STRATEGIC ADAPTIVE MANAGEMENT AS A FRAMEWORK FOR IMPLEMENTING INTEGRATED WATER RESOURCE MANAGEMENT IN SOUTH AFRICA

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Water Research Commission

by

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This report emanates from two projects titled
Building Capacity for Adaptive Management in the Inkomati Catchment Management Agency through Action Research
(WRC Project No K8/861)

and

Action Research with the Inkomati Catchment Management Agency to Develop Strategic Adaptive Management as a Framework for Implementing IWRM
(WRC Project No K8/862)

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EXECUTIVE SUMMARY

This report presents the findings of an action research project aimed at applying Strategic Adaptive Management (SAM) as a framework for implementing Integrated Water Resource Management (IWRM) at the catchment scale. IWRM is a legislative imperative in South Africa, and the Catchment Management Agencies (CMAs) that are responsible for IWRM at the catchment level must strive to implement coordinated and cooperative participatory management that ensures water resource use is sustainable, equitable, and efficient. Catchments are complex V-STEEP (Values – Social, Technological, Economic, Environmental, Political) systems, and their management requires diverse stakeholders to generate shared understandings of the system, and engage in consensus-driven decision-making and cooperative action towards shared objectives.

SAM is a fundamentally stakeholder-centred management approach that facilitates the iterative development of shared rationalities and future-focused objectives, as the basis for adaptive cycles of consensual decision making. SAM was developed by a group of South African scientists and natural resource managers in the late 1990s, with recognition of the limitations of "classic" forms of adaptive management. The approach was originally designed to support river and catchment management, and the implementation of new South African water legislation, but the delay in the formation of CMAs meant that SAM had not been applied in that context until this project was initiated.

The opportunity for this action research project arose in 2008 when the Inkomati Catchment Management Agency (ICMA) – the first CMA to be established in the country – engaged Rogers, the project leader, as scientific advisor for adaptive management and capacity building. Since then, the research team has engaged with the ICMA in two phases of action research, which:

i) Built institutional understanding of, and capacity in, SAM within the ICMA; and

ii) Developed the first Catchment Management Strategy (CMS) in the country, using SAM's Adaptive Planning component to produce a genuinely stakeholder-centred CMS.

The first phase of the project began by introducing the concept and process of SAM to the ICMA through a short series of seminars. The ICMA staff immediately recognised and accepted the concept of V-STEEP complexity, and the need for adaptive, learning-oriented, stakeholder-centred and value-driven management. The team decided to use SAM's Adaptive Planning Process (APP) as a means to structure the ICMA's way forward, and application of the APP was therefore used as the central intervention in the first phase of the action research initiative.

Adaptive Planning with the ICMA took place over three 4-5 hour workshops, during which a structured outcomes document was produced through consensus-driven dialogue. The document detailed: the ICMA's vision for IWRM; context for the management of the Inkomati catchment; values/principles to guide operations and decision making; vital attributes of the Inkomati catchment; determinants of, and threats to, vital attributes; and top level management objectives.

After developing these outcomes, the next step in the APP is usually to decompose the top level objectives into a hierarchy of objectives with increasing focus, rigour and achievability. However, the ICMA team at this time was feeling de-motivated and immobilised by resource constraints and bureaucratic challenges, and powerless to make progress towards such demanding objectives. The team therefore decided that they should rather design a few` simple integrated team projects that would be practically implementable, despite the challenges they faced, and that would have cross-cutting institutional and IWRM outcomes. The final report from the APP provided an anchor for the team through the project design process, as suggested projects were explicitly discussed and justified on the basis of: i) Rationale and expected impact, cross-checked against the ICMA's mandate and

values; ii) Contribution to meeting objectives and maintaining vital attributes; iii) Implementation and resources.

Initial scepticism from the de-motivated ICMA team was rapidly replaced with creativity, energy and confidence as the team designed three realistic and pragmatic projects that met these criteria:

- Project 1: Creating an adaptive information and decision network to ensure delivery of the Reserve to the Kruger National Park.
- Project 2: Developing a cooperative programme for Municipal Waste Water Treatment Works compliance and enforcement.
- Project 3: Implementing an integrated river operations system for managing the Crocodile River.

The first phase of the action research initiative had a number of positive institutional outcomes for the ICMA, including: team feelings of empowerment, increased confidence, improved communication and alignment among team members, and an emerging institutional culture of learning and adaptation. The APP and project development consolidated a realistic direction for the ICMA team, and stimulated a fundamental move from “building an institution” to “managing the water resource”. The action research process also clearly demonstrated the utility of SAM – particularly the APP component of SAM – for planning, decision-making, and organisational empowerment, within an IWRM context. Most important was that we demonstrated how a small team can be empowered to break through the bureaucratic fog of policy implementation and begin effective management at ground level, despite very severe resource constraints.

The second phase of the action research initiative was stimulated by a demand from the Minister of Water Affairs, in December 2009, that the ICMA produce a first generation CMS by the end of March 2010. Helping the ICMA to develop a CMS that was solidly stakeholder-centred, and which was embedded in a SAM approach to IWRM became the second key intervention in the action research project. The ICMA/project team successfully designed and implemented a CMS development process, within the given timeframe, that is:

- Compliant with all relevant legislation;
- Deeply grounded in the reality of social, technical, economic, environmental and political conditions in the catchment; and
- Strongly endorsed by Inkomati stakeholders.

The CMS development process was centred on a stakeholder engagement programme consisting of three preparatory empowerment workshops for historically disadvantaged stakeholders and five planning development workshops. The first of these was a stakeholder orientation workshop, followed by three sub-catchment visioning workshops – which utilised a slightly modified version of the APP – and a final catchment-wide integration workshop. Throughout the CMS development process, the ICMA conducted an extensive campaign to ensure that all Inkomati stakeholders had the opportunity to engage in all workshops that were relevant to them, and a wide diversity of stakeholders successfully participated in all CMS workshops.

The ICMA’s own experience of the APP had generated real trust in the effectiveness of this SAM component, and the ICMA eagerly embraced the opportunity to utilise the APP with stakeholders. Central to the Inkomati CMS development was use of the APP during the sub-catchment visioning workshops, to guide stakeholders in collectively developing and articulating a shared, desired future for the Inkomati and its sub-catchments. The “raw” workshop notes from each of the visioning workshops were written up into a visioning outcomes document for the sub-catchment in question, and then the three were integrated into a Desired Future document for the whole Inkomati catchment. This integrated document formed the basis for feedback to stakeholders at the integration workshop, and consensus-driven alterations were made and accepted. Similarly to the APP outcomes document

produced by the ICMA, the CMS Desired Future document detailed: stakeholders' vision for the catchment; values/principles to guide decision-making; vital attributes of the Inkomati catchment; threats; and objectives, including specific co-operative governance, sustainability, funding, and information-needs objectives.

A 'technical team' from the ICMA, Department of Water Affairs (DWA), and external advisors then translated the visioning/APP outcomes in the Desired Future document into a CMS designed to achieve the articulated desired future. An integral part of this translation process was the development of an "integration matrix" of stakeholder-derived objectives and strategic action programmes, which provided the final guidance to the technical team for drafting the required six CMS sub-strategies and, critically, provided the integrative framework through which the CMS derives a holistic structure and meaning.

The central outcome and achievement of this phase of the action research project was the timely completion of the first CMS in the country, in only three months, in a manner that was solidly stakeholder-driven. The CMS now provides an agenda for IWRM in the Inkomati catchment that was designed by, and is strongly endorsed by, diverse stakeholders. This is a significant breakthrough for the South African water sector, and provides valuable IWRM implementation lessons for the ICMA, other CMAs in the country, and the DWA.

The CMS development process undeniably demonstrated the applicability of the APP component of SAM to participatory IWRM implementation in South Africa. The process empowered diverse stakeholders to engage in dialogue, and reach consensus on a shared, desired IWRM future. The 'generic' APP was effectively modified for the IWRM context so that the outcomes could be easily translated into the official CMS structure (six sub-strategies) to provide the technically detailed document required by DWA. Once again we demonstrated how SAM processes can empower a small team to step beyond bureaucracy and effectively engage a broad, diverse stakeholder base to design a shared future in Integrated Water Resources Management; a future that maps out a path to improved equity, efficiency and sustainability of water resource use.

The second phase of the action research project also served to further embed the concept of SAM, and the process and value of the APP, within the ICMA; and introduced Inkomati stakeholders to the APP, the concept of adaptive IWRM, and the practice of coordinated multi-stakeholder decision making. The challenge now is to evaluate the other SAM components, through active learning-by-doing, and to test how well they too can be applied to an IWRM context.

ACKNOWLEDGEMENTS

We are deeply indebted to all the staff of the Inkomati Catchment Management Agency for their fortitude, stamina, strength of character and deep commitment to the CMA “cause”. Without them this project would never have materialised, let alone reached the satisfying and auspicious conclusion of facilitating the development of the first Catchment Management Strategy in the country. They have stamped a pragmatic ethic of delivery into the culture of the Inkomati Catchment Management Agency and set a pioneering example for CMAs across the country.

Sharon Pollard and Derick du Toit of AWARD, and the Dept. Water Affairs/ICMA Catchment Management Strategy Steering Committee, chaired by Eustathia Bofilatos, provided invaluable support and advice during the process to develop a Catchment Management Strategy for the Inkomati.

Although not part of this project, the work by Dirk Roux and colleagues on Institutional Learning smoothed the way for us.

Wendy Midgley worked tirelessly in the background to hold bureaucracy at bay and ensure that we could operate as smoothly as possible.

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LIST OF ABBREVIATIONS

APP	Adaptive Planning Process
CMA	Catchment Management Agency
CMS	Catchment Management Strategy
DSS	Decision-Support System
DWA	Department of Water Affairs
HDI	Historically Disadvantaged Individual
ICMA	Inkomati Catchment Management Agency
IWRM	Integrated Water Resource Management
KNP	Kruger National Park
NGO	Non-Governmental Organisation
NWA	National Water Act
SADC	Southern African Development Community
SAM	Strategic Adaptive Management
STEEP	Social, Technological, Economic, Environmental, Political
V-STEEP	Values – Social, Technological, Economic, Environmental, Political
WMA	Water Management Area
WUA	Water User Association
WWTW	Waste Water Treatment Works

CHAPTER 1: INTRODUCTION

1.1 The IWRM Mandate: Stakeholder-Centred Sustainability, Equity and Efficiency

Integrated Water Resource Management (IWRM) is a management philosophy that aims to promote the coordinated, integrated management of water and related resources in ways which enhance social and economic benefits, whilst also ensuring sustainability. IWRM's practical axioms are trans-disciplinary integration, and coordinated multi-stakeholder decision making and action.

The South African National Water Act (NWA) fundamentally embraces IWRM, recognising that "the ultimate aim of water resource management is to achieve the sustainable use of water for the benefit of all users" (RSA, 1998, Preamble). The NWA defines that IWRM must be decentralised and participatory, and that the overarching objectives of IWRM are to achieve water resource use that is sustainable, equitable and efficient.

- Sustainability: Over the past few decades, we have increasingly come to understand the interdependence between humans and ecosystems; the more we compromise the quality and quantity of our water resources, the more we compromise our own livelihoods. Unhealthy rivers and wetlands lead to unhealthy people and an unhealthy economy. Thus, ecological and socio-economic sustainability are interdependent, and are legal prerequisites for all water resource management decisions.

- Equity: The costs and benefits of water resource use must be distributed equitably across South African society, and internationally. This imperative of "fair access" should have special focus on those who have historically been disadvantaged in the costs and benefits of water resource use.

- Efficiency: With an average annual rainfall of little more than half the world average, South Africa is a water scarce country, as well as being vulnerable to floods and droughts. It is essential that the allocation of water is guided by the need for efficient, beneficial use of water that promotes an appropriately diverse, robust and stable economy.

According to the NWA, Catchment Management Agencies (CMAs) are expected to implement IWRM at the catchment scale. Catchments are complex social-ecological systems, where diverse STEEP (Social, Technological, Economic, Environmental, and Political) characteristics and processes are linked and interdependent. There are multiple and diverse valid perspectives of the STEEP system amongst stakeholders, different understandings of interlinkages and dependencies, and a multitude of different value sets that influence perceptions and understandings, and drive individual and collective stakeholder behaviours.

Sustainable, equitable and efficient IWRM will not be achieved within this complexity without shared understanding of the STEEP system among stakeholders, and consensus on coordinated and cooperative action that works towards shared objectives. IWRM processes, therefore, must be centred on empowered stakeholders engaging in consensual and adaptive decision-making, and cooperative implementation of decisions.

1.2 Strategic Adaptive Management: A Framework for Achieving the IWRM Mandate

Strategic Adaptive Management (SAM) is a management approach that is fundamentally stakeholder centred, and its "future building" processes have successfully been used to achieve consensus and

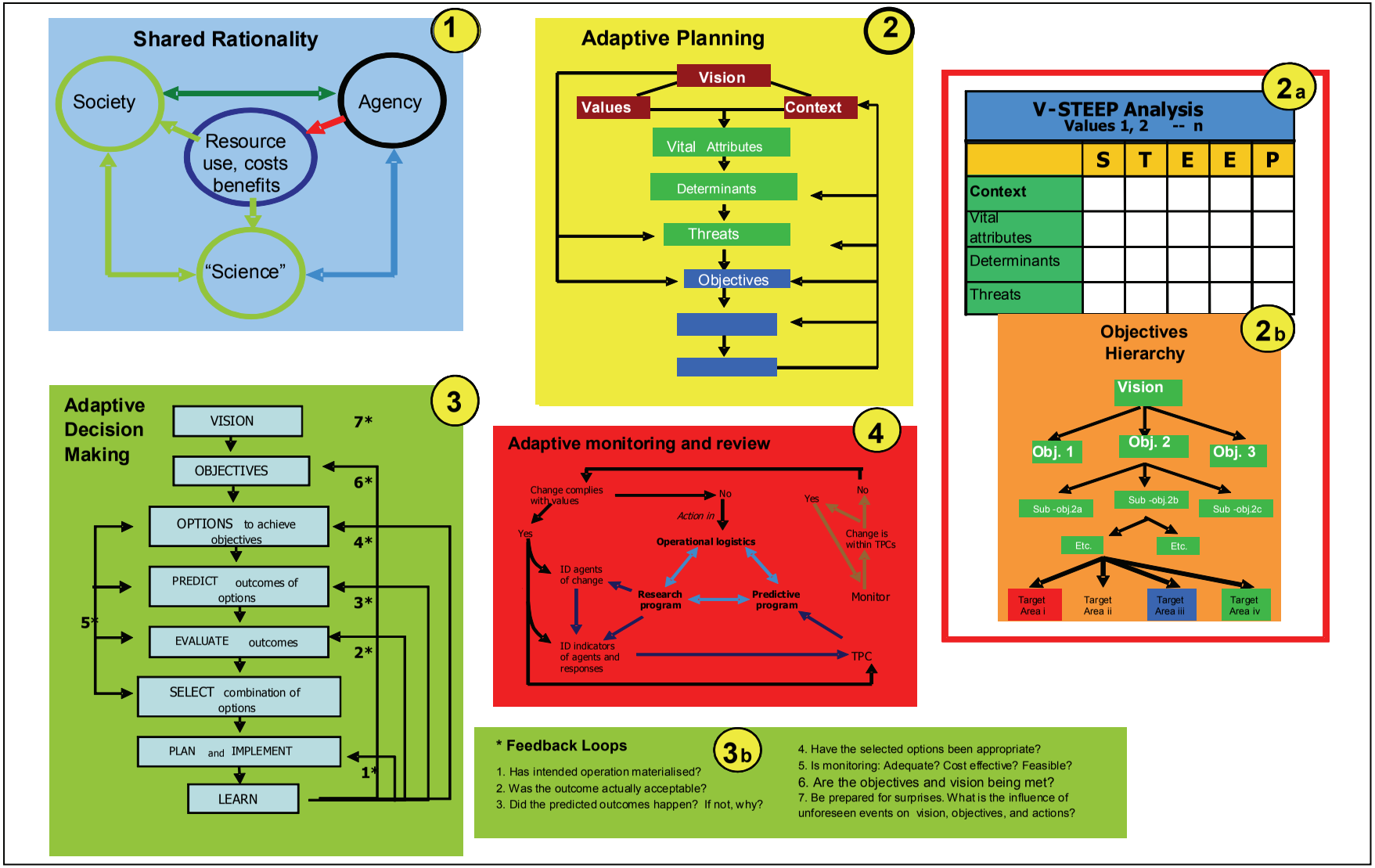


Figure 1. The Strategic Adaptive Management process (V-STEEP = Values – Social, technological, Economic, Environmental, Political; TPC = Threshold of Potential Concern)

cooperation between diverse and divergent stakeholders in a range of situations. SAM is a framework that includes a number of different components (Figure 1), and should be practised as iterative cycles of planning, implementing, monitoring, reviewing and learning.

SAM has been described in detail elsewhere (Rogers and Bestbier, 1997; Biggs and Rogers, 2003; Rogers & Sherwill, 2008), so in this report we provide a summary as context for discussing its value in IWRM.

"Adaptive management" was first introduced to the sphere of natural resource management by Holling (1978) with his concept of "Adaptive Resource Management". The term and practice of adaptive management has since morphed into many forms with Strategic Adaptive Management (Rogers and Bestbier, 1997) being one of them. Broadly speaking, adaptive management has been defined as: 'The process of treating resource management as an experiment such that the practicality of trial and error is added to the rigour and explicitness of the scientific experiment, producing learning that is both relevant and valid' (Meffe et al., 2002).

Meffe et al. (2002) suggest that the various forms of adaptive management can be summarised under three headings:

- **Active** (classic or true) adaptive management in which the emphasis is strongly on the scientific method, the process of "experiment" and on modelling.
- **Passive** adaptive management in which there is much less emphasis on the scientific method/experiment and more on learning by a range of means/tools.
- **Documented trial and error** in which there is no stipulated structure to the decision making process but what does happen and its consequences are nonetheless well documented.

"Classic" adaptive management has the following basic steps:

- List imaginative policy options.
- Model system function and likely response to the new policy.
- Identify gaps in knowledge during the modelling process.
- Management actions designed and implemented as large scale experiment to fill information gaps (e.g. a forest is divided into a large grid, and some blocks are cleared felled, some selectively logged, some not harvested at all, some subjected to fire and some not, etc.).
- Monitor system performance/response to management manipulation.
- Modify model on basis of experiment outcomes to decide on best policy.

There have been many commentaries on this basic approach (see Rogers, 2003) but for our purposes the main limitations are that:

- It requires a large homogeneous area to set up such a formal experiment. This might be available in a tropical or temperate forest but not in more arid or human modified environments. Furthermore, at the scale at which we might conduct IWRM, no two rivers or catchments are biophysically, let alone socially and economically, alike which makes direct comparisons very difficult.
- The central role of expert modelling restricts the range of stakeholders that can be properly involved and does not lend the process to supporting short term, on the ground, decision making and management.
- The process of learning that leads to adaptation is, or can be, largely left to the "experts".
- Learning and decision making, especially in an emerging democracy, are ongoing stakeholder-centred social processes, not expert-centred technical processes as in the classic form of adaptive management.

With this sort of critique in mind a group of South African scientists, and water and conservation managers developed the concept of Strategic Adaptive Management (SAM) in the late 1990s (Rogers

and Bestbier, 1997). SAM was originally designed to support river and catchment management but the delay in formation of CMAs meant it was not applied in that context until this project was initiated.

Since values bound decision making and a shared rationality leads to consensus, both explicitly underlie the SAM process (Figure 1). Shared values are explicitly articulated, and a shared rationality generated among stakeholders during an Adaptive Planning Process (APP; Figure 1, components 2, 2a, and 2b; further detailed in section 2.2). The APP:

- Scopes the decision making environment;
- Builds understanding of the V-STEEP system to be managed;
- Provides accountability by explicitly linking objectives to values and vision.

Adaptive decision making and implementation in the SAM process (Figure 1, components 3 and 4) are explicitly based on, and evaluated in terms of, the shared vision, values and objectives that were developed during Adaptive Planning. Adaptive monitoring of spatially and temporally explicit V-STEEP responses to management actions feeds back into explicit learning, and iterative decision making, operating, and research processes (Figure 1, component 4). SAM, therefore, is not focused on “experimenting” but rather emphasises multiple modes, sources and pathways of learning to improve understanding. To ensure transformation of people and institutions to a necessary adaptive, learning culture, SAM must also include an explicit change management strategy.

1.3 Action Research to Embed the Concept and Process of SAM as a Framework for IWRM

The opportunity for this action research project arose in 2008 when Rogers, the project leader, was engaged by the ICMA as scientific advisor for adaptive management and capacity building. The research team has since spent some 15 months engaged in an action research initiative which: i) built institutional understanding of, and capacity in, SAM within the ICMA (section 2); and ii) saw the ICMA develop the first Catchment Management Strategy (CMS) in the country, using the Adaptive Planning component of SAM to produce a genuinely stakeholder-centred CMS (section 3).

CHAPTER 2: BUILDING INSTITUTIONAL UNDERSTANDING OF, AND CAPACITY IN, STRATEGIC ADAPTIVE MANAGEMENT

2.1 Introducing the Concept and Process of SAM as a Framework for IWRM

The concept and process of SAM was first introduced to the ICMA through a short series of seminars on decision making in natural resource management, and the Strategic Adaptive Planning and Management processes. The concepts of dynamic management targets and trajectories, which result from complex and changing value sets and STEEP characteristics, were presented at the outset of the seminars (Figure 2). These concepts convinced the ICMA that natural resource management must be adaptive, it must include learning that is explicit, and IWRM decisions must be genuinely stakeholder-centred and value driven.

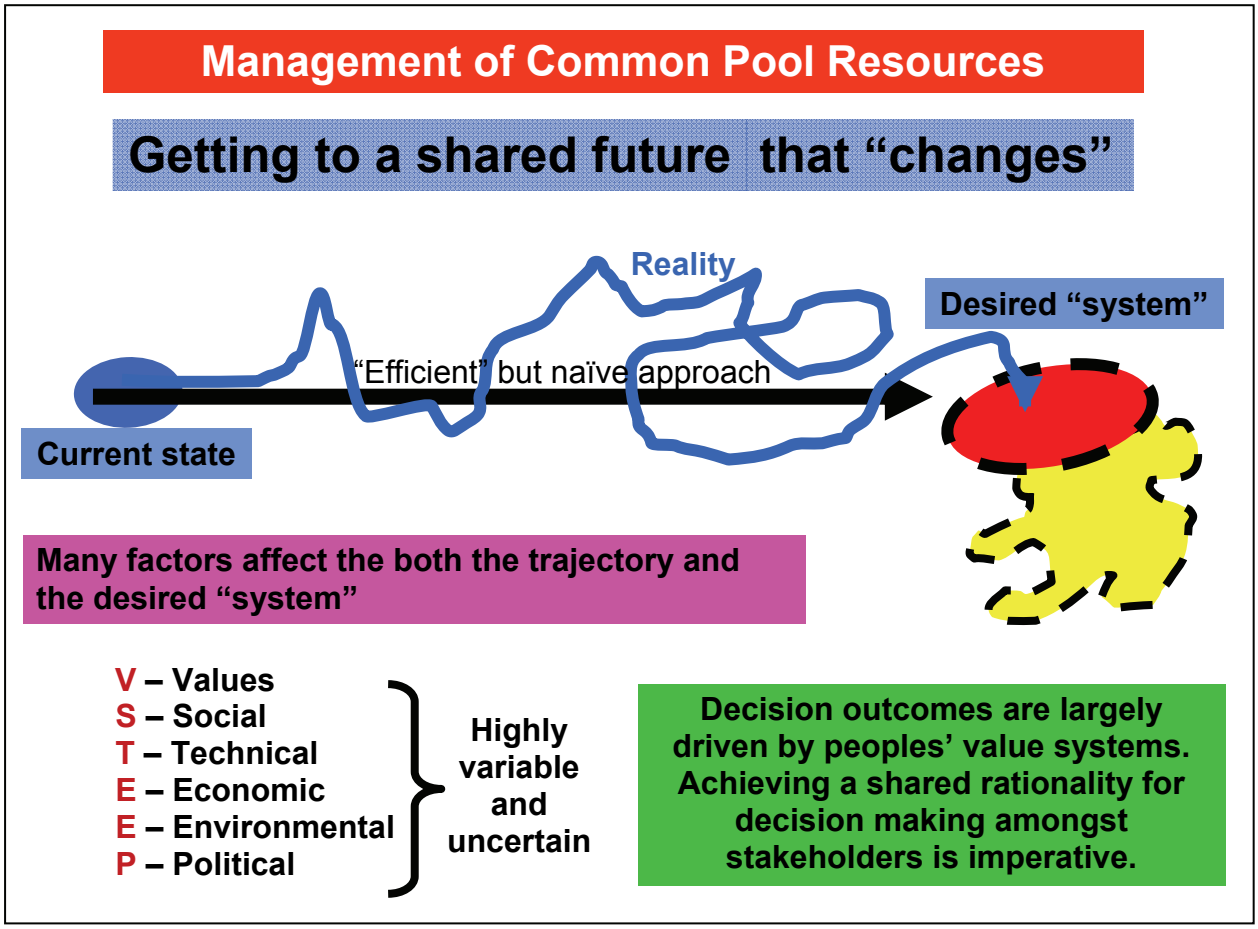


Figure 2. Seminar slide highlighting how variable and uncertain V-STEEP factors affect management targets and trajectories

There was immediate recognition and acceptance of these concepts by the ICMA staff, and a desire to proceed with SAM's planning process as a means to structure the ICMA's way forward. Application of the APP was therefore used as the first central intervention of the action research initiative.

2.2 ICMA Adaptive Planning for Management of the Inkomati Catchment

The APP (Figure 3) is empowering in itself but it also embodies many other techniques of learning, capacity building, consensus building and change management (Rogers and Sherwill, 2008). Adaptive Planning with the ICMA took place over three 4-5 hour workshops, which followed the six-step APP protocol outlined below (the full version of which, that was distributed to all ICMA staff and used during the workshops, is found in Appendix A).

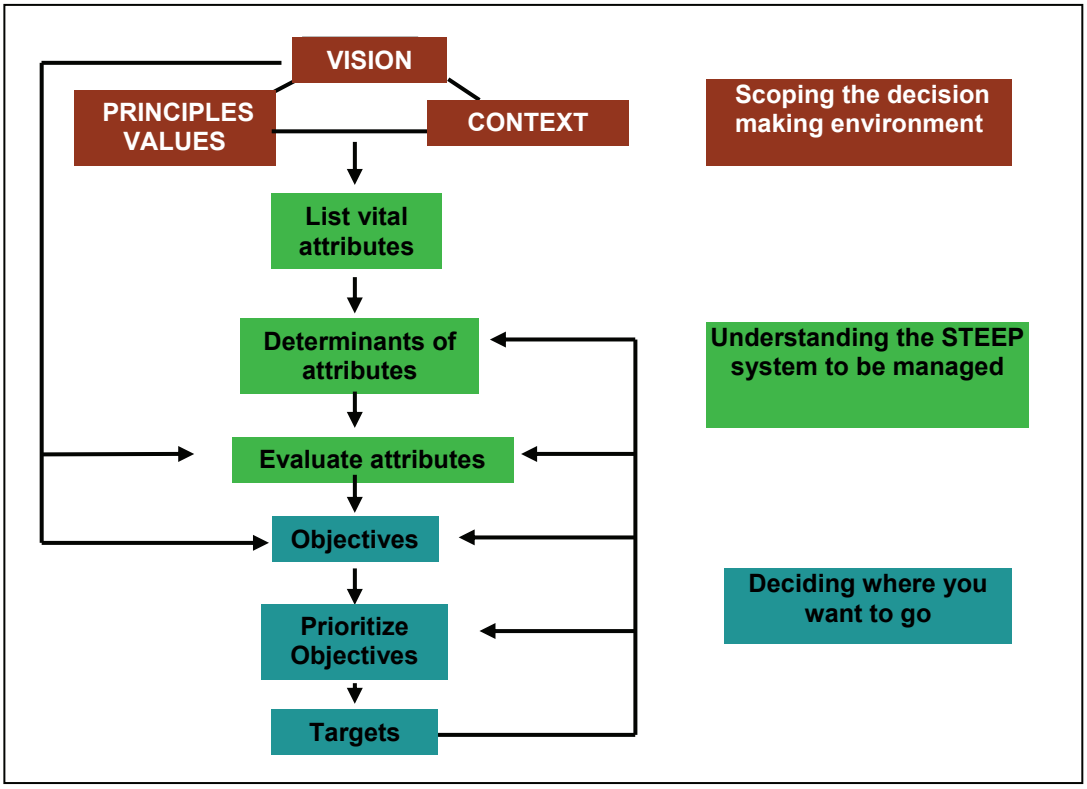


Figure 3. The Adaptive Planning Process for translating vision into achievable objectives (STEEP = Social, Technological, Economic, Environmental, Political)

- *Step 1. Reach consensus on the vision, values and operating principles.*

A vision is a concise statement describing an institutions core business and philosophy of management. A statement of the operating principles describes the core values of the organisation in terms of managing the resource. Before any management action can be taken the vision needs to be fully accepted to prevent subsequent procedural breakdown.

- *Step 2. Provide the context for setting the objectives*

Describe the context of/for the system to be managed, at local, regional, national and international scales and in socio-economic, environmental, technological, political and legal terms.

- *Step 3. Document the vital attributes of the system to be managed*

List the known and perceived, current and future vital attributes of the system. Current attributes may be determined from inventory type lists of V-STEEP characteristics of the system. These may be biodiversity and landscape types, social and cultural attributes, the role in the local economy, etc.

- *Step 4. Evaluate and consolidate the attributes*

Explore which attributes appear to be complementary and those that are conflicting. Attributes can be sifted, grouped together and condensed to provide a concise list of vital attributes for which the system would be managed.

- *Step 5. Record the determinants of, and constraints and threats to, the vital attributes*

A major purpose of management is to ensure the maintenance of the determinants of the vital attributes. List all the determinants of, and the constraints and threats to, the condensed list of vital attributes.

- *Step 6. Formulate the high level objectives*

Objectives are set to: i) ensure the maintenance of the identified vital attributes; and ii) overcome the constraints and threats to meeting the vision.

A hierarchical approach should be adopted to formulate a set of nested objectives of increasing rigour and achievability.

After each of the APP workshops, the project team synthesised the discussions of each step and returned these to the ICMA participants for comment. The syntheses were critically discussed at the next workshops and modified as appropriate to reflect staff consensus. The ICMA staff that participated in the APP exercise were:

Sizile Ndlovu: Chief Executive Officer
Vanrooi Khoza: Manager, Office of the Chief Executive Officer
Marcus Selepe: Executive Manager, Water Use, and after April 2009 Acting CEO
Brian Jackson: Executive Manager, Water Resource Planning and Programmes
Joseph Mabunda: Executive Manager, Institutions and Participation
Dumisani Nxumalo: Institutions Specialist, Sabie-Sand sub-catchment
Eva Lubede: Institutions Specialist, Crocodile sub-catchment
John Mngomezulu: Institutions Specialist, Upper and Lower Komati sub-catchment
Sylvia Machimana: Marketing and Communications Officer
Gary Robbertz: Financial Officer
Johan Boshoff: Board Secretary

The outcome presented below (2.3) was fully accepted by all ICMA staff that participated in the exercise.

2.3 Outcomes of ICMA Adaptive Planning for Management of the Inkomati Catchment

2.3.1 Vision

A vision is a concise statement describing an institution's core business and philosophy of management.

Our vision is of a pioneering catchment management system that empowers stakeholders to engage in consensual and adaptive decision making, to achieve reform, and to promote persistent social, economic and environmental justice across the Inkomati catchment.

2.3.2 Context for the management of the Inkomati catchment

The range of legal, ecological, social and economic facts, conditions, causes and surroundings, that

define the circumstances relevant to a problem provide the "context" for all decisions and are therefore important elements of any decision making environment.

The Inkomati economy is highly dependent on water, with forestry, irrigation-based agriculture and eco-tourism as the main economic drivers.

- Irrigation-based agriculture and forestry provide most jobs in the catchment.
- Rainfall in the catchment is spatially and temporally variable, and does not always correlate with water use requirements.
- Eco-tourism is based on the catchment's high biodiversity, relatively free-flowing river systems, and generally high water quality.
- Poor municipal waste (dumps, sewerage, storms water, etc.) management results in decreased water quality and fitness for use.
- Uncoordinated, poorly resourced land-use planning and management have potentially negative impacts on terrestrial and aquatic systems.
- Geographically, the catchment is the artery linking South Africa's industrial and administrative centre (Gauteng) with our important Southern African Development Community (SADC) neighbours Swaziland and Mozambique.

The National Water Act (RSA, 1998) is a highly enabling piece of legislation, which provides potential to pro-actively address current water resource management challenges in the catchment.

- Catchment water use is currently characterised by: inequitable distribution; water stress (quantity and quality over allocation before the Reserve is implemented); inefficient use in many, but not all, areas; strategic water export, in the form of interbasin transfers for Eskom and international obligations; and virtual water export, in the form of exported products.
- There is very poor enforcement and variable monitoring of water quality, quantity, and legal and illegal use.
- Legislative implementation is lacking, particularly in terms of: the Reserve; the transformation of irrigation boards to Water User Associations (WUAs); and co-operative governance. There is also a lack of strategic direction from DWA.

There is a wide diversity of water users, cultures, skills, knowledge and attitudes in the catchment.

- Gross disparities in technological and traditional knowledge and their transfer between age, gender and cultural groups exacerbates the variability in spatial distribution of water and land-use efficiency and development.
- There are vast disparities between social groups in terms of: employment opportunities and income; education levels and access to knowledge (particularly technological knowledge, for women and youth); understanding of water resources and IWRM; access to water and sanitation; access to productive land, and support and infrastructure that promote effective farming practices.
- Despite many challenges and a degree of resistance to water reform, there are many localised examples of voluntary resource-sharing, relationship building and skills development in the catchment on which we can draw.
- There is a perception that despite a general acceptance of the need for change amongst stakeholders, some of them exploit limitations in the law and its lack of implementation to frustrate the water reform process.

2.3.3 Values/principles to guide operations and decision making

Our values are the principles we use to evaluate the consequences of actions (or inaction), to propose and choose between alternative options and decisions. Values may be held by individuals, communities, organisations or even society at large. A group's values must reflect the values of the

individuals in that group.

- Our understanding and management of the Inkomati catchment reflect the social imperatives (e.g. transformation, equity, efficiency, empowerment, development) of an emerging African democracy.

- We practice problem solving leadership that embraces: ethics of Ubuntu (my humanity is defined by how others experience my behaviour), Simunye (we are one) and Batho pele (people first); and consensus driven stakeholder participation.

- Decisions within our mandate are made and are justified on the basis of the best available social, technical, economic, environmental and governance knowledge.

- We objectively balance, within our mandate, the reform and distribution of the costs and benefits of water resource use to ensure sustainable quality of human life, and social, environmental and economic justice.

2.3.4 Vital attributes

The few most important characteristics/properties within the catchment that relate to water management are its "vital attributes". They may be technical, ecological, legal, historic, social, political or economic.

1. The Kruger National Park (KNP) and Cape Town, are the mainstays of South African tourism. The Kruger National Park/Lowveld, and Trout/Panorama tourism draw-cards are vital to both the catchment and national economies.
2. The state of development in the catchment is still largely compatible with both tourism and agriculture.
3. The rivers are international rivers.
4. The Inkomati Water Management Area (WMA) is pioneering the field of participative IWRM and is thus an international point of interest and scientific attention.
5. There are currently governance structures, and a large, diverse and appropriate knowledge base, on which innovative and enthusiastic stakeholders can, and do, draw.
6. Despite the overall state of water stress, there is still potential for increased water yield and economic development in some areas of the catchment.
7. The catchment geology (especially that of the escarpment) acts as an important hydrological and water quality regulator, and primary driver of aquatic biodiversity (including a Ramsar wetland).

2.3.5 Determinants of, and threats and constraints to, vital attributes

A determinant is a factor or process that ensures the persistence of a vital attribute. Threats are factors within, or outside, a partnership that undermine its values and inhibit the pursuit of the vision. Threats and constraints are also factors or processes that inhibit ecosystem determinants or vital attributes.

Table 1. Determinants of, and threats and constraints to, the vital attributes of the Inkomati catchment

Vital Attribute	**Determinants**	**Threats and Constraints**
1: KNP/Lowveld, and Trout/Panorama tourist draw-cards are vital to both the catchment and national economies.	They are highly dependent on water of an appropriate quality and flow regime.	i) KNP/Lowveld – excessive storage, over allocation and pollution occurs upstream. ii) Panorama – over/poorly planned development (including of the tourism industry) and land-use leads to degradation/loss of wetlands/riparian fringe, to erosion and sedimentation. iii) Mining licences are granted and mining commences under current or other poor land/pollution management. iv) Forestry expansion is allowed to go ahead. v) Climate change [current prediction = more rain but over a shorter period therefore more intense and longer dry period].
3: The international character of major rivers.	Geographic location of the international boundaries and the nature of the agreements. Quantity and quality of water that must cross a boundary.	i) Continued over-allocation of water in the Inkomati, leading to potential legal challenges from Mozambique. ii) Continued over-use (legal and illegal) in Inkomati. iii) Continued poor performance/administration of DWA foreign office prevents timeous and appropriate negotiations with neighbours.
4: The Inkomati WMA is pioneering in the field of IWRM. It is an international point of interest.	ICMA is the “first born”! It has committed and enthusiastic staff.	i) The ICMA’s “upbringing” continues to be held back by DWA’s top-down control, uncertainty in decision making, lack of direction and inertia in delegating functions and responsibility to the ICMA. ii) Cannot get the right staff, of the right quality at the right time because of the above, salaries and other admin obstacles in DWA and the ICMA. iii) Too many “grannies” continue trying to “help” but instead “smother” the ICMA (often via DWA), diverting its focus and slowing down progress. iv) Continued pressure for the limited ICMA staff to “showcase” on many “stages” will prevent delivery. v) Continued lack of staff discipline, especially in respect of meetings, deadlines, etc. does and will erode professional image. vi) Staff have poor STEEP knowledge of the catchment.
5: There are currently governance structures, and a large, diverse and appropriate knowledge base, on	Many important governance structures have maintained cohesion and a level of functionality despite	i) Continued lack of, and poor co-ordination of, transformation of institutions from the past regime. ii) Delay of transfers to ICMA is leading to serious loss of institutional memory and a huge rise in opportunity costs for skills retention. iii) The knowledge base (data and metadata) remains

Vital Attribute	Determinants	Threats and Constraints
which our innovative and enthusiastic stakeholders can and do draw.	the transformation vacuum (limbo period). Transition period in NWA was six months! <u>Knowledge base:</u> Strategic response by DWA to the "first born". The ICMA acting as a draw card for researchers from all over the world.	uncoordinated, meta data are becoming outdated, and knowledge transfer between stakeholders is insufficient. This is exacerbating stakeholder fatigue and compounding skills and knowledge disparities between cultural, gender and age groups.
6: Despite the overall state of water stress, there is still potential for increased yield and economic development in some areas of the catchment.	Both dam sites and water available in these areas.	i) Resource development in the Inkomati is constrained by poor groundwater bearing capacity and is thus very surface water dependent. ii) The current poor knowledge of, and confused/naïve mindset about, the purpose and delivery of the Reserve, and its effects on development. iii) Continued lack of innovation on how to operationalise the Reserve in the face of development needs. iv) Outdated economic and resource operating rules/planning/surveys remain and there is no innovation towards resource economics. v) Opposition by lobby groups (e.g. environmentalists). vi) Inefficient current resource use approaches, including operating rules, continue.
7: The upper catchment, especially escarpment, geology is an important flow (dolomite cavities store water and extend winter flows) and water quality regulator, thus also a driver of biodiversity.	Geology, geomorphology (wetlands) and good natural ground cover, deep soils, in high fall rain areas.	i) Poor cooperative governance and enforcement leading to over- and inappropriate development and land-use. Especially activities that change the persistence of ground cover and runoff patterns, both of which affect delivery, fitness for use and costs/benefits for downstream users. ii) Poor quality effluent discharged by users, particularly municipalities. iii) Limited understanding of groundwater linkages.

2.3.6 Top level management objectives

Objectives are aimed at achieving the vision within the current catchment "context" and are aimed at overcoming threats, or constraints, to ensure the persistence of vital attributes and/or their determinants.

1. Adaptively develop/implement participative systems for authorisation, compliance, monitoring and enforcement that aim to protect the resource and ensure empowerment, reform and

socio-economic development.
a) Develop/implement empowerment programmes that promote strategic, adaptive and consensual decision making across the stakeholder base.
b) Facilitate improved access to the resource, for socio-economic activities, through the development of systems such as the CMS and river operating systems.
c) Develop/implement cost effective monitoring programmes that serve strategic, adaptive and consensual decision making.

2. Adaptively stimulate/develop/implement co-operative governance systems that promote co-ordination of spatial planning and development to protect the resource and catchment.
a) Grow multi-level, multi-sectoral (private, NGO and government) governance networks and engagement processes that keep ICMA agendas at the forefront, taking advantage of existing structures wherever they can achieve this purpose.
b) Structure the ICMA's advisory function, within resource constraints, to ensure ICMA needs are served alongside those who are requesting advice.

3. Set and pursue the agenda for international negotiations that reflect local conditions/needs.
a) Improve cross-boundary stakeholder relationships and understanding of current agreements.
b) Strategically improve understanding of local catchment conditions and IWRM needs to inform decision making about international obligations under changing circumstances (i.e. do not wait for a crisis or demand from a neighbour).

4. Become the information hub of the catchment by adaptively developing/implementing systems (including operative) for the coordination, generation and distribution of knowledge and skills for innovative, participative IWRM.
a) Design and implement a system of data and metadata management, pertinent to participative IWRM in the Inkomati, that is accessible to all stakeholders.
b) Identify, collect and collate data/information for the system in 4.a) and map the stakeholder network, including the distribution of STEEP competencies, activities, needs, decision making mandates, etc.
c) Using outputs from 4.a) and 4.b) develop a strategic plan for knowledge acquisition that will guide future partnerships with stakeholders, and with other knowledge/skills providers.
d) Develop/implement strategic empowerment programmes that are explicit about the transfer and diffusion of knowledge/skills across the stakeholder network.

5. Adaptively develop/implement institutional services within the ICMA to create an enabling environment that supports achievement of the above objectives as they evolve to meet changing circumstances.
a) Explore and internalise the characteristics and processes of an enabling environment for pioneering IWRM in an emerging African democracy.
b) Co-ordinate and align the adaptive systems that serve objectives 1-4.
c) Improve internal networking.
d) Improve internal service infrastructure, e.g. the computer network.

2.4 Translating High Level Objectives into Practical Actions

The next step in the APP, after developing ‘top-level’ objectives such as the five above, is usually to decompose these into a series of component objectives, to form a hierarchy of objectives with increasing focus, rigour and achievability (Figure 1, component 2b). However, at the time when these top level objectives were written the ICMA team was generally de-motivated by institutional

challenges, immobilised by resource constraints and bureaucratic obstacles, and feeling powerless to make progress towards such demanding objectives. The team therefore decided that they should rather design a few simple, integrated team projects that would be practically implementable in spite of the challenges, and that would have cross-cutting IWRM and institutional outcomes. If they were to be successful in breaking the bureaucratic impasse in which the ICMA found itself and motivate staff, these projects should:

- Have valuable, visible, and long-lasting impacts in the catchment.
- Simultaneously contribute towards the achievement of many ICMA objectives.
- Be practically implementable, and thus make a clear break from the typical water resource management "talk-shops" into pioneering IWRM action.
- Creatively overcome the challenge of the ICMA's extremely limited financial resources, through building partnerships that bring stakeholder resources to bear on IWRM.

Initial scepticism and doubt from the de-motivated ICMA team was rapidly replaced by creativity, energy and anticipation as they began to design the projects. The brainstorming and designing process was highly empowering for the team as, for the first time, they experienced IWRM philosophy being translated into practical and achievable actions. The team realised that creative activities, such as the project design process, that include all ICMA divisions lead to innovative thinking and ways forward that can bypass perceived boundaries and problems. The outcome of the Adaptive Planning Process provided an anchor for the team as each project was explicitly debated and justified on the basis of: i) Rationale and expected impact, cross-checked against the ICMA's mandate and values; ii) Contribution to meeting objectives and maintaining vital attributes; iii) Implementation and resources. There was a rapid increase in ICMA confidence and motivation as the team devised three realistic and pragmatic projects that met these criteria:

2.4.1 Project 1: Creating an adaptive information and decision network to ensure delivery of the Reserve to the Kruger National Park

2.4.1.1 Rationale and expected impact

The KNP is the most downstream South African stakeholder both in the Crocodile and Sabie-Sand catchments, and it relies heavily on the ecological Reserve to meet its national mandate of biodiversity conservation. The aim of this project is to engage in an action research programme to map and operationalise a stakeholder network between the ICMA and the KNP to ensure effective delivery of the appropriate quantity and quality of water through the KNP. This will require identifying the spatial and temporal distribution of people, institutions, information/data and decisions required to bring effect to the Reserve. Given the ICMA's position as coordinator of IWRM in the region, and its relationships with and knowledge of local stakeholders, the ICMA's role in this project will be critical.

Success in this project will induce major changes in mind-set for some people who see delivery of the Reserve as essentially a technical process and for others who see it as an impending threat to their livelihoods. It will be a first for South Africa, will provide national kudos for the ICMA as part of this pioneering collaborative endeavour, and will build ICMA credibility with the conservation sector, who are one of the largest stakeholder groups in the Inkomati catchment.

2.4.1.2 Contribution to meeting objectives and maintaining vital attributes

Objective 1: Adaptively develop/implement participative systems for authorisation, compliance, monitoring and enforcement that aim to protect the resource and ensure empowerment, reform and socio-economic development; 1a) Develop/implement empowerment programmes that promote strategic, adaptive and consensual decision making across the stakeholder base.

Objective 2: Adaptively stimulate/develop/implement co-operative governance systems that promote coordination of spatial planning and to protect the resource and catchment. 2.a) Grow multi-level, multi-sectoral governance networks and engagement processes that keep ICMA agendas at the forefront, taking advantage of existing structures wherever they can achieve that purpose.

Objective 4: Become the information hub of the catchment by adaptively developing/implementing systems (including operative) for the coordination, generation and distribution of knowledge and skills for innovative, participative IWRM.

Persistence of Vital Attribute 1: Lowveld Biodiversity-based Tourism.
Ensuring Determinant 1: Water of an appropriate quality and flow regime.
Overcoming Threat i: Improve spatial and temporal patterns of upstream storage, allocation and pollution.

Persistence of Vital Attribute 5: There are currently governance structures, and a large, diverse, and appropriate knowledge base, on which innovative and enthusiastic stakeholders can and do draw.
Ensuring Determinant 1: KNP is a governance structure that has maintained cohesion and can support the ICMA.
Overcoming Threats i and iii: Improve environment for stakeholder participation (countering fatigue) and institutional transformation.
Overcoming Threat iii: Improve co-ordination and transfer of knowledge.

Persistence of Vital Attribute 5: There is still potential for increased yield and economic development in some areas of the catchment.
Overcoming Threat ii: Change confused/naive mindsets about the purpose and delivery of the Reserve.
Overcoming Threat iii: Overcome lack of innovation on how to operationalise the Reserve.

2.4.1.3 Implementation and Available Resources

KNP has a strong culture of stakeholder involvement and co-operative governance, and it is the pioneer of Strategic Adaptive Management. In this context it has obtained funding from the Water Research Commission to strengthen its internal river management and actively link it to decision making of the ICMA and its stakeholder base. The KNP, therefore, is already beginning to implement a project to map and operationalise this network, which the ICMA can valuably collaborate with, without requiring large financial or human resource commitments.

2.4.2 Project 2: Developing a cooperative programme for Municipal Waste Water Treatment Works compliance and enforcement

2.4.2.1 Rationale and expected impact

It has long been known and discussed by the ICMA and its stakeholders that municipal Waste Water Treatment Works (WWTWs) in the Inkomati catchment are below capacity, poorly maintained, and are often point sources of direct river pollution. While waste water disposal is the responsibility of local and district municipalities, and not the ICMA, the aim of this project is for the ICMA to enter into a cooperative programme with the relevant municipalities to help facilitate innovative solutions to their WWTW compliance problems.

The project will involve: collecting and collating water quality data with the proto-CMA and municipalities; building shared understandings between role-players of the financial, legal, technical, social, etc. issues that are the real problems behind non-compliance; working together to find innovative solutions to the problems; and monitoring outcomes to check effectiveness of solutions. The programme will create high profile stakeholder awareness of the ICMA as a watchdog and an empathetic enforcer, who are pro-actively addressing a key concern that they have heard from stakeholders. If successful, this project will have long-term positive implications for water resource quality, health and development, and will set an inspiring precedent for co-operative governance across the catchment.

In addition, this project will provide an excellent opportunity for ICMA staff and proto-CMA staff to engage with each other and to begin working together in a focused and purposeful way. Ultimately, it may practically help to ease (and possibly speed up) the future transition of proto-CMA staff to the ICMA.

2.4.2.2 Contribution to meeting objectives and maintaining vital attributes

Objective 1: Adaptively develop/implement participative systems for authorisation, compliance, monitoring and enforcement that aim to protect the resource and ensure empowerment, reform and socio-economic development. 1.c) Develop/implement cost effective monitoring programmes that serve strategic, adaptive and consensual decision making.

Objective 2: Adaptively stimulate/develop/implement co-operative governance systems that promote co-ordination of spatial planning and development to protect the resource and catchment. 2.a) Grow multi-level, multi-sectoral (private, NGO and government) governance networks and engagement processes that keep ICMA agendas at the forefront, taking advantage of existing structures wherever they can achieve this purpose. 2.b) Structure the ICMA's advisory function, within resource constraints, to ensure ICMA needs are served alongside those who are requesting advice.

Objective 4: Become the information hub of the catchment by adaptively developing/implementing systems (including operative) for the coordination, generation and distribution of knowledge and skills for innovative, participative IWRM. 4.b) Identify, collect and collate data/information for the system in 4.a) and map the stakeholder network, including the distribution of STEEP competencies, activities, needs, decision making mandates, etc. 4.d) Develop/implement strategic empowerment programmes that are explicit about the transfer and diffusion of knowledge/skills across the stakeholder network.

Persistence of Vital Attribute 1: Lowveld Biodiversity-based Tourism.
Ensuring Determinant 1: Water of an appropriate quality and flow regime.
Overcoming Threat i: Take steps to deal with a significant source of upstream pollution.

Persistence of Vital Attribute 4: The Inkomati WMA is pioneering in the field of IWRM.
Overcome Threat ii) Ease some of the practical obstacles to staff transfer from the proto-CMA to the ICMA.

Persistence of Vital Attribute 6: The upper catchment geology is an important flow and water quality regulator, and thus driver of biodiversity.
Overcome Threat i) Improve cooperative governance and enforcement, to improve delivery, fitness for use and cost/benefits for downstream users.
Overcoming Threat ii) Directly address the poor quality effluent discharged by municipalities.

2.4.2.3 Implementation and resources

Many proto-CMA staff, currently based at the regional DWA office, are already doing much of the monitoring and data collection work that will be required. As these staff are seconded to the ICMA, they can be brought in and introduced to the ICMA's new strategic direction (the three projects and their emergence from the APP) and should be able to build on their current activities, allowing the ICMA, proto-CMA, and the municipalities to work together to implement the project. In addition, the ICMA has a twinning agreement with a water resource management institution based in Holland, Waterschap Groot-Salland, who are eager to develop a programme of capacity building with the municipalities in the Inkomati. It is envisaged that Waterschap Groot Salland will play a key role in the implementation of this project, and that the ICMA will be involved primarily in an advisory and facilitatory role, and, crucially, will ensure that the programme holistically fits within their broader approach to IWRM implementation in the catchment.

2.4.3 Project 3: Implementing an integrated river operations system for managing the Crocodile River

2.4.3.1 Rationale and expected impact

The Crocodile River is the most stressed of the three rivers in the Inkomati catchment and has a wide range of pressing problems, simmering conflict, and the lowest level of cohesion in current management. The Crocodile River real-time operations Decision-Support System (DSS) is a project that was originally conceived by DWA with input from the ICMA. The development of the DSS software has been completed by DWA, but both DWA head office and DWA regional office have concerns regarding their positions to implement the project further. The project coordinating committee are frustrated with the delays in implementation, and are keen for the ICMA to now take the lead.

The implementation of a river operations system will involve, at its centre, the development of a broader participatory decision-making system into which the technical DSS software and monitoring gauges (rainfall, abstraction, flow) will fit. As such, the project provides a foundation on which virtually all other critical ICMA/IWRM imperatives can be built e.g. water allocation reform, implementation of international obligations and the Reserve, and implementation of compliance, monitoring and enforcement. The project, therefore, has the potential to have broad and diverse positive impacts across the Crocodile catchment and its stakeholder groups, and the many lessons that will inevitably be learned by the ICMA team in the integrated planning and implementation of this project can be transferred to the Komati and Sabie-Sand sub-catchments, and nationally.

If successful, the project will make a bold statement to DWA about the ICMA's capabilities, will give the ICMA a massive credibility boost with stakeholders in general, and will serve the self-identified need of the irrigation sector in particular, who are one of the largest stakeholder groups in the Inkomati catchment.

2.4.3.2 Contribution to meeting objectives and maintaining vital attributes

Objective 1: Adaptively develop/implement participative systems for authorisation, compliance, monitoring and enforcement that aim to protect the resource and ensure empowerment, reform and socio-economic development. 1.a) Develop/implement empowerment programmes that promote strategic, adaptive and consensual decision making across the stakeholder base. 1.b) Facilitate improved access to the resource, for socio-economic activities, through the development of systems such as the CMS and river operating systems. 1.c) Develop/implement cost effective monitoring programmes that serve strategic, adaptive and consensual decision making.

Objective 2: Adaptively stimulate/develop/implement co-operative governance systems that promote co-ordination of spatial planning and development to protect the resource and catchment. 2.a) Grow multi-level, multi-sectoral (private, NGO and government) governance networks and engagement processes that keep ICMA agendas at the forefront, taking advantage of existing structures wherever they can achieve this purpose.

Objective 3: Set and pursue the agenda for international negotiations that reflect local conditions/needs. 3.a) Improve cross-boundary stakeholder relationships and understanding of current agreements. 3.b) Strategically improve understanding of local catchment conditions and IWRM needs to inform decision making about international obligations under changing circumstances (i.e. do not wait for a crisis or demand from a neighbour).

Objective 4: Become the information hub of the catchment by adaptively developing/implementing systems (including operative) for the coordination, generation and distribution of knowledge and skills for innovative, participative IWRM. 4.a) Design and implement a system of data and metadata management, pertinent to participative IWRM in the Inkomati, that is accessible to all stakeholders. 4.b) Identify, collect and collate data/information for the system in 4.a) and map the stakeholder network, including the distribution of STEEP competencies, activities, needs, decision making mandates, etc. 4.d) Develop/implement strategic empowerment programmes that are explicit about

the transfer and diffusion of knowledge/skills across the stakeholder network.

Vital Attribute 1: The KNP/Lowveld and Trout/Panorama tourist drawcards are vital to both catchment and national economies. The persistence of this vital attribute is highly dependent on water of an appropriate quality and flow regime. The Croc Op will create an opportunity for the flow regime of the Crocodile River to be monitored and adaptively managed. DSS technology will make river flow data available to stakeholders, and operational management decisions will be taken regularly in order to promote a flow regime that will maintain the ecological sustainability on which these tourist economies are dependent.
Threat i) Excessive storage and over-allocation occur upstream. The Croc Op will address these threats directly, through its focus on flow regime management, appropriate and dynamic allocation restrictions (so that, even if the resource remains technically over-allocated, appropriate restrictions will mean that in practice, it is not over-allocated), and compliance monitoring.

Vital Attribute 2: The international character of major rivers. The persistence of this vital attribute depends on: a) the geographic location of the international boundaries and nature of the agreements; b) quantity and quality of water that must cross a boundary. The Croc Op's focus on flow regime management will ensure that international obligations are considered, in terms of quantity, at both decision-making and implementation levels. Reliable quantification of the water in the resource also has the potential to lead to re-negotiation of agreements in future.
Threat i) Continued over-allocation of water in the Inkomati. The Croc Op will address this threat directly, over a variety of time scales. In the short-term, the implementation of appropriate water-use restrictions will mitigate over-allocation in practice; while in the longer term, water allocation reform processes will be used to prevent over-allocation in both theory and practice.
Threat ii) Continued over-use (legal and illegal) in the Inkomati. In terms of legal water use, as for threat i) the Croc Op will directly address this problem. Additionally, monitoring of water use, via the data loggers that have been installed at all abstraction points, will clearly identify those users who illegally exceed their allocations. Identification is the first step towards preventing this illegal use, and the ICMA must ensure that appropriate enforcement processes are also established and implemented.

Vital Attribute 3: The Inkomati Water Management Area is pioneering in the field of IWRM. The persistence of this vital attribute depends on the ICMA's committed and enthusiastic staff. The Croc Op embodies an innovative and pioneering approach to IWRM that has organically grown out of an Adaptive Planning Process, and takes into account the ICMA's severe resource constraints. It serves as a much needed morale boost for ICMA staff, and has the potential to begin a positive feedback loop which will keep the staff committed and enthusiastic.
Threat i) The ICMA's “upbringing” continues to be held back by DWA's top-down control, uncertainty in decision-making, lack of direction and inertia in delegating functions and responsibility to the ICMA. The Croc Op is a joint project between DWA and the ICMA and, as such, is an opportunity for the ICMA to encourage DWA to relinquish control, and show DWA that the ICMA is capable and ready to be delegated more functions.
Threat vi) Staff have poor STEEP knowledge of the catchment. Throughout the planning and implementation of the project, staff STEEP knowledge will improve. The project also highlights why it's important to have STEEP knowledge, which kinds of STEEP knowledge are relevant and which are missing from the ICMA staff's knowledge base.

Vital Attribute 4: There are currently governance structures and a large, diverse and appropriate knowledge base on which stakeholders can, and do, draw. This vital attribute is determined by: a) many important governance structures having maintained their cohesion and functionality despite the transformation vacuum; and b) DWA's strategic reaction to the first CMA in the country, and the ICMA acting as a draw card to researchers from all over the world.

Threat i) Continued lack of, and poor co-ordination of, transformation of institutions from the past regime. The Croc Op will necessarily bring together a range of stakeholders, including irrigation boards, emerging farmers, and land claim farmers. The Croc Op has the potential to create new spaces in which these (and other) stakeholder groups can begin to build working relationships and trust, which is a vital step towards the establishment of new WUAs and/or the transformation of irrigation boards into WUAs.
Threat ii) Delay of transfers to ICMA is leading to serious loss of institutional memory and a huge rise in opportunity costs for skills retention. The Croc Op project provides an opportunity for the ICMA to 'bring in' proto-CMA staff from the DWAF regional office. If the ICMA starts to work with proto-CMA staff on a range of issues (from DSS implementation itself, to all the broader programmes that the Croc Op feeds into e.g. compliance monitoring and enforcement), the transfer of skills and staff to the ICMA has the potential to progress 'naturally'.
Threat iii) The knowledge base (data and metadata) remains uncoordinated, metadata are becoming outdated, and knowledge transfer between stakeholders is insufficient. New interactions between stakeholders, which the Croc Op will precipitate, will lead to cooperative knowledge generation, and the transfer of knowledge and skills.

Vital Attribute 5: Despite the overall state of water stress, there is still potential for increased yield in some areas of the catchment. This vital attribute depends on there being both dam sites and water available in these areas. The Crocodile system, which currently has only one major dam, does have the potential for further dam development in the future. However, whilst the Crocodile remains primarily a run-of-river system, the Croc Op project still allows for economic development, through water allocation negotiations and reforms, whilst at the same time allowing for reduction of the overall level of water stress in the catchment.
Threat ii) The current poor knowledge of, and confused/naive mindset about, the purpose and delivery of the Reserve, and its effects on development. By starting to implement the Reserve – and talk about it in different ways – we can influence how various stakeholders perceive the Reserve. The Croc Op will pioneer the implementation of the Reserve in a way that explicitly balances Reserve delivery with developmental needs, emphasises the Reserve as a sustainability index, and has the potential to provide a novel and inspiring example of Reserve implementation for other IWRM practitioners.
Threat iii) Continued lack of innovation on how to operationalise the Reserve in the face of development needs. As for threat ii).
Threat vi) Inefficient current resource use approaches, including operating rules, continue. The Croc Op provides an opportunity to adaptively develop new operating rules for the Crocodile system and, at the same time, introduce a new approach to resource use. The project provides a platform from which stakeholder/practitioner mindsets and 'ways-of-doing' can be changed, and where broader IWRM discourse and practical approaches can be influenced.

Vital Attribute 6: The upper catchment geology is an important flow and water quality regulator, thus also a driver of biodiversity. Although the Croc Op will not directly affect the determinants of this vital attribute, the project has the potential to indirectly influence its persistence through mitigation of some of the threats.
Threat i) Poor cooperative governance and enforcement, leading to over- and inappropriate development and land-use. The Croc Op is a potential starting point for broader cooperative governance initiatives. It can provide a platform for building working relationships and trust, so that different sectors and departments have a more solid base from which to engage about broader planning and land-use issues.
Threat iii) Limited understanding of groundwater linkages. The spatial-explicitness and temporal real-time-ness of the DSS model will allow for groundwater linkages to be examined in both space and time.

2.4.3.3 Implementation and resources

The project already has commitment from major stakeholders, particularly the irrigation boards, and much of the initial capital requirements (e.g. development of the DSS model, installation of meters and gauges) have already been covered by DWA. The ICMA has an in-house technical expert, who has been part of the DWA project from the outset, and the in-house capacity to develop broader stakeholder empowerment and ownership strategies (Appendices B and C).

2.5 Conclusion

The first phase of the action research initiative had a number of positive institutional outcomes for the ICMA. The APP and project development consolidated a strategic team direction for the ICMA for the first time since its establishment, and stimulated a move – in both practice and mindset – from "setting up an institution" to "managing the water resource". The ICMA team explicitly reflected that they found the process of developing a realistic shared direction, and using creative team brainstorming and dialogue to break down perceived boundaries and constraints, highly empowering. The team increased in confidence, communication and alignment between team members improved, and an institutional culture of learning and adaptivity is beginning to emerge.

The action research process also clearly demonstrated the utility of SAM – in particular the APP component of SAM – for internal planning and decision making by organisations, such as CMAs, who are responsible for IWRM implementation. The empowering nature of the APP itself was affirmed within an IWRM context; and the SAM framework, through the project development 'deviation', was seen to be flexible enough for the ICMA/project team to have adapted it effectively to suit their particular requirements at a particular time.

CHAPTER 3: ADAPTIVE PLANNING TO DEVELOP A STAKEHOLDER-CENTRED CATCHMENT MANAGEMENT STRATEGY

In December 2009, the Minister of Water Affairs asked the ICMA to produce a first generation Catchment Management Strategy (CMS) – a three to five year strategic action plan for IWRM in the catchment – by the end of March 2010. Helping the ICMA to plan and facilitate a stakeholder-centred CMS development process, that was embedded in a SAM approach to IWRM, became the second key intervention in this action research initiative. The development of the CMS was a carefully designed process, which successfully produced a first generation strategy that is compliant with all relevant legislation, deeply grounded in V-STEEP reality, and strongly endorsed by Inkomati stakeholders.

3.1 The CMS Development Process

The development of the CMS was centred on a stakeholder engagement programme (Figure 4) that consisted of three preparatory empowerment workshops (3.1.3) and five planning workshops: a stakeholder orientation workshop (3.1.2); three sub-catchment visioning workshops (3.1.4 and 3.1.5); and a final catchment-wide integration workshop (3.1.6). The Adaptive Planning component of SAM was used as the framework for engagement with which stakeholders collaboratively designed a shared desired future for IWRM in the Inkomati catchment. A 'technical team' from the ICMA, DWA and external advisors translated the output of the APP into a strategy to achieve this desired future (3.3).

3.1.1 Ensuring continuity in stakeholder participation

The ICMA conducted an extensive (Figure 4) campaign to ensure that the full spectrum of Inkomati stakeholders had the opportunity to participate in all CMS workshops relevant to them. The first step of this campaign was to comprehensively revise and update the ICMA's stakeholder database, to ensure that individuals from every sector, both current and potential future water users, in every sub-catchment, were included. Each of these individuals received invitations, via email, fax or hand-delivery, to each of the workshops, and follow-up phone calls and personal visits were made encouraging people to participate in the CMS process and to pass on the invitation to others who might be interested. Radio and newspaper announcements, in a range of languages, were also used to advertise the workshops to as broad a range of stakeholders as possible.

3.1.2 Stakeholder orientation workshop

The first CMS workshop was a stakeholder orientation workshop (February 15th 2010) at which the ICMA first presented to stakeholders the need for, and purpose of, a CMS. They also proposed a process for developing the Inkomati CMS, and the rationale behind this process (including the concepts of dynamic V-STEEP systems and consequent need for adaptive decision-making). An orientation document (Appendix D) outlining this information, the required sub-strategies of a CMS, and a brief STEEP overview of the Inkomati catchment was distributed to all known stakeholders, via email or hand delivery, prior to the meeting. This process is detailed further in the final CMS report which was submitted to DWA (ICMA, 2010).

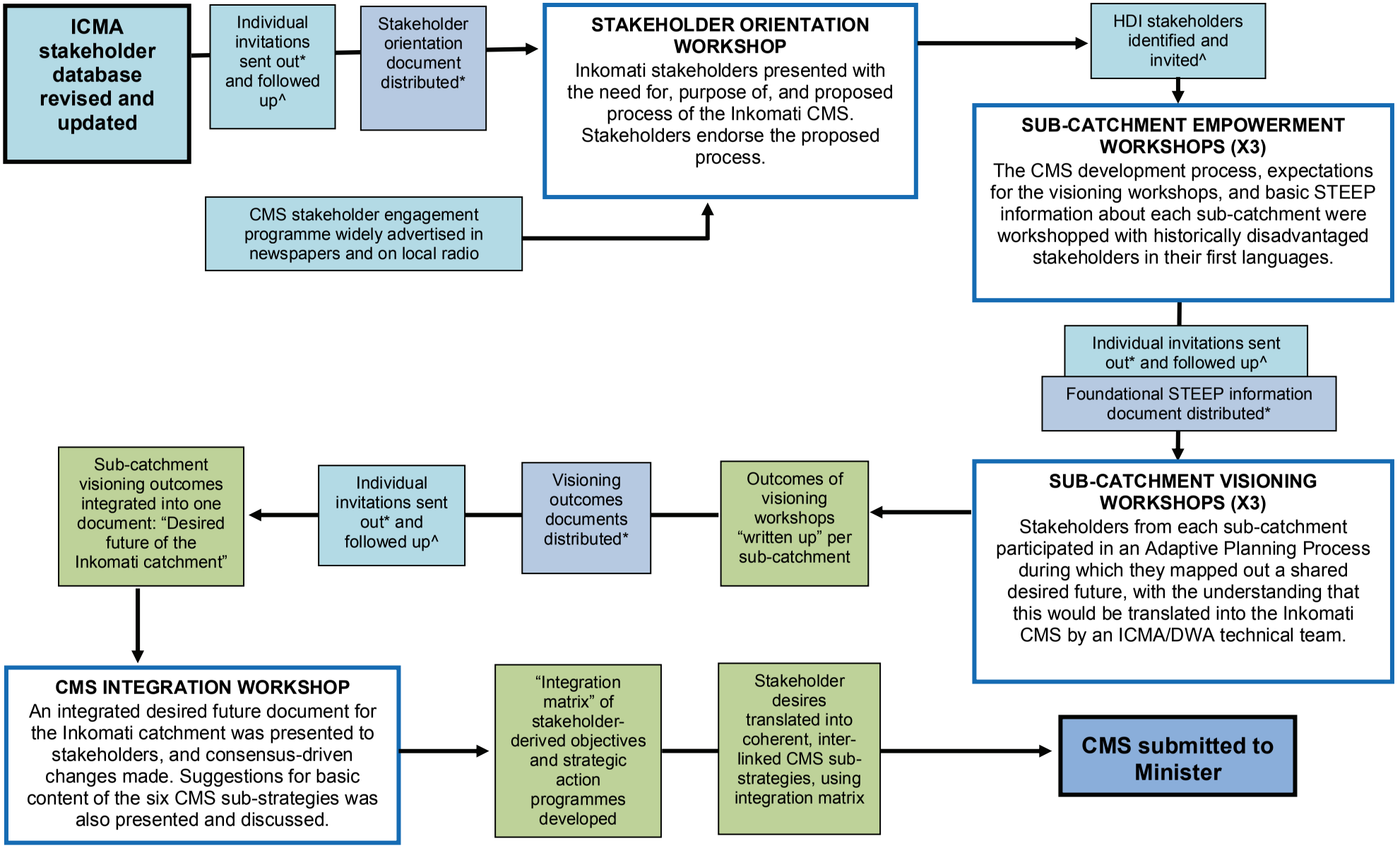


Figure 4. Summary of the Inkomati Catchment Management Strategy (CMS) development process (* via email, fax, and hand delivery; ^ via phone calls and personal visits; ICMA = Inkomati Catchment Management Agency; HDI = Historically Disadvantaged Individual; STEEP = Social, Technological, Economic, Environmental, Political; DWA = Department of Water Affairs)

3.1.3 Preparatory empowerment workshops

To ensure that all stakeholders were in a position to articulate their needs and perspectives, a preparatory empowerment workshop was held in each sub-catchment prior to the visioning workshops. These preparatory workshops targeted historically disadvantaged individuals, primarily emerging farmers, who were specifically identified in each sub-catchment. The workshops were facilitated by Dumisani Nxumalo, the ICMA's Institutions Specialist. They were used as an opportunity to explain the CMS process fully to these stakeholders in their first languages, and included an outline of the STEEP information document (Appendix E) that stakeholders would work with at the visioning workshops. These participants were also counselled about the types of contributions that they could make at the visioning sessions, questions they could ask, and responses that they could expect from the ICMA and other stakeholders. Collective decisions were also taken about how translation should be facilitated during the later workshops, and transport arrangements were finalised. These empowerment workshops proved to be extremely successful, with all stakeholder groups engaging meaningfully throughout the visioning workshops. A diversity of historically disadvantaged individuals' needs and perceptions were thus clearly reflected in the visioning outcomes.

3.1.4 Visioning workshops

The ICMA's own experience of the APP had generated real trust in the effectiveness of this SAM component, and the ICMA eagerly embraced the opportunity that the CMS provided to see the APP used with stakeholders. The three CMS visioning workshops utilised a specifically modified version of the APP (Figure 5):

- The wording of each component was adjusted to align more closely with 'general DWA language', and particularly the terminology used in the Guidelines for Catchment Management Strategies (DWAF, 2007), e.g. "Guiding principles, values, criteria" instead of "Principles/values" and "Reconcile attributes..." instead of "Evaluate attributes";
- "Context" was specified as "STEEP Context" and divided into the "Current givens" and "Likely changes" that the "Catchment Description" is expected to have according to the DWA Guidelines for CMS (DWAF, 2007);
- Four particular categories of objectives were specified (Resource Sustainability; Review Process; Financial Sustainability; and Participative, Co-operative Decision-Making) to align with the six CMS sub-strategies required by DWA.

The APP embodies an approach to multi-stakeholder negotiations that provides a realistic and grounded foundation for the value-based decision making that is critical for managing common pool resources such as water. The 'future-focused' APP also, when well facilitated, provides direction that prevents divergent stakeholders getting stuck in disputes about current 'conflicting' perspectives, behaviours, and needs. All workshops were well attended by a diversity of Inkomati stakeholders (Table 2), and the APP was successfully used to generate a shared understanding of the STEEP context of the catchment and divergent stakeholder needs and perspectives, and to develop a shared set of values and objectives for the desired future of the Inkomati WMA and its three sub-catchments.

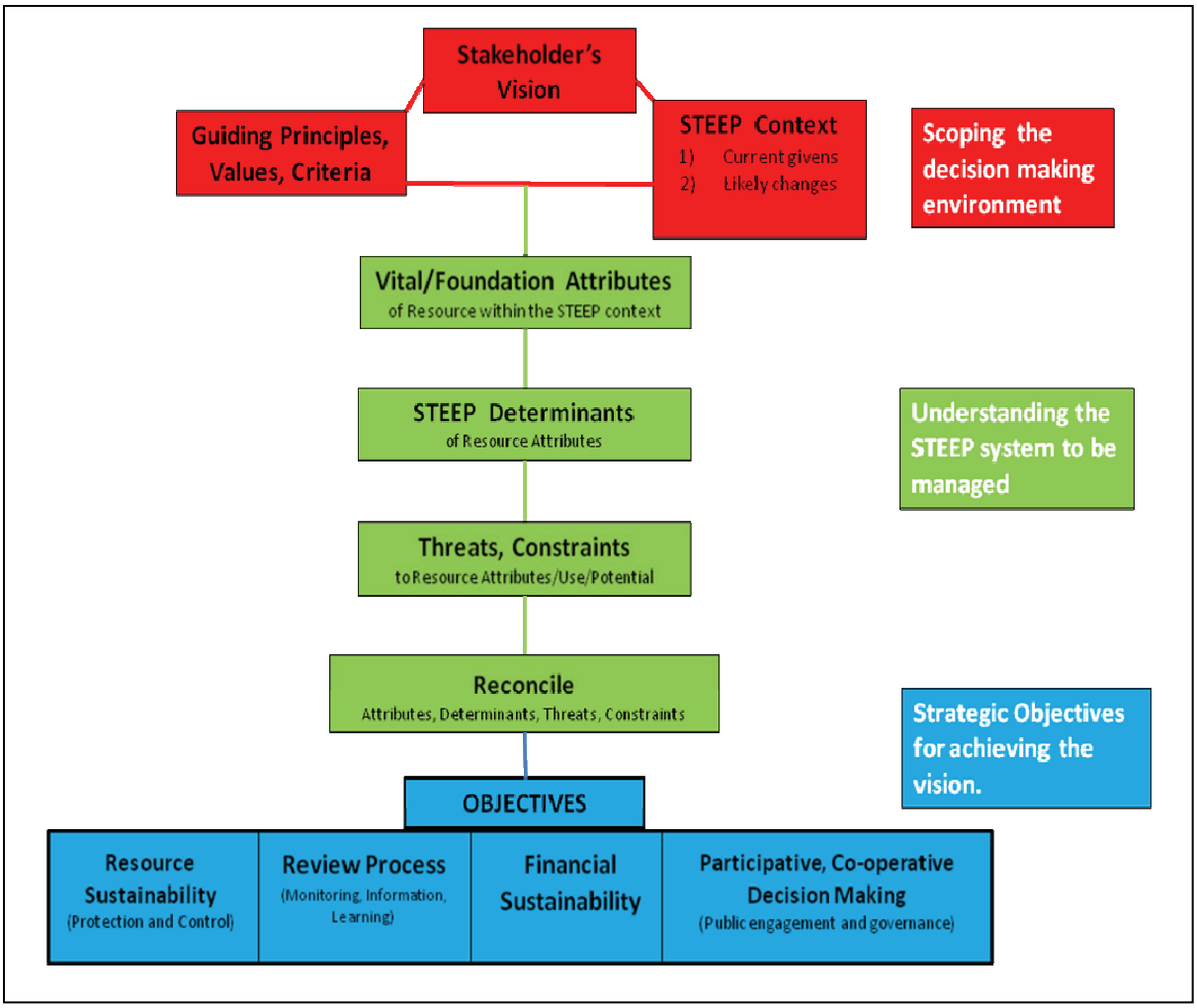


Figure 5. The Adaptive Planning Process for translating vision into achievable catchment management objectives (STEEP = Social, Technological, Economic, Environmental, Political)

3.1.5 Facilitating the visioning process/APP

Three simple procedures were used to start each of the visioning workshops, and set the tone of the negotiations.

Firstly, the facilitator introduced the APP and asked for stakeholder agreement to proceed with it. Once this was obtained, the facilitator introduced the following "rules of engagement" and they too were accepted by all participants before proceeding:

- Everyone will be able to, and needs to, give their own perspective on any issue. We (other participants) will all accept it as their perspective.
- We can all ask questions of each other to seek clarification at anytime.
- The best way to achieve what you need is to help others get what they need.
- Seek first to understand THEN to be understood. Listen first and speak later.

Table 2. Stakeholder attendance at the Inkomati Catchment Management Strategy workshops[1]

Stakeholder Sector	**Number of Representatives from Sector**			
	Orientation Meeting (15th February 2010)	Komati Visioning Workshop (10th March 2010)	Sabie-Sand Visioning Workshop (12th March 2010)	Integration Workshop (24th March 2010)
Communal property associations	3	1	3	6
Community based organisations	1	1	1	1
Conservation	8	2	7	6
Consulting firms	4	1	1	3
Department of Agriculture, Rural Development and Land Affairs	13	1	3	7
Department of Economic Development, Environment and Tourism (Mpumalanga)	-	-	-	2
Department of Water Affairs	6	1	3	8
District municipalities	4	1	1	3
Emerging farmers	27	11	23	35
Eskom	-	1	-	-
Forestry	1	-	3	2
Government departments (other than those specified)	10	-	9	1
Industry	3	-	-	3
Inkomati Catchment Management Agency	10	10	9	10
Inkomati Catchment Management Agency, Governing Board	3	2	1	2
Irrigation boards	11	3	1	5
Land Claims Commission	-	2	-	-
Local municipalities	4	-	1	9
Lomati River Forum	-	1	-	-
Non-governmental organisations	3	2	3	5
Progressive Realisation of the Inco-Maputo Agreement project	-	3	-	-
Rural development organisations	4	-	1	1
South African National Civic Organisation	1	1	1	2
South African Police Service	-	-	1	1
Traditional Authorities	-	-	1	-
Water service providers	2	-	-	-

[1] At the time of writing, the attendance register for the Crocodile Visioning workshop (9th March 2010) was unavailable.

Thirdly, the facilitator went systematically around the room and asked every person individually to voice their “primary” or “key” concerns/issues with respect to water in the sub-catchment. Each of these concerns was typed up onto a projector screen at the front of the room. This simple process encouraged each participant to trust that their individual concerns had been noted, and highlighted that every participant’s perspective was valued equally. It also gave every participant a first impression of where the other stakeholders were ‘coming from’ and thus provided a crucial base for co-learning and building a common rationality. This initial voicing of concerns also, critically, created a ‘participant-driven’ space at the beginning of the workshops in which the facilitator helped the stakeholders establish the mandate of the workshop and thus avoid time consuming digressions during the proceedings. An important clarification in the Inkomati workshops was the distinction between Water Resource Management and Water Services, and the fact that the water services backlog (a key concern of many stakeholders) cannot be directly addressed by the ICMA.

The purpose of recording these concerns/issues was *not* to build an agenda for the workshop. On the contrary, it was to demonstrate that there is a complex set of issues to deal with, and indeed, too many to workshop in one day. The facilitator therefore explained that the APP is designed to provide a framework for integrating the concerns and potential solutions, and re-confirmed stakeholder permission to continue with it, on the understanding that participants could return to the concerns/issues list towards the end of the day to check that all recorded items had been dealt with.

The facilitator, after spending this critical time ensuring that all participants felt comfortable and included, then began to address each specific component of the APP (Figure 5). He started with the “Scoping the decision making environment” component, moved on to “Understanding the STEEP system to be managed”, then concluded the workshop with the “Strategic objectives for achieving the vision”. Each step within these three components was addressed individually, with the facilitator beginning with an explanation of the component and its steps. For example, for the “Guiding principles, values, criteria” step (Figure 6), the facilitator began by explaining that these “values” are the shared principles that the ICMA and its stakeholders will use to evaluate the consequences of their actions (or inaction), and to propose and chose between alternative options and decisions. Participants were then asked to think about and express the concepts/words/phrases that they felt reflected the values by which they want decision making to be guided. The facilitator went round the room, to each participant who indicated they wanted to contribute, and each concept/word/phrase was typed up onto a projector screen at the front of the room. The facilitator ensured that each participant felt happy that their contribution had been accurately recorded, and a list of “guiding principles, values and criteria” (Figure 6) was progressively generated by the stakeholder group.

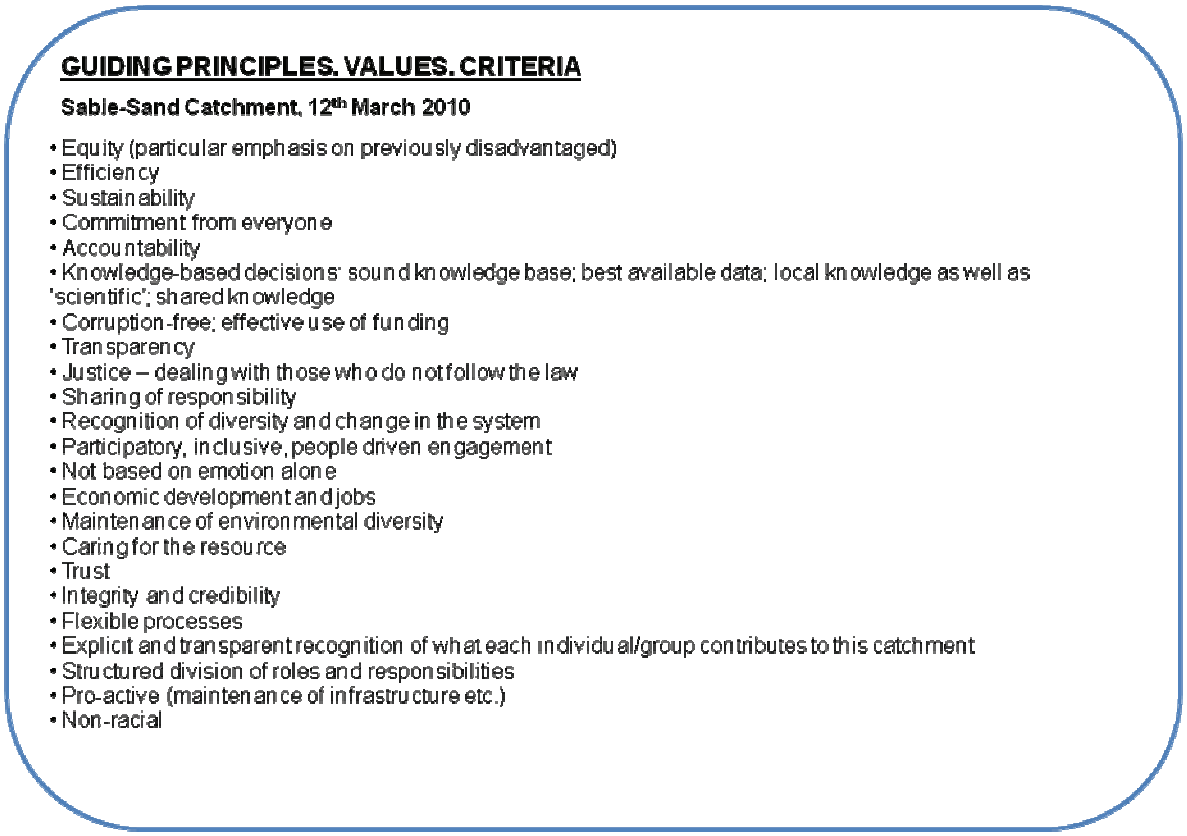


Figure 6. "Raw" list of guiding principles, values, and criteria for decision-making produced by stakeholders in the Sabie-Sand catchment during the Inkomati Catchment Management Strategy visioning process

When the facilitator perceived that the rate of new contributions had slowed, and that the input was becoming repetitive, he would bring the free-flow session to a close and ask two final questions: i) Is there anything vital missing from the list? and ii) Is there was anything on the list that is inappropriate and should not be there? Once there was consensus that the answer to both these questions was "no", the facilitator moved on to the next component of the process, and followed the same participatory procedure. Asking these questions and reaching consensus (usually a very quick process by this stage because stakeholders have already developed trust and a common rationality for the process) is extremely important in achieving buy-in and trust among stakeholders. The list was left in its "raw" state during the workshop with the assurance from the facilitator that stakeholders would have the opportunity to vet the "word-smithed" version before it was submitted to DWA. One full set of "workshop notes", showing the lists produced for each APP component in the Sabie-Sand sub-catchment, is included in Appendix F.

The only component of the APP for which the above engagement procedure was not followed was the "STEEP Context" component of "Scoping the decision-making environment". A large amount of background research had already been carried out, during 2008/2009, as part of the initial foundational steps for the CMS, and the most pertinent of this information was summarised and given to stakeholders as a "Foundation Information Document" (Appendix E). At the visioning workshops, the facilitator took the stakeholders through this document section by section, providing the opportunity for them to comment. Primarily, the facilitator asked participants if they were aware of additional/improved data sources which could supplement and enhance the STEEP information in the document.

3.1.6 Integration workshop

Each set of "workshop notes" was written up into a visioning outcomes document for the sub-catchment in question (Appendix G) and circulated to stakeholders for comment. The three documents were then integrated into a Desired Future document for the whole Inkomati catchment. This integrated document in turn formed the basis of feedback to stakeholders at the final integration workshop, held on March 24th 2010. At this workshop the facilitator went through the document section by section, seeking stakeholder responses and suggestions for improvement. Consensus-driven alterations were thus made and accepted, to create an integrated, and stakeholder centred visioning document for the Inkomati catchment (3.2). Stakeholders were also, at this workshop, given a series of presentations by the ICMA staff on the proposed "strategic action programmes" for the six draft CMS sub-strategies, the content of which was open for discussion.

3.2 Outcomes of Stakeholder Adaptive Planning for Management of the Inkomati Catchment

3.2.1 Vision

- We share the Inkomati water resources, and responsibility for their management, amongst ourselves and with our neighbours.
- Our decision making environment, including delegated functions, enables collaborative action towards equity, sustainability and efficiency in a continually evolving socio-economic system.
- We manage the resource adaptively, co-operatively and progressively to achieve social, economic and environmental justice, and promote healthy living.

3.2.2 Values/principles to guide decision making

- We acknowledge the interdependence of our responsibilities for caring for the resource and there is explicit recognition of the diversity achieved by what each individual/group contributes to promoting equity, efficiency and sustainability.
- Decisions, actions and outcomes are subject to performance evaluation against measurable goals, indicators and timeframes.
- We strive for a trusting, transparent and corruption-free system of catchment management that is cognisant of existing agreements and promotes fairness before the law and economic development.
- Management is adaptive, open to critique and outcomes driven, with solutions being practical, achievable and implemented.

3.2.3 Vital attributes of the Inkomati catchment

- Livelihoods in the catchment are inextricably tied to the health of the rivers and their tributaries through an economy based largely on tourism, irrigation agriculture, forestry, mining and government.
- The very variable, in both space and time, rainfall is largely generated in a small area of the upper catchment but demand is highest in the lower reaches where the soils are better and poverty levels are high.

- The catchment is a critical element of an internationally renowned conservation area and international tourist hot-spot both of which are dependent on healthy aquatic systems and good water supply.

- The rivers are an important source of water for both Mozambique and Swaziland.

- Knowledge of, and expertise in, water resource management is high but the human skills base is low.

- There are still large disparities in access to water and current water allocations are not meeting the domestic and economic needs of many stakeholders.

- Although water resources management is currently poor, there are examples of well organised water resource management institutions and agricultural water allocation systems that can act as examples for the future.

- Water use infrastructure is generally limited and water management is largely "run-of-river". There is potential for improving water yield (e.g. more water storage facilities).

- The wide altitudinal range from west to east is accompanied by high biodiversity and a diverse and scenic landscape mosaic in which rivers and wetlands play a very important role.

3.2.3.1 Sabie/Sand sub-catchment specific vital attributes

- The rivers, riparian zones and other wetlands have a high biodiversity.
- The catchment has a very good research profile/data set.

- Dolomite cavities store and steadily release water over the dry period.

- The Sabie and Sand rivers are very different hydrologically as the Sand does not reach up onto the high rainfall escarpment.

3.2.3.2 Komati sub-catchment specific vital attributes

- The catchment straddles political boundaries (South Africa, Swaziland, Mozambique) creating two distinct river sections each with their own management issues.
- The relatively undeveloped upper catchment delivers good quality water which is transferred out of the catchment to support the national power generation system.

- Vast, intact wetland systems are very important in groundwater-surface water interactions.

- Very high biological diversity is complemented by a rich cultural heritage and unique petrology (oldest rocks in Africa and oldest signs of life in the world).

3.2.3.3 Crocodile sub-catchment specific vital attributes

- The very high biological diversity is complemented by high cultural diversity, a rich heritage and unique petrology (oldest rocks in Africa and oldest signs of life in the world).
- The sub-catchment has very high urban growth because it straddles the Maputo Development Corridor and contains the Mpumalanga Capital (Nelspruit).

3.2.4 Threats

- Despite the willingness and commitment of some, there is a high degree of public discontent, scepticism and resultant apathy towards water resource issues. This is clearly a function of un-kept promises, little progress in improving access to water for the previously

disadvantaged and a lack of commitment to implementing the Reserve. There is a serious threat of these water issues leading directly to civil protest and unrest.

- Very poor land- and water-use planning is threatening our ability to address fundamental issues of equity and sustainability of the water resource. This is because poor planning leads to uncontrolled urban, rural, agricultural, industrial and mining development and the invasion of alien species. These in turn lead to degradation of the scenic mosaic and pollution from poorly maintained and inadequate infrastructure. Ninety percent of the urban centres in the Inkomati will have insufficient capacity to deal with waste water within three years.

- Very limited and dysfunctional infrastructure (small dams, canals, off-stream storage, etc.) in the lower reaches of the catchment, entrenches and exacerbates the imbalances of the past and the plight of the previously disadvantaged.

- Corruption, continued circumvention of the National Water Act by developers and mining, and continued lack of law enforcement are negatively impacting on socio-economic development and rapidly reducing the sustainability of water resources. (Issues in need of law enforcement include illegal water abstraction and waste dumping; illegal land use within wetlands and riparian zones; illegal river regulation and drainage of wetlands; illegal fishing, hunting, harvesting of medicinal plants, etc.).

- Non-implementation of the Reserve and agriculturally biased flow regimes are undermining the sustainability of the water resource and thus its delivery of the ecosystem services upon which the poor subsist, biodiversity conservation depends and tourism and irrigation rely for profitability.

- Lack of cooperative governance at national, (Departments of Water Affairs, Agriculture, Minerals and Energy, and Environment), provincial (e.g. landuse planning) and local (service delivery) levels is undermining the management of water resources for improved equity, efficiency and sustainability.

- The lack of assignment and delegation of functions, staff and finances to the ICMA means there is no institutional capability for IWRM and these issues continue to spiral out of control.

Some specifics:

- Many stakeholders feel the “Ecological Reserve” process is being conducted in a “clandestine” manner. Their continued suspicion about it will seriously hamper stakeholder buy-in and therefore implementation.

- Uncontrolled mining operations in the upper Komati catchment will be a major threat to water quality and thus national energy production.

- The rivers are oversubscribed under a poor and un-implementable allocation policy/plan.

- Climate change, and a pervasive uncertainty about how to deal with such complex problems, threaten our ability to plan strategically.

And finally:

- Given the international nature of the Inkomati drainage basin, all of these threats have the potential to be transferred to our international neighbours.

3.2.5 Objectives

Stakeholders were adamant that their primary objective is for the ICMA to achieve full delegation and assignment of authority so that it can practice IWRM to achieve equity, efficiency and sustainability of water use.

Including:

- Ensure that the ICMA has the capacity and skills to perform its functions.
- Develop pragmatic, workable decision-making structures and processes.
- Complete the licensing process, water allocation reform, etc.
- Develop a solid financial strategy.
- Establish Water User Associations.
- Actively participate in co-operative governance, planning, enforcement/policing, and training.
- Careful quantification of goals for progressive realisation of objectives.

3.2.5.1 Co-operative governance

Urgently develop a system of co-operative governance and stakeholder engagement that gives water a high profile across local, regional and national government structures. The system must:

- Mobilise sufficient political will and support to hear the voice of the crying masses for water and to follow through with the strategy.
- Recognise the problem of cumulative effects and stop the circumvention of water policy in the name of development.
- Contain a clear plan to engage service providers/authorities about infrastructure development, maintenance and the polluter pays principle.
- Incorporate the National Freshwater Ecosystem Priority Areas framework.
- Get mining and tourism on board.
- Participate in international programmes.
- Strengthen stakeholder participation and engagement in decision making and law/policy compliance and enforcement.

3.2.5.2 Sustainability

- Increase the water yield, especially for resource poor farmers by, for example, developing new infrastructure, repairing old infrastructure, eradicating alien vegetation, and by promoting conjunctive uses of water, water conservation, water demand management and wetland rehabilitation.
- Water use is fully metered/measured, audited, reconciled, monitored and compliant across the Inkomati catchment.
- A process for implementing the Reserve must be put in place and must include full integration of the National Freshwater Ecosystem Priority Areas framework.

- Water quality and ecosystem health monitoring, auditing and making the data public.

3.2.5.3 Funding

Develop a transparent and attainable plan for funding that identifies the sources of funds, mechanisms for gathering those funds and for allocating them to priorities. The plan must include:

- Ensuring of performance auditing of the ICMA's financial operations.
- Development of a billing system that includes waste discharge charges.
- Implementation of a system of incentives, disincentives (e.g. the waste discharge charge system), and benchmarks to ensure more equitable and efficient water use.

3.2.5.4 Information needs

- Develop a transparent and implementable strategy for information collection, and use, in IWRM monitoring and evaluation. We need a better quantified water balance.
- Quantify climate change effects on water availability.
- Develop an effective communication strategy.

3.3 Translating Stakeholder Objectives into a Catchment Management Strategy

The final stakeholder visioning document, presented above, was then used by the ICMA team to develop a matrix (Table 3) of stakeholder-derived objectives and strategic action programmes. This matrix formed the final guidance to the technical team for drafting the required six CMS sub-strategies, and provided the integrative framework through which the CMS derives a holistic structure and meaning. Without this integrative structure, the CMS would consist of a fragmented array of strategic actions, with numerous redundancies but no clarity about the overlaps or the linkages between actions.

The matrix guidance ensured that the 'technical' strategic actions of the CMS were genuinely designed to meet stakeholder needs, and that the country-wide legislative CMS requirements (RSA, 1998; NWRS, 2004; DWAF, 2007) were all fulfilled, in a way that is relevant for the Inkomati context and the local realities of the system. The full version of the integration matrix (Appendix H), populated with the strategic actions that comprise each of the six strategic action programmes, forms the backbone of the final CMS document (ICMA, 2010), which is a noteworthy product that resulted from the stimulus of this action research project.

Table 3. Integration matrix for the Inkomati Catchment Management Strategy

	Practical IWRM to achieve equitable, sustainable, and efficient uses of Inkomati water resources which meet evolving stakeholder needs and legal obligations					
	A sustainable water resource		**Collaborative and coordinated IWRM for wise socio-economic development**			**Secure financial arrangements for IWRM**
Sub-Strategies / **Strategic Action Programmes**	Resource Directed Measures (RDM)	Source Directed Controls (SDC)	Cooperative Governance	Stakeholder Engagement	Information & Monitoring	Finance
Achieving equity						
Managing flow						
Managing water quality						
Generating and managing knowledge						
Achieving compliance and enforcement						
Generating revenue						

3.4 Conclusion

The central outcome and achievement of this phase of the action research project was the timely completion of the first CMS in the country, in a manner that was solidly stakeholder-driven. There is now an agenda for IWRM in the Inkomati catchment, one which was designed by, and remains strongly endorsed by, the diverse Inkomati stakeholder base. This is a significant breakthrough for the South African water sector, and provides valuable IWRM lessons for the ICMA, other CMAs in the country, and the DWA.

The CMS development process undeniably demonstrated the applicability of the APP component of SAM to participatory IWRM implementation in South Africa. The process empowered highly diverse stakeholders to dialogue about IWRM issues in 'non-technical' language, in a space where all participants' perspectives were voiced and valued equally. The directional structure of the APP empowered the stakeholder group to reach consensus on a shared desired IWRM future for the Inkomati catchment. The APP was effectively modified for the IWRM context so that the shared, desired future outcomes were sufficiently aligned to DWA requirements that they could be easily translated into the CMS structure (six sub-strategies) to provide the technically detailed document required by DWA.

The second phase of the action research project also served to further embed the concept of SAM, and the process and value of the APP, within the ICMA; and introduced Inkomati stakeholders to the APP, the concept of adaptive IWRM, and the practice of coordinated multi-stakeholder decision making. The challenge now is to evaluate the other SAM components, through active learning-by-doing, and to test how well they too can be applied to an IWRM context.

REFERENCES

BIGGS HC and ROGERS KH (2003) An Adaptive System to Link Science, Monitoring and Management in Practice. In: Du Toit JT, Rogers KH and Biggs HC (Eds.) The Kruger Experience: Ecology and Management of Savanna Heterogeneity. Island Press, Washington.

DEPARTMENT OF WATER AND FORESTRY (2007) Guidelines for the Development of Catchment Management Strategies: Towards equity, efficiency and sustainability in water resources management. By Pollard SR, Du Toit D, Reddy Y, and Tlou T. Department of Water Affairs and Forestry, Pretoria.

HOLLING CS (1978) Adaptive Environmental Assessment and Management. John Wiley & Sons, New York.

INKOMATI CATCHMENT MANAGEMENT AGENCY (2010) The Inkomati Catchment Management Strategy: A First Generation Catchment Management Strategy for the Inkomati Water Management Area.

MEFFE GK, NIELSEN LA, KNIGHT RL and SCHENBORN DA (2002) Ecosystem Management: Adaptive, community-based Conservation. Island Press, Washington.

REPUBLIC OF SOUTH AFRICA (1998) National Water Act (Act No. 36 of 1998). Department of Water Affairs and Forestry, South Africa. *Government Gazette no. 19182.* Government printers, Pretoria.

ROGERS KH (2003) Adopting a heterogeneity paradigm: Implications for management of protected savannas. In: Du Toit JT, Rogers KH and Biggs HC (Eds.) The Kruger Experience: Ecology and Management of Savanna Heterogeneity. Island Press, Washington.

ROGERS KH and BESTBIER R (1997) *Development of a protocol for the definition of the desired state of riverine systems in South Africa.* Department of Environmental Affairs and Tourism, Pretoria.

ROGERS KH and SHERWILL T (2008) A Framework for Developing and Implementing Management Plans for South African National Parks. www.sanparks.org/parks/kruger/conservation/scientific/

APPENDIX A: STEP-BY-STEP PROTOCOL FOR THE ADAPTIVE PLANNING PROCESS: TRANSLATING VISION INTO ACHIEVABLE OBJECTIVES

This protocol provides a step-by-step process for decomposing the vision into a series of "objectives" of increasing focus, rigour and achievability. The finest level of the hierarchy is defined by achievable targets.

Procedural tips are given in text boxes for each protocol step. This protocol should ideally be implemented in a workshop environment with the assistance of a facilitator who is familiar with both the protocol and consensus facilitation.

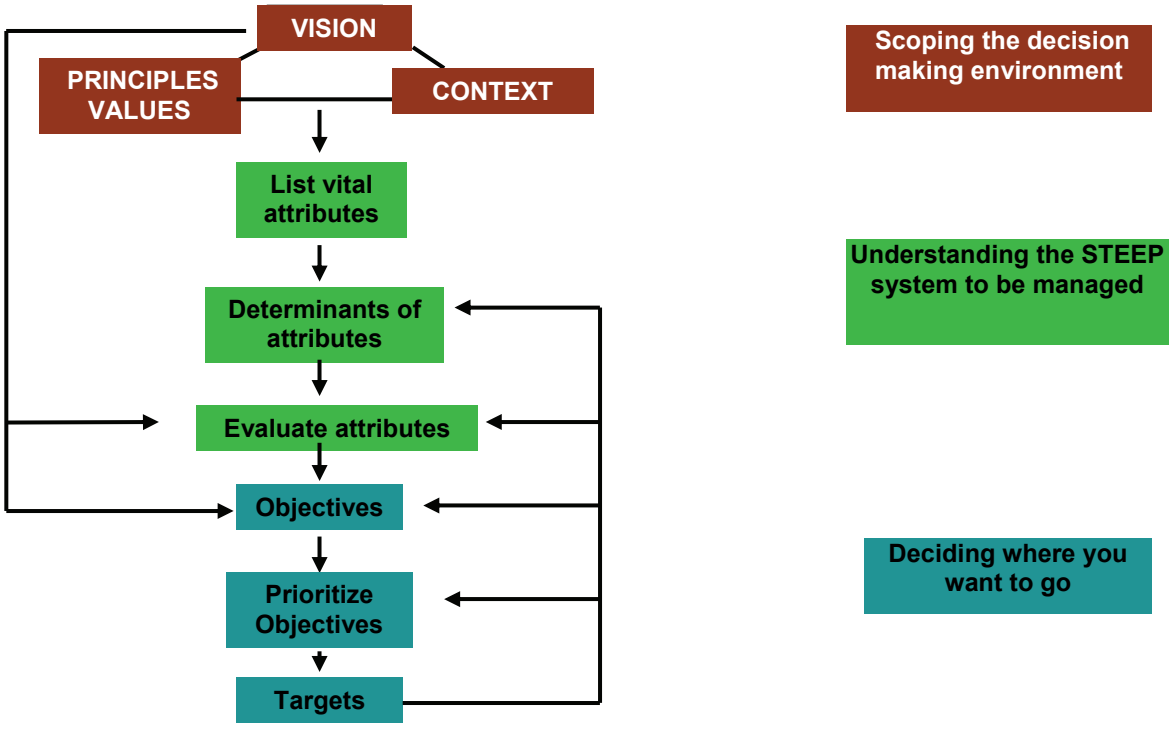


Figure 1: A strategic planning framework for translating vision into achievable objectives

Step 1. Reach consensus on the vision, values and operating principles

A vision is a concise statement describing an institutions' core business and philosophy of management, whereas a statement of the operating principles describes the core values of the organisation in terms of managing the resource. Before any other management action can be taken the vision and operating principles need to be fully accepted to prevent subsequent procedural breakdown. Development of a sound information base to provide the full context (Step 2) for management will greatly assist this process.

> This is one step at which value and needs-based negotiation (See Guide to building cooperation) is essential. Identify the key elements of the vision and develop operating principles for each.
>
> Since the operating principles describe core institutional values they should be used as checks and balances at each step of the protocol.

Step 2. Provide the context for setting the objectives

Describe the context of/for the system to be managed, at local, regional, national and international scales and in ecological, socio-economic, political and legal terms. Often socio-economic, legal and ecological factors are included in international, regional, national and local context.

This step requires considerable brainstorming, knowledge of the literature, local conditions and policies, governmental policies and international agreements. It is important to involve all stakeholders in building this context to ensure common understanding as a base for future negotiations.

Step 3. Document the vital attributes of the system to be managed

List **all** the known and perceived, current and future vital attributes of the system.

Current attributes may be determined from inventory type lists of V-STEEP characteristics of the system. In protected areas these may be species diversity and landscape types, social and cultural attributes, the role in the local economy, etc.). Scenario modelling may be useful for identifying future attributes.

The next step is to discuss and evaluate these lists to reduce them to the essential elements compatible with the vision.

This is an important step in the objective setting process as it identifies the fundamental purpose(s) of management for a particular resource.

It is essential that everyone's perceptions of the strengths/vital attributes are aired. This is a step that brings participants mental models of the system to the surface. Sometimes it exposes hidden agendas. Careful facilitation and much tact are needed in this phase. Encourage participants to put their "cards on the table" to produce a provisional list of their perceptions of the vital attributes, without debating their merits. Then reduce the list by eliminating those incompatible with each other, or the vision.

Step 4. Evaluate and consolidate the attributes

Matrices are a useful tool in exploring which attributes appear to be complementary and those that are conflicting. Attributes can be sifted, grouped together and condensed. Thus the end product would be a concise list of vital attributes for which the catchment would be managed.

Personal values play an important role in this step as long held assumptions about what is "vital" in a catchment need to be discussed and supporting evidence found. Look for common ground to rationalise the list of attributes to ensure compatibility with the vision and operating principles, including institutional values).

This can be a complex task. Techniques such as ordination, overlapping, congruency, optimization, linkage and interaction may be used to investigate compatibility and trade-offs between strengths if round table discussion does not resolve the issues.

Table 1. An example of a matrix used in the initial evaluation of the strengths of Nylsvley Nature Reserve (O – complimentary, X – conflicting, ? – unknown).

Strength	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1	-	O	O	O	O	O	O
2		-	?	O	X	?	O
3			-	O	O	O	O
4				-	O	O	O
5					-	O	X
6						-	?
7							-

Step 5. Record all the determinants of, and constraints and threats to, the vital attributes

A major purpose of management is to ensure the maintenance of the determinants of the vital attributes. List all the determinants of, and the constraints and threats to, the condensed list of vital attributes. Knowledge of the environmental and cultural "goods and services" the system has the potential to deliver is essential to this step. A matrix can be set up to facilitate the process of assigning determinants, threats and constraints to the particular strengths.

> Expert opinion is needed for this important step but do not let it be constrained by the lack of site specific knowledge. Use experts across the V-STEEP spectrum where you can.
> Develop hypotheses of determinants if they are not known. This is invoking an adaptive approach to management which will test their importance over time.

Table 2. An example of a section of the matrix used in assigning determinants, threats and constraints to the particular vital attributes of Nylsvley Nature Reserve.

Vital Attribute	Determinant	Threat	Constraint
1. A good information base.	History of involvement: academic, research, management.	Lack of support from funding agencies.	Reserve is a very small part of floodplain and catchment; lack of understanding of the system as a whole. Information is not in a user friendly format. Management does not have clear objectives, and therefore does not demonstrate their information requirements.
2. It is an excellent breeding and staging site for nomadic aquatic birds.	Hydrological regime drives wetland processes, water quantity and quality. Grazing and fire regime on reserve influences breeding and other life history strategies.	Water resources development in catchment is a threat to the hydrological regime (water is scarce) – extraction is a high risk. Exotic plants in the catchment – alter water quantity (reduce runoff) and quality.	Management does not know how to, and have not, explicitly managed for birds.
3. The NNR has a large number of red data listed species (especially fauna).	Habitat availability due to grazing and fire regime on reserve, and the hydrological regime.	Droughts. Over utilisation of the catchment area, e.g.: overgrazing.	High human impact. Management practices for other species – veld and fire.

Step 6. Formulate the high level objectives

Objectives are set to;
1) ensure the maintenance of the identified vital attributes of the system being managed, and
2) overcome the constraints and threats to meeting the vision.

A hierarchical approach should be adopted to formulate a set of nested objectives of increasing rigour and achievability. Note that this is an iterative process of identifying, structuring and analysing objectives, and understanding how they relate to each other.

Repeatedly cross reference the vision, principles, context and vital attributes with constraints and threats to set up statements of intent to ensure vital attributes are maintained by overcoming threats and constraints.

Several devices can help stimulate formulation of objectives:
1. Drawing up a wish list.
2. Use of alternatives.
3. Identifying problems and shortcomings – articulate reasons for concern.
4. Identify consequences of existing objectives and management actions.
5. Use of different perspectives.

It is important to recognise that objectives at different levels in the Objectives Hierarchy would probably be used to direct operations at different levels in the institutional hierarchy.

Step 7. Prioritize the high level objectives

Prioritising objectives is both difficult and subtle. Use the vision, strengths, principles and context as a basis to prioritize the objectives. They provide the checks and balances. It is important to note that the priority may change according to the level of management personnel involved so try to involve a wide range.

Negotiation is an important tool. Not all the objectives will stand up to this process and there will be many perceptions of what is most important.

The preceding steps of the protocol have set a good foundation though. Use this information to give the checks and balances needed to rationally prioritize the objectives. Do not do it by vote as this often reduces decisions to gut feel or personal agendas.

One of the most useful devices for prioritising is simply to ask WHY? Why is A preferred to B? and to relate the answer to the vision, principles and vital attributes.

Step 8. Set lower level objectives

Construct an Objectives Hierarchy by decomposing the higher level objectives set into component objectives ("sub-objectives") of increasing focus, rigour and achievability. The final level represents acceptable, achievable and measurable objectives.

There is also a need to **prioritise these lower level objectives**. Different degrees of rigour can be given to the time frame of different priorities. An objective may have a low priority because other objectives have to be achieved first, not because it is less important. Future objectives may have low priority now, but will be given a time frame for revisiting them. One of the reasons for prioritising is to check for redundancy between objectives. Quite often one lower objective serves two higher level objectives, or needs minor modification to do so. The more these can be identified the more duplication, or waste of effort, can be eliminated.

Use the same procedure as for formulating objectives (Step 6) to sub-divide objectives into smaller and smaller, more circumscribed units until the statement ceases to describe an intent and becomes one of "what must be done". You have set the final objectives when clear statements of the temporal, spatial and resource limits have been identified and they are unequivocally achievable.

The most difficult task is to ensure that the smallest number of objectives is set to achieve a particular high level objective. Again, ask WHY? Why is this needed, why is it the best option? Remember, the purpose is to maintain vital attributes by overcoming constraints and threats. Also remember that one reason why you are conducting this exercise is to focus management on priority, achievable and measurable objectives. Therefore repeatedly check that the resources needed are available or potentially available.

APPENDIX B: CROC OP PROJECT, FRAMEWORK FOR IMPLEMENTING THE DECISION MAKING SYSTEM (DUMISANI NXUMALO, 19-07-2009)

Stakeholder Empowerment (external)

Database

- Identification of key stakeholders-current water users (high impact and low impact, users) as well as **future-potential users** (especially land reform beneficiaries, who may not currently be using the resource or will need to increase their use in the future to be competitive/overcome the disadvantages of the past) through liaison with the Land Claims Commission.)

- At a secondary level we have to develop a data-base of affected and interested parties (i.e. those who do not directly use the resource, but may get services from a water services provider or water service authority). These may be communities, individuals or institutions but the focus should be at community level to begin with. Ultimately, we need to distinguish between direct and indirect stakeholders and recognise that, even at this broad level of categorisation, we will need two different approaches to engagement.

We can use simple software, which is already accessible by the ICMA, to create the initial database e.g. Microsoft Excel, or Microsoft Access. Stakeholders themselves can be of significant assistance in populating the database, since they are likely to know other stakeholders in the area and can assist in identifying those who are not already in the database. This will need to be facilitated by an ICMA staff member (Diketso?), who will also be responsible for future updates of the database as additional stakeholders are identified.

Identification analysis of needs

- Gather stakeholder needs: not just in terms of water requirements, but also in terms of e.g. capacity building, knowledge, empowerment needs.

- Although needs will definitely 'break down' into sectoral categories, to better understand both individual and collective needs, a multi-pronged strategy is required that includes both forum meetings and individual stakeholder visits. The latter will develop personal rapport and provide an opportunity for those who, for various reasons, may not be able to engage effectively at mass meetings.

- Feasible time frames for engagement, and the timing of these two types of interactions relative to each other need to be finalised as part of the project action plan.

- Similarly, practical 'grouping' details still need to be worked out for forum meetings e.g. delineating the catchment area into manageable geographic and/or sectoral entities.

- Preparatory work (for both forum and individual interactions) will include collating existing information from previous stakeholder engagements i.e. from I&P staff, and from projects such as Future Search.

- Strategies/ approaches for both meetings and individual visits will need to be well planned to ensure that useful information is generated in each case. Questionnaires could be distributed prior to forum meetings, perhaps as part of the project information brochure.

- An analysis of these needs is necessary-so that we explain or demonstrate how the CROC-OP will address their needs or how stakeholders themselves see the CROC-OP addressing some or all of their needs.

This process needs to be as basic and thorough as possible, taking in to account that needs are time bound (short and long term) and may change over time. Yes so perhaps you can give us some practical suggestions. I mention a few possibilities in my comments but you would you would know better than I. GIS to provide translation resources. ADP internal needs

Project announcement or initiation

- Before the project is announced project documentation needs to have been distributed
- Depending on resources availability and taking in to account the diversity of our stakeholder we have to develop appropriate materials-that will give a generic outline of the project e.g. picturesque brochures, pamphlets, posters.
- It is also desirable to embark on a multimedia strategy to profile the project, in terms of its strategic thrust to the province (PGDS) and its multiplier effect on the entire Water Management Area.
- Both the above steps require strong coordination, and joint decision-making with the marketing department.

It would be important to involve stakeholders from the Sabie Sand and the Komati sub catchments at representative level so that they can understand what the project is and how they will benefit from it in the long term. This is to ensure that stakeholders learn and share experiences from each other. This step needs careful planning to prevent stakeholders in the Sabie-Sand and Komati feeling like 'poor cousins' or contributing further to stakeholder fatigue: if there are meetings, we need to ensure that participants go away feeling that they gained something from them.

Operation Forum/Advisory Forum

- The role and responsibilities of the forum need to be developed and clearly spelt out: e.g.

- To act as a steering committee for the project

- To ensure that stakeholder needs and interest are catered for

- To monitor progress and provide feedback to stakeholders

Once the project is completed the role of the forum will be operational in line with the project objectives. We need to move from the current “talk shop” situation to one in which stakeholders will have an active role. How will we do this?

We also need to consider whether the forum needs to be separate from the Crocodile Forum or be a Sub Committee of the forum. My view is that the operation forum should somehow be autonomous, so that it can freely make decisions, but a mechanism must be found to make it report to the broader forum

- **An empowerment programme (external)** needs to be developed specifying the role and responsibilities of the stakeholders pre and post project completion:
- the empowerment programme needs to take into account the experience, skills and knowledge of the irrigation boards and to explore ways to ensure stakeholder to stakeholder knowledge transfer:

- encourage field visits to farms (HDI and Commercial) for practical experience. This has the possibility of building and strengthening relationship. "**Participatory natural resource management**; a process that engages stakeholders on multiple levels of decision making and facilitates the formation and strengthening of relationships among stakeholders for mutual learning."

- a specific and dedicated resource should be allocated to HDI empowerment so that they can participate effectively in decision making processes (to resolve issues of mere attendance as opposed to participative attendance)

- it may be necessary to design a short term and long term strategy – to deal with issues of language barriers. The often 'technical' nature of WRM discourse means that there are additional barriers to understanding for non-English speakers. It will be important to translate our information brochures into languages other than English, and also to assess the need for translators during forum (and other) meetings.

- a community awareness campaign need to be developed-so that there is a broad understanding of the project and how communities can be involved on issues of water quality and quantity. This can be done with

- municipalities and other relevant institutions. Obviously, this is a large part of the communications and marketing strategy!

-Capacity building should:

* ensure that the key stakeholders and priority issues are targeted to meet the priority outcomes of the CROC- OP project

* encourage partnership between stakeholders

* value and build on existing capacity involving local expertise and knowledge

* be based on learning from each other through sharing resources, experience and expertise

* be based on principles of trust, mutual reciprocity and norms of action

* encompass learning by doing and other appropriate learning styles

* value and utilize indigenous expertise and knowledge

* accessible to the entire community

* based on access to accurate, scientific and technical information and

- should contribute to building human and social capital

It is necessary to make presentation to and to get a buy-in from our strategic stakeholders like the Premier's office; the Water for all flagship programme; the Enhlazeni District Collaboration forum. We must demonstrate how the project fits in to the broad developmental goals of government.

- **Empowerment programme (internal):** It is critical for all ICMA staff to be brought on board about the project, with roles and responsibilities specified. This is to ensure that the ICMA as an institution at all levels is fully appraised of the project, its impact, what they have to do to make it happen, and the consequences of their not doing their part.. This can be done by means of staff meetings and the attendance of staff at its launch. All staff members need to

attend all briefings in this regard and the office of the CEO will ensure that this happens. It is actually in the interest of all to be knowledgeable of ICMA programmes etc.

- Obviously I & P is the champion of the project from a stakeholder perspective and therefore a dedicated division-specific empowerment programme should be developed. The programme must include but not be limited to:
- project outline in terms of timelines or time frames and objectives
- roles and responsibilities at each phase of the project- **the project design should indicate the kind of stakeholder involvement desired or envisaged at each phase e.g. consultation, information sharing etc.**
- **I & P** must be empowered on all aspects of the projects including at least basic technical aspects of the project- this will enable the division to play a more meaningful and productive role and will add value to their interaction with stakeholders. As a simple starting point, a glossary or encyclopaedia of technical terms would be useful.
- **The Board needs to buy in. A presentation needs to be made to the Board-CEO office. We can strategise about our presentation to the Board in the same terms that we strategise about engaging with other stakeholders: the Board is a stakeholder group that has particular needs. How can we provide for these needs with this project, and present it as such?**

**** WATER ALLOCATION REFORM (WAR) PRINCIPLES ****

To reform water allocation such that the following prerogatives hold:

- Redress both in race and gender

- Sustainable and efficient water use

- Socio-economic initiatives

- Support of government programmes (poverty eradication, job creation, economic development, & nation building)

- Issue here "water is a productive asset

APPENDIX C: CROC OP PROJECT, SHAPING STAKEHOLDER OWNERSHIP (SYLVIA MACHAMANI, 21-07-2009)

- **Background**

The Crocodile River Operations project aims to attract and retain positive interest from targeted stakeholders. One way of achieving this would be dependent on the way in which we communicate the whole idea and intentions of the programme to the envisaged partners and stakeholders. Dealing with water can be highly sensitive and it is therefore imperative to inform and involve people in the process of developing, protection, equitable use/ access, conservation, management and control of the resource. This is in accordance with the NWA and NWRS.

- **Objectives**

- Support and advise the project with marketing, branding and communications needs
- Develop and acquire marketing material that will be most suited to put the project on the map
- Develop well structured themes and core messages that will be communicated to stakeholders
- To timeously inform the stakeholders of the situation and developments around the resource
- To bring stakeholders together by means of participative communication, thus creating a platform for information sharing and problem solving.

- **Environmental analysis**

Currently we are in the era wherein some people's attitude towards government structures is negative due to incompetence and lack of people skills by some government officials. This leads to misconceptions by the stakeholders even before you prove your worth to them. We have to consistently prove that we are stakeholder oriented in order to win their trust.

The issue of 'redress', as one of the areas of focus, may evoke a sense of uncertainties and fear for stakeholders who were previously advantaged. This may also open an opportunity for creating pressure by the previously disadvantaged in claiming their share of the resource. The ICMA in the gap between this two groups of stakeholders and has to play a major role in closing this gap.

We also need to embrace the media by constant interaction and feedback. The media has the power to influence the publics to have positive attitudes towards anything. Currently our relationship with the media is not very certain as our encounters with them have been very limited due to our poor financial standing. However, we need to change things around for it to work in our favour. This will also help in identifying the media interests and be able to respond to them accordingly.

Knowledge within the ICMA is not shared such that there is a big knowledge gap from one division to another. This reflects as an incompetence of the institutions as stakeholders expect staff to have information about the institution in their fingertips.

The ICMA does not have the budget to successfully execute the intended communication programme for this project. There is a need for stakeholder involvement in this regard.

- **Communications challenges**

The level of communication in the Crocodile sub-catchment, and the water management area in general, is not up to speed. It is critical to create channels for free flow of information and regular feedback. Exchange of information at all levels needs to be encouraged and platforms for such opportunities needs to be created.

The water management area is complimented by a fully established print and electronic media. These medium needs to be used to our benefit. However, some of the publications are not distributed in some parts of the catchment, which may disadvantage some of our stakeholders in terms of information dissemination. In this case alternative means should be used to make sure all stakeholders intended for a particular message are reached.

The ICMA must be seen to be within reach by all groups and be able to attend to their concerns with passion. ICMA staff members at all levels must be equipped/ capacitated to handle and refer stakeholder queries and concerns promptly and competently.

- **Messages and Themes**

5.1 Theme

'A share of the Crocodile, a very committed way of making the most out of the Crocodile River for the benefit of all who depend on it'

The theme could be used as a base for all communications intended for the project. Since this system is designed to benefit all people depending on the Crocodile River, the theme is best suited to assure all people of the intended equitable and sustainable use of the resource.

5.2 Messages/ sub-themes

These are the messages that can be communicated in various stages/ phases of our realizing the project in support of the project theme. This could be used for the development of the posters and media messages

5.2.1 Why IWRM in the Crocodile?

(IWRM is the way to go in working together, all parties involved, towards equitable access and benefit for all people who depend on the Crocodile River for their livelihood. The usage of this sub-theme in the initial stages of communication will enlighten stakeholders about the importance and benefit of their involvement in the programme)

5.2.2 Sustainable water use in the Crocodile *(for life and development. People should be able to work together in determining how the resource could be used sustainably to insure that future generations and developments are catered for)*

5.2.3 Healthy River, healthy crocodiles (*this will address water quality issues and will target the industries that are currently not doing well in compliance for water quality. The communities at large need to be taken aboard these issues. Cartoon posters will be used in this sub-theme).*

- **Messengers, Audience and Channels**

It should be clear **who** will be responsible for which messages and **to whom** and **how**. This will clear uncertainties in terms of responsibilities as well as support functions.

Messengers	Audience	Channels
WRPP	Internal target audience (Governing board)	Oral presentation Information brochures to follow later
WRPP	Internal target audience (ICMA Staff)	Oral presentation Information brochures
WRPP	Essential target audience – Constitutional mandate (DWEA HO and RO)	Oral presentation Information brochures Posters
WRPP	Essential target Audience (identified project partners)	Oral presentation Information brochures Posters
WRPP and I&P	Essential target audience – business orientation (primary water users)	Information brochures posters print media
I&P	Auxiliary target audience – small scale users	Information brochures Posters Cartoon posters
I&P	Community at large	Cartoon posters Information brochures Radio

- **Types of events**
- *Project Launch*.

A big come together gathering/ event by all stakeholders involved to officially launch the project would be beneficial. This could give an opportunity for Media involvement, and high profile politicians/

persons who may not be necessarily be involved in the project itself. It will also give the project a special attention which is what the ICMA needs at the moment. The process could earn the organization some credibility.

- *Field visit to the resource*

The field visit may possibly be complimented with possibly a barbecue at Kwena dam .This could be a good team building exercise for ICMA staff members, and has a potential of improving our relationships with stakeholders in a less formal environment. Making it fun will make it interesting.

- *Awareness campaigns*

Awareness campaigns will help in mobilizing community involvement/ participation. Community involvement is an area which is often neglected. This people may not be directly affected by the situation at hand but they play a vital role in resource conservation and management.

- **Communication programme**

The programme is going to be rolled-out in three phases to make sure that all audiences have been reached at the strategic timing. It has to be sold internally and get a buy-in of all internal stakeholders before it can be taken out to external stake holders.

Phase 1: This phase will concentrate on the internal stakeholders (ICMA staff and GB). The project will be introduced to the GB and thereafter to the ICMA staff members.

Phase 2: This stage will be targeted to essential target audiences who are important in the success of the project. In this situation we are looking at DWEA, project partners and all primary water users are to be spoken to next.

Phase 3: In the overall, the community plays an important role in the sustainable use and conservation of the resource. Therefore this group will be the last group to be consulted as it may take a number of workshops in capacity building and awareness programmes.

It should be borne in mind that these phases are not to be seen as separate stages, but rather as a logical way of building up from one phase to the next.

- **Structures and Processes**

In order for the project to successful is also dependent on other structures that have particular interests and roles to play. The partners identified hereunder have either financial muscle or knowledge or both, to help the ICMA achieve its objectives. These stakeholders need to be consulted with in order to get their buy-in and role plays/ active participation in the project.

STRUCTURE/ PARTNER	ROLE
DWEA HO	
DWEA RO	
Dept of AGRIC	
TSB	
Sappi Ngodwana	
Premier's office – Water for all flagship project	
Halls	
MMC/ Delta Manganese	
Mbombela municipality	
Irrigation Boards	
Silulumanzi	
Water User Associations	
Sub-catchment water forums	

- **Action plan**

Element/ Task	Responsibility	Date	Remarks
PHASE 1			
Development of information brochures	M&C		This is the generic information brochure that outlines the project objectives.
+			
PHASE 2			
Development of posters and cartoon posters (themed)	M&C		This is for basic and themes messages targeted at stakeholders
Procurement of Banners and t-shirts	M&C		These resources are important during the project launch
Editorial coverage and Press statement	M&C		Critical for project launch
PHASE 3			
Procurement of carry bags/ backpack and squeeze bottles	M&C		These promotional materials will be used during the field visit.
Radio slots	M&C and ACEO		Informative and give opportunity for stakeholders to call

INKOMATI CATCHMENT MANAGEMENT STRATEGY

STAKEHOLDER ORIENTATION INFORMATION DOCUMENT

TABLE OF CONTENTS

1. INTRODUCTION

The Inkomati Catchment Management Agency (ICMA) is responsible for the protection, use, development, conservation and control of water resources in the Inkomati water management area. The ICMA is committed to co-operative and consensual participatory decision-making, that strives for sustainable, equitable, and efficient water resource management throughout the catchment.

The ICMA, in close collaboration with the Department of Water Affairs, is developing a first order Catchment Management Strategy (CMS) that will outline strategic action programmes for WRM in the Sabie-Sand, Crocodile, and Komati sub-catchments. The ICMA will conduct a series of five stakeholder meetings and workshops which will ensure that the CMS development process is stakeholder centred.

1. **Orientation Meeting (February 15th 2010)**
   A general purpose meeting to inform stakeholders, and gain their acceptance, of the need, purpose and process of this CMS.

   This will be followed by workshops for the stakeholders of individual catchments. These "visioning workshops" will be designed to ensure stakeholders can map out their future water use strategy to ensure equity, efficiency and sustainability in managing the water resources of their catchment.

2. **Crocodile sub-catchment visioning workshop (March 9th 2010)**

3. **Sabie-Sand sub-catchment visioning workshop (March 11th 2010)**

4. **Komati sub-catchment visioning workshop (March 12th 2010)**

5. **Final Strategy Meeting (March 24th 2010)**

An overall approach to Integrated Water Resources Management (IWRM) in the Inkomati Water Management Area will be framed at this workshop. This framework will be written up and presented to the Minister as the 'First Generation' Catchment Management Strategy. If this first generation CMS is accepted by the Minister it will become the "Agenda" for participatory IWRM of the Inkomati. A draft Framework has been developed and is shown over the page in diagram 4.

1.1. PRINCIPLES

Certain Principles and assumptions for the development of the CMS have been made considering the short timeframe.

- The CMS will be completed in Collaboration with the Department of Water Affairs and Forestry (DWA). Key project coordinators from both parties were agreed to. These are Patrick Ntabeni from DWA Regional Office, Matho Gwala at DWA Head Office and Brian Jackson from the ICMA

- A Strategic Reference group of IWRM Experts will also be utilised for external comment and review on the process and CMS chapters.

- The Inkomati Water Management Area (WMA) will be divided into the three main Sub-Catchments as the appropriate scale for the CMS development.

- Strategic Adaptive Management (SAM) methodology will form the core of the CMS development and future implementation.

2. THE INKOMATI CATCHMENT MANAGEMENT AGENCY

The institutional framework outlined in the National Water Act, Act 36 of 1998 (NWA), provides for the progressive decentralisation of water resource management to appropriate local levels as well as providing for stakeholder participation in water resource management. The mechanism put in place by the NWA to achieve this decentralisation is that of Catchment Management Agencies.

The **ICMA** is the first Catchment Management Agency (CMA) to be established by the Department of Water Affairs (DWA) and is defined as a schedule 3 (a) public entity in accordance with the Public Finance Management Act No 29 of 1999 (PFMA). It is **subject to regulation by the PFMA and the NWA.**

The ICMA has inherited **several Initial functions** upon its establishment. These are outlined in section 80 of the NWA as follows:

(a) to **investigate and advise** interested persons on the protection, use, development, conservation, management and control of the water resources in its water management area;

(b) to **develop a catchment management strategy**;

(c) to **co-ordinate the related activities of water users** and of the water management institutions within its water management area;

(d) to **promote the co-ordination of its implementation** with the implementation of any applicable development plan established in terms of the Water Services Act, 1997 (Act No. 108 of 1997); and

(e) to **promote community participation** in the protection, use, development, conservation, management and control of the water resources in its water management area.

On top of these initial functions, the ICMA has also been **assigned the functions in section 19 and 20 of the NWA:**

19 Prevention and remedying effects of pollution

20 Control of emergency incidents

In the future, the ICMA **may be delegated or assigned further functions** by DWA in terms of **schedule 3 of the NWA**. These have not been assigned to the ICMA yet and are summarised as:

- Power to manage, monitor, conserve and protect water resources and to implement catchment management strategies
- Catchment management agencies may make rules to regulate water use
- Catchment management agencies may require establishment of management systems
- Catchment management agencies may require alterations to waterworks
- Catchment management agencies may temporarily control, limit or prohibit use of water during periods of water shortage

2.1. MISSION

Our mission is of a pioneering catchment management system that empowers stakeholders to engage in consensual and adaptive decision making, to achieve reform, and to promote persistent social, economic and environmental justice across the Inkomati catchment.

3. STAKEHOLDER ENGAGMENT PROCESS FOR THE INKOMATI CATCHMENT MANGEMENT STRATEGY

3.1. WHAT IS A CATCHMENT MANAGEMENT STRATEGY?

A CMS lays out medium- to long-term **strategic action programmes** to achieve catchment water-use that is sustainable, equitable, and efficient.
According to the Guidelines for CMS (DWAF, 2007), the CMS must**:**

- not be in conflict with the National Water Resources Strategy (NWRS);
- be reviewed from time to time;
- include a water allocation plan which includes a set of principles for allocating water to existing and prospective users, taking into account all matters relevant to: the protection, use, development, conservation, management, and control of water resources.

Section 9 of the NWA States that a catchment management strategy must –

(a) take into account the class of water resources **and resource quality objectives** contemplated in Chapter 3, the requirements of **the Reserve** and, where applicable**, international obligations**;

(b) not be in conflict with the **national water resource strategy**;

(c) set out the **strategies, objectives, plans, guidelines and procedures** of the catchment management agency for the protection, use, development, conservation, management and control of water resources within its water management area;

(d) take into account the geology, demography, land use, climate, vegetation and waterworks within its water management area;

(e) contain **water allocation plans** which are subject to section 23, and which must set out **principles for allocating water**, taking into account the factors mentioned in section 27(1);

(f) take account of any **relevant national or regional plans** prepared in terms of any other law, including any development plan adopted in terms of the Water Services Act, 1997 (Act No. 108 of 1997);

(g) **enable the public to participate** in managing the water resources within its water management area;

(h) take into account the needs and expectations of existing and potential water users; and

(i) set out the **institutions to be established**.

The desire to develop a perfect CMS the first time around is likely to be strong. However, this is a pioneering effort, without precedent, taking place in a world that is constantly changing. It will require adaptation as we each learn more about the catchment, the stakeholders and their water use activities, and the complexity of Integrated Water Resources Management itself. The process of developing a CMS must therefore be iterative, with knowledge and skills being built as part of an

adaptive approach to decision making. By definition, strategies will be 'generational' with the first CMS providing a strong base from which to manage, learn and review.

Even a first generation CMS, however, must meet certain basic criteria to ensure that the CMA begin managing the water resource, which itself is the fundamental base on which stakeholders can build a more equitable and sustainable future.

Section 8 (3) of the NWA states that a catchment management strategy –

(a) may be **established in a phased and progressive manner** and in separate components over time; and

(b) must be **reviewed at intervals of not more than five years**.

3.1.1. CMS DEVELOPMENT AS A STAKEHOLDER-CENTRED PROCESS

Section 10 (2) of the NWA States that In developing a catchment management strategy, **a catchment management agency must consult with—**

a) the Minister;

b) any **organ of state which has an interest** in the content, effect or implementation of the catchment management strategy; and

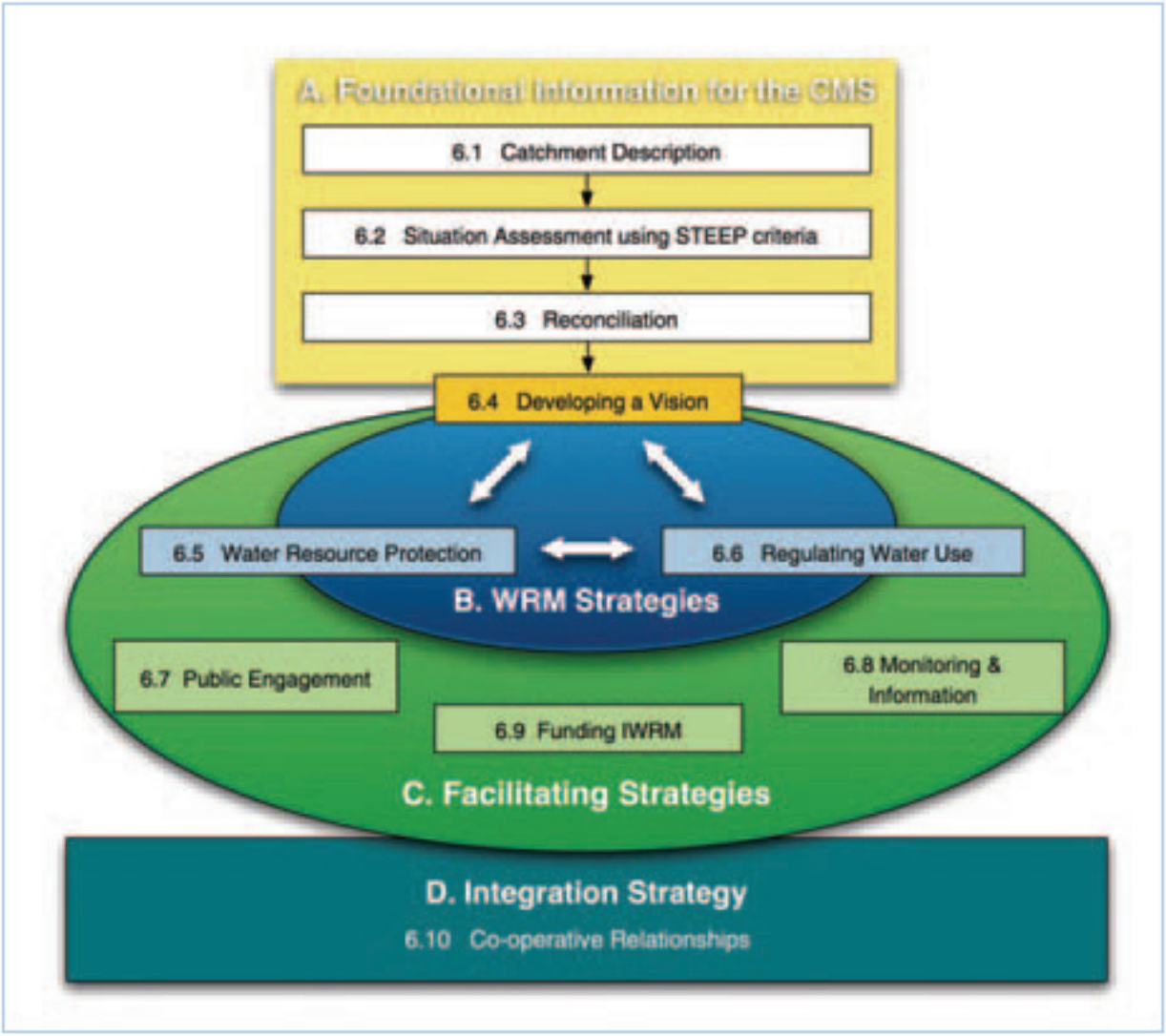
c) any **persons**, or their representative organisations--

i) **whose activities affect or might affect water resources** within its water management area; and

ii) **who have an interest** in the content, effect or implementation of the catchment management strategy.

The Guidelines for CMS (DWAF, 2007) splits a Catchment Management Strategy into ten sub-strategies that cluster together into four 'parts'. See figure 6 below.

Figure 6: Framework for Catchment Management Strategies (Guidelines for CMS, DWAF 2007)



Part A concerns the **stakeholder visioning process**, the outcomes from which provide the water resource objectives on which the rest of the CMS is built. The first step of this visioning process is to research/document detailed information about the STEEP (Social, Technological, Economic, Environmental, and Political) characteristics of the water management area, and its individual sub-catchments. This information provides the contextual profile from which the stakeholders can develop realistic desires for the future. Part A, therefore, does not involve strategy development *per se*, but it provides the essential foundation for developing strategic action programmes in parts B to D.
i.e.

In part A, we generate an understanding of **what our water resources are like now**,

and we collectively decide **what we want our water resources to be like in the future**.

In parts B to D, we decide **how we will go about achieving this shared desired future**.

Part B is where we develop the sub-strategies that deal **directly** with **managing the water resource** e.g. water-use registration and licensing; pollution control; water pricing; Reserve implementation; water quality objectives; compliance monitoring and enforcement. Specifically, a CMS must include a water allocation plan, that sets guiding principles for the allocation of water to existing and prospective users.

Parts C and D provide the 'supporting' sub-strategies that, although vital for successful implementation of the CMS, do not directly deal with water resource management. Part C is where we develop **facilitating sub-strategies** such as: information management and monitoring; finances; and, critically, ongoing programmes for stakeholder engagement and empowerment. Part D, the **integration sub-strategy**, is where we develop action programmes for building relationships between relevant institutions, and for practicing co-operative governance.

A more detailed description of these four CMS parts, and the ten sub-strategies that comprise them, can be found in Section Four of this document, and in the Guidelines for CMS Development produced by DWA.

3.1.2. WHAT ARE WE AIMING TO ACHIEVE? SUSTAINABILITY, EQUITY AND EFFICIENCY DEFINED

Sustainability: Over the past few decades we have increasingly come to understand the interdependence between humans and ecosystems; the more we compromise the quality and quantity of our water resources, the more we compromise our own livelihoods. Thus, ecological and socio-economic sustainability are interdependent, with unhealthy rivers and wetlands leading to unhealthy people and an unhealthy economy. Sustainability is therefore a legal prerequisite for all water resource management decisions.

Equity: The costs and benefits of water resource use must be distributed equitably across society. This imperative of "fair access" also applies to our neighbouring countries. Thus, allocation of water should address "fair access" with special focus on those who have historically been disadvantaged in the costs and benefits of water resource use.

Efficiency: With an average annual rainfall of little more than half of the world average, South Africa is a water-scarce country, and is vulnerable to floods and droughts. It is essential that the allocation of water is guided by the need for efficient, beneficial use of water that promotes an appropriately diverse, robust and stable economy.

3.2. HOW WILL THE INKOMATI CATCHMENT MANAGEMENT STRATEGY BE DEVELOPED?

3.2.1. BACKGROUND AND CONTEXT OF THE INKOMATI CMS

The Inkomati CMA and DWA have been engaging the CMS development process for some time, and have worked their way through many of the inevitable challenges that have arisen, and will continue to be faced, by such a pioneering initiative. In the national spirit of "delivery" the Minister of Water Affairs has requested that a first generation CMS for the Inkomati Water Management Area be on her desk by March 31st 2010.
In response, the ICMA has devised a proposal for an efficient, but intensive, CMS development process which will enable us to comply with the Minister's directive, and follow the guiding principles given by DWA.

Much of the groundwork has already been done, and the first step (part A, Section 4.1.1) of generating an understanding of the current state of our water resources is well underway. The Inkomati *status quo* report has already been written, and the DWA have produced a number of guides and information documents specifically for the Inkomati catchment. (e.g. the DWA internal strategic perspective (the pre-cursor to the CMS); principles for developing a water allocation framework; scenario reports detailing the economic consequences of water-use curtailment; identification of opportunities for emerging water users; preliminary Reserve determinations etc.).

All this information, and all other relevant documents, will be collated and communicated to stakeholders over the next few weeks.

3.2.2. STAKEHOLDER VISIONING PROCESS: DECIDING ON A SHARED FUTURE

The ICMA team propose that each of the three sub-catchments holds its own stakeholder visioning workshop, so that the specific STEEP realities (Section 4.1.4) and stakeholder perspectives of each sub-catchment will not be lost in generalisations about the whole Inkomati Water Management Area.

The stakeholder visioning process at each of these workshops will be based on the contextual STEEP information that has already been sourced, and will have already been communicated to stakeholders before the workshops. The workshops will be run using the future-building process contained in Strategic Adaptive Management, which is the decision making approach that the ICMA has adopted.

3.2.3. STRATEGY DEVELOPMENT: SUGGESTING STRATEGIES TO ACHIEVE THIS SHARED FUTURE

Once there is sufficient consensus on a shared future, a strategy must be outlined for getting there. This includes designing the sub-strategies described in Parts B, C and D, i.e. the direct water resource management, facilitating, and integration sub-strategies.

The ICMA proposes that these sub-strategies are drafted primarily by the ICMA/DWA team, guided by the outcomes of the stakeholder visioning processes, and thus will be designed to meet the objectives that stakeholders will have themselves developed. The drafts will then be presented to stakeholders at the final stakeholder workshop (March 24th), where we will seek consensus-driven recommendations for amending the draft strategies. The ICMA will then present the 1st generation CMS to the Minister for her assessment.

It is important to understand that this 1st generation CMS will be about a process of moving forward toward equity, efficiency and sustainability. It will NOT set fixed allocations to any sector or individual. It will rather provide guidance on how we move forward to better, participative IWRM.

3.2.4. ROLES AND RESPONSIBILITIES

The roles and responsibilities of all key participants, including the ICMA and DWA, will need to be discussed and explicitly decided at the first stakeholder meeting (on February 15th).

In any event, the **ICMA/DWA team will be responsible for ensuring that all decision-making is transparent, consensual, and justified** on the basis of sustainable, equitable, and efficient water resource management.

In turn, **stakeholders will need to commit themselves to participating in the process**. It is important that the same individuals commit to attending all three relevant meetings (the orientation meeting; the relevant sub-catchment visioning workshop; and the final strategy meeting). Participating individuals will also need to commit time to preparatory work between meetings: becoming familiar with the contextual STEEP information about your sub-catchment, for example, is crucial to enable you to participate meaningfully in the stakeholder visioning workshop.

4. THE TEN SUB-STRATEGIES OF A CMS

It is important to note that, although these sub-strategies are listed linearly, their development does not have to follow in a sequential manner. In fact, for many of the sub-strategies, their development requires simultaneous development of sub-strategies that appear both before and after them in the given 'sequence'.

4.1. PART A: FOUNDATIONAL INFORMATION FOR THE CMS

4.1.1. SITUATION DESCRIPTION

Key questions:

- What are the STEEP (Social, Technological, Economic, Environmental, and Political) characteristics of the catchment, as related to water?
- How are these STEEP characteristics likely to change in the next 10 to 20 years?

The **objective** of describing the current and potential future STEEP characteristics is to provide a holistic, contextual profile of the catchment. This profile is necessary for stakeholders to develop realistic desires and objectives for the future, and for appropriate strategic action programmes to be developed that realistically aim towards equity, sustainability and efficiency of water use.

The intended **outcome** is a synopsis of:

i) the best available information on the STEEP characteristics of the sub-catchment and;
ii) likely future STEEP scenario(s).

The situation description will:

a) identify which information is of a reasonable quality to be used as the basis for water resource management strategies.
b) identify key gaps and priorities.
c) provide a reasonable assessment of STEEP trends, including the demands of other developmental plans, e.g. Provincial Growth and Development Strategy (PGDS).
d) specify the critical issues in each sub-catchment, and cross-check that these are being taken up in the appropriate sub-strategies of the CMS.

4.1.2. SITUATION ASSESSMENT

Key question:
What are the **implications of the situation in the catchment** for achieving equity, sustainability, and efficiency in water resource management?

The **objective** is to provide a holistic (biophysical, social, economic, political and institutional) assessment of the current situation and its implications for future WRM within the WMA as a sound basis for developing appropriate strategic direction. The intended **outcome** is a critical assessment of the current situation and likely future situations according to appropriately derived criteria. This information will be used to inform the vision and subsequent CMS.

The situation assessment will:

a) provide a reasonable, holistic assessment of the current situation in the catchment;
b) provide a reasonable and holistic assessment of the likely future profile based on an understanding of likely changes in socio-economic, environmental and political characteristics;
c) identify the key gaps, and cross-check that these are addressed as part of the CMS;
d) specify the critical issues, and cross-check that these are taken up in the appropriate strategic area of the CMS.

4.1.3. RECONCILIATION: BALANCING WATER AVAILABILITY WITH WATER REQUIREMENTS

Key questions:

- **What quantity and quality of water is available** for allocation in the catchment, and **what quantity and quality of water is required**?
- **What will the situation be under different scenarios**?

The **objective** of reconciliation is to weigh up the water requirements in a catchment, against the water availability (quantity and quality), to determine if the catchment has a water 'deficit' or 'surplus'. This grounds the stakeholder visioning process, and the development of sub-strategies in local reality.

The intended **outcome** is a geographically-based reconciliation of availability versus requirement for the current situation, and for potential future scenarios. These scenarios will emerge from the stakeholder visioning process, and the water resource management sub-strategies. Thus, reconciliation is not a once-off, stand alone process, but is an integral part of many CMS development (and, more generally, water resource management) activities.

Estimates of water availability must take into account the requirements of:

a) Resource Quality Objectives and the Reserve;
b) water to meet international rights and obligations;
c) a "contingency" to meet projected future water requirements including possible transfers of water to another water management area;
d) water-use of strategic importance.

The water-balance assessment will:

a) describe the quality of information and confidence of results;
b) clearly outline scenarios, current and potential future, for which it was conducted;

c) clarify that 'water requirements' are only valid if they are for the "beneficial, effective, and efficient" use of water (as specified in the National Water Act, Chapter 5);
d) take into account the quality and quantity of use under Schedule 1 and general authorisations in order to assess their relative importance;
e) take into account obligations (the Reserve, international and strategic needs) before any other needs;
f) take into account water for needs committed to under certain agreements (e.g. Ramsar Wetlands of International Importance);
g) identify priorities and gaps;
h) include an assessment of groundwater (use; aquifer status; groundwater/ surface water interactions);
i) present results in such a way that they can be used in discussions with stakeholders.

4.1.4. STAKEHOLDER VISIONING

Key question:
How do stakeholders envision achieving equity, sustainability and efficiency in water resource management in the catchment?

The **objective** of the visioning process is for stakeholders to come to a consensus on realistic shared desires and objectives for the future sustainable, equitable and efficient management of water resources in their catchment.

The intended **outcome** is a visioning document that provides medium- to long-term direction for the sustainable, equitable and efficient water resource management in the catchment, which will be used as the basis for deriving sub-strategies that are realistic and locally attainable.

The stakeholder visioning process will:
a) Present an expression of shared future desires and objectives for the water resources in the catchment;
b) Be consensus driven;
c) Provide strategic direction for the sustainable, equitable and efficient management of the catchment water resources.
d) Be based on an understanding of the STEEP characteristics of the catchment, and the results of the situation assessment and reconciliation;
e) Be transparent, with the process by which consensus was reached explicitly recorded;
f) Explain where the visioning process fits into the broader process of Strategic Adaptive Management, and therefore how progress towards the desired future will be monitored, and when and how the desired future may be reviewed.

4.2. PART B: WATER RESOURCE MANAGEMENT SUB-STRATEGIES

4.2.1. ENSURING SUSTAINABILITY: RESOURCE DIRECTED MEASURES (RDM) SUB-STRATEGY

Key questions:

- Which strategic **resource protection measures are necessary to ensure the sustainability** of water resources in the catchment?
- How will these strategic actions complement those of the source directed controls in achieving equity and efficiency of use?

The **objective** of the resource directed measures sub-strategy is to complement the source directed controls sub-strategy (section 4.6) and ensure sustainability of the catchment water resources. The outcomes of the stakeholder visioning process will guide the sub-strategy in giving effect to the desired Management Class, the Resource Quality Objectives, the Reserve, and any other necessary protection measures.

The intended **outcome** is a sub-strategy that holistically addresses the sustainability of the water resources through:
a) water resource classification;
b) determination and implementation of the Resource Quality Objectives;
c) determination and implementation of the Reserves; as well as
d) associated protection measures (either governmental or civil society).

The resource directed measures sub-strategy will:
a) align with the source directed controls sub-strategy, and the outcomes of the stakeholder visioning process;
b) explicitly consider issues of co-operative governance and institutional arrangements.

The outcomes of the resource directed measures sub-strategy will affect, and be affected by, the strategies and activities of a large number of different institutions. Thus, partnerships need to be considered, and roles and responsibilities formalised, with the following institutions: The Department of Environmental Affairs; Working for Water; Working for Wetlands; the Rivers Health Programme; Conservation agencies; the Department of Agriculture; the Department of Trade & Industry; the Department of Minerals & Energy; the Department of Provincial & Local Government; the Department of Land Affairs, and the Land Claims Commission; Traditional Authorities; Water User Associations; non-governmental organisations.

4.2.2. SOURCE DIRECTED CONTROLS (SDC) SUB-STRATEGY

Key question:
Which strategic actions are necessary to ensure the equitable, efficient, and sustainable use of water resources in the catchment?

The **objective** of the source directed controls is, through co-implementation with the resource directed measures, to ensure that water use and development in the catchment is equitable, efficient and sustainable.

The intended **outcome** is a sub-strategy that, under the guidance of the stakeholder visioning process, holistically addresses the equitable, efficient, and sustainable use of the water resource, through four regulatory components:

a) Authorisation of water use
- Authorisations and entitlements, including transfers of water use entitlements.
- Water allocation plans and schedules, including water allocation reform.
- Licensing and compulsory licensing.

b) Additional source directed controls
- Water conservation and water demand management.
- Options to augment water supply (other than conservation and demand management).
- Water quality management, and pollution control.

c) Pricing, charges, incentives and disincentives.
- Including a waste-discharge charge system.

d) Compliance monitoring and enforcement.
- Measures to ensure that the conditions of entitlements are being met.

The source directed controls sub-strategy will:
a) articulate specifically how each action programme will give effect to equity, efficiency, and sustainability;
b) align with the outcomes of the stakeholder visioning process, and the resource directed measures sub-strategy;
c) address the need for co-operative governance, and alignment between various plans e.g. Water Services Development Plans, and the Allocation Plan.

4.3. PART C: FACILITATING SUB-STRATEGIES

4.3.1. PUBLIC ENGAGEMENT AND CAPACITY DEVELOPMENT SUB-STRATEGY

Key question:
What strategic programmes are required to ensure that **water resource management** in the catchment is **centred around empowered stakeholders engaging in consensual and adaptive decision-making?**

The **objective** of this sub-strategy is to give effect to participatory management of water resources in the catchment. Specifically, in a first order CMS, this sub-strategy must ensure that consensus-driven stakeholder engagement in the adaptive implementation, evaluation, and development of the CMS will be sustained.

The intended **outcome** is a sub-strategy that details when and how stakeholders in the catchment are provided genuine opportunities to participate in water resource management decision-making. The sub-strategy must address:
a) stakeholder empowerment needs and action programmes;
b) communication and access to information;
c) how to ensure that stakeholder engagement is at the centre of the adaptive development and implementation of this, and all other, CMS sub-strategies.

The public engagement sub-strategy will:
a) indicate how the Catchment Management Agency will establish, sustain and maintain appropriate participatory decision-making platforms and processes;
b) define appropriate participatory processes in terms of specific water resource management tasks;
c) explain how different groups and individuals, with different needs, will be engaged;
d) explain how 'adequate representation' will be decided i.e. who decides what is 'adequate'?

4.3.2. MONITORING AND INFORMATION MANAGEMENT SUB-STRATEGY

Key questions:

- What are the information and monitoring needs of water resource management activities/organisations in the catchment?
- How can information and monitoring activities be managed, coordinated and consolidated to facilitate CMS implementation, and to ensure compliance with national standards?

The **objective** of the information management and monitoring sub-strategy is to provide a strategic plan that:

a) will provide the Catchment Management Agency with the information needed to effectively facilitate adaptive and stakeholder-centred water resource management, and to meet their responsibilities for reporting to the Minister of Water Affairs on the sustainability of the water resources in their care;
b) is consistent with the national standards and requirements as per the National Water Act (RSA, 1998);
c) guides the generation, access, analysis and sharing of the range of information necessary to adaptively monitor, evaluate, and modify water resource management planning and implementation;
d) ensures that information is utilised effectively (to learn from and then act upon), instead of just being collected, and that the question of which information is appropriate and useful to collect is reviewed regularly.

The intended **outcome** is a sub-strategy to:
a) manage water resources monitoring and information in collaboration with the Department of Water Affairs;
b) monitor, analyse and evaluate water resource management intentions and actions through nationally approved methods, procedures and techniques.
c) incorporate findings into an adaptive management process.

The sub-strategy for monitoring and information management will:
a) align with the National Water Resources Strategy and National Water Resource Monitoring Framework;
b) collate monitoring and information needs from all other sub-strategies of the CMS;
c) organize these needs into priorities and address gaps;
d) set out how information will be generated, accessed, analysed, and distributed and how it will be utilised for learning and adaptation;
e) set out co-operative and collaborative arrangements for information management and monitoring, between institutions, and within the Catchment Management Agency;
f) highlight constraints and suggest a strategic direction to address these.

4.3.3 FINANCIAL SUB-STRATEGY

Key questions:

- How will water resource management activities, as detailed in the other CMS sub-strategies, be funded?
- How will the costs of the corporate functions of the Catchment Management Agency be funded?

The **objective** of the finance sub-strategy is to set out financial arrangements for water resource management (including waterworks and equity) for the catchment. Reference must be made to the costs associated with the functioning of the CMA.

The **intended outcome** is a sub-strategy that sets out how adaptive implementation of the CMS and functions of the Catchment Management Agency will be funded.

The finances sub-strategy will:
a) align with the revised National Pricing Strategy;
b) collate needs from all other sub-strategies of the CMS;
c) deal with additional costs as well as the escalation of costs;
d) provide indicators for monitoring financial management;
e) stipulate how the waste discharge charge system will be developed and implemented;
f) outline an approach for dealing with subsidies and specify the source of funding. For example, subsidies to emerging farmers from the Department of Water Affairs Regional Office;
g) outline the financial arrangements for linkages between the Catchment Management Agency and the Department of Water Affairs Regional Office with respect to water resource management functions.

4.4. PART D: INTEGRATION SUB-STRATEGY

4.4.1. CO-OPERATIVE GOVERNANCE AND INSTITUTIONAL ARRANGEMENTS SUB-STRATEGY

Key question:
How can appropriate institutional relationships for the adaptive planning and implementation of the CMS be identified, established, and maintained?

The **objective** of this sub-strategy is to ensure that an appropriate and dynamic institutional network is identified, established, and maintained in such a way that the Catchment Management Agency becomes the coordinating hub for all activities in the catchment that may affect the sustainability of the water resource, or the equity and efficiency of its use.

The intended **outcome** is a sub-strategy that describes how the Catchment Management Agency will establish and maintain appropriate institutional relationships, and how they will seek to facilitate effective communication, and capacity and platform sharing, in order to encourage mutually beneficial institutional engagements.

The integration and co-operative governance sub-strategy will: Outline how the capacities within different institutions in the catchment can be optimised to achieve water resource management objectives;

a) Stipulate how co-operation can be fostered, based around the planning and implementation activities of other institutions?
b) Detail how existing institutions be used to facilitate stakeholder engagement in water resource management activities;
c) Cross-check specifically with the information and monitoring sub-strategy;
d) Consider international agreements;
e) Specify contributions to the overall Integrated Disaster Management Plan (of Local Government), and specifically address risk-reduction strategies;
f) Provide for the co-operative governance needs of all other CMS sub-strategies.

5. OVERVIEW OF THE INKOMATI WATER MANAGEMENT AREA:

South Africa has been divided into **nineteen (19) Water Management Areas** in order to decentralise the management of water resources, and to provide local stakeholders with opportunities to become involved with water resources management. **The Inkomati Water Management Area** is one of these 19, situated in the North East of the country and wholly within the Mpumalanga Province. See Figure 1.

Figure 1: Location of the Inkomati Water Management Area:

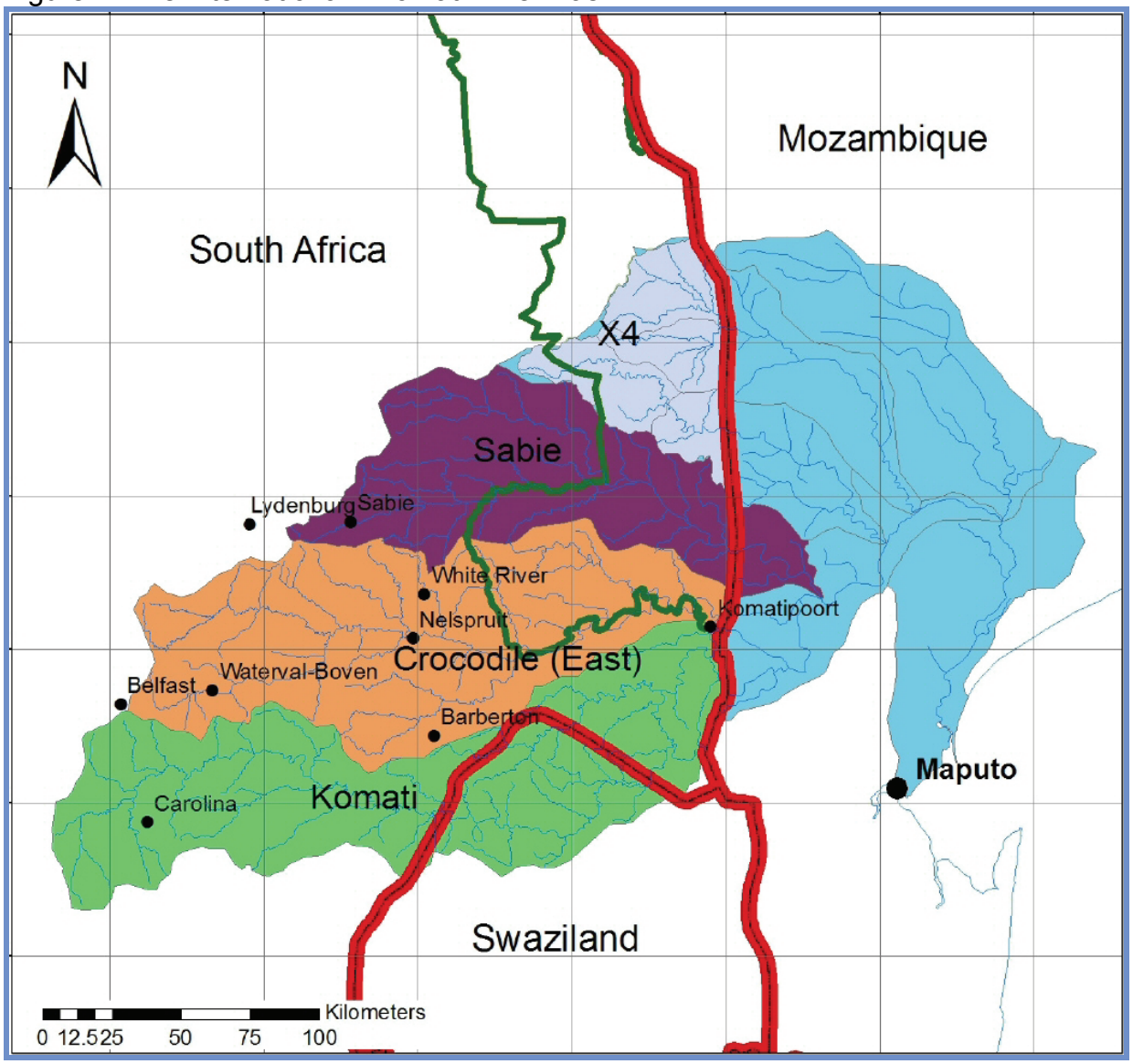
Figure 1: Location of the Inkomati Water Management Area

The main rivers in the Inkomati WMA are:

the Komati River catchment, which rises in South Africa, flows through Swaziland and then re-enters South Africa before flowing on into Mozambique;
the Crocodile River catchment;
the Sabie and Sand River catchment, and
the undeveloped Uanetse River that is wholly within the Kruger National Park

These rivers are all part of the Inkomati **international watercourse** which is shared between the Republic of Mozambique, the Kingdom of Swaziland and the Republic of South Africa and thus all the rivers in the Inkomati WMA flow through Mozambique to the Indian Ocean. The Komati River flows first into Swaziland, then back into South Africa, before entering Mozambique. Thus, the Inkomati water management area has certain **international obligations**, in terms of the quality and quantity of water that flows across its borders. The water sharing arrangements of the three countries (South Africa, Swaziland, and Mozambique) are set out in the Interim IncoMaputo Water Use Agreement, which is legally binding See Figure 2 and Figure 3.

Figure 2: The International Inkomati River Basin:



5.1. THE MAIN ATTRIBUTES OF THE INKOMATI WMA

The Inkomati Water Management Area is a complex Catchment that has a relatively unique combination of aspects in South Africa, namely:

- Water Availability is highly variable.

The WMA is divided by the Great Escarpment (which runs roughly along the Graskop, Sabie, Nelspruit, Barberton axis) into a western plateau and sub-tropical Lowveld in the east. This affects **the rainfall pattern**, showing a generalised West-East gradient, with the Westerly mountainous regions receiving as much as 1200mm/yr and the Eastern-most areas as little as 400mm/yr. There is also a marked seasonality to the rainfall with wet summers and dry winters. This is also variable over longer periods with changes in rainfall seen from year to year and longer time scales.

Figure3: Topography and General Layout

Figure 4: Rainfall:

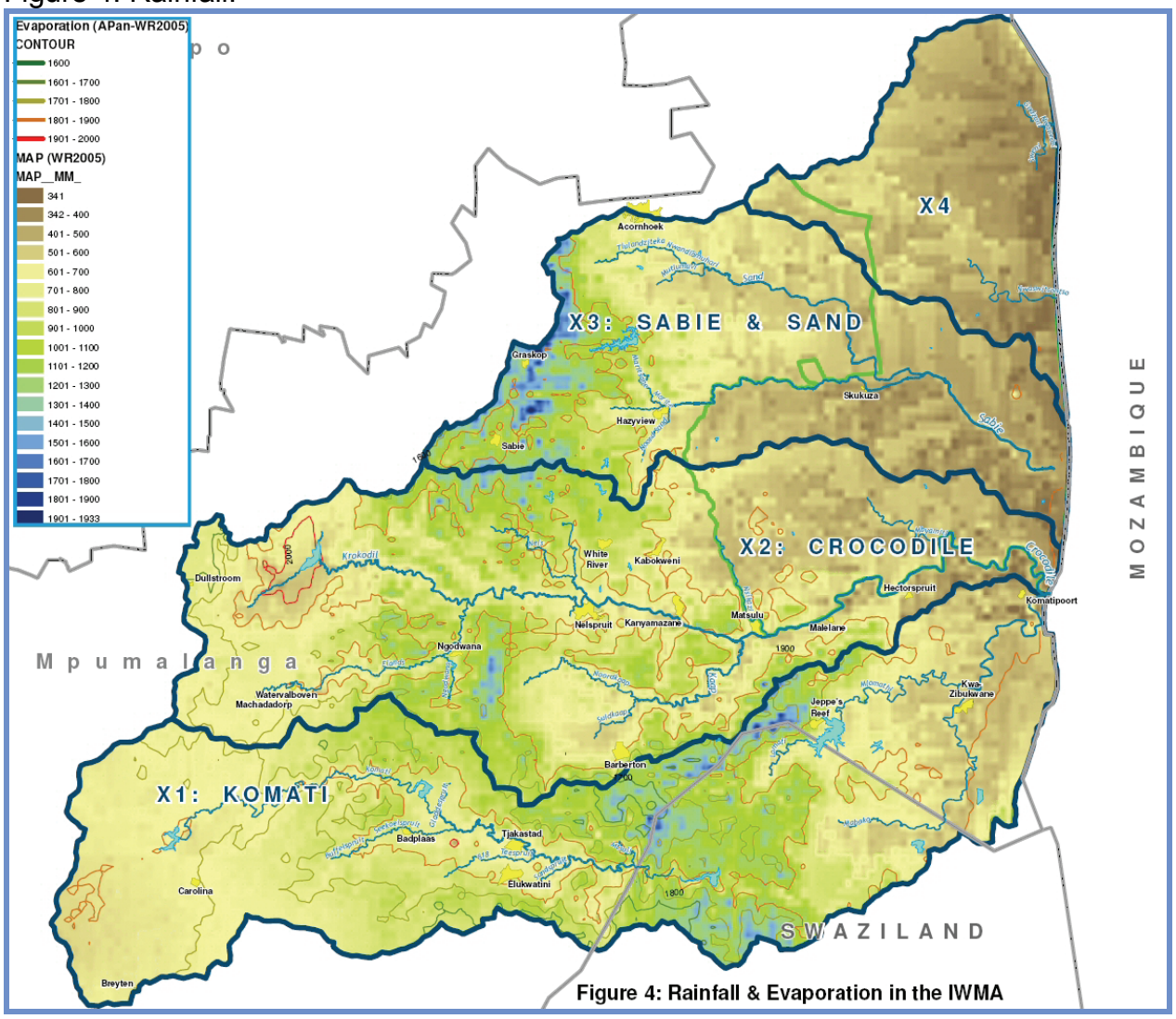


Figure 4: Rainfall & Evaporation in the IWMA

The current **climate change predictions** are that yearly rainfall will increase, but that it will fall over a shorter period, which will create longer and more intense dry seasons

Most of the water demand is located in the lower, drier and hotter parts of the WMA. I.e. Where there is little rainfall. These factors create complexity and an unstable situation for the economy of the Region, which is reliant on the availability of water and makes the proper management of the river flows very important.

- The Catchment is ‘Stressed’.

The availability of water from the rivers is generally less than the demand for water out of the resource to enable both a sustainable economy and resource. However, this level of stress is dependant on the level of risk that water users are willing to accept.

The implementation of the Reserve, which is an amount of water that must remain in the rivers to enable sustainability in the Catchment and for basic human needs, will increase this level of stress and the NWA prioritises the Reserve.

See Diagram 1 and 2 below for the level of Stress with and without a Reserve.

Diagram 1: Current Water Availability vs. Water Demand:

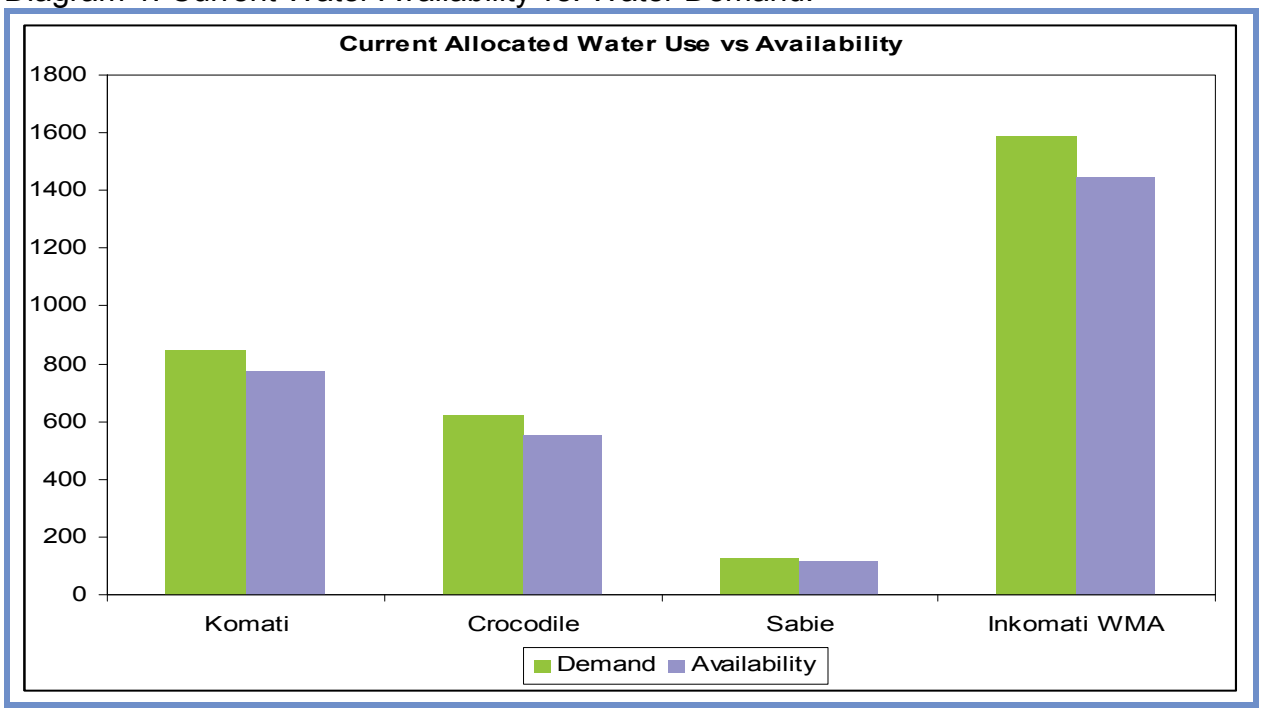
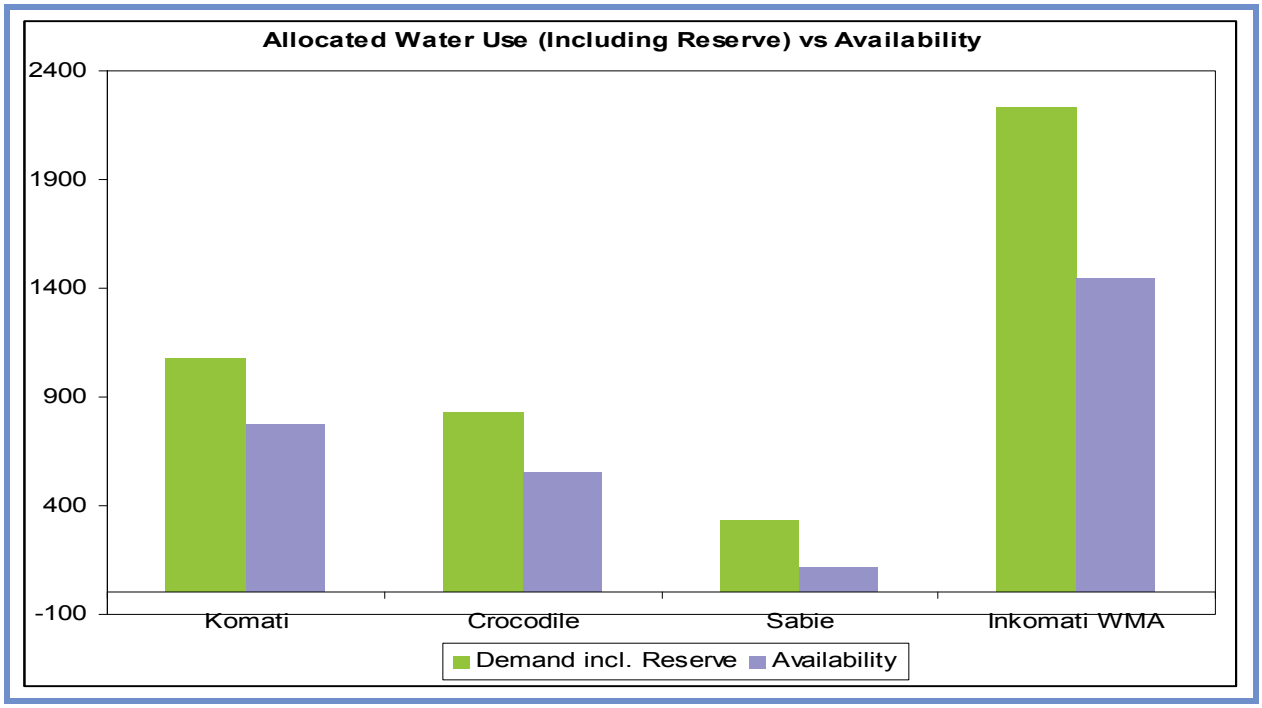


Diagram 2: Current Water Availability vs. Demand (Including possible Reserve Requirements)



Despite the overall state of water stress, there is still potential for increased yield and economic development in some areas of the catchment.

- Important ecologically

Approximately 37 % of the Kruger National Park (KNP) is situated in the Inkomati WMA, and along with many other Important Nature Reserves, underlines the importance of providing water to aquatic ecosystems. To sustain this regional economy, and ensure the creation of jobs for the community it supports, it is very important that the natural environment is carefully managed and its resources are allocated to the benefit of all the communities in the WMA.

- Important Tourism

The KNP/Lowveld, and Trout/Panorama tourism draw-cards are vital to both the catchment and national economies.

- International Obligations.

Geographically, the catchment is the artery linking South Africa's industrial and administrative centre (Gauteng) with our important SADC neighbours Swaziland and Mozambique.

Both the Crocodile and Komati rivers flow into other countries (Swaziland and Mozambique). As a result, international treaties and committees have been set up on these rivers to control the use of water from them by the three countries. These treaties set limits to the amount of water that south Africa may utilize out of the rivers as well as on the amounts of water that the countries are obliged to release downstream. South Africa, and hence the ICMA is obliged to operate within these international treaties.

Currently, South Africa is Operating the Rivers to meet the Piggs peak Agreement which requires a minimum flow of 2 cumecs from the rivers of the Inkomati WMA across the Mozambican border at Ressano Garcia. This will in due course be replaced with more sophisticated flow pattern requirements of the newer Interim Inco-Maputo Agreement (IIMA) which has a higher minimum flow requirement of 2.6 cumecs for ecological purposes plus a further amount for downstream demands.

This is the next highest priority water use in law after the Reserve.

- Strategic importance

The two major dams on the Komati River, Vygeboom and Nooitgedacht dams were built to provide water to the Eskom power Stations on the highveld. Most of the water from the upper Komati is for the use of Eskom. This is defined as a water use of strategic importance and it is imperative that the resource is protected so that the availability of water strategic Use is secured.

- Numerous Large Land Claims

Mpumalanga has the largest and most land claims in the country. Many of these are within the Inkomati WMA. Many of these have already been settled. It is important for the ICMA and other relevant stakeholders to help ensure that the claimants are supported to allow the economy of the region to continue to grow.

- Diverse Water Users

The Inkomati WMA has many commercial farmers as well as the largest number of previously disadvantaged and emerging farmers in the country. There is also strategic water use, very important international and ecological water requirements and significant urban, rural and industrial users in the catchment. It is also one of the few WMA's with extensive afforestation.

Figure 5: Land use

- Priority for Implementation of numerous sections in the NWA

As a result of the diverse and stressed nature of the catchment, it is currently one of the highest priorities for the implementation of numerous portions of the National Water Act. Chief among these are Water allocation reform, compulsory licensing, the reserve and operating rules. The CMA has and will continue to play an ever increasing role in the implementation of these requirements.

- Other Attributes

There is poor enforcement and variable monitoring of water quality, quantity, and

legal and illegal use.

Legislative implementation is lacking, particularly in terms of: the Reserve; the transformation of irrigation boards to WUAs; and co-operative governance. There is also a slow progress on strategic direction around the institutional transformation in the country.

However, there are currently governance structures, and a large, diverse and appropriate knowledge base, on which innovative and enthusiastic stakeholders can, and do, draw.

Disparities in technological and traditional knowledge and their transfer between age, gender and cultural groups exacerbates the variability in spatial distribution of water and land use efficiency and development.

There are disparities between social groups in terms of: employment opportunities and income; education levels and access to knowledge (particularly technological knowledge); in the understanding of water resources and IWRM.

Despite many challenges to water reform, there are many localised examples of voluntary resource-sharing, relationship building and skills development in the catchment on which we can draw and many Land Claims have already been successfully transferred.

5.2. SOCIAL ECONOMIC ASPECTS

The **population** of the water management area was recorded as around 1.5million people in 1995, about two thirds of whom were classified as urban or semi-urban, and the remainder as rural. There is a wide diversity of water users in the catchment, and **inequalities between social groups** can be seen in terms of: employment opportunities and income; education levels and access to knowledge (particularly technological knowledge for women and youth); understanding of water resources, and water resource management; access to water and sanitation; access to productive land, and support and infrastructure that promote effective farming practices.

The **economy** of the water management area is highly dependent on water, with forestry, irrigation-based agriculture and eco-tourism as the main economic drivers. Consumptive water use reflects this economic situation, with **irrigation** the largest user, accounting for over half of all water use in the catchment, and the **forestry** sector the third largest user. The second largest water use is for direct transfers out of the area, for international obligations and for nationally directed strategic transfers to Eskom. Refer to Diagram 3.

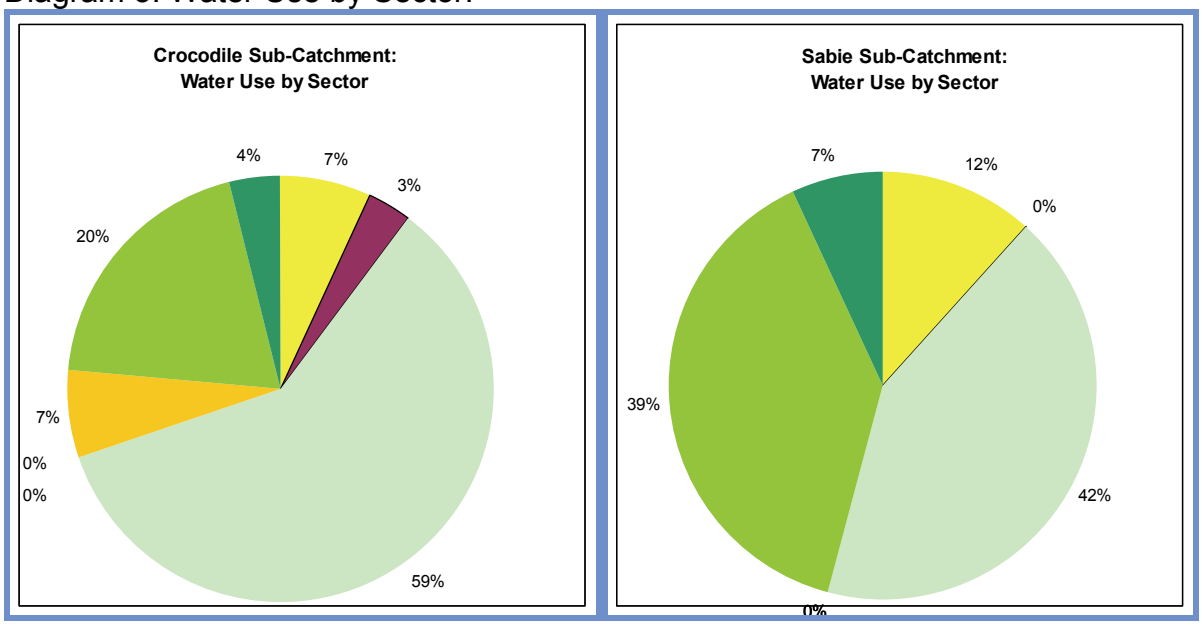
Irrigation-based agriculture and forestry provide most (approximately 60%) of the jobs in the catchment.

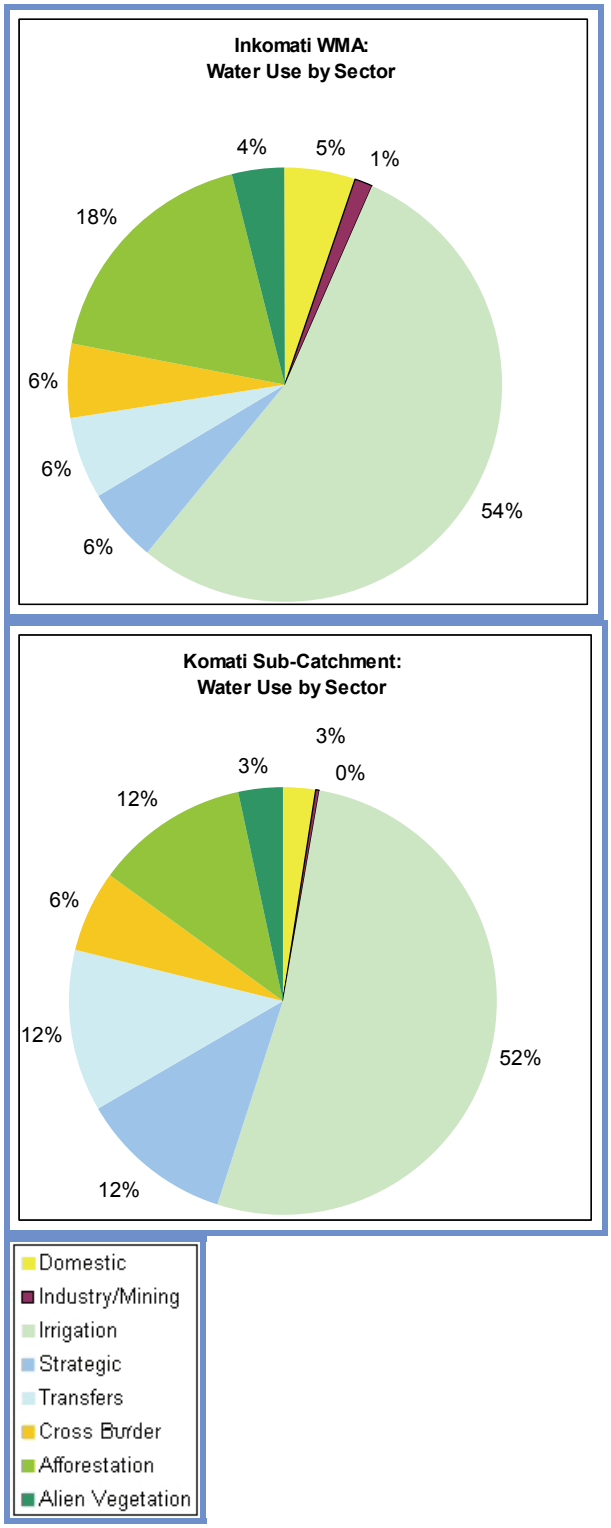
The Lowveld **eco-tourism** industry, which is recognised as vital to South Africa's national economy, is based on the high biodiversity, relatively free-flowing river systems, and generally high water quality that currently characterise the Inkomati.

Industrial Water use is relatively minor in the Inkomati with much of the industry located within the Municipalities and thus being classified as domestic Use. Amongst those companies which are dependent on water are Sappi, which owns a pulp and paper mill, and Tsb Sugar Ltd which has two sugar mills at Malelane and Komatipoort. These industries contribute significantly to the economy with relatively little water use.

With the exception of some coal mines towards the highveld region and some small gold mines near Barberton, there is very little **mining** activity taking place in the area. The likelihood of further mine expansion in the WMA in future is high. Mining also contributes significantly to the economy but also poses a significant water quality threat.

Diagram 3: Water Use by Sector:





The combined economic activities of the Inkomati WMA contribute approximately 2.3% of the South Africa's **Gross Domestic Product** (GDP), and 33.9% of the Gross Geographic Product (GGP) of Mpumalanga Province. On a national scale, therefore, the WMA's population of 3.7% contributes only 2.3% of the GDP. However the WMA does export some of its resources for productive use to other WMAs, including the water that is transferred from the upper catchments of the Komati River for power generation in the Olifants WMA.

5.3. SUB-CATCHMENTS OVERVIEW:

5.3.1. THE CROCODILE SUB-CATCHMENT

Like the water management area as a whole, the Crocodile sub-catchment is dominated by forestry and irrigation, and these two sectors make up around three quarters of the water use requirements of the Crocodile. The Sappi paper mill at Ngodwana and the sugar mill at Malelane are the main industrial water users.

Water quality has been identified as a pending problem with a worsening trend at present, particularly as the Crocodile flows through the economically and ecologically significant Kruger National Park.

Mining is relatively small in the Catchment, but there are several significant mines, especially in the Barberton Area, that provide significant job creation and economic stimulus.

The main towns in the Catchment are Nelspruit, White River. KaNyamazane, Kabokweni, Malelane, Matsulu, Machadodorp, Dullstroom, Waterval Boven and Barberton.

The Kwena dam, located in the upper catchment, is the only major water infrastructure in the sub-catchment and the majority of water available is thus linked directly to the rainfall patterns resulting in highly variable water availability with most of the Runoff occurring far upstream of the major demand nodes. A new computer-modeled decision support system for the operations of the Crocodile River has recently been completed, and a joint ICMA/DWA project to implement this system is in its infancy.

At present, the water requirements exceed availability, and the sub-catchment is considered to be stressed. The water-stressed situation in the Crocodile sub-area is especially serious, given this sub-area's potential for economic growth.

The Crocodile is also an International River and the International Obligations to Mozambique must be met by South Africa.

There is potential for further catchment dams.

5.3.2. THE KOMATI SUB-CATCHMENT

The Komati is the most developed sub-catchment in the Inkomati water management area in terms of water infrastructure. The Vygeboom and the Nooitgedacht dams in the Upper Komati supply water to Eskom, via an inter-basin transfer scheme, and this strategically important water has been reserved by the National Water Resources Strategy (DWA, 2004). The recently completed Maguga dam in Swaziland, and the Driekoppies dam in the Lower Komati are relieving some of the water stress in the Lower Komati sub-area.

The main water users in the Upper Komati are forestry and irrigation, along with Eskom's inter-basin transfer, while irrigation is the primary water use in the Lower

Komati. Considerable expansion of irrigated areas in the Lower Komati has led to stress on the water resource, but there has been successful development of a number of emerging farmer enterprises, and the related construction of the Komati sugar mill. A breakdown of the current water use authorisations shows that a large percentage of allocations go to emerging farmers. However, there is a huge demand for additional water use by emerging farmers and insufficient water availability to meet that demand.

The main towns in the upper catchment are Carolina, Elukwatini, Ekulindeni and Badplaas. The main town in Swaziland is Piggs Peak. The main towns in the lower catchment are Komatipoort, Tonga, Mazibikela and Jeppes Reef with numerous other important communities

The International Nature of the Sub-catchment, with the Komati River flowing into Swaziland and then back into South Africa again before flowing into Mozambique requires South Africa to satisfy the international treaty demands. This complicates the management of this sub-area considerably, because if Swaziland does not meet its obligations to South Africa, it makes it difficult for South Africa to meet its obligations to Mozambique and so on. The Komati Basin Water Authority (KOBWA), which manages the international allocations between South Africa and Swaziland is an important institution for cooperation with.

The water quality is the sub-catchment is currently in a good state, but has the potential to deteriorate. Coal mining and prospecting licenses are being granted in the Upper Komati, upstream from the Eskom abstraction dams, which could potentially degrade the water quality to levels that are unfit for use.

5.3.3. THE SABIE-SAND SUB-CATCHMENT

While the Sabie sub-area of the catchment is dominated by forestry, irrigation and eco-tourism. The Sand sub-area's water requirements are primarily for domestic use, irrigation and eco-tourism. The relatively small amount of forestry in the upper Sand is being rehabilitated to indigenous vegetation and should increase availability in the Sand sub-area where water requirements exceed water availability. However, this rehabilitation may be reversed to some extent in future.

The main towns in the Sabie catchment are Sabie, Graskop, Hazyview, Marite and Hoxani. The main towns in the Sand catchment are Bushbuckridge, Tulamahashe and Acornhoek.

An inter-basin transfer pipeline has been constructed to take water from the new Inyaka dam in the Sabie sub-area for domestic requirements in the more water-stressed Sand sub-area.

The quality of water in both rivers is important for the KNP and, from the Sand, for the Sabie-Sand game reserve. Water pollution from inadequate sewage systems has been identified in the Sabie River, while sedimentation has been identified as a potential problem in the Sand.

Inefficient irrigation use in the Sand is a major source of conflict between that sector and the eco-tourism sector downstream.

INKOMATI CATCHMENT MANAGEMENT STRATEGY

FOUNDATIONAL INFORMATION FOR STAKEHOLDER VISIONING

TABLE OF CONTENTS:

PHYSICAL CHARACTERISTICS

TOPOGRAPHY

- The Inkomati Water Management Area (IWMA) is divided by the Great Escarpment (which runs roughly along the Graskop, Sabie, Nelspruit, Barberton axis) into a plateau or Highveld in the west, and sub-tropical Lowveld in the east.

Figure 1: Topography of the IWMA

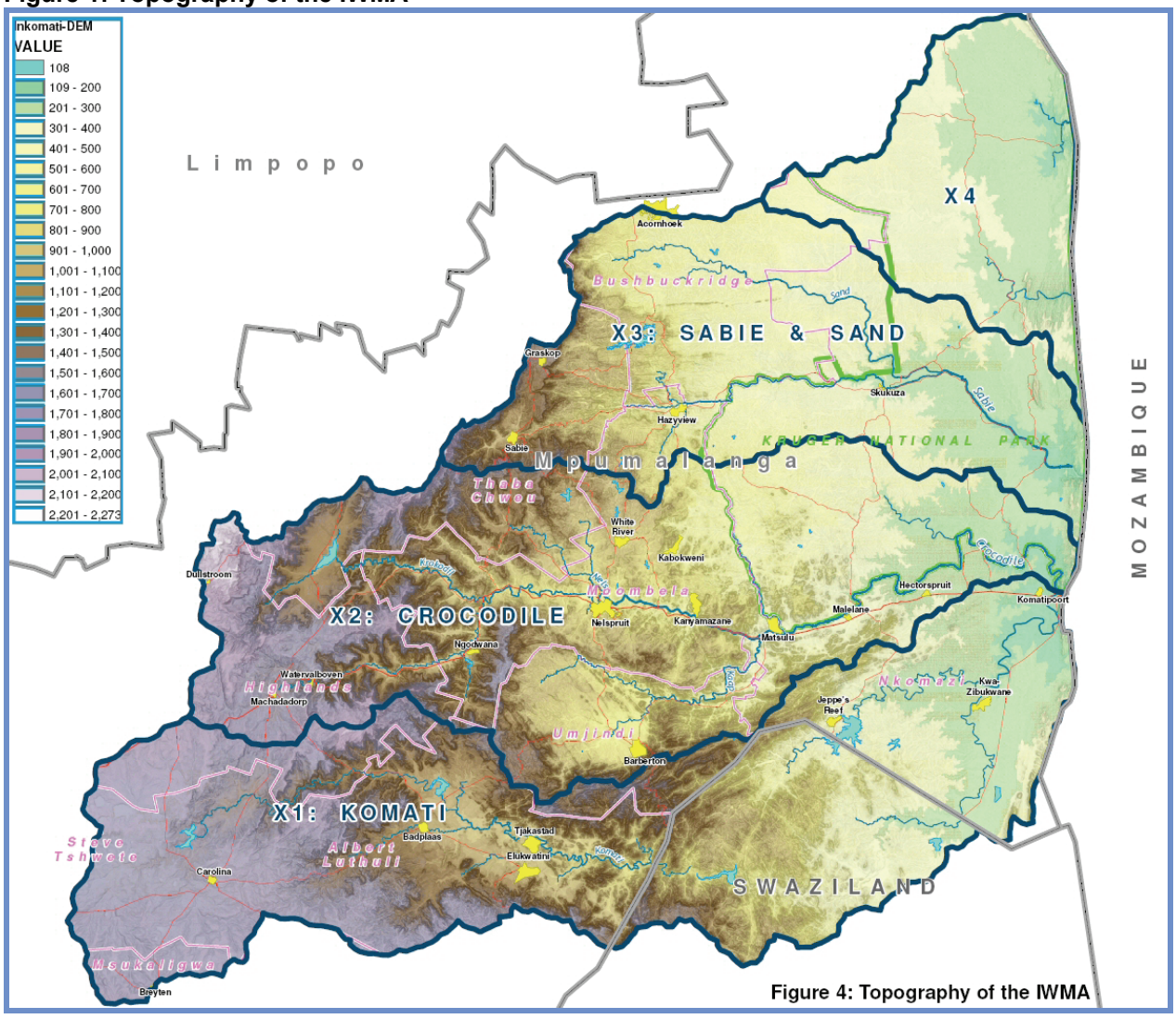


Figure 4: Topography of the IWMA

RAINFALL

- The rainfall patterns in the IWMA are directly influenced by the area's topography: by far the most rain falls in the westerly mountainous areas.
- Rainfall is also highly seasonal, with ten times more rain falling in summer (October to April) than winter (May to September).
- Current climate change predictions are that summers will become wetter but shorter, and that the dry period will become longer with less rainfall.

Figure 2: Rainfall in the IWMA (MAP = Mean Annual Precipitation)

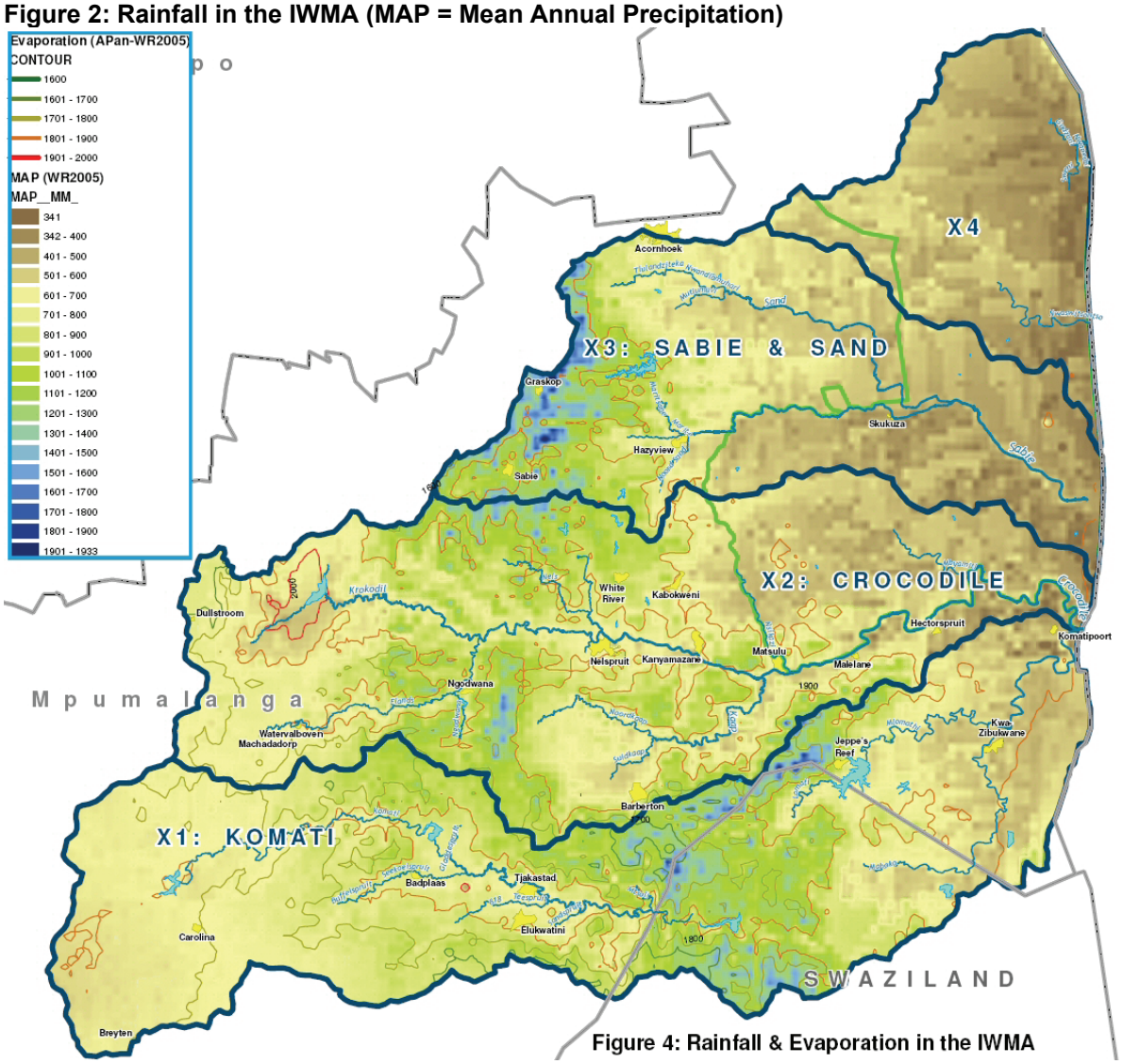


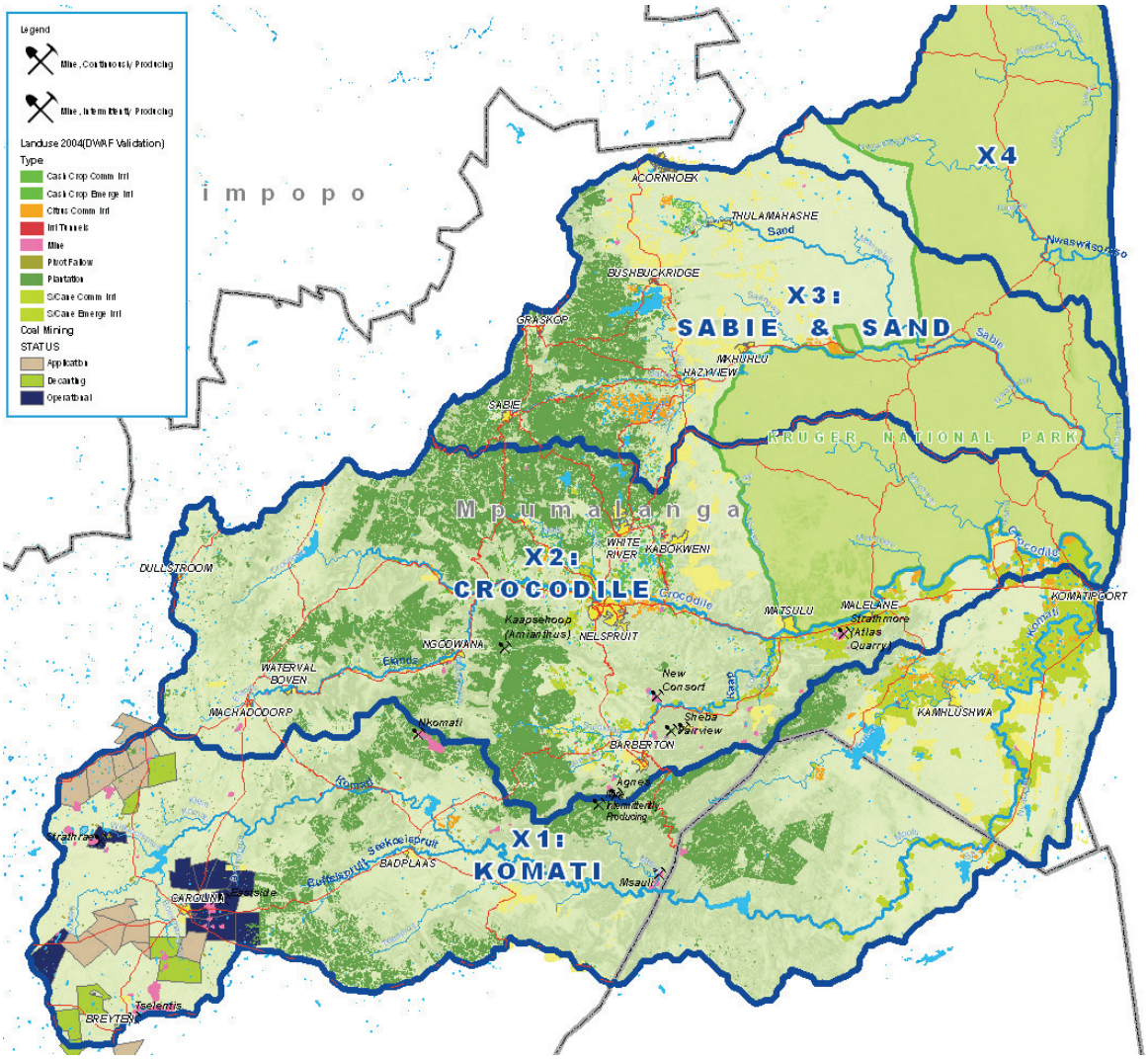
Figure 4: Rainfall & Evaporation in the IWMA

LANDUSE

- Commercial agriculture is a key land use in the IWMA, while irrigation is the primary water use in the Inkomati, and agriculture creates significant employment in the area.
- There are numerous large land claims in the area, many of which have already been settled and farmland has been handed over.
- Forestry is also extensive.

Land use classification	Area (ha), 2004
Irrigated agriculture	121 805
Dryland agriculture	118 876
Plantations	365 613

Figure 3: Land Use in the IWMA



ECONOMIC CHARACTERISTICS

- The Inkomati WMA falls wholly within the province of Mpumalanga, but the borders of Mpumalanga extend beyond the Inkomati WMA.
- Economic data is available for Mpumalanga province, but have not yet been compiled for the IWMA, or for each sub-catchment. This is a data gap that will be addressed in the CMS.

Table 1: Economic Data for Mpumalanga Province (Mpumalanga Development Profile, 2004)

Economic Sector	% of Gross Geographic Product	% of Total Employment
Agriculture, hunting, forestry, and fishing	6.1	18.1
Community, social and personal services	14.6	15.4
Construction	1.6	6.1
Finance, insurance, real estate, and business services	5.4	5.3
Manufacturing	27.2	11.2
Mining and quarrying	22.3	7.5
Transport, storage, and communication	4.5	3.6
Wholesale and retail trade	8.2	13.9
Private households	-	10.9
Undetermined	-	6.3

The economy of the IWMA is generally dependant on and linked to the availability of water.

DEMOGRAPHIC CHARACTERISTICS

- The total population of the Inkomati WMA is around 1.5million.
- 52% of the population of the IWMA is female.
- Around 66% of the population of the IWMA is rural, but there is a trend towards urbanization.
- A number of former “homeland” areas exist in the IWMA, which have notably high population densities, and specific water resource management challenges.
- More specific demographic data sets are available for Mpumalanga province, and for district and local municipalities. However, the borders of the Inkomati WMA do not align with either provincial or municipal boundaries, and demographic data (other than population) has not yet been compiled for each sub-catchment. This is a data gap that will be addressed in the CMS.

Table 2: Population breakdown of various areas within each sub-catchment (DWA, 2003)

Secondary catchment		
Description	Sub-catchment	Population
Komati	Upper Komati	99,665
	Lower Komati	245,350
	Upper Lomati	1,228
	Lower Lomati	68,956
Sub-total		**415,154**
Crocodile	Upper Crocodile	5,519
	Middle Crocodile	254,780
	Elands	18,284
	Kaap	47,427
	Lower Crocodile	152,654
Sub-total		**478,664**
Sabie-Sand	Upper Sabie	209,644
	Sand	407,413
	Lower Sabie	245
	Upper Rio Uanetze	228
Sub-total		**617,530**
Total		**1,511,348**

INSTITUTIONAL CHARACTERISTICS

MUNICIPALITIES

- The three district municipalities that fall within the IWMA, and their main urban centres, are:

  Ehlanzeni:
  - Bushbuckridge (Acornhoek, Bushbuckridge, Tulamahashe and numerous other Communities throughout the municipality)
  - Mbombela (Barberton, Hazyview, Kabokweni, KaNyamazane, Nelspruit, Ngodwana, White River and other Communities in Southern Nsikazi)
  - Nkomazi (Hectorspruit, Komatipoort, Malelane, Mazibikela, Tonga and numerous other Communities throughout the municipality)
  - Thaba Chweu (Sabie and Graskop)
  - Umjindi (Barberton)

  Gert Sibande:
  - Albert Luthuli (Badplaas, Carolina, Elukwatini, Ekulindeni and other communities in the Mswati Region)
  - Msukaligwa (Breyten)
  - Steve Tshwete

  Nkangala:
  - Highlands (Dullstroom, Machadodorp, Waterval-

Figure 4: District and Local Municipalities within the IWMA

Figure 25: Municipal and District Boundaries in the IWMA

IRRIGATION BOARDS

- There are currently 26 irrigation boards operating in the Inkomati WMA.
- According to the National Water Act of 1998, these irrigation boards must transform into Water User Associations. However, this transformation process has not been successful in the Inkomati WMA, and as such, the powers and functions of these irrigation boards are still regulated by the 1956 Water Act.
- The Irrigation Boards per sub-catchment are:

Komati Catchment

- Komati River Irrigation District
- Kaalrug Irrigation District (on the Mhlambanyathi River)
- Lomati Irrigation District (on the Lomati River)

Crocodile Catchment

- Elands Valley Irrigation District (on the Elands River)
- Crocodile River Major Irrigation District (on the Crocodile River, with 5 subdistricts) with the following minor Districts:
    - Friedenheim I rrigation District (Crocodile River)
    - Malelane Irrigation District (Crocodile River)
    - Tenbosch Irrigation District (Crocodile River)

- Sand River Irrigation District
- The Kaap River Major irrigation District with the following minor Districts:
  - Queens River Irrigation District
  - Suid Kaap I rrigation District (Kaap River)
  - Noord Kaap Irrigation District (Kaap River)
  - Eureka Irrigation District (Kaap River)
  - Louws Creek Irrigation District (Kaap River)
  - Lower Kaap Irrigation District (Kaap River)
- White River Valley Irrigation District with the following minor Districts:
  - White River Estates Irrigation District
  - Ranch-Karino Irrigation District (White River)
  - Curlews Irrigation District (White River)
  - Manchester-Noordwyk Irrigation District (White River)
  - Good Hope Irrigation District (White River)

Sabie-Sand Catchment

- Sabie River Irrigation District
- White Waters Major Irrigation District with the following minor districts:
  - Burgershall Irrigation District (Sand River)
  - De Rust Irrigation District (Sand River)

INTERNATIONAL AGREEMENTS

The International Nature of the Rivers in the Inkomati WMA has resulted in a number of obligations on the basin states in terms of international agreements.

TREATY ON THE DEVELOPMENT AND UTILIZATION OF THE WATER RESOURCES OF THE KOMATI RIVER BASIN (THE KOMATI RIVER TREATY)

In 1978 **South Africa and Swaziland** established a Joint Permanent Technical Committee (JPTC) which became the Joint Water Commission (JWC) when the Komati River Treaty was signed in 1992.

The Komati Basin Water Authority (KOBWA) is a bi-national company formed in 1993 through the Komati River treaty and provides for the allocation of water between the two countries as shown below.

Table 3: Treaty Allocations.

Party	High Assurance	Low Assurance
South Africa	157.8	381.0
Swaziland	15.1	260.2
TOTAL	**172.0**	**641.2**

PIGGS PEAK AGREEMENT

This agreement with Mozambique was signed in Piggs Peak in 1991 to enable Driekoppies and Maguga dams to be built. It requires South Africa and Swaziland to ensure an interim 2 m^3/s minimum cross border flow averaged over three days at The border with Mozambique near Komatipoort.

THE INTERIM INCOMAPUTO AGREEMENT (IIMA)

This agreement between Mozambique, Swaziland and South Africa was signed in 2002 sets new limitations on water use in each of the countries, target flows to be maintained to sustain the riverine ecology and sets water quality standards. It has not yet been fully implemented.

Table 4: Target IIMA ecological flows at key points in the Inkomati WMA.

River	Key Point	Interim Target Instream Flow	
		Mean (million m^3/a)	Minimum (m^3/s)
Sabie	Lower Sabie	200	0,6
Crocodile	Tenbosch	245	1,2
Komati	Diepgezet	190	0,6
	Mananga	200	0,9
	Lebombo	42	1,0
Incomati	Ressano Garcia	290	2,6

T**he utilization of water for each country** is set out as follows

(a) The Republic of Mozambique:

First priority supplies:	19 million m3/a
	(up to 87,6 million m3/a-reserved)
Irrigation supplies:	280 million m3/a
Afforestation: Area	25 000 ha
	Runoff reduction 25 million m3/a

The additional reserved water use of up to 87,6 million m3/a is intended for the city of Maputo and will be drawn from the total water available from the further development of the Inkomati watercourse.

(b) The Republic of South Africa:

First priority supplies:	336,6 million m3/a
Irrigation supplies:	786 million m3/a
Afforestation: Area	364 975 ha
	Runoff reduction 475 million m3/a

(c) The Kingdom of Swaziland:

First priority supplies:	22 million m3/a
Irrigation supplies:	261 million m3/a
Afforestation: Area	32 442 ha
	Runoff reduction 46 million m3/a

The water utilization for each Country has been further broken down into the major sub catchments (not shown)

An important point to note is that the current water allocation in South Africa appears to be higher than the IIMA allowed water use. However, due to the requirement of frequent restrictions, the full internal South African water allocation in is not available for use.

PROGRESSIVE REALIZATION OF THE INCOMAPUTO AGREEMENT (PRIMA)

For the implementation of the IIMA, an Implementation Activity and Action Plan (IAAP) was developed by the Countries. The IAAP consists of 12 projects. These focus on issues such as integrated water resources management, disaster management, stakeholder participation and joint operating rules.

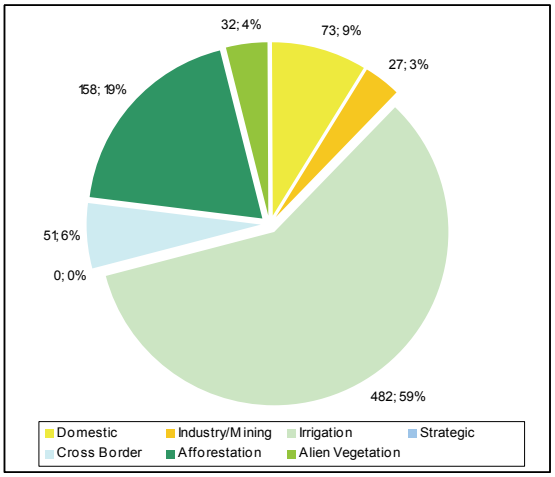
To implement the IAAP, the PRIMA Program was developed. The PRIMA program aims at the realization of the objectives of the IIMA. Nine of the IAAP projects have been started under PRIMA. The full Prima Project is scheduled to run until 2012.

It will play an important role in the future management of the WMA.

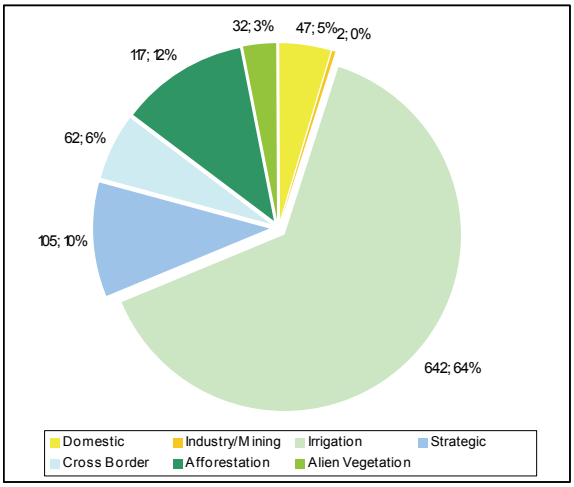
CURRENT WATER USE

Figure 5: Current percentage water use, by sector, in the IWMA.

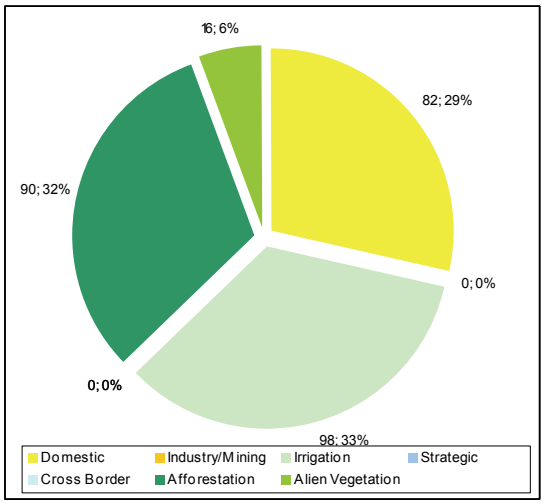
Crocodile Water Demands.



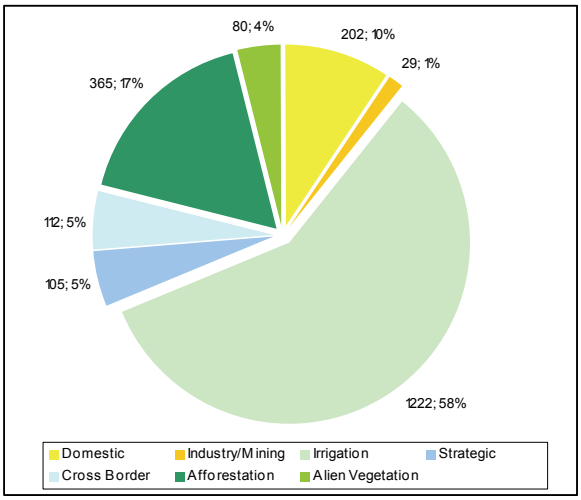
Komati Water Demands



Sabie Water Demands.



Inkomati WMA Water Demands



- Water demand therefore includes, *inter alia*, the Reserve, international obligations, strategic obligations, Stream Flow Reduction Activities, irrigation, and industrial and domestic requirements.
- Currently, the Reserve is not being implemented in any of the sub-catchments in the Inkomati WMA. Water allocation for all other uses is summarised in Table 5.
- The implementation of the Reserve will have a notable impact on the water balance i.e. availability vs. demand (Figures 6a & 6b).

Table 5: Current allocated water uses in the sub-catchments of the IWMA

User group	Komati (incl. Swaziland)	Crocodile	Sabie
Cross border flows	61.5	50.5 (1.6m³/s)	0
Strategic	105.1[1]	0	0
Industrial	2.4	26.6	0
SA Domestic	28.3	46.3 (73)	27.1 (82)[6]
Swazi Domestic (Treaty)	22.0	-	-
SA Irrigation (Treaty)	381	482.2 (307)[5]	97.5 (98)[5]
Swazi Irrigation (Treaty)	261[2]	-	-
Transfers	8.5[3]	-	8.0[4]
TOTAL water use	**869.8**	**605.6**	**132.6**
Afforestation (SFRA)	117.3	157.4	89.6
Alien vegetation (SFRA)	32.1	32.1	16.4
TOTAL	**149.4**	**189.5**	**106.0**

Note:
(1) Water transferred out of the catchment for use by Eskom power stations
(2) Includes 122 million m³ transferred to irrigators in the Mbuluzi [W60] catchment
(3) Includes Lomati Dam transfer to Umjindi LM (Barberton)
(4) Includes Sabie canal transfer to Nsikazi North in the Crocodile
(5) SA allocations applied; IIMA allocations are less
(6) Treaty allocation for urban and industrial users

(IIMA (5) = Interim Inco-Maputo Agreement)

CURRENT WATER QUALITY AND POTENTIAL THREATS

- Generally, the water quality in the IWMA is interpreted to be good.
- However, water quality is seen to be decreasing in all three sub-catchments.
- Regular monitoring of a variety of water quality variables at identified locations in the Rivers is undertaken. However, enforcement requires more priority.
- A Waste Discharge Charge System, based on the idea of 'polluter pays', has been gazetted by the Department of Water Affairs. The CMS must include the framework under which this system will be implemented.
- The primary causes of decreasing water quality in each sub-catchment are currently understood to be:

Sabie-Sand

- Trout farming, especially in the Mac-Mac tributary.
- Sewage output from communities, such as those at Sabie, Graskop, and Kiepersol.
- Inadequate sanitation services, particularly in the Sand sub-area, and inadequate Waste Water Treatment Works throughout the sub-catchment.
- Return flows from small fruit orchards and banana plantations.
- Sawdust from the local saw mill.
- Overgrazing, with consequent soil erosion and in-stream sedimentation.

Crocodile

- Increased trout farming activities, which have included wetland destruction.
- Return flows from the Sappi paper mill at Ngodwana.

- Sewage output from communities, such as those at Machadodorp, Waterval Boven and Elandshoek.
- Inadequate sanitation services and Waste Water Treatment Works.
- General increases in urbanization, industrial activity, and irrigation throughout the sub-catchment.
- Mining activities in Barberton.

Komati

- Potential increases in coal mining activity in the upper catchment could have serious negative impacts on water quality, and could impact on the ability of the Komati to provide high-quality strategic water for Eskom.
- Inadequate sanitation services, particularly in the Nkomazi region, and inadequate Waste Water Treatment Works.
- Intensive agricultural and irrigation activities in the Lower Komati.

WATER AVAILABILITY AND CURRENT ALLOCATIONS

- Surface water provides for 92% of the water available in the Inkomati WMA. Groundwater provides the other 8%.

The Runoff in the Catchment follows a similar distribution to the Rainfall Pattern.

Figure 6: Surface Runoff for Crocodile Catchment.

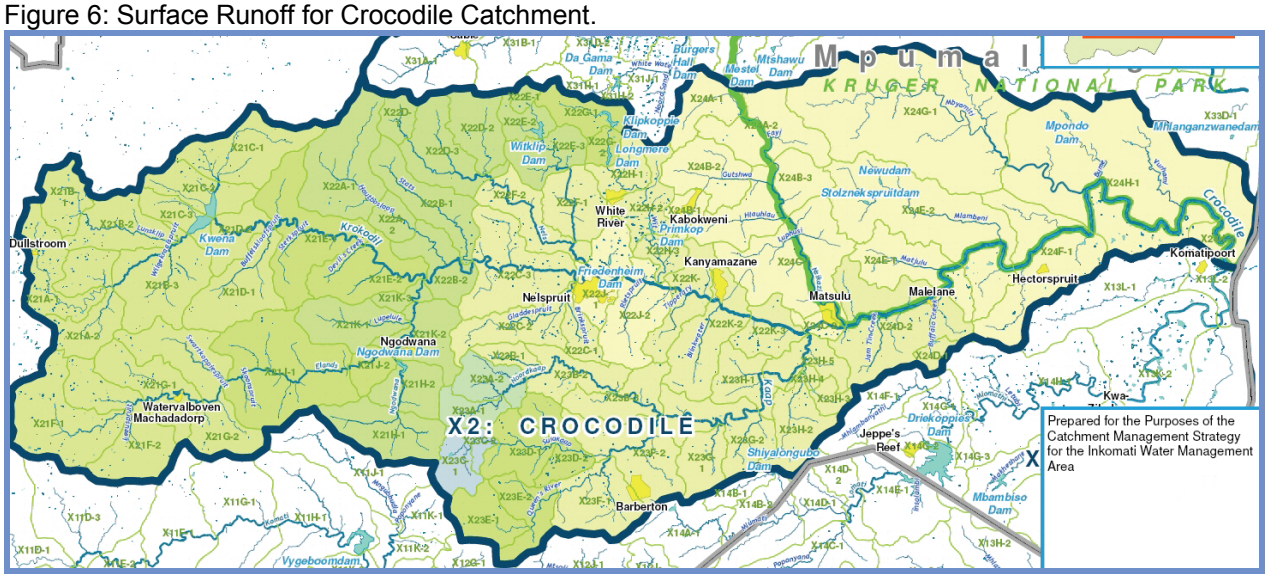


Figure 7: Surface Runoff for Komati Catchment.

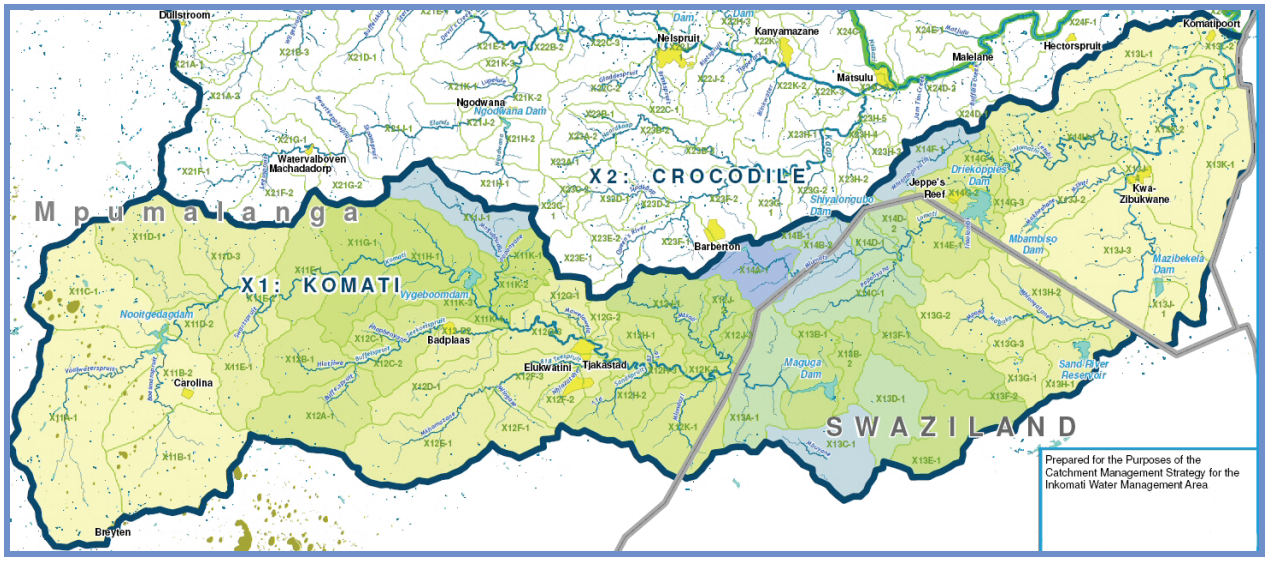


Figure 8: Surface Runoff for Sabie Catchment.

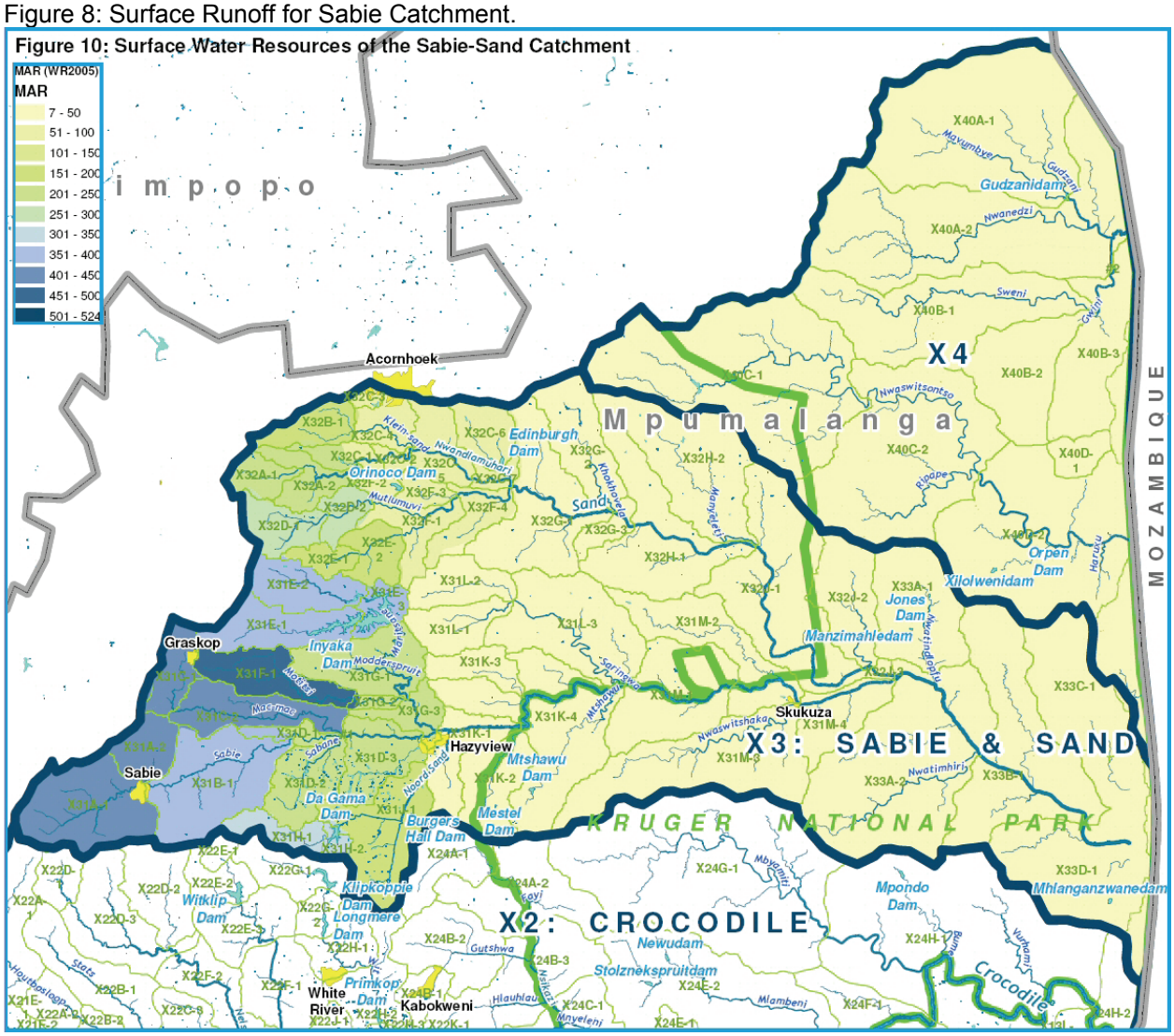


Table 6: Surface water resources in each sub-catchment in the IWMA (MAR = Mean Annual Runoff)

Catchment	MAR (mill m^3/annum)	Unit MAR (mm/annum)
Crocodile		
X21: Upper Crocodile & Elands	467.3	151
X22: Middle Crocodile	359.4	152
X23: Kaap	204.2	125
X24: Lower Crocodile	106.6	32
Sub Total	1137.5	
Komati		
X11: Upper Komati (above Vygeboom)	341.9	99.9
X12: Middle Komati to Lomati Confluence	301.9	117.5
X13: Lower Komati	396.7	109.1
X14: Lomati	316.4	213.1
Sub Total	1356.9	
Sabie		
X31: Upper Sabie	527.3	178
X32: Sand	136.0	71.3
X33: Lower Sabie	12.5	8.6
Sub Total	675.8	
Nwanedzi		
X40:Nwanedzi	36.5	11.4
Grand Total	**3206.7**	

- Thus, the total runoff in the IWMA is around 3,207 million m^3 per annum.
- However, this total is not all 'available' to be allocated to individuals or institutions (e.g. municipalities, farming):
    - Firstly, the law states that three water demands must be provided for before any other demands are met:
        - The Reserve – which is a certain quantity (and quality) of water that must not be abstracted from the river, in order to ensure sustainability;
        - International Obligations – All rivers in the IWMA flow into Mozambique, and the Komati River also flows through Swaziland. There are a number of international treaties, which South Africa has agreed to, which determine the quantities and qualities of water which must flow into Mozambique and Swaziland;
        - Strategic Obligations – This is particular to the Komati sub-catchment, and the water that is abstracted from the Upper Komati for use by Eskom in power generation.

- Secondly, runoff volumes are actually variable from year to year (so some years will have considerably less runoff than 3,207 million m^3), and is influenced by:

    - Rainfall
    - Commercial forestry plantations (forestry is classified as a Stream Flow Reduction Activity);
    - Alien vegetation;
    - Rain-fed agriculture;
    - Evaporation;
    - Storage capacity i.e. in dams.

GROUNDWATER

The impact and interaction of Groundwater on the available surface water is very important.

Table 7: Groundwater Abstractions and impact on surface water runoff.

Catchment	Groundwater Abstractions (mill m^3/annum)	Impact on runoff (mill m^3/annum)
Crocodile		
X21: Upper Crocodile & Elands	3.08	0.39
X22: Middle Crocodile	5.63	0.58
X23: Kaap	7.34	0.75
X24: Lower Crocodile	2.63	0.21
Sub Total	18.68	2.13
Komati		
X11: Upper Komati (above Vygeboom)	6.15	0.78
X12: Middle Komati to Lomati Confluence	1.87	0.27
X13: Lower Komati	1.83	0.13
X14: Lomati	4.32	0.54
Sub Total	14.17	1.72
Sabie		
X31: Upper Sabie	4.13	0.64
X32: Sand	4.02	0.46
X33: Lower Sabie	0.5	0.0
Sub Total	8.65	1.1
Grand Total	**41.5**	**4.95**

Groundwater abstractions are generally insignificant and if correct then groundwater abstractions are not a big issue in terms of their impact on river baseflows. However like any SFRA the abstractions have the greatest impact on the dry season flows and low flow or dry conditions and there is evidence of some local groundwater concerns.

Groundwater information has been identified as a data gap.

CURRENT WATER BALANCE

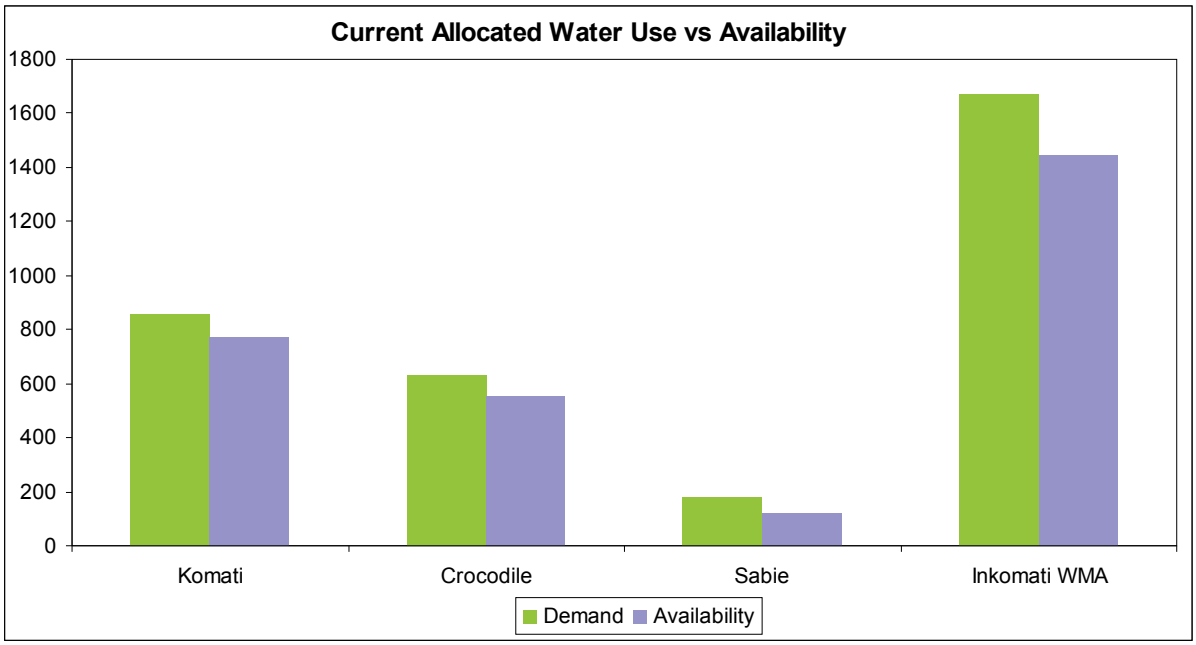
- The Inkomati WMA is currently water 'stressed' i.e. demand exceeds supply in all three sub-catchments (Table 6):
  - The Crocodile has a water deficit of 50.3 million m^3 per annum.
  - The Komati has a water deficit of 94.4 million m^3 per annum.
  - The Sabie-Sand has a water deficit of 15.9 million m^3 per annum.
- When the water requirements for the Reserve are included in the calculations, the water stress is increased (Figures 9a &96b).

Table 8: Current water balance (i.e. demand vs. supply) for each sub-catchment in the IWMA (IIMA = Interim Inco-Maputo Agreement; RSA = Republic of South Africa).

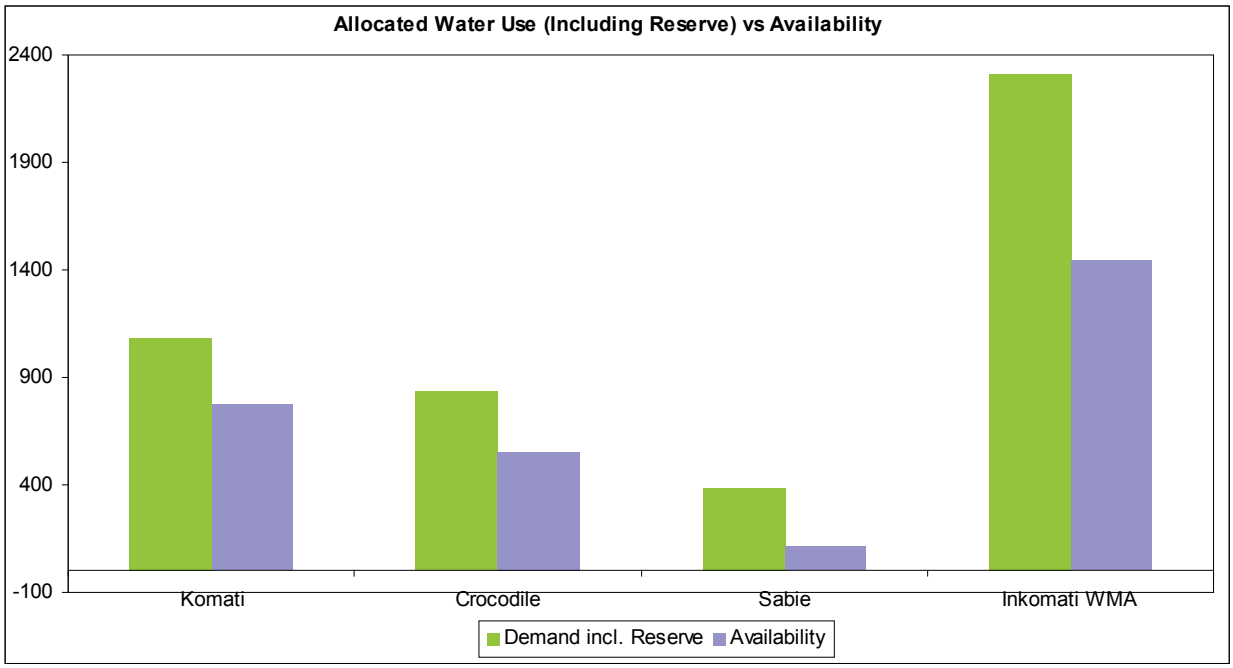
Sector	Current Demand (mill m^3/a)	Current Supply (mill m^3/a)	Current Assurance (% of demand)
Crocodile River			
Cross Border Flows (IIMA)	50.5	50.5	**100**
Irrigation (RSA Allocation)	482.2	431.9	**90**
Domestic / Urban	46.3	46.3	**100**
Industrial	26.6	26.6	**100**
Strategic	-	-	**-**
Sub-Total	**605.6**	**555.3**	**92**
Komati River			
Cross Border Flows (IIMA)	61.5	61.5	**100**
Irrigation (RSA)	380.5	325.9	**86**
Irrigation (Swaziland)	261.2	227.5	**87**
Domestic	54.2	52.3	**97**
Industrial	2.4	2.4	**100**
Strategic	105.1	101.2	**96**
Transfers	4.6	4.3	**93**
Sub-Total	**869.5**	**775.1**	**89**
Sabie / Sand River			
Irrigation (controlled)	23.2	23.2	**100**
Irrigation (uncontrolled)	74.3	58.4	**80**
Domestic	35.1	35.1	**100**
Industrial	-	-	**-**
Strategic	-	-	**-**
Transfers	-	-	**-**
Sub-Total	**132.6**	**116.7**	**87**
Grand Total	**1162.01**	**1071.96**	**92**

"Assurance" refers to the reliability of the supply: if assurance is 80%, the user can expect to get the volume they require 80% of the time. The other 20% of the time, they can expect their usage will be restricted.

Figure 9: Current water balance for the sub-catchments in the IWMA:
a) Without including water requirements for the Reserve



With Reserve water requirements included



POTENTIAL RECONCILIATION AND FUTURE SCENARIOS

- A Water Allocation Plan must be developed in the CMS to achieve reconciliation of these water imbalances, and to satisfy the guiding principles of equity, sustainability and efficiency.
- There are many different activities that would contribute to the process of reconciling the water balance, such as:
  - Compulsory licensing, as part of the Water Allocation Reform programme;

- Preventing illegal water use: this would require strong compliance monitoring and enforcement, which at present are lacking;
- Improved water use efficiency (incl. Water conservation and Demand Management;
- Removal of alien vegetation;
- Construction of new dams;
- Revision of river/dam operating rules;
- Promotion of alternative water uses e.g. rainwater harvesting, recycling, groundwater

- A variety of different scenarios can be modeled, to see how different combinations of activities would be likely to affect the water balance in each sub-catchment. These will need to be developed further during the CMS process and will include:
  - Implementation of Internationally obligated cross border flows
  - Implementation of the reserve
  - Other Scenarios will be explored following the visioning process and distributed for comment.

APPENDIX F: "RAW" WORKSHOP NOTES FROM THE SABIE-SAND SUB-CATCHMENT VISIONING PROCESS

Key Issues

- How will the CMS solve the issue of equity? (the poor)
- Funding strategy for the implementation of the CMS
- Water quality
- How to get mining sector involved
- Alien plants
- Maintaining a healthy river
- Helping rural development
- Local level water resource management
- Continued collaborative spirit
- Involvement of existing water boards
- Ecological integrity, including the Reserve
- Full use of existing capacity (infrastructure)
- Flow rate (environmental flows)
- Improving infrastructure to prevent water loss
- Sharing the water resource (unpolluted) between all stakeholders
- Population increase
- Pollution from sewage discharges
- Water use as an economic development tool
- Appropriate monitoring of the Reserve
- Management structure of the ICMA
- Structuring water resource management to ensure better service provision
- Interbasin transfer from the Sabie to the Sand – managing for domestic water use
- Financial resources for farming
- Infrastructure!! (development and upgrading)
- Alternative energy sources for drawing water from rivers
- Land rights don't come with water entitlements
- Alien trees that use more water (invasives and planted)
- Linking issues of water access and power failures – cooperative governance
- Wetland protection
- Communication of information, skills, knowledge to communities, particularly through traditional leadership – the role traditional leaders can play in protecting the resource
- Diverse catchment – high quality of life for residents, good tourism potential
- Enforcement, and compliance monitoring
- We can rise to the challenge! Pioneering CMA, CMS in particularly stressed catchments
- Over-allocation, and international water requirements
- Encouraging appropriate water and land use in the catchment
- Mismatch of municipal and catchment boundaries
- How the agricultural sector will adapt to climate change
- Implementation of operating rules for the Sabie-Sand system
- Raising of the Corumana Dam wall
- Sabie and Sand catchments have very different water characteristics
- Catering for future emerging farmers
- Degradation of rivers, through siltation from poor agricultural practices and urban development
- International relations with Mozambique, particularly to address issues of uncertainty of climate change and adaptation (sea water desalination)
- Accountability

- Cooperation
- Local government capabilities to deal with domestic water use and education

Vision

- Sustainable
- Ecologically in tact
- Continually evolving (socio-economic)
- The Sand River flowing
- Better infrastructure/ better use of current infrastructure
- Beneficial for all
- Better water quality
- Biodiverse and adaptable
- Polluter pays principle implemented
- Enabling environment
- Accessible and affordable water
- Intergovernmental cooperation
- Well balanced – ecological and developmental needs
- Collaborative action to solve problems
- More effective allocation system
- Mustn't forget we are sharing this water
- Cross-level decision-making
- Enforcement for Integrated Water Resources Management

Values

- Equity (particular emphasis on previously disadvantaged)
- Efficiency
- Sustainability
- Commitment from everyone
- Accountability
- Knowledge-based decisions – sound knowledge base; best available data; local knowledge as well as 'scientific'; shared knowledge
- Corruption-free; effective use of funding
- Transparency
- Justice – dealing with those who do not follow the law
- Sharing of responsibility
- Recognition of diversity and change in the system
- Participatory, inclusive, people driven engagement
- Not based on emotion alone
- Economic development and jobs
- Maintenance of environmental diversity
- Caring for the resource
- Trust
- Integrity and credibility
- Flexible processes
- Explicit and transparent recognition of what each individual/group contributes to this catchment
- Structured division of roles and responsibilities
- Pro-active (maintenance of infrastructure etc)
- Non-racial

Vital Attributes

1. Prime conservation area of the country, and internationally.
2. Rivers and riparian zones are biodiverse; lower Sabie in particular has high geomorphological diversity, biological diversity, and thus high tourism potential.
3. Has a good research profile/ data set.
4. Many wetlands.
5. Much adventure tourism upstream, which is river and scenic mosaic dependent.
6. Rainfall primarily in upper catchment, demand primarily in lower >> flows must be managed.
7. Rainfall is very variable, in both space and time.
8. There is a small area in the upper catchment where the majority of the runoff is generated.
9. Potential for more water storage.
10. Stakeholders generally willing to collaborate.
11. Rich cultural diversity; large human potential.
12. The Sand has some of the highest density rural areas anywhere in South Africa, and the smallest water resource in the Inkomati.
13. Large dependence on the rivers for livelihoods across all sectors.
14. International tourist hot-spot.
15. Current water allocations are not reaching the domestic and economic needs of many in the catchment.
16. Current water quality status is relatively good.
17. First ever government endorsed land use change (forestry to conservation) – being reversed currently.

Threats to Vital Attributes

- Public apathy towards water issues
- Corruption (particularly government)
- Uncontrolled population growth
- Inappropriate development (affects water quality; scenic)
- Crime
- Lack of commitment to implementing the Reserve
- Uncontrolled dumping
- Pollution, from e.g. sewage systems, farming, industry
- Uncontrolled growth in forestry
- Climate change, and uncertain understanding
- Alien invasive plants
- Inappropriate land use practices and planning
- Continued non-provision of water to communities
- Continued poor water use practices
- Small dams
- Continued lack of law enforcement
- Continued lack of delegation of functions
- Continued lack of delegations down the line
- Lack of infrastructure maintenance
- Not understanding the linkages between water resource management and the provision of water services
- Continued illegal water abstraction
- HIV/AIDS
- High evapotranspiration rates
- Financial constraints – Integrated Water Resource Management costs money

- Lack of consideration of water availability by e.g. municipal water services plans, provincial agricultural department
- Not maintaining tributaries in good condition
- Lack of real consideration of sustainability (mindsets)
- Poor monitoring for sustainability
- Continued poverty
- Erosion
- Lack of implementation of operating rules
- Wild fires in the upper catchment, leading to massive erosion and sedimentation
- Damaging of wetlands

Objectives

- Need better water balance data
- Training
- Implementation and enforcement of operating rules
- Get functions delegated to the ICMA!
- Create pragmatic, workable decision-making structures and processes
- Development of cooperative programmes with other local institutions for enforcement and policing
- Develop a solid financial strategy
- Evaluation and monitoring
- Hear the voice of the crying masses for water
- Mobilise sufficient political will and support to follow through with the strategy
- Better fire prevention strategy (ICMA to join regional fire protection association)
- Proper awareness campaign
- Ensure there is proper planning (cooperative governance)
- A clear plan to engage with service providers about infrastructure maintenance
- Careful quantification of progressive realisation, in terms of implementing water flow and quality
- Establish Water User Associations
- Get proper legal backup
- Frequent and effective feedback to stakeholders from the ICMA governing board
- Uncontrolled harvesting of aquatic biota
- ICMA must actively participate in other water-related processes
- Good and implementable strategy for information collection, and use, in Integrated Water Resources Management

APPENDIX G: VISIONING OUTCOMES DOCUMENT FOR THE SABIE-SAND SUB-CATCHMENT

Inkomati Catchment Management Strategy
Visioning Exercise
Sabie/Sand River Sub-catchment
12 March 2010

Facilitator: Prof Kevin Rogers

The facilitator introduced the customised Adaptive Planning Process and explained how this process would provide the insight on stakeholders perspectives of a desired future state for the Sabie/Sand sub-catchment. In so doing stakeholders were providing guidance to the technical team that would draft the catchment management strategy (CMS). This team will comprise ICMA and DWA staff, as well as a range of external experts. The first draft CMS would be circulated to stakeholders and again workshopped with them on 24 March 2010. The plan would then be submitted to the Minister DWA for approval.

This document represents the outcome of the first stakeholder (public participation) meeting for the Sabie/Sand sub-catchment of the Inkomati Catchment.

Key Issues

- How will the CMS solve the issue of equity? (the poor)
- Funding strategy for the implementation of the CMS
- Water quality
- How to get mining sector involved
- Alien plants
- Maintaining a healthy river
- Helping rural development
- Local level water resource management
- Continued collaborative spirit
- Involvement of existing water boards
- Ecological integrity, including the Reserve
- Full use of existing capacity (infrastructure)
- Flow rate (environmental flows)
- Improving infrastructure to prevent water loss
- Sharing the water resource (unpolluted) between all stakeholders
- Population increase
- Pollution from sewage discharges
- Water use as an economic development tool
- Appropriate monitoring of the Reserve
- Management structure of the ICMA
- Structuring water resource management to ensure better service provision
- Interbasin transfer from the Sabie to the Sand – managing for domestic water use
- Financial resources for farming
- Infrastructure!! (development and upgrading)
- Alternative energy sources for drawing water from rivers
- Land rights don't come with water entitlements
- Alien trees that use more water (invasives and planted)
- Linking issues of water access and power failures – cooperative governance
- Wetland protection

- Communication of information, skills, knowledge to communities, particularly through traditional leadership – the role traditional leaders can play in protecting the resource
- Diverse catchment – high quality of life for residents, good tourism potential
- Enforcement, and compliance monitoring
- We can rise to the challenge! Pioneering CMA, CMS in particularly stressed catchments
- Over-allocation, and international water requirements
- Encouraging appropriate water and land use in the catchment
- Mis-match of municipal and catchment boundaries
- How the agricultural sector will adapt to climate change
- Implementation of operating rules for the Sabie-Sand system
- Raising of the Corumana Dam wall
- Sabie and Sand catchments have very different water characteristics
- Catering for future emerging farmers
- Degradation of rivers, through siltation from poor agricultural practices and urban development
- International relations with Mozambique, particularly to address issues of uncertainty of climate change and adaptation (sea water desalination)
- Accountability
- Cooperation
- Local government capabilities to deal with domestic water use and education

Vision

A vision is a concise statement describing the shared desire for the future conditions of the sub-catchment.

Values

Our values are the principles we use to evaluate the consequences of actions (or inaction), to propose and chose between alternative options and decisions. The sub-catchment value set reflects the values shared by the stakeholders of the sub-catchment.

- Stakeholders share the responsibility for caring for the resource and there is explicit recognition of what each individual/group contributes to promoting equity, efficiency and sustainability.
- We strive for a trusting, transparent and corruption-free system of catchment management that promotes fairness before the law and economic development.
- Decision making is participatory, inclusive and proactive. It is based on the best available local and scientific knowledge to ensure integrity and credibility.
- We appreciate the range and dynamics of cultural and environmental diversity that characterise our catchment.

Context

The range of social, technical, economic, environmental and political facts, conditions, causes and surroundings that define the circumstances relevant to a problem, provide the □context□ within which decisions are made. The context is therefore a fundamental element of any decision making environment.

Vital Attributes

The few most important characteristics/properties of the system to be managed are its □vital attributes□. They may be may be technical, ecological, legal, historic, social or economic.

- The catchment is a critical element of a prime internationally renowned conservation area, and international tourist hot-spot. As well as ecotourism downstream, there is much adventure tourism upstream, all of which is river and scenic mosaic dependent.
- The rivers, riparian zones and other wetlands have a high biodiversity. The Sabie river in the Kruger Park has a particularly high geomorphological and biological diversity, and thus high tourism potential
- There is a large dependence on the rivers, which still have a relatively good water quality, for livelihoods across all economic sectors (rural poor to very high end tourism ventures).
- Most rainfall is generated in a small area of the upper catchment but demand is primarily in the lower reaches where there are high levels of poverty. Rain is very variable, in both space and time, but flow is regulated by dolomite cavities, especially in the Sabie catchment, which store and steadily release water over the dry period.
- The Sand has some of the highest density rural areas anywhere in South Africa, and the smallest water resource in the Inkomati. Current water allocations are not meeting the domestic and economic needs of many in the catchment.
- The first ever government endorsed land use change of forestry to conservation would have improved water yield but is currently being reversed.
- Stakeholders are generally eager to collaborate, and are aware of the value of their rich cultural diversity and large human potential.
- The catchment has a very good research profile/data set.
- There is potential for more water storage facilities, and for using current facilities more efficiently.

Threats

Threats are factors within, or outside, a partnership that undermine its values and inhibit the pursuit of the vision. Threats are also factors or processes that inhibit ecosystem determinants or vital attributes.

- Despite the commitment of many stakeholders, there is still high degree of public apathy towards water resource management issues. This is probablyexacerbated by continued non-provision of water to communities and a lack of commitment to implementing the Reserve.
- Corruption (particularly in government), crime (including illegal water abstraction) and continued lack of law enforcement is hampering development.
- Climate change, and our uncertain understanding thereof.
- Inappropriate land and water use practices and poor planning are leading to: uncontrolled population growth; uncontrolled forestry development; invasion by alien plants; degradation of the scenic mosaic; and pollution from poorly maintained infrastructure, uncontrolled dumping, sewage systems, farming, and industry.
- A continued lack of small dams in the lower reaches of the catchment increases the gap between haves and have-nots.
- Continued lack of delegation of functions to ICMA and of delegations down the line

Objectives

Objectives should be aimed at overcoming threats to ensure the persistence of vital attributes and/or their determinants, under the guidance of the vision statement.

The primary objective must be to achieve full delegation of authority to ICMA so that they can develop pragmatic, workable decision-making structures and processes, develop a solid financial strategy, establish Water User Associations, and actively participate in co-operative governance, planning, enforcement/policing, fire prevention and training.

- Mobilise sufficient political will and support to hear the voice of the crying masses for water,

and to follow through with the strategy.

- A clear plan to engage with service providers about infrastructure maintenance and the polluter pays principle implemented.
- Careful quantification of goals for progressive realisation of improved water flow, water quality and the Reserve.
- Good and implementable strategy for information collection, and use, in Integrated Water Resource Management, evaluation and monitoring. We need a better quantified water balance.

APPENDIX H: INTEGRATION MATRIX FOR THE INKOMATI CATCHMENT MANAGEMENT STRATEGY

Red Text: Highest ICMA Priorities	OBJECTIVES: Practical IWRM to achieve equitable, sustainable, and efficient uses of Inkomati water resources which meet evolving stakeholder needs and legal obligations					
	A sustainable water resource		Collaborative and coordinated IWRM for wise socio-economic development	Secure financial arrangements for IWRM		
Sub Strategies / Strategic Action Programmes	WRM Sub Strategies		Integration Sub Strategies	Facilitation Sub Strategies		
	Resource Protection (RDM)	Regulating Water Use (SDC)	Cooperative Governance & Institutions	Stakeholder Engagement	Information & Monitoring	Finance
Achieving equity		- Establish a viable, up to date and transparent system for water authorisation. - Develop a first Generation Water allocation plan - Implement Water Allocation Reform	- Coordinate activities to increase access to water for resource poor farmers - Facilitate innovative solutions to the water services backlog.	- Establish participatory IWRM decision-making process. - Facilitate empowerment programmes. - Establish Water User Associations.		- Develop and implement a realistic and cost effective process for processing water use licence applications.
Managing flow	- Facilitate the progressive, and stakeholder centred implementation of the Reserve.	- Consolidate systems for integrated planning and operations of river systems	- Promote coordinated river operations. - Decrease water losses and increase water use efficiency	- Establish and maintain appropriate River Operations Committees. - Ensure Reserve processes are transparent and inclusive.	- Research systems, for integrated river operations. - Monitor progressive realisation of the Reserve and international obligations.	
Managing water quality	- Support DWA to classify the resource and setting Resource Quality Objectives - Implement	- Consolidate and implement workable procedures to determine license conditions for wastewater disposal.	- Institute a cooperative spatial/ develop. planning for water sustainability - Manage pollution	- Ensure implementation of Resource Quality Objectives and Reserve are transparent and inclusive.	- Implement accessible and transparent water quality and ecosystem monitoring systems.	- Implement Waste Discharge system to cover costs of managing quality of the water resource

	the above		incidents. - Prevent further water quality degradation.			
Generating and managing knowledge			- Build knowledge sharing networks nationally and internationally.	- Embed systems of social co-learning / co-generation of knowledge into IWRM decision-making processes.	- Identify monitoring & information Institutions - Operationalise learning reflection and review system - Participate in IWRM networks etc. - Learning Strategy	
Achieving compliance and enforcement	- Ensure the necessary monitoring requirements for compliance are implemented	- Consolidate clear and realistic standards which different types of water use must be compliant - Ensure appropriate Enforcement of the different water uses	- Investigate enforcement needs and methods - Develop transparent system for dealing with transgressors.	- Awareness and education to help with mindset changes.	- Operationalise transparent and accessible systems for monitoring compliance, and actions against transgressors	- Ensure cost recovery from transgressors in terms of Sections 19 and 20 of National Water Act
Generating revenue					- Audit for transparent and directed use of IWRM funding. - Operationalise payment monitoring	- Investigate and develop realistic mechanisms through which water use charges can be implemented.