the IRR.

The purpose of these meetings was to present and discuss the outcomes and recommendations of the classification study to stakeholders. Detailed information relating to the future phases of the classification process was outlined at these meetings.

4.12 WEBSITE

All technical reports and supporting documentation made available to the public during the course of the study were uploaded on https://www.dwa.gov.za/rdm/WRCS/ under 'Mvoti - Umzimkulu WMA'.

The IRR was continually updated throughout the three-year period of the implementation of the project and submitted to DWS on a monthly basis. This was undertaken to ensure that all stakeholders have access to information and are informed of the issues and concerns of fellow stakeholders.

4.13 RECORD KEEPING

An important part of the stakeholder engagement process is record keeping. The following information has been kept on record both as hard and electronic copies:

- Minutes of meetings.
- Attendance registers.
- Comment sheets.
- Letters, e-mails and faxes.
- Stakeholder Engagement Report (this section), which summarises stakeholder engagement activities up to the submission of the project close-out report.
- Issues and Response Register.

4.14 CONCLUDING REMARKS

The stakeholder engagement process followed has provided sufficient opportunities for stakeholders to become involved and contribute in the process. Stakeholders received information through a variety of avenues in different languages. The process has taken place over a long enough period to provide sufficient time for stakeholders to contribute. The stakeholder process was transparent; stakeholders had access to all technical documents and project team members to clarify matters of concern.

Based on the inputs received during the stakeholder engagement process, the following conclusions may be drawn:

- Due to the need of improved water resources management in the study area, the project attracted massive stakeholder interest. This was evident through good representation of

sectors and organisations at all PSC meetings as well as at the broader stakeholder meetings.

- A comprehensive database has been compiled during the study and Public Participation consisted of key representatives from most sectors and organisations within the study area. This database will be handed over to DWS to facilitate continuity with stakeholder engagement activities in the study area.
- There were however concerns about the lack of representation from the Department of Mineral Resources (DMR) throughout the process. Although they were invited to meetings, they did not attend any of the scheduled meetings. Stakeholders raised a number of illegal mining issues which require a regulatory effort and action from DMR's side.
- I&APs were afforded sufficient opportunities to engage meaningfully during the study. Stakeholders also utilised the communication channels and opportunities which were provided to them.
- Issues and concerns identified were recorded and considered, where possible, during the study. These issues are captured in the IRR, which will be a living document until the gazetting process has been concluded.
- Meetings held were informative and project updates which were provided through BIDs ensured that stakeholders were kept updated of the project progress.

Overall, the levels of stakeholder participation throughout the study have been encouraging and stakeholders are thanked for their inputs in the process. It is, therefore, recommended that communication with stakeholders is maintained to achieve the desired improvement in managing water resources in the Mvoti to Umzimkulu catchments and to assist with the implementation of Resource Directed Measures in the said catchment.

5 CAPACITY BUILDING AND TRAINING

The Mvoti to Umzimkulu Classification study was identified by both DWS and the PSP as an unique opportunity to train DWS personnel on Reserve and Classification procedures, and further build on previous training exposure. The primary aim of this component was to build the capacity of water resource managers attached to the study, both those in the regional offices (DWS regional) and the head office of DWS in Pretoria. Task D8 was identified as the Mentorship and Capacity Building task during the Inception Phase of the study. Input from DWS, and experience from previous Classification studies, were critical in designing the programme.

The Inception Report of March 2013 noted that previous exposure or training in EcoClassification or the RDRM would be an advantage to trainees. It was also stated that not all trainees would participate in each step or workshop, but that participation would depend on level of experience, prior training and expected outcomes of training. The following DWS staff members were proposed at inception stage as trainees participating at levels other than just training sessions:

- Barbara Weston: Overall project management, wetlands and estuaries.
- Tinyiko Mpete: Specifically water quality and hydrology.
- Boniwe Nobulele: Specifically water quality and ecology.
- Philani Khoza: Specifically groundwater and water quality components.
- Tovho Nyamande and Mmaphefo Thwala: Specifically socio-economics and IHI; and the SASS5 component of the EWR assessment.

Capacity building and training was conducted at the following levels outlined in Section 5.1 to 5.3.

5.1 MENTORSHIP PROGRAMME

The CD: WE nominated Ms Tovho Nyamande and Ms Mmaphefo Thwala to the Mvoti – Umzimkulu mentorship programme. A mentorship programme was developed with the assistance of both Ms Nyamande and Thwala, and Ms Shane Naidoo, the Director of the Water Resource Classification Directorate at the time. Note that Ms Nyamande was only involved with the project and programme to the end of 2013. The mentorship programme is attached as Appendix A, and was designed as per the integrated steps followed during the study. It shows the mentorship opportunities offered to Ms Nyamande (2012 - 2013) and Ms Thwala, and attendance by one or both DWS officials.

Note that included in the mentorship programme were (1) tasks to be covered by the capacity building programme (including the dedicated training sessions); (2) general tasks, e.g. preparation of GIS maps (Nyamande and Thwala, May/June 2013); preparation of a glossary for project reports (Thwala, May 2014); as well as (3) project management tasks to be conducted by Ms Nyamande and Ms Thwala (e.g. attendance of specialist workshops and review of project reports).

In addition, Ms Nyamande and Ms Thwala attended a number of one-on-one mentorship opportunities, as outlined below and shown in Appendix A:

- Ms Nyamande met with the economic team on 27 November 2012 – see draft programme attached as Appendix B.
- Ms Thwala attended a Cost-Benefit Analysis (CBA) workshop offered by Mosaka Consulting (T/A Conningarth Economists) on 3 - 6 November 2014 in lieu of the proposed day's training on economics and scenarios. See agenda attached as Appendix B.

- Ms Thwala had one-on-one training opportunities at the River specialist workshop in August 2014 and exposure to the models used in each specialist field.
- Ms Nyamande also produced a socio-economic zone map for the Usutu to Umhlathuze WMA Classification project in December 2013, with the assistance of William Mullins and Riekie Cloete. This additional task was requested of the team for internal DWS use.
- Ms Thwala assisted Dr Scherman at the rivers water quality RQO TWG session held in Durban in January 2015 to gather stakeholder input. She also ran a similar process with the Durban DWS Regional Office on 3 March 2015 to gather information for drafting water quality river RQOs.

5.2 SPECIALIST WORKSHOPS

A programme of field-based activities and specialist workshops were constantly updated and forwarded to Ms Nyamande (2012 and 2013) and Ms Thwala for their information – see Appendix C.

5.3 CAPACITY BUILDING PROGRAMME

The following list of training sessions or workshops were undertaken during the study. These were available to the trainee project managers, as well as other DWS staff (head office and region). All workshops were undertaken in Durban. Agendas, outlining Aims and Learning outcomes, and attendance lists are attached as Appendix C.

- **Training session 1 - Introductory session:** Integration of the WRCS, the Reserve and RQOs. Three very distinct processes, which show significant overlap within its individual process descriptions and manuals, were integrated and integrated steps designed. This integration process and the rationale therefore was presented and discussed with participants. This workshop was undertaken in Durban on 25 February 2013. Trainees were provided with a CD of information.
- **Training session 2 – Status quo and preliminary IUAs:** This two-day workshop discussed the process of status quo assessment and delineation processes for rivers, estuaries, economics and ecosystem services. The application of Water Resource Use Importance for prioritising RUs and the production of preliminary IUAs was also discussed. The training was held in Durban on 13 and 14 May 2013. Trainees were provided with a CD of information.
- **Training session 3 - Water quality (rivers):** A joint training session was held for the Classification study and the DWS regional office, around water quality issues in Resource Directed Measures (RDM), due to demand around water quality requirements particularly for licensing purposes. The training was held in Durban on 31 July and 1 August 2013. Trainees were provided with a CD of information.
- An additional informal training session (**Training session 4; originally proposed as Training session 3**) was held in Durban after the Project Management Committee meeting of 24 February 2015, regarding the use of Multi Criteria Decision Analysis and integration of study results to formulate Management Classes. The results of the study are nested in the ecological, economic, ecosystem services, and water quality consequences of various operational scenarios. Based on a recommended scenario, the resulting Management Classes are derived. This training was conducted by Pieter van Rooyen and attended by Ms Thwala.
- Note that training on Spatial and Time Series Information Modelling (SPATSIM) and the RDRM was run in Grahamstown by Prof Denis Hughes and Dr Tendai Sawunyama in November 2013. Attendance was offered to Ms Nyamande, together with the managers from the Inkomati Classification study. Unfortunately, she was not available for the training.

5.4 CONCLUSIONS

Feedback and auditing of training and mentorship was conducted internally within the Directorate. Training sessions were generally well attended by DWS head office and Regional Office Classification personnel.

Most mentorship opportunities were taken up by Ms Thwala across the study period. She provided good support to the PSP team, particularly with regard to liaison with the regional office and the completion of the RQO and gazetting tasks. She had to finish the study in the absence of her director, and took on the additional responsibilities admirably and under difficult circumstances. It is recommended that Ms Thwala be provided with additional opportunities to work with project and PSP teams, so as to further build on the experience gained during this Classification study.

6 ISSUES, CHALLENGES AND LESSONS LEARNT

6.1 SCALE OF THE STUDY

This was the first Classification study that included a Reserve determination component (not just using previous results) as well as the determination of RQOs. Although this did not prove to be a problem as these processes seamlessly fit together, a significant challenge was encountered with the inclusion of 64 estuaries, and numerous towns including a large metropolitan area which impacts on a large number of these estuaries due to waste water management practices. Large volumes of treated waste water is discharged into a number of estuaries in the Study Area. Since the pilot study (Olifants Doorn), which tested the Water Resource Classification Guidelines, only considered one large river system and one estuary. The approached developed from this pilot investigation did not provide insight on how to deal with different levels of information availability and there was no approaches set-out for dealing with estuaries, as for rivers, at desktop level of detail. (For rivers the methods to deal with many nodes at sub quaternary have been developed during the previous Letaba and Inkomati NWRCS studies). The estuaries were however problematic, especially as desktop tools did not exist either with the determination of priorities, EcoClassification, nor with setting EWRs. Approaches (and in some cases methods) had to be developed during the study which was hindering production work on the study. Guidelines (for both rivers and estuaries) are required that clearly stipulates the different levels of approaches required, a prioritisation process as well as entrenching the fact that once one has to deal at WMA scale, a desktop level approach is acceptable for low and medium priority areas.

6.2 WATER RESOURCE INFORMATION, UNCERTAINTIES AND SOLUTIONS

At the beginning of the study various water resource and hydrological model datasets were collated and it was found that there was only low uncertainty and high resolution models available for uMkhomazi and Umzimkulu river catchments. It was also found that some of the hydrological time series dataset ended more than ten years prior to the study date with the related difficulties to relate present day ecological observations to the recent years' hydrological regime. Consideration should be given to undertake appropriate hydrological studies prior to performing Classification.

Natural and present day hydrological data, appropriately disaggregated to the resolution needed for the 64 estuaries at the onset of the study was absent and primary hydrological work to generate monthly time series information had to be undertaken. This was achieved by applying and adjusting high uncertain modelling information from WRC studies that were concurrently running at the same time of the Classification Study.

The need for such high resolution hydrology (modelling) was not identified as a requirement in the TOR and the required work (man hours) was therefore excluded from the proposal. The lesson learnt points to the need for pre-assessments of information availability, detailed specification of resolution requirements and the associated expected intensity of assessments per catchment or water resource. This information is needed to specify where desktop (strategic) and where comprehensive methods are needed and should be part of the TOR. Note that there are other data requirements such as long term estuary water level recordings and berm breaching data which also dictates what would be possible in terms of the assessment level – whether it would be at a desktop or comprehensive level.

6.3 GROUNDWATER

The existing stipulated methodologies are based on mean annual estimates which resulted in the following:

- The groundwater component of the Reserve in the Classification process which cannot be integrated with time series requirements for EWRs, and for an integrated surface and groundwater hydrology.
- Groundwater balances in which recharge cannot be accounted for, or where baseflow exceeds recharge and which is not calibrated against observed baseflow time series on which EWRs are based.
- An inability to distinguish between recharge which is lost as Interflow in high lying areas and hence not available to boreholes. It is the recharge that reaches the local or regional aquifers that is allocatable for abstraction, not the entire recharge volume.
- An inability to quantify the impact of current and future abstraction scenarios except by simple subtraction from mean annual baseflow estimates, which is not realistic.
- A need to resimulate and recalibrate the hydrology to include the impacts of streamflow reduction and groundwater abstraction against observed flows so that the impacts of groundwater abstraction on baseflow can be isolated and quantified and so that recharge volumes are calibrated against a water balance.

The development of RQOs which monitor the integrated impact on EWRs in rives is required. This cannot be achieved by simply monitoring groundwater levels, as water levels only reflect the impact of groundwater within a small radius of influence of an abstraction area. They indicate localised over exploitation and not impacts over an IUA, or on baseflow. A very large number and dense monitoring network is required for this, which is not available. Monitoring in the vicinity of perennial rivers is difficult to interpret as levels are maintained by the river flow, hence do not quantify baseflow reduction or losses from the river. The information that is actually required is the impact of abstraction on EWRs. This cannot be addressed by a coarse water level monitoring network, in regions with a strong baseflow dependence, RQOs should be based on baseflow monitoring at gauging weirs. There is a resistance to quantitative RQOs set as baseflow volumes, even though this data is available at gauging weirs, and is a direct measure of the impacts of groundwater abstraction and Streamflow reductions (SFRs) on baseflow.

It is often commented that groundwater abstraction cannot be monitored so it cannot be set as RQOs. However, groundwater abstraction estimates based on Water Use Authorisation and Registration Management System (WARMS) or other estimates are accepted to derive the groundwater component of the Reserve and the allocatable groundwater in classification studies. This is a significant divergence of opinion. The issue of current abstraction versus registered use is a significant problem when setting RQOs and allocatable groundwater. It is imperative that methods to estimate groundwater use be standardised.

Use is often measured against Harvest Potential or recharge via a stress index to derive stressed areas or areas of high importance for monitoring. This is not useful for setting RQOs or for classification in areas where most of the recharge is lost in high lying areas as interflow and is not available for abstraction. This is also not a very useful approach in areas highly dependent on baseflow, as even a low stress index resulting from abstraction may have a significant impact on baseflow needed for EWRs. It would be more useful if groundwater use were integrated into RQOs as a quantitative impact on baseflow, which can be calculated using a calibrated model and be monitored as an RQO at a gauging weir.

The existing simplistic Groundwater Resource Directed Measures (GRDM, Dennis *et al.*, 2012) methodology based on mean annual data and water levels is applicable in areas with little or no baseflow, however, where significant baseflow exists, and where EWRs are baseflow dependent, an integrated approach based on a calibrated time series and water balance, and impacts of groundwater abstraction on baseflow is needed

6.4 LINKAGES WITH RESERVE STUDIES

It has become apparent during these and other Classification studies that it is imperative that updated Reserve data is used that is linked to the same and latest hydrology used for planning and Reconciliation studies. Out of date Reserve results cannot be used in the scenario evaluation and when updated purely on the basis of new hydrology, the original ecological and habitat motivations are not necessarily applicable. Ideally, hydrological updates, Reserve studies, and Classification should be planned together and ideally integrated. This links to point 6.1 above.

It is also necessary that standards on the level of Intermediate Reserves (or Comprehensives) are set and adhered to. It was for example assumed that the recent Intermediate/Comprehensive Reserve work undertaken prior to the Classification study on the Umzimkulu River could be used as such in the Classification studies. However, EcoSpecs set for e.g. vegetation consisting of one line for all the EWR sites are not the required standard and the results could therefore not be used for gazetting.

The use of a 20-year old Comprehensive Reserve information on the uMkhomazi River was problematic due to the fact that the EWR site's benchmarks were not surveyed on the grid by DWS surveyors after EWR studies as was the norm. It was fortuitous that the same consultants did the work and through photographs and records kept managed to find some (not all) of these benchmarks. This should be a standard in all Intermediate or Comprehensive Reserve studies as the cross-sections should always be available in the future for follow-up studies and monitoring.

6.5 RQO DETERMINATIONS

The RQO guidelines are detailed but not necessarily practical and based on the data normally available. Application has shown that there are different levels and approaches being applied and that the authors of the guidelines are making adjustments in their studies when the time consuming approaches causes problems. These adjustments are not necessarily provided to other PSPs involved in RQOs. The RQO guidelines require revision and it must be ensured that there are suitable links to the work generally undertaken as part of Reserve studies. Large sized areas seem to be the norm for classification and this factor should also be considered in the revision. When both the Classification and RQO guidelines were written, the roll out to WMA was not envisioned.

The links to EcoSpecs are broadly referred to and reference is made to the methods developed for Reserve studies. These methods were however developed during the 2009 Reserve studies and were never formalised. Furthermore, these methods are continuously being updated by RQS, DWS and the final approaches have not yet been made available for use since it is still in development and refinement. It is further recommended that revised guidelines integrate the RQO and EcoSpecs, and that clear guidelines are provided for the technical reports as well as the information required for gazetting. Another confusing issue is that it is perceived that RQOs will be specifications for monitoring. This is not necessarily the case, the one being an objective and the other a specification. The focus is on objectives on RQOs and the 'translation' to EcoSpecs is not well defined or necessarily part of the TOR for RQO studies.

More guidance is requested from DWS specialist scientists regarding methods and tools and the RQO process, particularly for water quality. DWS can also assist PSPs with stakeholder demands on problematic catchments (e.g. those already non-compliant in terms of water quality objectives), so as to ensure that the principle of protection is ensured, even within the realm of industrial, agricultural and other water use demands.

6.6 SCENARIO DEFINITIONS AND EVALUATION

Since Classification is carried out to find the most appropriate balance between protection of the ecology and water use for socio-economic benefits, it is essential to have properly defined scenarios (operational scenarios) for evaluation. The parallel Reconciliation Strategy process provided these scenarios for analysis and there were significant benefits in running the two studies in parallel.

The WRCS guidelines only listed possible methods that can be considered to undertake scenario comparisons and evaluations. This lead to the development and application of multi-criteria analysis methods where the socio-economics, ecosystem services and the ecology is rated for each scenario and integrated through the application of relative weights to derive overall scenarios ratings that facilitate the ranking of scenarios. This method did not attempt to express the ecological health in monetary terms – the ecology was rated and evaluated by applying the numerical health scoring approach – which is part of the standard ecological assessment methods. It is proposed that expanded guidelines be developed that will streamline how future classification studies compare and evaluate scenarios.

Consideration should be given to introduce pilot applications of selected IUAs for demonstration of the full process to stakeholders. The rationale is to capacitate those stakeholders that are interested in the detail analysis and evaluation methods. The need for pilot applications should be defined in the TOR with clear descriptions of the intended detail. The aim with such pilot application is to identify early on in a study what the stakeholder inputs and issues are. Appropriate change management can then be incorporated in the study to avoid potential stakeholder initiated impasses that only emerge towards the end of the study.

The application of the Classification process in and around large urban areas (where there are significant pressure for expanding socio economic activity, the economic implications of different ecological protection levels) need to be compared in terms of alternative mitigations measures (such as wastewater treatment options) rather than whether or not further urban expansion can be allowed.

6.7 STAKEHOLDER PARTICIPATION

The technical complexity of the study makes it difficult for stakeholders to meaningfully participate and it is recommended that stakeholders would need to be capacitated if they are really to engage effectively. At meetings stakeholders often raised issues and concerns not directly pertaining to the topics which were presented and related to the study objectives. Although stakeholders had the beneficial opportunity to liaise with one another it begs the question of how much they indeed understood of what was presented to them.

6.8 ESTUARIES

During this study significant progress was made on the automation of the data processing especially at the desktop level. Data processing and analysis of 64 estuaries for between 2 and 10 scenarios required cross discipline coordination and sharing of methods.

The Estuary desktop model was applied as a high-level strategic assessment tool. In the absence of long-term measured data (lacking for most systems in the WMA) it provided an overview of the pressures on each system, the present estuary condition (PES), estuary importance, recommended condition (REC) and the possible responses to future flow/quality changes. However the results are of low confidence as little physical data exist to validate predictions against.

The evaluation of the water quality scenario implications required innovative volumetric approaches based on inflowing river/discharge water quality parameters, volume of inflow and the volume of the estuary. A combination of the estuary desktop model and more detailed volumetric approaches was used. This however does not replace the need to detailed numerical modelling in permanently open systems, especially if flow does not arrive at the head of the estuary.

During the execution of the study it became clear that additional waste water scenarios needs to be developed to predict what long-term future development trends along this coast means in terms of risk to estuary health condition. Therefore a VO was obtained to generate wastewater management scenarios for the urban area north and south of eThekwini and to assist with the evaluation of estuary ecological responses. This included the evaluation of the socio-economic implications derived on the basis of wastewater management alternatives

The study had a number of policy consequences that will ripple through the government sectors that deal with natural resource management in South Africa, i.e. water, biodiversity, coastal management and fisheries. For example the study showed that restoring all estuaries in the region to a minimum of a D Category (or higher) is not feasible (e.g. Durban Bay is a harbour). It also showed that restoration in some of the systems would carry very high economic consequences, e.g. removal of all wastewater and restoration of catchment water quality. Therefore in striving for a balance between socio-economic concerns and biodiversity targets, some of the smaller system will be targeted for additional waste water disposal, which means that they will decline further in health condition. The implication of these recommendations in context of other legislation need to be debated between the relevant departments in order to put forward coherent conservation guidelines that also consider the economic imperatives. There was no inter departmental meetings between DWS, Department of Environmental Affairs (DEA), Department of Agriculture Forestry and Fisheries (DAFF) and the South African National Biodiversity Institute (SANBI) to resolve at a national level the conflict between the National Estuary Biodiversity Plan 2011 and the recommendations of the Classification process. The recommendation is that this conflict be addressed before the next Classification study.

As a large number of interventions focus on restoration of riparian habitat, control of artificial breaching and management of catchment water quality (driven by stormwater and informal settlement runoff) these mitigation measures will have to be implemented as part of formal estuary management plans developed under the National Estuary Management Protocol promulgated by the Integrated Coastal Management Act. While the project outputs were tailored to facilitate this cross-sectorial collaboration, on the ground implementation will require significantly more

resources to achieve this. This collaboration should be fostered earlier in future classification projects as it allows for a more seamless roll out of future remedial actions.

As a large number of estuaries are set to improve in condition to meet the Water Resource Classes (and their associated Target Ecological Categories (TECs)) it will be very important to launch a regional scale monitoring programme to track if mitigations are being instigated and if targets are being achieved. Regional scale monitoring programmes will also be more cost effective versus the ad hoc style monitoring that typified data collection along this coast to date and resulted in a relatively low confidence assessment. Such a monitoring programme will require interdepartmental cooperation in both the data collection aspects and in the report of monitoring results against the targets set in this study.

A number of scientific gaps were identified that would have inform the ultimate decision-making process if the information was available. The following aspect needs be addressed for regional assessments, and management objective setting, to be more sensitive to the requirements of small estuaries:

- ***Need for research on estuarine connectivity and inter-estuary recruitment:*** There are a large number of small systems in the study area that collectively add up to significant estuarine area along this coast, most of it captured in temporarily open/close systems. The gaps opening up as a result of poor condition systems (in most cases low oxygen in winter) along the coast is worrying. But no scientific support is available to guide planners in what are the consequences to estuarine connectivity. In short, the "health of your neighbour matters" as it ensures overall resilience to the network of small estuaries along this coast, but the science is lacking to show the degree to which the health of adjacent estuaries influences each other.
- ***Science-based policy to drive selection of TEC:*** If coastal development is taken as inevitable, the net result is a continuous escalation of pressures on estuaries. A policy decision needs to be made on whether estuarine degradation should be spread over the region or focussed on a few compromised systems while others remain in a near natural state. For example, whether waste water is disposed to a number of adjacent systems (but systems must remain at a functional level), or collected at a central point and discharged into a single targeted system. While most researchers support the idea of a targeted systems (especially if they are of insignificant ecological/social importance and/or poor present condition), existing policy is driving the opposite behaviour, with the result that the pressure is spread along the coast.
    - ***Nutrient responses:*** The large numbers of small estuaries are very sensitive to nutrient loading. There is a need to better understand the role of the different nutrient species in microalgae and macrophyte production to be able to predict tipping points and present/future condition assessments.

6.9 STAKEHOLDERS AND THE GAZETTING PROCESS

During the initiation of the study, there was much uncertainty of the level of detail that will be included in the Gazette as the final product at the end of the study. However, as previous and parallel studies reaches this point, more clarity was obtained and it became apparent that only results that were based on reasonably detailed investigations were to be included. This resulted in uncertainty during the course of the study since the stakeholders could not be informed from the start of the process as to what information will be included or not in the Gazette. The lesson learnt is that in future, stakeholders must be made aware of what will be included and what information

will be available in technical documents to be used for licencing, strategic planning and management of the WMA.

7 BENEFIT TO CLIENT

7.1 GENERAL

- The objectives of the study have been achieved within the stipulated budget and timeframe.
- The WRCS have been successfully implemented according to the gazetted steps.
- A robust stakeholder engagement process was followed throughout the study with broad based and diverging contributions from various sectors interested in the management of the water resources.
- Buy-in with sector and stakeholder groups has generally been achieved.
- Department personnel have derived adequate benefit from the capacity building programme and activities undertaken and are in a position to maximise their involvement in future Classification studies.
- Linkages and alignment with other studies and initiatives have been achieved (Reconciliation, Groundwater Reserve study, etc.).

7.2 CAPACITY BUILDING

The PSP and project manager has valued the input and assistance received from the designated project managers. The joint sessions were both fruitful and assisted in building a good working relationship between the Department and the project team.

7.3 INFORMATION REPOSITORY

All the reports and relevant information utilised and generated as part of Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area study were provided electronically on a disk.

The study was structured and divided into various tasks and sub-tasks which formed the basis for the outline and indexing of electronic data. Data have been indexed according to the main tasks and sub-tasks developed for this Study (outlined below) and should be used as a 'general road map' when searching for files. Main tasks and associated index of electronic data have been colour coded for easier reference. The electronic data directory structure used for this purpose is outlined below and indicates electronic data pertaining to main tasks and sub-tasks.

Table 7.1 Outline of indexed electronic data generated per task and sub-task

Electronic data relevant for Main Tasks	Electronic data relevant for sub-tasks
TECHNICAL REPORTS	MS Word
	PDF
TASK A_PROJECT MANAGEMENT	A1_Project Management Meetings
TASK C_WATER RESOURCE INFORMATION AND DATA GATHERING	Hydrology
	Reserve_Related_Studies
	RDM_Database_Information
	Other_Reserve_Reports
	Estuaries
	Other_Reports
	Google_Earth_Files
TASK D1_IUAs_RUs_STATUS QUO	D1.1_Water resources component

Electronic data relevant for Main Tasks	Electronic data relevant for sub-tasks
	D1.2_Rivers
	D1.3_Economics
	D1.4_Goods_and_Services
	D1.5_Water_Quality
	D1.6_Wetlands
TASK D2_STAKEHOLDER_INVOLVEMENT	D2.2_Stakeholder_ID_Database_Compilation
	D2.3_Project_Announcement
	D2.4_Issues_and_Response_Report
	D2.5_Stakeholder_Meeting
	Variation_Order-Task_VD_2.4
	Variation_Order-Task_VD_2.5
TASK D3_QUANTIFY_EWRS	D3.2_EWR_Site_Selection
	D3.6_Intermediate_Data_Analysis
	D3.7_Rapid_Data_Analysis
	D3.8_EWRs_DBNs
TASK D4_ID_EVALUATION_OPERATIONAL_ SCENARIOS	D4.1_Scenario_ID
	D4.2_River_Ecological_Consequences
	D4.5_EGSA_Consequences
	D4.7_MC_Determination
	Variation_Order-Task_VD_4
TASK_D5_STAKEHOLDER INVOLVEMENT	D5.1_Project Steering Committee
	D5.2_Progress_Feedback_Letter
	D5.3_Newsletters
TASK_D8_CAPACITY BUILDING	Training_Session_1
	Training_Session_2
	Training_Session_3
MAPPING	Shapefiles
SCENARIO_COMPARISON_FACILITY	WMA11_Scenarios
WATER_RESOURCES_DATABASE	1. Documentation
	2.1 Natural Flow for DBNs
	2.2 Present Day Flow for DBNs
	2.3 Nat and PD Flows for EWR Sites
	2.4 Ecological Water Requirements
	2.5 Operational Scenarios
	2.6 Dam Spill Analysis

8 RECOMMENDATIONS

The following recommendations are made:

- It is highly recommended to have reconciliation studies run parallel with classification studies.
- Validated water use data is a prerequisite for high confidence classification outcomes.
- Long term monitoring is critical. Without the necessary investment before the study, high confidence results cannot be provided regardless of how much time and effort goes into field investigations.
- Operationalisation and monitoring of the Class and RQOs are required in order to implement proposed recommendations and exercise compliance control.
- It is recommended that the members of the PSC be valued as stakeholders of the department who have already been capacitated to a certain degree. They have already received and have participated in the process and should be kept informed of the next steps.
- Where legislative mandate conflicts arise it is recommended that the relevant departments be identified upfront and additional high level authority meeting be held to ensure conflict resolution before detail public participation, e.g. coastal catchments with a joint mandate on waste disposal shared by DEA and DWS or the TEC of priority systems for conservation planning.
- It is recommended that Ms Thwala be provided with additional opportunities to work with Classification projects and PSP teams, as to further build on the experience gained during this Classification study.
- Specialist scientists within DWS need to play a much stronger role in advising and guiding PSPs, and therefore steering components of studies so that DWS goals and objectives are met. This is particularly important for the water quality task. This kind of assistance from DWS would also be helpful in terms of meeting stakeholder goals within time and budget constraints. Due to the emphasis on stakeholder participation, PSPs can get into a position where they are “over” producing in an effort to satisfy stakeholders. As it is impossible to satisfy everyone all of the time, technical guidance is needed from DWS to ensure that DWS goals are kept in perspective.
- The integration of water quality down a river and into the estuary (in catchments containing both), is not clearly considered in the Classification guideline documents.
- Water quality models for evaluating consequences of scenarios are still not available for variables other than Total Dissolved Salts. This means that water quality consequences cannot be evaluated at the same level of confidence as other components.
- Methods determining the Reserve for wetlands need to be improved and expanded on and it should consider how scenario consequences will be evaluated. At present major water development scenarios that impact wetlands which are not river related have not occurred, but this may well happen in future studies.

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10 APPENDIX A: MENTORSHIP PROGRAMME

Learning area	Task description	Skills required	Mentee participation / involvement
Integrated step: Step 1: Delineation of the RUs and IUAs and describe status quo			
Ecology Hydrology Water Quality Socio-economics GIS	Establishment of a network of nodes to be used as the basis of the Classification Process.	▪ Application of GIS. ▪ The use of Google Earth. ▪ Sourcing of data. ▪ Allocation of nodes. ▪ Photos (taking photos and important of photos). ▪ Data collection and sourcing (what to collect and how). ▪ To import field data into GIS and Google earth. ▪ Delineation of the RUs. ▪ Delineation of the socio-economic zones. ▪ Delineate the Groundwater Resource Units.	Shape files to be sent to TN[1] and MT[2] for dummy map generation. May/June 2013. Support (P da Sousa, WRP) can be provided for map finalization; liaison underway with MT.
	Hot sport identification and level assessment.		1 Meeting with economic team to discuss approach, data collection and delineation of economic zones: TN, December 2012. 2 Assist in identifying and finalising hotspots and biophysical nodes zones (18 - 22 February 2013: TN did not attend): Rivers. 3 Estuarine desktop assessment (29 - 31 May 2013): Attended by TN and MT.
	Delineation of IUAs and RUs.		1 IUA workshop: Feb 2013 – TN did not attend. 2 Delineation of RUs in form of discussion session with team leader and report review: July 2013.
	Determination of the present-day status of the catchment (ecological, economic, social, Ecosystem Goods, Services and Attributes (EGSA) and Water Quality (WQ)).		1 Review of Status Quo Report. 2 WQ component (Rivers) covered in WQ training workshop run as part of the general capacity building programme on 31 July and 1 Aug 2013. Attended by MT. TN and MT to spend a day with WQ mentor to discuss approaches, data analysis and methods. This task was completed with MT at the August 2014 river workshop. 3 IUA delineation etc. completed in February 2013.
	Water resources rezoning and identification of important water use.	Development of a list of ecosystem indicators and definition of a scoring system.	No specific training component for this step.
Integrated step: Step 2: link the value and condition of the water resource			
Stakeholder engagement	Define the catchment vision and input to the Background Information Document (BID).		1 Input to the catchment visioning conducted as part of first Stakeholder meeting in March 2013. 2 TN and MT to draft BIDs (TN only involved in first BID) and provide to PSP for review and finalisation.
Integrated step: Step 3: Quantify EWRs and changes in non-water quality EGSA			
Ecology Hydrology WQ	1 Extrapolation and estimation processes. 2 Understanding the hydrology of Mvoti. 3 Analysing the nodes.	▪ Desktop EWR estimation for biophysical nodes. ▪ Interpretation of the result.	Attendance of specialist workshops and discussion with the relevant specialists.
		▪ Setting and running the models. ▪ Exposure to hydraulics methods (helping in data collection in the field and Interpretation of the result).	1 Attendance of Rapid river specialist workshop: 4 - 5 November 2013. 2 Attendance of 12 - 16 May 2014 Intermediate river specialist workshop and exposure to each model used with the relevant specialist. Attended by MT. 3 TN and MT to spend a day with the WQ specialist regarding modelling options considered and used for the study. Approaches used were discussed during the river specialist workshop. 4 Estuary biophysical surveys; Umkomaas Estuary, 11 - 12 September 2013.

Learning area	Task description	Skills required	Mentee participation / involvement
			Attended by MT. 5 Exposure to hydraulic field methods (i.e. cross-sectional surveys): 12 - 16 August 2013. Attended by TN and MT. 6 Attendance of estuary EWR specialist workshop in Durban: 20 - 24 October 2014. The workshop was not attended by MT due to a logistical error made by the training coordinator.
	EGSA	Understanding the linkages between the EGSA, REC and PES.	TN and MT to attend a day with Greg Huggins re: socio-economics, so as to develop an understanding of EGSAs and the assessment thereof. Undertaken during 11 - 15 August 2014 river workshop. MT attended.
	EWR	Interpretation of the EWR template (WQ).	1 RDM template for water quality (rivers) was covered during the water quality training workshop of July/Aug 2013. 2 TN and MT to review all templates.
Integrated step: Step 4: Identification and evaluation of scenarios within IWRM			
Ecology Hydrology WQ Socio-economics	Establishment of operational scenarios taking into account the relationship among social, economic and ecological trade-offs.	▪ The development of the Ecological Sustainable Baseline Configuration scenarios. ▪ Setting, running the models (yield and WRPM) and interpretation of the results.	1 Spend a day with economics team re: approach to scenarios, and assistance with report: September 2014. MT attended a CBA workshop offered by Mosaka Consulting (T/A Conningarth Economists) on 3 - 6 November 2014 in lieu of the proposed day's training. 2 Attendance of 20 - 24 October 2014 (estuaries) and 11 - 15 August 2014 (rivers) specialist workshops and exposure to each model used with the relevant specialist. River workshop attended by MT. Ms Thwala did not attend the estuary workshop. She was offered attendance of the Gouritz estuary workshop on 17 - 21 November 2014 in lieu, as the approach followed is the same as that of the Mvoti workshop, but was not able to attend. 3 Attendance of 27 October 2014 internal meeting to integrate consequences and determine preliminary Management Classes: A formal meeting was not held for this task and results discussed electronically between team members. 4 Review and input to all reports, i.e. including individual specialist reports. 5 At 11 - 15 August 2014 river workshop, MT attended specialist sessions with Louw, Koekemoer, Scherman, Mackenzie and Rountree. 6 Ms Thwala will attend an additional training session on the process to select Management Classes after the PMC meeting of 24 February 2015.
Integrated step: Step 6: EcoSpecs and non-ecological water quality component			
Determination of the RQOs	Development of the RQOs.	Training on the use of the RQOs toolkit and development of numerical limits.	1 Attendance of 28 October 2014 internal preparatory meeting in Pretoria for RQO determinations. A formal meeting was not held for this task and results discussed electronically between team members. 2 MT assisted Dr Scherman at the WQ RQO TWG session in Durban on the 22 January 2015, to gather stakeholder input. 3 MT attending the estuary RQO meeting on 18 May 2015.
Integrated step: Soft skills			

Learning area	Task description	Skills required	Mentee participation / involvement
Communication Public participation Stakeholder engagement	Stakeholder consultation	Arrange PMC Meetings (logistics and minute-taking). Drafting of invitations to PSC and Public meetings. BID, Newsletters. Presentations Skills (PMC, PSC, Forum public meetings and other stakeholder engagements).	
	Catchment visioning		
Additional tasks			
			Production of socio-economic zones map by TN for internal DWA Usutu to Umhlathuze WMA Classification project: Dec 2013. Mullins and Cloete to review and assist.

1 Ms Tovho Nyamande 2 Ms Mmaphefo Thwala

11 APPENDIX B: MENTORSHIP IN ECONOMICS

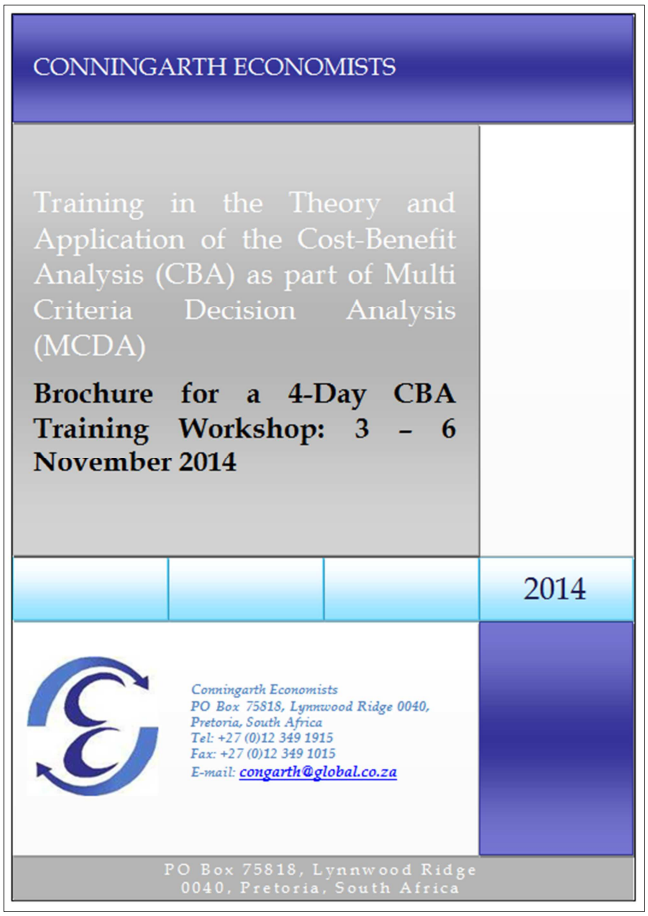
Draft mentorship programme for Ms Nyamande: Classification of Significant Water Resources in the Mvoti to Umzimkulu Wma: WP10679.

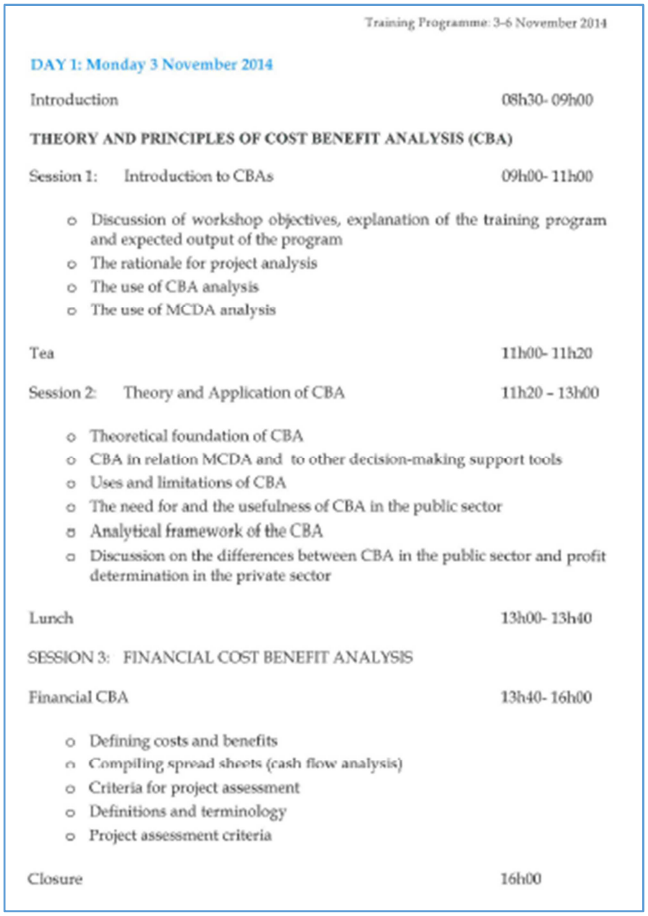
Learning area	Task description	Mentee Participation/involvement	Performance indicator	Deliverable
Socio-economics **(Classification step 2)**	Determination of the relationship between the value and the condition of the water resource	Development of a list of ecosystem indicators and definition of a scoring system	Socio-economic evaluation and decision-analysis framework	Socio-economic report

Programme for mentorship for Ms Nyamande: Classification step 2

5.1.2 Task D1.2: Economic component

- The economics team proposes that Ms Nyamande participates in the study in the initial stages of the project.
- It is planned that the team will discuss with her the manner in which the economic zones will be delineated.
- Ms Nyamande can also assist with sourcing data and if she has better contact to access certain data it will be utilised.
- Training will be scheduled for 27 November 2012.
- One working day is allocated to provide mentorship.





Training Programme: 3-6 November 2014

DAY 1: Monday 3 November 2014

Introduction 08h30- 09h00

THEORY AND PRINCIPLES OF COST BENEFIT ANALYSIS (CBA)

Session 1: Introduction to CBAs 09h00- 11h00

- Discussion of workshop objectives, explanation of the training program and expected output of the program
- The rationale for project analysis
- The use of CBA analysis
- The use of MCDA analysis

Tea 11h00- 11h20

Session 2: Theory and Application of CBA 11h20 – 13h00

- Theoretical foundation of CBA
- CBA in relation MCDA and to other decision-making support tools
- Uses and limitations of CBA
- The need for and the usefulness of CBA in the public sector
- Analytical framework of the CBA
- Discussion on the differences between CBA in the public sector and profit determination in the private sector

Lunch 13h00- 13h40

SESSION 3: FINANCIAL COST BENEFIT ANALYSIS

Financial CBA 13h40- 16h00

- Defining costs and benefits
- Compiling spread sheets (cash flow analysis)
- Criteria for project assessment
- Definitions and terminology
- Project assessment criteria

Closure 16h00

DAY 2: Tuesday 4 November 2014

ECONOMIC COST BENEFIT ANALYSIS

Session 1: Economic CBA 09h20- 11h00

- Defining prices in CBA
- Principles in the calculation of shadow prices
- General problems with the determination of shadow prices
- Valuation of inputs and outputs
- Surrogate prices
- Alternative approaches
- Application procedures for CBA

Tea 11h00- 11h20

Session 2: Advanced aspects regarding CBA 11h20-13h00

- Probability theory
- Depreciation
- Benefit Cost Ratio
- Discount rates
- Externalities
- Residual value
- Using NPV as a basis for SAM-based macro-economic Impact Analysis development
- Other points as raised by trainees.

Lunch 13h00- 13h40

Session 3: Practical Applications of CBA 13h40- 16h00

Elementary classroom example of a CBA
(Eastern Cape case study)
Note: Participation by all. Case study will be determined by participants.

Closure 16h00

DAY 4: Thursday 6 November 2014

Session 1: Extensive CBA case study Application: Infrastructure 09h00- 13h00

Note: An example of the Durban Point Development (Marine theme Park) will be discussed.

Lunch 13h00- 13h40

Session 2: CBA Report Writing & Data Archiving 13h40-16h00

Closure 16h00

12 APPENDIX C: PROGRAMME OF SPECIALIST WORKSHOPS

	Date	Task	Deliverable	Activity	Objective	Trainee identification and importance	Training description	Venue	Comment
1	18 - 22 Feb 13	D1.7 1.9	D11 D13	Analysis of data by specialists.	Completing the DSS spreadsheet in terms of: 1 Confirm NFEPA. 2 EIS and REC. 3 REC for RDRM. 4 Hotspot ID. 5 Selection of Desktop Biophysical Node.	Tovho Nyamande: High importance (plus probably one more person).	Understanding the process and rationale of the DSS spreadsheet.	Malelane	Ms Nyamande has been provided with the dates. Logistical information will be provided.
2	13 Feb 13	D1.8	D12	Internal team leader meeting.	Consider all status quo components and delineate preliminary IUAs.	Tovho Nyamande: High importance.	Participate in the identification of IUAs.	Pretoria	Ms Nyamande has been provided with the dates. Logistical information will be provided.
3	29 - 31 May 13	D3.13	R4	Estuarine desktop assessment.	Determine estuary PES (64 systems) and preliminary selection of EWR sites and data collection.	High importance for RDM (Reserve) personnel.	Involvement in identifying EWR Intermediate sites.	Durban	Dates and logistical arrangements will be forwarded to interested parties.
4	19 - 27 Jun 13	D3.2	D16	Reconnaissance site visit.	Preliminary selection of EWR sites and data collection for use by the RDRM.	Low training importance as only cross-sectional surveys and photographs to be taken.			
5	19 - 27 Jun 13	D3.4	D18	WQ recon site visit (parallel to above).	Identify WQ issues across the study area.	Moderate importance for small group of WQ trainees (2/3 persons) who will be directly involved in data analyses.	Involvement in identifying WQ status and issues.	On site	Dates and logistical arrangements will be forwarded to interested parties.
6	16 - 19 Aug 13	D3.14	D25	Estuary biophysical surveys (2 trips: Recon and Intermediate EWR sites).	Obtain all data necessary for EcoClassification and EWR determination at Intermediate and Rapid sites.	High importance for RDM (Reserve) personnel.	Participate in field data collection (on EWR Intermediate sites).	On site	Dates and logistical arrangements will be forwarded to interested parties.
7	12 - 19 Aug 13	D3.3	D25b	Biophysical surveys and data collection.			Training opportunities only for those that have EcoClassification training in EcoStatus models and have a biological or geomorphological	On site	Dates and logistical arrangements will be forwarded to interested parties.

	Date	Task	Deliverable	Activity	Objective	Trainee identification and importance	Training description	Venue	Comment
							background.		
8	4 - 6 Nov 13	D3.8	D21	Analysis of data by specialists.	Determining EWRs for Rapid EWR river sites.	Low importance due to nature of analysis - specialist mostly working on their own.	Preferably RDM (Reserve) personnel with training in the RDM models used during EcoClassification and the RDRM.	Pretoria	Dates and venue have been forwarded
9	12 - 16 May 14	D3.7	D20	Analysis of data by specialists.	Determining EWRs for Intermediate EWR river sites.				
10	11 - 15 Aug 14	D4.2		River ecological consequences.	Determining ecological consequences to operational scenarios.	High importance for RDM (Reserve) personnel.	Training in the process of determining ecological consequences for rivers.	Malelane	
11	20 - 24 Oct 14	D4.3.1	D29	Analysis of data by specialists.	Set the PES, REC, EcoSpecs and EWR for estuaries. Evaluate consequences.		Training in the Estuary EWR process	Durban	Logistical arrangements were not forwarded to TM due to an error by the Training Coordinator. She has been offered attendance of the 17 - 21 Nov 2014 Gouritz estuary workshop as the methods and approaches are exactly the same.
12	22 Jan 15			WQ RQOs: rivers.	Gather input from stakeholders on WQ variables for which RQOs must be set.			Durban	Dates and venue were forwarded.
13	18 May 15			Estuary RQOs.	Gather input from stakeholders on indicators for which RQOs must be set.			Durban	

13 APPENDIX D: TRAINING WORKSHOP AGENDAS AND ATTENDANCE LISTS

13.1 TRAINING SESSION 1: FEBRUARY 2013 - INTRODUCTORY SESSION

- **Aim:** General dissemination of information regarding the links between the steps of a Classification study, Reserve assessment and the preparation of RQOs.
- **Learning outcomes:** Training Session 1 provides a general understanding of the process and will prepare participants for Training Sessions 2 and 3, which will be project-specific. Links to Training Sessions 2 and 3 are shown below.
- **Presenters:**
  - DL: Delana Louw
  - PS: Patsy Scherman
  - BS: Bongi Shinga
  - GH: Greg Huggins

13.1.1 Agenda

	Topic	Time	Time allocation (mins)	Presenter	Subject
	INTEGRATED STEPS	**09:00**	**10**	**PS**	**INTRODUCTION**
1	**Delineation: RUs and IUAs and describe status quo (EcoClassification Desktop level)**	09:10	30	DL	1.1 RUs and IUAs
		09:40	30	DL	1.2 Status quo assessment
		10:10	20	PS	1.3 Water quality aspects
Above links to Training Session 2: Status quo assessment					
		10:30	**30**	**TEA**	
2	**Link value and condition, catchment vision. Stakeholder involvement**				
	EGSA: Role and importance. Links to step 1, 3, 4	11:00	60	GH	1 Introduction to EGSA
					2 Step 1: Status quo and ID of EGSA at catchment scale
					3 SCI
					4 Step 4: Scenario evaluation
3	**Quantify EWRs and changes in non-water quality EGSA**	12:00	40	DL	3.1 EWRs
	LUNCH	**12:40**	**30**		**LUNCH**
4	**Identification and evaluation of scenarios within IWRM**	13:10	20	DL	4.1 Role of the yield model and scenarios.
		13:30	20	DL	4.2 Ecological Consequences
		13:50	20	PS	4.3 Water quality consequences
		14:10	10	PS	4.4 Economic consequences

	Topic	Time	Time allocation (mins)	Presenter	Subject
		14:20	10	DL	4.5 Integration and preliminary MC
Above links to Training Session 3: Integration of results to formulate Management Classes					
5	**Stakeholders process**	14:30	30	BS	5. DWA Stakeholder process
6	**EcoSpecs and non ecological WQ component**	15:00	10	DL	6.1 RQOs - General
		15:10	10	DL	6.2 Biota EcoSpecs and TPCs
		15:20	30	PS	6.3 Water quality EcoSpecs and WQ RQOs
7	**Prepare information for gazette**	15:50	10	DL	7. Gazette
	Closing questions	16:00	15	PS	
		16:15			**CLOSURE**

13.1.2 Attendance register

Attendance Register: Training Workshop 1: February 2013	
Name	**Department / Division**
Samuel Malinga	DWA: WQM KZN
Philani Khoza	DWA HO
Neo Leburu	DWA: WQM KZN
F Khoza	DWA: WQM KZN
Nobubele Boniwe	DWA: RDM SWRR
Rufus Nengovhela	DWA: WRC
Tinyiko Mpete	DWA: RDM SWRR
Khethiwe Methula	DWA: WQM KZN
Mpume Mdlalose	DWA: WQM KZN
Nonkululeko Mokoena	DWA: WQM KZN
Lindiwe Dladla	DWA: WQM KZN
Atholia Sebagena	DWA: WQM KZN
Simphiwe Mazibuko	DWA: RDM SWRR
Halalisiwe Mdletshe	DWA: WQM KZN
Manisha Maharaj	DWA: WQM KZN
Coleen Moonsamy	DWA: WQM KZN
Renelle Pillay	DWA: WQM KZN
Sibusiso Sikhosana	DWA: WQM KZN
Deborah Vromans	Scherman Colloty & Associates
Norman Ward	DWA KZN: Water Use
Aletta Phoshoko	DWA: WQM KZN

13.2 TRAINING SESSION 2: MAY 2013 - STATUS QUO AND PRELIMINARY IUAs

- **Aim:** To present both the approaches and the outcomes to trainees.
- **Learning outcomes:** Training Session 2 will consist of both the presentation and explanation, and a participative exercise to identify IUAs. uMdloti (tertiary catchment U30) was used as an example for training purposes.
- **Presenters:**
  - DL: Delana Louw

- PS: Patsy Scherman
- GH: Greg Huggins
- WM: William Mullins
- LvN: Lara van Niekerk

13.2.1 Agenda

Subject	Time	Time allocation (mins)	Presenter
DAY 1: 13 May 2013			
INTRODUCTION	**08:50**	**10**	**GH**
1. ECOLOGICAL GOODS AND SERVICES ATTRIBUTES (EGSAs)	**09:00**	**120**	**GH**
1.1 What are EGSAs			
1.2 What methods are available			
1.3 Participatory example			
1.4 Results and what this means			
	11:00	**30**	**TEA**
2. WATER RESOURCE USE IMPORTANCE	**11:30**	**60**	**DL**
2.1 Decision Support System			
2.2 Water Resource Zones (incl. groundwater)			
	12:30	**30**	**LUNCH**
2.3 Water Resource Use Importance	**13:00**	**60**	**DL**
3. ESTUARIES	**14:00**	**120**	**LvN**
3.1 Ecosystem boundaries			
3.2 Key pressures on estuaries in WMA11			
3.3 Present Ecological State of the estuaries in WMA11			
3.4 Biodiversity Importance			
3.5 Interactive session: Integrating the information			
General questions, discussion	**16:00**	**30**	**PS**
DAY 2: 14 May 2013			
4. RIVER ECOLOGY	**08:30**	**90**	**DL**
4.1 Description of status quo (incl. water quality)			
4.2 Ecological zones			
	10:00	**30**	**TEA**
4.3 Hypothetical secondary: Description	**10:30**	**120**	**DL**
4.4 Study task: Description of PES, EIS, and delineation into zones			
4.5 Water quality: PES determination			
	12:30	**13:00**	**LUNCH**
5. ECONOMICS	**13:00**	**120**	**WM**
5.1 Why economics in the study?			
5.2 Explanation of macro-economic parameters			
5.3 Economic Regions approach - why?			
5.4 Identification of large water users			

Subject	Time	Time allocation (mins)	Presenter
5.5 Information gathering			
5.6 Budget approach vs. turnover approach			
5.7 Water Impact Model			
5.8 Application of modelling system			
6. IUA DETERMINATION	**15:00**	**50**	**DL PS**
6.1 Describe the IUAs and provide reasoning			
6.2 Study task: Delineated IUAs for hypothetical catchment			
CLOSURE	**15:50**	**10**	**PS**

13.2.2 Attendance register

Attendance register: Training Workshop - 2 May 2013	
Name	**Department / Division**
Philani Khoza	DWA HO
Neo Leburu	DWA: WQM KZN
Nobubele Boniwe	DWA: RDM SWRR
Khethiwe Methula	DWA: WQM KZN
Mpume Mdlalose	DWA: WQM KZN
Nonkululeko Mokoena	DWA: WQM KZN
Manisha Maharaj	DWA: WQM KZN
Coleen Moonsamy	DWA: WQM KZN
Renelle Pillay	DWA: WQM KZN
Sibusiso Sikhosana	DWA: WQM KZN
Aletta Phoshoko	DWA: WQM KZN
Nolusindo Jafta	DWA: RQS
Mmaphefo Thwala	DWA: WRC
Tovho Nyamande	DWA: WRC

13.3 TRAINING SESSION 3: JULY 2013 – WATER QUALITY

- **Aims:**
  - General dissemination of information regarding water quality process undertaken for the Reserve and Classification - Mvoti trainees.
  - Methods to undertake a desktop Reserve assessment for water quality - regional DWA and RDM participants.
  - Discussion session regarding gaps in water quality methods and approaches - all participants.
- **Learning outcomes (Classification study):** Training Session 3 will provide a general understanding of the process and methods used in the water quality component of Classification.
- **Presenter:**
  - PS: Patsy Scherman

13.3.1 Agenda

DAY 1: 31 July 2013 - Desktop Reserve Assessment - Water Quality	
Time	**Topic**
8.30am	**TEA**
9am	1. Welcome and Introduction
	2. Expectations of workshop
	3. RDM and the water quality Reserve process
10.30am	**TEA**
11am	4. Methods developed for the desktop process (2008)
	5. DISCUSSION and UPDATE OF APPROACH
1pm	**LUNCH**
2pm	6. Tools available for use, e.g. TEACHA
4.30pm	7. Discussion re: Reserve template
5pm	**CLOSURE**
DAY 2: 1 August 2013 - Water Quality and Classification	
8.00am	**TEA**
8.30am	1. Clarification of terms: e.g. EcoSpecs vs User specs, RQOs vs RWQOs
	2. Status quo and EcoClassification
	3. PAI model
10.30am	**TEA**
11am	4. Evaluating scenarios and water quality consequences
	5. Modelling options; load calculations
1pm	**LUNCH**
2pm	6. Water quality and EGSAs
	7. Use of RWQOs (EcoSpecs and non-ecological WQ) and refinement
5pm	**CLOSURE**

13.3.2 Attendance register

Attendance register: Training workshop 3 - July / August 2013	
Name	**Department / Division**
Philani Khoza	DWA HO
Tinyiko Mpete	DWA: RDM SWRR
Nobubele Boniwe	DWA: RDM SWRR
Thapelo Machaba	DWA: RDM SWRR
Barbara Weston	DWA: RDM SWRR
Mmaphefo Thwala	DWA: WRC
Neo Leburu	DWA: WQM KZN
Aletta Phoshoko	DWA: WQM KZN
Halalisiwe Mdletshe	DWA: WQM KZN
Manisha Maharaj	DWA: WQM KZN
Coleen Moonsamy	DWA: WQM KZN
Renelle Pillay	DWA: WQM KZN

Attendance register: Training workshop 3 - July / August 2013	
Name	**Department / Division**
Sibusiso Sikhosana	DWA: WQM KZN
Khethiwe Methula	DWA: WQM KZN
Lindiwe Dladla	DWA: WQM KZN
Lindokhuhle Ntenga	DWA KZN: V+V
Calvin Annamalay	DWA KZN: V+V
Travis Ballard	DWA KZN: V+V
Matthew Harris	DWA KZN: V+V
Nathaniel Chinsamy	DWA KZN: V+V
Sibango Lwandle	DWA: WQM KZN
Makwabasa Ntombethu	DWA: WQM KZN
Ntombie Maaiba	DWA: WQM KZN
Nonkululeko Mokoena	DWA: WQM KZN

14 APPENDIX E: REPORT COMMENTS

Page / Section	Report statement	Comments	Changes made?	Author comment
Comments from: Mmaphefo Thwala – 18 March 2016				
ii		It is Pongola to Mzimkulu WMA.	Yes	Corrected.
iii		Please refer to Technical Working Group sessions for standardizing the terminologies.	Yes	
iv		The study has not been achieved within the stipulated timeframe, VO.	No	We disagree with this statement. As outlined in section 3.2, essentially two VOs were granted: 1 Additional budget to deal with additional stakeholder requirements as well as an extension of time: Undertake enhanced stakeholder engagement on detail technical aspects **that were requested by stakeholders** at a Project Steering Committee (PSC) meeting. Additional budget was required to prepare presentation material as well as arrange and facilitate four enhanced technical workshops that were not included in the accepted Project Proposal. Additional time was required to schedule the work sessions in-between the technical work plan activities. 2. Provision for additional professional services by the study team **to assist DWS to address comments received during the 60 day gazetting period.** All this was done within the stipulated time frames.
v		Page v at the top: stakeholders are not generally comfortable with the recommended outcomes (coastwatch, eThekwini and other unhappiness/ misunderstandings from other stakeholders on E/Fs).	Yes	
3-1		the graph is missing a title for the x and y axes and series 1 and 2.	Yes	
4-7		include CMFs, email correspondence	Yes	
Comments from: B Weston – 18 March 2016				
Sec 1.1		What about the Reserve – Add a paragraph on that.	Yes	

Page / Section	Report statement	Comments	Changes made?	Author comment
Sec 1.2		What about the estuaries and major wetland systems – include please.	Yes	
		Add a study area map.	Yes	
Sec 1.3	DWAF, 2008b	Did you use version 2	No	Estuaries were assessed using most updated methods which would include version 2.
Table 1.1	Delineate the units of analysis and Resource Units, and describe the status quo of the water resource(s).	Present State – why are you changing the terms.	No	These are the integrated steps derived for the study and status quo specifically refers to a WRC step which describes the current condition of the IUA in terms of various aspects and does not relate to the PES derived during Reserve determination process.
	Quantify the Ecological Water Requirements and changes in non-water quality ecosystem.	Non-water quality ecosystem - What does this mean – refer to all the Water Resources.	No	In the Mvoti - Umzimkulu Classification study water quality consists of the following two broad components: ▪ Ecological, i.e. as part of the Ecological Water Requirement (EWR) or Reserve process. A standard process is followed for scenario evaluation. Ecological Specifications or EcoSpecs are the output of the Reserve process. ▪ Users, i.e. water quality related to users or role players other than ecology, for example: Domestic Use, Agriculture - Stock Watering, Agriculture – Irrigation, Industrial - Category 3 and Recreation - Intermediate Contact. UserSpecs are defined. Water quality is therefore incorporated in the consequence assessment as: ▪ Part of ECOLOGICAL consequences; ▪ a service identified in ECOSYSTEM SERVICES; ▪ indirectly in the ECONOMICS in terms of water treatment costs; and ▪ USER WATER QUALITY consequences assessment (this document).
		Determine the Ecological Category configuration – TEC. Should this not reflect in Step 4 or consequences of 4 on the REC.	No	The steps refer to integrated steps which were developed for this study as there was overlap between the Reserve process, the WRCS and RQOs. You comment refers to step 3 and 4 and is basically reflected here if you consider table 1.1 and Section 2.2 where the reports are described and how the

Page / Section	Report statement	Comments	Changes made?	Author comment
				outcomes correlate to the integrated study steps.
Table 2.1	Status Quo	Present State or what does Status Quo mean – keeping it in the current state?	No	Refer to author comment made under Table 1.1.
	1. RU determination for rivers requirement more detail Reserve assessment. 2. EWR site selection - Prelim 3. Non-water quality ecosystem.	Clarify.	No	1 and 2. Table 2.1 is a summary of the study Tasks outlined in detail in the Inception report. This refers to delineation as part of the Reserve process. Prelim EWR sites are selected and then ground-truthed during site visit. 3. See author comment under Table 1.1.
		1. What about groundwater – do not see anything on that or reference to it in introduction or if it was done in other studies. 2. Same for Wetlands 3. Did you not do anything on the consequences on the High conservation wetlands? 4. What about estuaries?	Partial	1 and 2. Wetlands and groundwater description added in the study area section. 3. Volumetric Ecological Water Requirements (EWRs) for wetlands within the Mvoti WMA have not been determined, but input to the identification of hotspots and subsequent selection of river EWR sites in this study was given during the status quo assessment. During that phase of the study, twenty four sub-quaternary catchments which had large Freshwater Ecosystem Priority Areas (FEPA) wetlands that are dependent on the mainstem rivers or large tributaries were identified within the Mvoti Water Management Area. The inclusion of large wetlands which are dependent on river flows provided input and motivation for some EWR sites to be located within these catchments, and ultimately for EWRs to be determined for the rivers here. Ultimately any scenarios impacting on these EWR sites were assessed keeping the associated wetlands in mind. 4. Yes. Estuaries ito PES, REC, Scenarios and RQOs were covered in detail. Refer to report 9.4 specifically.
Table 2.2		Why are deliverables numbers missing in first columns.	No	They are not missing. Where there are no deliverable numbers, these tasks were not deliverables per se, but were tasks that had to be done in order to produce a deliverable and were included in the table to portray sequential steps taken during the study tasks.
Sec 2.2.4	DWA, 2013c	Look at your reference in Section 1.3. Was it the 2008 version the specialists used.	No	This reference does not refer to the 2008 Estuary methods manual, but to the actual study report produced as part of this report.

Page / Section	Report statement	Comments	Changes made?	Author comment
Sec 2.2.4		And Step 2. What report relates to integrated Step 2.	No	No standalone report was produced for integrated step 2. This step refers to the Stakeholder process and is covered in this report as a separate Chapter – 4. Have now made reference to the visioning under the main report description.
Sec 2.2.5	These desktop biophysical nodes are low priority and require desktop EWR estimates.	Is this correct? Should we say this	Yes	Reworded.
Sec 2.2.23	Priority monitoring areas for baseflow reduction.	What do you mean	Yes	Reworded. An estimate in reduction in baseflow from further groundwater abstraction was made.
		Need to define non-ecological water quality ecosystem.	Yes	
Sec 3.1		Where is Table 3.2?	Yes	Corrected typo.
Sec 4	Various comments		Yes	
Sec 6.6	This method did not attempt to express the ecological health in monetary terms	Clarify please.	No	
Sec 6.8	However the results are of low confidence as little physical data exist to validate predictions against.	Not current – it is not the term we use.	Yes	
	For example the study showed that restoring all estuaries in the region to a minimum of a fair condition.	Not the term we use.	Yes	
	The implication of these recommendations in context of other legislation need to be debated between the relevant departments in order to put forward coherent conservation guidelines that also consider the economic imperatives.	Thought this is what the Classification process does – please elaborate.	Yes	
Sec 7		What about raw data that needs to be given to RQIS	No	Raw data collected during site visits are provided in the assessment models.
Sec 8	▪ Operationalisation and monitoring are required in order to implement proposed recommendations and exercise compliance control.	Of what? Clarify.	Yes	
	▪ Where legislative mandate conflicts arise it is recommended that the relevant departments be identified upfront and additional high level authority meeting be held to ensure conflict resolution before detail public participation, e.g. coastal catchments with a joint mandate on waste disposal shared by Department of Environmental Affairs (DEA) and DWS or the	What about this – do you mean that the final decision on deriving a TEC should be in accordance of the relevant organs of State.	Yes	

Page / Section	Report statement	Comments	Changes made?	Author comment
	TEC of priority systems for conservation planning.			