

TABLE OF CONTENTS

EXECUTIVE SUMMARY	III
ACKNOWLEDGEMENTS	IX
TABLE OF CONTENTS.....	XI
LIST OF FIGURES	XIII
LIST OF TABLES.....	XVI
LIST OF ABBREVIATIONS	XVII
1 INTRODUCTION AND OBJECTIVES	1
1.1 Background and motivation for study	1
1.2 Project objectives	2
1.3 Project structure	2
2 INTEGRATED CATCHMENT MONITORING FRAMEWORK (ICM MIND MAP)	4
2.1 Introduction and underlying philosophy	4
2.2 Development of the ICM mind map	5
2.3 Content of the ICM mind map	11
2.3.1 Definition of objectives and applications of monitoring programme	11
2.3.2 Definition of data users	11
2.3.3 Available databases and custodians of data	12
2.3.4 Monitoring variables at specific sites	13
2.3.5 Selection of monitoring sites, spatial scale and frequency of monitoring	14
2.3.6 Guidelines on methodologies for data collection, handling, analysis, presentation and quality assurance, inventory of accredited laboratories	17
2.4 Interactions, lessons learnt and sustainable strategies	20
2.4.1 Integrated monitoring approach	20
2.4.2 Data exchanges	20
2.4.3 Collation of existing weather data	21
2.4.4 Collation of existing soil data	21
2.4.5 Scale of application.....	22
2.4.6 Interactions between governance levels	22
2.4.7 Modelling requirements	24
2.4.8 Financial and practical feasibility	25
3 EXAMPLE OF APPLICATION, DEMO/PILOT STUDY SITE	26
3.1 Selection of demo/pilot study site	26
3.2 Definition of objectives of monitoring programme, data users and applications	27
3.3 Description of the catchment and baseline data.....	27
3.3.1 Topography	27
3.3.2 Climate	29
3.3.3 Geology	30
3.3.4 Hydrology	32
3.3.5 Hydrogeology	34
3.3.6 Soils and land use	38
3.4 Monitoring gaps and requirements	40
3.5 Data collection and results	41
3.5.1 Atmospheric data	41
3.5.2 Surface water monitoring	46
3.5.3 Borehole drilling and vadose zone profiling	47
3.5.4 Groundwater monitoring	51
3.5.5 Geophysical study	56

3.5.6	Isotope studies.....	57
3.5.7	Water balance of the Sandspruit catchment	59
3.5.8	Hydrological modelling.....	60
3.6	Benefits of the expanded monitoring programme at Sandspruit	65
4	OVERALL CONCLUSIONS AND RECOMMENDATIONS	66
5	LIST OF REFERENCES	68
6	APPENDIX A: A STEP-BY-STEP PROCEDURE FOR DESIGNING A GROUNDWATER MONITORING SYSTEM (DWAF, 2004A)	72