1. INTRODUCTION AND BACKGROUND

1.1 DEVELOPMENT OF RDM METHODOLOGIES (DWAF 1999)

The Water Law Principles of 1996 clearly set the direction of the future of water resources management. The twin threads of sustainability and equity run through the Principles, the National Water Policy of 1997 and the National Water Act (Act 36 of 1998). ***The key to balancing sustainability and equity lies in the provisions for the Reserve, and in our ability to quantify a Reserve, as well as to manage water uses so as to meet the Reserve.***

The move to integrated management of water resources, on an ecosystem basis, requires the introduction of a new set of tools for resource management, tools that are flexible, protective and can take account of extreme differences within South Africa, both in socio-economic conditions, and in natural variability of aquatic ecosystems.

The move to resource management has been a gradual one over the last ten years, driven by need, as South Africa approached the limits of new development of water resources and was forced to begin a shift to careful management of existing available resources. To support this change, new tools and new ways of making decisions have been under development within the Department of Water Affairs and Forestry (DWAF) and within other agencies responsible for natural resource management.

In response to requirements for environmental impact assessment, and as a result of the Department's commitment to follow the Integrated Environmental Management Procedure in planning and implementation of major water resources developments, a considerable amount of effort within the South African scientific community was focused on finding ways to assess the water requirements of aquatic ecosystems (Instream Flow Requirements (IFRs)).

Therefore when the drafting of water legislation began in 1997, a selection of tools was already available which were in line with the new thinking arising from the Water Law Principles and the National Water Policy. The tools had not, at that time, been specifically tailored to fit the legislation (since the legislation itself had yet to be developed in detail), but it was clear that existing scientific approaches and procedures had the potential to serve as the foundation for a new suite of policy and regulatory tools for implementation of policy and legislation.

1.2 PHASED IMPLEMENTATION OF POLICY AND LEGISLATION (DWAF 1999)

It was recognised that implementation of the new Water Act should be carried out in a "phased and progressive manner". The new definition of water use required a much broader approach than in the past; the provisions for ecosystem protection required new skills and capacity, and the introduction of catchment management agencies required a new institutional structure.

Three critical phases which will determine and guide the development of policy and regulatory tools are:

- The period leading up to “day 1" which requires only the most essential procedures to be in place on the day on which the Act comes into effect.
- The transitional phase, a three to five-year period of transition from “day 1", during which special transitional tools and procedures might be required, in an environment which would allow pilot testing and refinement of tools and development of the full suite of tools needed to implement the Act.
- Full scale implementation in selected areas or catchments around the country, a phase covering the five to ten year time frame after the Act comes into effect.

1.3 TOOLS FOR THE TRANSITIONAL PERIOD

The principal method for determining IFRs of aquatic ecosystems, the Building Block Methodology (BBM) is a procedure which takes 8 to 12 months to complete with reasonable confidence. This method was seen to be reasonably comprehensive and as a transitional measure, there was a need to develop tools for determining the Reserve which could provide answers within a relatively short period, in order to meet initial demands, until such time as high-confidence Reserve determinations could be carried out.

Until the classification and Reserve determination procedures have been prescribed, all Reserve determinations (rapid, intermediate or comprehensive) are considered to be preliminary. Phases 1 and 2 of the Resource Directed Measure (RDM) project (which began in August 1997) have focused almost entirely on the development of tools for the preliminary determination of the Ecological Reserve, since this is the most urgent short-term priority.

1.4 THE RESOURCE DIRECTED MEASURE PROJECT

The RDM project resulted in a series of 15 volumes comprising the set: Resource Directed Measures for Protection of Water Resources. The aim of the volumes pertaining to rivers (quantity) was, within the framework of any existing methodologies (such as the BBM), to devise more rapid methods with specific emphasis on an intermediate methodology (the Intermediate Ecological Reserve Methodology (IERM)). Parallel to the RDM Project, a manual for applying the BBM methodology was being published. A description and manual (ref) for the application of the BBM methodology was therefore not required as part of the RDM project.

The volume that addresses river methods is
Volume 3: Resource Directed Measures - River Ecosystems (DWAF 1999, vol 3)

1.5 REVISION OF THE EXISTING RDM DOCUMENTATION

Volume 3 consisted of a description of three levels of Ecological Reserve determination methods with the emphasis on an intermediate approach. The methods were described in a core document which was supplemented by various specialist appendices (Table 1.1). These specialist appendices addressed the various tools, methods and information requirements required to apply the Reserve determination methods.

The problems with volume 3 were identified as follows:

- The document attempted to discuss in an integrated way both quality and quantity aspects. As the quantity and quality methods are not integrated, the documentation comes across as disjointed.
- The methods describe the determination of a single option Reserve (i.e. one flow regime); not Reserve Scenarios (various flow regimes that result in different river ecological states). This however allowed no flexibility for the decision maker to assess the implications to other users and whether socio-economic motivations may override the single option. A scenario based approach that provides various Reserve scenarios resulting in different ecological states are now required. All methods must therefore have the capacity to provide Reserve scenarios rather than a single Reserve.

1.6 FOCUS AND OBJECTIVES OF THE REVISION

Apart of the problems identified (1.5 above) by the specialists involved, a range of interviews were held within DWAF to identify any additional requirements as part of the revision. In summary, the comments were that the rivers quality method (BBM) is well tested, has been applied often and works well. ***It was advocated that a revision of the methods as such were not required; an update would be more applicable. The concerns were focused on implementation and operation of the results and on clear method descriptions to allow less experienced (in IFR methods) specialists to apply the methods.***

The product of this revision is therefore a document that describes the theoretical basis of the methods and the sequential steps and numerical methods required to execute them.

The present RDM documents relating to the technical methodology (quantity reserve for rivers) were assessed during the revision. Important appendices have been modified and new ones added where necessary. This front-end main document provides an overview of the generic procedures. During the revision, emphasis has been placed on updating the technical methodology.

Note that the revision is aimed at the River Quantity component (i.e. IFRs) only.

1.7 THIS REPORT

This report serves as the 'front-end main report"' referred to above. The report comprises a technical summary of the process that needs to be followed to undertake Ecological Reserve (rivers quantity)[1] determinations in rivers and to ensure that it is implementable. The technical summary is provided as an annotated flow diagram (Fig 2.1). The report then outlines a step-by-step process according to the flow diagram and provides references to the specialist appendices for detailed explanations.

The specialist appendices which form part of the existing RDM documents are listed below. Those that are being updated, and new appendices are highlighted in bold in the

[1] hereafter referred to as the Ecological Reserve

table and also listed below the table. The table also includes columns describing the decisions on the necessity for an update and the persons responsible.

Reference to appendices which have not been updated are made according to their EXISTING numbers. Reference to appendices that have been updated and added are according to the NEW numbers (letters).

The existing and new specialist appendices will not be amalgamated during this project. This will take place, along with re-shaping them into a user-friendly form in the next phase, which falls outside the mandate of this project.

Table 1.1 List of specialist appendices in existing RDM documentation

RDM 99 Appendices	Status quo	Decision
R1: Ecoregion classification	**Has been updated by Kleynhans and is available.**	**Now Appendix A.**
R2: Stream classification	None.	-
R3: Desktop	Outdated.	-
R4: Intermediate Habitat Integrity	No updating required.	Confirmed by Louw with Kleynhans.
R5: Comprehensive Habitat Integrity	No updating required.	Confirmed by Louw with Kleynhans.
R6: PES	**Rewriting required.**	**Louw - on hold.** **Now Appendix I**
R7: EIS	**Has been updated by Kleynhans and is available.**	**Now Appendix D**
R8: SI	Updating required.	Decision : Outside TOR.
R9: Economics	Updating required.	Not part of TOR.
R10: ?	Not provided in documentation.	
R11:?	Not provided in documentation.	
R12:?	Not provided in documentation.	
R13: DSS	**To be revised and to incorporate R24.**	**Hughes.** **Now Appendix C**
R14: IERM	**To be included in main document.**	**Hughes & Louw.**
R15: CERM	**To be included in main document.**	**Louw, Hughes and O'Keeffe.**
R16: Hydrology information	**To be updated and include paper to Journal of Hydrology.**	**Hughes** **Now Appendix B.**
R17: Hydraulics	**Include habitat modelling.**	**Birkhead.** **Now Appendix E.**

RDM 99 Appendices	Status quo	Decision
R18: Geomorphology	**Update to include CERM and sediment transport modelling.**	**Dollar Now Appendix F.**
R19: Riparian vegetation	Stand	-
R20: Fish	**Update.**	**Kleynhans. Now Appendix G.**
R21: Aquatic invertebrates	Stand.	-
R22: IFR sites	Stand.	-
R23: RQO	Requires updating.	Not as part of this project - dependant on classification system.
R24: Previous IFR results	**Incorporated into New Appendix C**	**Hughes.**
R25: Yield, implementation operation.	**Revised**	**Hughes & Louw. Now Appendix D.**
R26:?	Not provided in documentation.	
R27:?	Not provided in documentation.	
R28:?	Not provided in documentation.	
R29: integrated RQOs.	Not applicable.	-
R30 : IERM	Needs revision to form part of DSS.	Not part of this study.
R31 : Monitoring.	Needs revision.	Not part of TOR.
RERM (III)	**New**	**Louw. Appendix H.**
BBM, Stressor Response & DRIFT	**New**	**O'Keeffe, Hughes, Louw. Appendix J.**

SUMMARISED LIST OF APPENDICES THAT WILL FORM PART OF THE 2001 REVISION

A: Preliminary Ecoregion Classification System for South Africa (Kleynhans) (R1)

B: Providing hydrological information and data analysis tools for the determination of Ecological Instream Flow Requirements for South African Rivers (Hughes) (R16)

C: A Decision Support System for an Initial Low-Confidence Estimate of the Quantity Component of the Ecological Reserve for Rivers (Hughes) (R13)

D: Ecological Importance and Sensitivity (R7)

E: The procedure for generating hydraulic information for the Ecological Reserve (Birkhead) (R17)

F: The procedure for generating geomorphological information for the Ecological Reserve (Dollar) (R18)

G: The use of ecological information on fish in the specification of the flow component of the Ecological Reserve (Kleynhans) (R20)

H: RERM (III) : Approach and application (Louw)

I: BBM, Stressor Response and Drift (O'Keeffe, Hughes, Louw)

J: Procedure for assessing the Present Ecological Status and defining Ecological Reserve Categories (Louw - on hold) (R6)

1.8 CONSTRAINTS OF THE REVISION

The following issues do not directly form part of the TOR.

- **Issues regarding implementation and operation**
  It was however stated that all procedures must be designed to be implementable and that this does form part of the TOR. The compatibility of outputs, and Reserve tools linked to operation and implementation are therefore documented. Inputs from 'outside' and the required links are not documented.
- **Issues regarding the classification system**
  The classification system to determine the Management Classes has not yet been finalised. The ecological component of the Management Class (referred to as the Ecological Reserve Category) does however form an integral part of any Ecological Reserve methodology and will have to be addressed in a summarised form. No methodology can be described or explained without addressing the classification of the ecological component. The technical description for the methods to be used by the various specialists to determine Present Ecological State and to derive the Ecological Reserve Categories require a specialist appendix in a manual form. This appendix has been put on hold.
- **Socio/cultural importance**
  This aspect normally forms part of the Ecological Reserve procedure as it addresses the dependancy of communities on an ecologically healthy and naturally functioning river. It addresses aspects such as sustainable use of resources, medicinal plants, building material such as reeds and cultural uses of the river for eg baptism. This appendix (R8) requires updating to incorporate new approaches. Revision of this appendix falls outside the TOR for this project.
- **Decision Support System : Cost/effectiveness and RDM protocols**
  It was proposed to provide a specialist appendix to describe a tool that will assess the cost effectiveness linked to confidence of different levels of Ecological Reserve assessments. This will also be linked to the RDM protocols and criteria for determining the levels of Ecological Reserve required. The writing of the specialist appendix was put on hold. However, a summary of this will form part of this report as it provides background to the different levels of Reserve determination.
- **Stakeholder processes**
  A process that includes the required interaction of stakeholders should run parallel with the Ecological Reserve determination process and be integrated with the process. Input from both processes are required at various stages. This process falls outside the TOR of this study.
- **RQOs and monitoring**
  Methods to define RQOs and monitoring falls outside the TOR of this study.