INTEGRATED WATER RESOURCE MANAGEMENT (IWRM): FROM THEORY TO PRACTICE, FROM POLICY TO OUTCOMES

Report to the
Water Research Commission

by

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EXECUTIVE SUMMARY

Introduction

The research reported in this document interrogates integrated water resource management (IWRM) as a feasible approach to water management. In general, the research interrogates the narratives about the transfer of IWRM theory to IWRM practice, about the shift from IWRM policy to IWRM practice. Specifically, the research interrogates (a) the concept of integrated water resource management; (b) whether IWRM can be implemented; (c) the nature of the regulatory environment for water management and whether the regulatory environment in South Africa is enabling or disabling for implementing IWRM; and (d) the roll-out of the post-1994 water policy in the Olifants-Doorn Water Management Area as an example of IWRM implementation.

Chapter 1

Water management prior to IWRM is referred to as fragmented water management, supply-oriented water management or traditional water resource management. The IWRM narrative seems to suggest that IWRM replaced the previous approach to water management. However, Allan (2006) identifies five water management paradigms (localised water provision, the hydraulic mission, environmental security, economic efficiency and political expedience) that influence water resource management. Allan's exposition of the evolution of water resource management shows that the water resource management paradigm of today subsumes the previous paradigms. This might explain why integrated water resource management is such a complex assignment.

Integrated water resource management as an approach to water management has been put on the international water agenda at the UN Conference on Environment and Development in Dublin in January 1992 and further elaborated at the UN Conference held in Rio de Janeiro in July 1992. The international push for IWRM was pursued through the establishment of the World Water Council and its tri-annual World Water Forums and through the establishment of the Global Water Partnership (GWP), together with its regional offices and country water partnerships. The key function of the GWP is the promotion of IWRM and to encourage transformation of water policies to policies that are IWRM-friendly. In addition to the regional GWP offices promoting IWRM, regional political groupings such as the Southern African Development Community (SADC) and the European Union (EU) were also encouraging member states to accept IWRM as their water management paradigm.

Despite the promotion of IWRM there are authors who question its utility (Walther, 1987; White, 1998; Jewitt, 2002; Biswas, 2004) whereas others (Swatuk, 2005; Jonker, 2002, 2007; Van der Zaag, 2005; Koudstaal et al., 1992; Jeffrey and Geary, 2006) are of the opinion that even though implementation is uneven and often elusive, it is possible to implement IWRM.

Chapter 2

Analysis of Chapter 18 of Agenda 21 as well as analysis of the definitions from a small selection of articles from the IWRM literature seems to suggest that the key issues and thus the key concepts in IWRM are access and sustainability. Integrated water resource management is therefore defined as simultaneously achieving two seemingly contradictory objectives of providing access to and ensuring sustainability of water resources. By achieving the twin objectives of access and sustainability through integrated water resource management it is hoped that there will be a significant improvement in the quality of life of especially the marginalised and vulnerable groups in society.

Despite having access to water, many communities and households remain vulnerable to the consequences of water scarcity. Because of the persistence of vulnerability there are expectations that integrated water resource management will translate into increased equity, reduced vulnerability and enhanced resilience, succeeding where in the past traditional water resource management has failed. To achieve integrated water resource management, water users should focus their activities on resource protection, appropriate land use, optimal water use and governance.

Chapter 3

By the year 2000 IWRM appeared to have been generally accepted internationally by stakeholders in the water sector as the preferred approach to water resource management. Doubts about its utility, persistently high numbers of people without access to safe drinking water or decent sanitation and continuous reports of degradation in the quality of water resources in those countries that embraced the IWRM philosophy, lend credence to the increasing discourse on the failure of IWRM of being the solution to the water management problems.

While the pro-IWRM narrative was growing at the international, regional and national levels there was also a growing narrative that it is impossible to implement IWRM. The two questions raised over this contradiction are:

1. Is integrated water resource management as an approach to water resource management not being implemented because of being inherently impossible to implement?
2. Are there other reasons (lack of funding, inadequate human capacity, for example) for IWRM seemingly not being implemented?

Of the ten reasons identified from the literature of why there is a failure to implement IWRM, three seem to be inherent in IWRM thereby making it impossible to implement IWRM. The three reasons are: IWRM cannot be operationalised; IWRM cannot be measured; and problematic IWRM science. The rest of the reasons speak to actions that are to be performed in the process of water management and can therefore be corrected.

Chapter 4

Prior to 1997 water policy addressed the matter of increasing water scarcity through supply augmentation, water allocation and water resource management as a central bureaucracy through a ministry for water affairs (Backeberg, 1994). At that time the water sector in South Africa was “characterized, amongst others, by an increasing water demand, intensive competition among water uses and users, high rehabilitation requirements for water supply infrastructure, pressing externalities caused by water pollution and the high social cost attached to subsidization of increased water supply” (Backeberg, 2005). What Backeberg had failed to address in the characterisation of the water sector at that time are the gross inequalities in water supply and sanitation services prevalent in South Africa (MacDonald and Ruiters, 2005).

It is within the context described above that the post-1994 government of South Africa embarked on the development of an operational environment for water management that addresses the issues of both water services (access) and water quality (sustainability). The operational environment of any organisation is shaped by three factors, namely rules, capabilities and ethos. Rules refer to policies, laws and regulations of society that govern the actions of people. For our purposes we recognise four indicators pertaining to rules, namely political rules, operational rules, credibility of rules and enforcement of rules. Capabilities refer to the combination of resources that allows an organisation to function. For the purposes of this project we recognise five resource types, namely human resources, financial resources, capacity building, appropriate technologies and good corporate governance. Ethos refers to the informal rules that operate in organisations and which often determine the manner in which people in organisations behave. For the purposes of this study we recognise two indicators under ethos, namely culture and enforcement of culture.

Together the above provide a set of indicators that allow us to understand the contribution of rules and regulations, resource availability and the behaviour of its people on the functioning of an organisation, i.e. whether the operational environment is enabling or disabling.

Legislation is one determinant of whether an operational environment is enabling or disabling. The focus of the Water Services Act is on providing access to water whereas the focus of the National Water Act is on ensuring sustainability. When looking at these two Acts in combination the access-sustainability linkage is clearly observed. One could thus argue that the conditions for integration have been met and that the policy and regulatory environment is thus enabling to achieve integration in water resource management. But the evidence for the access-sustainability link is much stronger than between the Acts in combination. The National Water Services Act speaks to the access and also emphasises sustainability whereas the National Water Act speaks to sustainability and also emphasises access.

In March 2000 at the Second World Water Forum in The Hague, Muller (2000) observed: “A definitive evaluation of such impacts in a field as complex and diverse as water legislation can necessarily only be made over a long period. The preliminary indicators of the response to South Africa’s new water legislation are however encouraging”. The above shows that by August 1998 the policy and legislative environment (political rules) were enabling for integration to be achieved in water management practices in South Africa. This conclusion is consistent with Muller’s assessment at the Second World Water Forum in The Hague.

Chapter 5

Some researchers such as Biswas (2004, 2008) maintain that it is impossible to implement IWRM whereas others such as Moriarty et al. (2010) are of the opinion that in developing countries, IWRM as conceptualised by GWP cannot be implemented but that “'light' integrated water resources management (IWRM): that is, IWRM that is opportunistic, adaptive and incremental in nature and clearly focused on sustainable service delivery” can be implemented

The second most stated reason why IWRM cannot be implemented is because of a lack of conceptual clarity. Despite the number of authors who claim that IWRM suffers from a lack of conceptual clarity, the Department of Water Affairs seems to have a clear understanding of the IWRM concept and this understanding is in line with the conceptualisation formulated at the Earth Summit in Rio de Janeiro in 1992. In this study, the Olifants-Doorn WMA is used as a case study to assess the implementation of IWRM. Access to water is more than access to water for basic human needs. It also means access to water for productive

purposes, access to the economic opportunities afforded by water, and access to water for cultural needs.

Based on data supplied by StatsSA, in the two municipalities (Matzikama and Cederberg) that wholly fall within the boundaries of the Olifants-Doorn Water Management Area, 96.4% of people in the case of the Matzikama municipality and 97.7% of people in the case of the Cederberg municipality have access to water for human consumption. In the Olifants-Doorn Water Management Area access to water for productive purposes is primarily water for agriculture with small amounts to industry (wine cellars) and mining (Namakwa Sands). Access to productive water to emerging farmers has been provided through a project jointly funded by the Department of Water Affairs and the Danish International Development Agency (DANIDA). At least 400 persons in 41 communal projects were given access to water, land and other resources (finance, training, advice). Commercial agriculture in the form of cultivating grapes, citrus, deciduous fruit and potatoes is mature and access to productive water seems never to have been a problem (apart from periods of drought) in that water was provided through various government-funded irrigation schemes. A third category of access to water this project recognises is “access to the economic opportunity afforded by water”. With this is meant the economic activities that are connected to the availability of water for domestic and/or productive purposes. For example, where a reticulation system is installed to provide water services to households an economic opportunity is created for the provision of plumbing services. The availability of water for small-scale irrigation agriculture and livestock farming through the DWAF-DANIDA IWRM project in the Olifants-Doorn Water Management Area created a number of such economic opportunities. These opportunities are in training (establishing food gardens; multi-purpose use of fruit trees; water awareness programmes; community empowerment projects); tap and leak repairs; eradication of invasive alien plants and rehabilitation of eroded river reaches; project management of food gardens in schools and rain-water harvesting facilitation; and groundwater monitoring projects. Assessing the implementation of IWRM in the Olifants-Doorn WMA the following pertaining to access emerges: providing access to water for basic human needs and productive purposes is generally achieved as is providing access to the economic opportunities provided by water. In terms of ensuring sustainability the following emerges.

The provisions of Chapter 3 have been implemented in that the water resources in the Olifants-Doorn Water Management Area have been classified and the Reserve has been determined. Although the resource quality objectives (RQOs) have not been determined according to the official guidelines on determining the RQO published in March 2011 (DWAF, 2011), indications of what the RQOs could be are included in the Reserve determinations as well as in the report on the classification process. In short, all the

elements required by the National Water Act to ensure sustainability of the water resources in the Olifants-Doorn Water Management Area are in place. However, no evidence has been found of a systematic implementation of the recommendations contained in the State of the Rivers Report (Olifants/Doring and Sandveld Rivers, DEAT, 2006), or the Reserve determinations that were used in the water-licensing process in the Olifants-Doorn Water Management Area since 2006, or that mechanisms to monitor flow and quality have been put in place. This indicates that the progress in identifying the nature and extent of the resource protection measures that is required, is not matched by progress in action to implement the protection measures.

Chapter 6

The project set out to gain an understanding of whether IWRM is implementable and if it is, how one moves from theory to practice or from policy to outcomes. What are the factors that facilitate or constrain the implementation of IWRM? Since 1994, water resource management in South Africa has undergone a major transformation, and tracing the evolution of IWRM in South Africa, indications are that the Department of Water Affairs has mostly got it right.

Measured on the policy-outcome-continuum of constitutional imperatives-policy-legislation-regulations-strategies-plans-methodologies-capabilities-ethos-implementation-outcomes, the dearth of positive outcomes seems to be mostly laid at the door of the ethos in the Department. Most of the data indicate that there is a hesitancy to implement, a fear of making a mistake. This conclusion seems to be supported by anecdotal evidence (Schreiner, 2013) and by the views of ex-employees of the Department (Jonker et al., 2010).

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CHAPTER 1
IWRM theory – practice/policy outcomes

1.1. Interrogating IWRM

The research presented in this document interrogates integrated water resource management (IWRM) as a feasible approach to water management. In general, the research interrogated the narratives about the transfer of IWRM theory to IWRM practice, about the shift from IWRM policy to the implementation of IWRM. Specifically, the research interrogated the following: (a) the concept of integrated water resource management; (b) whether IWRM can be implemented; (c) the nature of the regulatory environment for water management and whether the regulatory environment in South Africa is enabling or disabling for implementing IWRM; and (d) the roll-out of the post-1994 water policy in the Olifants-Doorn Water Management Area as an example of IWRM implementation.

1.2. Evolution of integrated water resource management

Often when reading about integrated water resource management one is left with the impression that this has been the approach to water resource management ever since water management as an activity became necessary. However, in the past there had been a different approach to water management. The approach to water management prior to the acceptance and promotion of integrated water resource management can be referred to as fragmented water management, supply-oriented water management or traditional water resource management and the narrative of IWRM seems to suggest that first there was traditional water resource management and then there was integrated water resource management. Traditional water resource management would entail predicting demand, and looking for water resources to develop in order to supply the demand through the construction of dams and reticulation systems.

Allan (2006) identifies five water management paradigms that influenced water resource management. The first (before the Industrial Revolution) is when water was required for domestic and livelihood purposes and the source of the water was localised. The second paradigm (19th to mid-20th century) is referred to as the “hydraulic mission”. During this paradigm science and engineering played a central role in water management. There was the sense that nature can be controlled and governments, agricultural interests, power generators and other big water users all scrambled to secure water for their constituencies. The third paradigm (late 1970s through to 1980s) raised the matter of environmental security, the notion that nature cannot be controlled and the idea that environmental water

requirements are paramount. The 1990s brought the realisation that water is an economic good, that it has an economic value, and that water needs to be allocated efficiently. In this fourth paradigm, economic principles are dominant. The fifth paradigm (which rose to prominence starting 1992 through the Dublin and Rio conferences) posits that water resource management is a political process. Allan's exposition of the evolution of water resource management shows that the water resource management of today subsumes all the paradigms. Water resource management today includes elements of localised water provision, of the hydraulic mission, of environmental security, of economic efficiency and political expedience, and this might explain why integrated water resource management is such a complex assignment.

1.3. The push for integrated water resource management

Integrated water resource management as an approach to water management was put on the international water agenda at the UN Conference on Environment and Development in Dublin in January 1992 and further elaborated at the Rio Conference in July 1992 where the main outcome was Agenda 21 (UNEP, 1992). According to some authors, the IWRM narrative is not a new one. Water management actions of, for example, the Tennessee Valley Water Authority are usually cited as examples of IWRM practices. Although the examples often cited as water management actions could be classified as being IWRM, it is from 1992 onwards that there was a concerted effort to initiate and maintain a global dialogue of IWRM as an approach to water management. Promoting IWRM as the preferred approach to water resource management was so vigorous that at times it was called "the new holy grail" of water management (Merrey, 2008), the panacea (Meinzen-Dick, 2007) of/to water management, a buzzword (Van der Zaag, 2005) and a nirvana concept (Molle, 2008).

The international push for IWRM was pursued through the establishment of the World Water Council and its tri-annual World Water Forums and through the establishment of the Global Water Partnership (GWP), together with its regional offices and country water partnerships, for the promotion of the IWRM dialogue and to encourage transformation of water policies to policies that are IWRM-friendly. In addition to the regional GWP offices promoting IWRM, regional political groupings (Southern African Development Community and European Union) were also encouraging member states to accept IWRM as their water management paradigm. The Southern African Development Community (SADC) reaffirmed its commitment to IWRM as its approach to water resource management for the region in a document titled "Regional Strategic Action Plan on Integrated Water Resources Development and Management" (2011-2015) (SADC, undated), generally referred to RSAP

III. The European Union set out its approach in the European Water Framework Directive (2000). In the SADC IWRM policy was extensively promoted and lobbied for by the GWP as indicated above. In addition, a network of academic institutions called WaterNet offered training (Jonker et al., 2012) and contributed to the IWRM knowledge base through research (Van der Zaag, 2007).

1.4. Ambivalence towards integrated water resource management

In the introduction to the 2004 National Water Resource Strategy the then Minister of Water Affairs and Forestry, Ms Buyelwa Sonjica, wrote: ”As enshrined in the National Water Act, integrated water resources management is intended to enable us to meet the needs of our people for water, jobs and economic growth in a manner that also allows us to protect and where necessary, rehabilitate our aquatic ecosystems” (p.6). The National Water Resource Strategy is informed by the 1997 Water Policy and the National Water Act of 1998 and is a most powerful statement of the intention that water management practices in South Africa will follow an IWRM approach.

However, IWRM has come under strong criticism in recent years. Questions about the utility of IWRM as an approach to water management have been raised in a number of publications (Walther, 1987; White, 1998; Jewitt, 2002). Biswas (2004) wrote a scathing critique of IWRM. He asserted that as an approach to water management it was impossible to implement. Biswas stated that: “What is now needed is an objective, impartial and non-dogmatic assessment of the applicability of integrated water resources management” (Biswas, 2004:255). This echoes the view of White (1998) who wrote: “it is a sad fact that the number of truly incisive and comprehensive post-audits of completed water management efforts is very small”. In 2008 Biswas repeated the view that IWRM cannot be implemented. In the same year Merrey wrote “it is time to abandon Integrated Water Resources Management (IWRM) as a guide for implementation” (Merrey, 2008:899). This opinion of Merrey is significant because in a previous article (Merrey et al., 2005) he was still of the opinion that IWRM could be implemented.

In contrast to the above authors who claim that it is impossible to implement IWRM, there are authors who are of the opinion that, even though implementation is uneven and often elusive, it is possible to implement IWRM (Swatuk, 2005; Jonker, 2002, 2007; Van der Zaag, 2005; Koudstaal et al., 1992; Jeffrey and Gearey, 2006). The development of the 1997 White Paper on a National Water Policy for South Africa was an open process with extensive public participation and the final product was widely applauded and accepted by the stakeholders in the water sector. However, questions remain whether the policy and thus

IWRM have resulted in changing water management practices. Regular reports appear in newspapers about the deteriorating quality of the water in the rivers of South Africa as well as reports of increasing civil unrest caused by a lack of service delivery. This seems to indicate that water management has failed.

1.5. Summary and conclusion

In addition to Chapter 1, five more chapters form part of this report. Chapter 2 elaborates the IWRM concept, while Chapter 3 unpacks the claim in the literature that IWRM cannot be implemented. Chapter 4 interrogates the nature of the policy and regulatory environment in South Africa and Chapter 5 assesses the roll-out of the water policy in the Olifants-Doorn Water Management Area. Chapter 6 presents a naïve model as a way to implement IWRM. The references cited in the text appear in the reference list (Section 7).

CHAPTER 2

Conceptualising integrated water resource management

2.1. The meaning of integration

According to the *Oxford English Dictionary* integration means the "action of combining things to form a whole". Thus when trying to formulate a conceptualisation of IWRM, one needs to identify two or more "things" relevant to water resource management that can be "combined" and which then would result in some new "whole". These "things", for the purpose of developing IWRM theory, are words, terms or concepts that take on specific meaning related to water resource management. Key concepts can be identified "using existing theory or prior research" (Hsieh and Shannon; 2005) or the "relevant literature" (Kondracki, 2002). This study uses Chapter 18 of Agenda 21 (UNEP, 1992) to identify and define the key concepts pertaining to integrated water resource management. The key concepts are then validated using definitions of integrated water resource management from the literature (Agarwal et al., 2000; Merrey et al., 2005; Ballweber, 2006).

2.2. Construction of the concept IWRM

Chapter 18 of Agenda 21 is titled "Protection of the Quality and Supply of Freshwater Resources: Application of Integrated Approaches to the Development, Management and Use of Water Resources Section 18.1 is a short description of the hydrosphere and factors that impact on it. Section 18.4 is a very short description on transboundary water resources and the issues that are of importance to riparian states. Section 18.5 lists seven programme areas.

In order to identify the key concepts in Chapter 18 of Agenda 21, sentences or phrases that explain and expand the meaning of that particular section were extracted, put in a table and the words with the same meaning printed in bold type. Words that appear in bold print in the description of each section contribute to identifying and defining a key concept. To arrive at an appropriate conceptualisation of integration in water resource management, four (or more?) definitions of IWRM were tabulated and compared to concepts consistent with those contained in Chapter 18 of Agenda 21.

Source	Descriptions
Agenda 21 Chapter 18 section 18.2 (1992)	The general objective is to make certain that adequate ***supplies of water*** of good quality are maintained ***for the entire population*** of this planet, while **preserving** the hydrological, biological and chemical **functions of ecosystems,**
Agenda 21 Chapter 18 section 18.3.	The gradual **destruction and aggravated pollution of freshwater resources** in many world regions, along with the progressive **encroachment of incompatible activities** demand integrated water resources planning and management. The multisectoral nature of water resources development in the context of socio-economic development must be recognized, as well as **the multi-interest utilization** of water resources.
Agenda 21; Programme area A: Integrated water resources development and management. Section 18.8.	**Water resources have to be protected**, taking into account the functioning of the aquatic ecosystem and the perennially of the resource, in order to satisfy and reconcile **needs for water in human activity**.
Agenda 21: Programme area B: Water resources assessment. Section 18.23.	Water resources assessment, including the identification of potential sources of freshwater supply, comprises the continuing determination of sources, **extent, dependability and quality of water resources** and of the **human activities** that affect those resources.
Agenda 21; Programme area C: Protection of water resources, water quality and aquatic ecosystems. Section 18.36.	The complex interconnectedness of freshwater systems demands that freshwater management be holistic and based on a **balanced consideration of the needs of people and the environment**.
Agenda 21 Programme area D: Drinking-water supply and sanitation. Section 18.47 and 18.48.	Safe water-supplies and environmental sanitation are vital for **protecting the environment**, improving health and alleviating poverty. Safe water is also **crucial to many traditional and cultural activities**. **Protection of the environment** and safeguarding of health through the integrated management of water resources and liquid and solid wastes
Agenda 21: Programme area E: Water and sustainable development. Section 18.57.	The development objective of this programme is to support local and central government's efforts and **capacity to sustain national development and productivity** through **environmentally sound management** of water resources **for urban use.**
Agenda 21: Programme area F: Water for sustainable food production and rural development. Section18.68.	Water resource management must be developed within a comprehensive set of policies for **(i) human health; (ii) food production**, preservation and distribution; (iii) disaster mitigation plans; (iv) **environmental protection and conservation of the natural resource base**.

When scrutinising the descriptions column of the table, phrases with similar meanings are: supplies of water of good quality are maintained for the entire population (section 18.2); the multi-interest utilisation (section 18.3); needs for water in human activity (section 18.8); human activities (section 18.23); balanced consideration of the needs of people and the environment (section 18.36); many traditional and cultural activities (section 18.47); for urban use (section 18.57); human health and food production (section 18.68). All of the phrases point to water that is to be used for the benefit of people. Access to water therefore seems to be a key issue and thus a key concept in water resource management. One of the "things" to be combined in the integration of water resource management is access.

Further analysis of the descriptions column of the table yields the following phrases alluding to the same outcome: functions of ecosystems (section 18.2); destruction and aggravated pollution of freshwater resources (section 18.3); water resources have to be protected (section 18.8); quality of water resources (section 18.23); balanced consideration of the needs of people and the environment (section 18.36); protecting the environment (section 18.48); environmentally sound management (section 18.57); environmental protection and conservation of the natural resource base (section 18.68). All of the phrases in this paragraph point to the protection of the environment. The purpose for protecting the environment is to ensure that it is sustained and sustainability is therefore a key concept in water resource management. Sustainability can thus be regarded as the other "thing" that can be combined in the integration of water resource management.

Continued scrutiny of the table for more phrases does not yield more new concepts.

In constructing the concept integrated water resource management using the *Oxford English Dictionary* as a guide, the "things" that need to be combined to form the "whole" seems to be access and sustainability.

Applying the same methodology used above to the analysis of definitions from the water resource management literature, yields the same result as the analysis of Chapter 18 of Agenda 21, as shown below:

Agarwal et al. (2000)	IWRM is a process which promotes the co-ordinated development and management of water, land and related resources, in order to ***maximize the resultant economic and social welfare in an equitable manner*** without compromising the **sustainability of vital ecosystems**.
Merrey et al. (2005)	IWRM is the promotion of human welfare, especially the ***reduction of poverty and encouragement of better livelihoods and balanced economic growth***, through effective, democratic development and management of water and other natural resources at community and national levels, in a framework that is equitable, sustainable, transparent, and as far as possible **conserves vital ecosystems**
Ballweber (2006)	IWRM supersedes traditional multi-purpose natural resources management by explicitly encompassing ***societal goals*** and **ecosystem functions**.

The first issue that can be identified from the definitions is that of providing access to water (*supplies of water for the entire population; maximize the resultant economic and social welfare in an equitable manner; reduction of poverty and encouragement of better livelihoods and balanced economic growth; societal goals)* and providing access tends to pull water out of the resource (river/lake/aquifer). The second issue that can be identified from the definitions is that of ensuring sustainability (*preserving functions of ecosystems;*

sustainability of vital ecosystems; conserves vital ecosystems; ecosystem functions) and ensuring access tends to keep water in the resource (river/lake/aquifer).

Analysis of Chapter 18 of Agenda 21 as well as analysis of the definitions from a small selection of articles from the IWRM literature seems to yield the same result: the key issues and thus the key concepts in IWRM are access and sustainability. In water resource management then, it seems that the two "things" that need to be "combined" to form a "whole" are providing access and ensuring sustainability. For the purpose of this study thus, integrated water resource management means simultaneously achieving the two seemingly contradictory objectives of providing access and ensuring sustainability.

2.3. Elaboration of the key concepts access and sustainability

2.3.1. Sustainability

According to the *Oxford English Dictionary* sustain means "to keep (something) going over time or continuously". This meaning is consistent with the notion of sustainability of the water resources implying keeping the resource going over time or continuously. The elaboration of sustainability is based on the ideas contained in a paper by Broman, Holmberg and Robert (2000) titled "Simplicity without reduction: Thinking upstream towards the sustainable society Broman et al. (2000) use the natural laws of conservation of matter and thermodynamics to derive what they call the System Conditions for Sustainability. System earth is a closed system as far as matter is concerned. This means that matter cannot be destroyed or created but is continuously recycled through a myriad of different bio-geochemical cycles (nitrogen cycle, carbon cycle, etc.). As far as energy is concerned, system earth is an open system with energy continuously entering the system as sunlight and continuously leaving the system as heat. Energy and matter are joined in that the flow of energy through the system drives the bio-geochemical cycles. The energy changes from one form to another and in the process produces the different products of each bio-geochemical cycle. It is this flow of energy through the system that maintains the quality of the resources in ecosystems. Disruptions of the bio-geochemical cycles cause pollution (recycling bottlenecks) which, when left unattended threatens sustainability. People have no effect on sunlight (incoming energy) but they can have an effect on the bio-geochemical cycles (i.e. functions in the ecosphere) (Broman et al., 2000).

The focus of the System Conditions for Sustainability is on the causes of disruption in the bio-geochemical cycles. According to Broman et al. (2000) there are three of these system conditions and "for society to be sustainable, the ecosphere must not be systematically subject to

(1) increasing concentrations of substances from the earth's crust,
(2) increasing concentrations of substances produced by society,
(3) impoverishing physical manipulations or overharvesting"

For the purpose of this study, the third system condition (cause) is separated into two distinct conditions (causes), namely:
(4) impoverishing physical manipulation; and
(5) overharvesting

The above is the formulation for ecosystems in general. When referring to water one can relate the above criteria to the water-related determinants of ecosystems of Falkenmark (2003). Falkenmark (2003) identified three water-related human actions that disturb ecosystems. They are:
(1) Flow-control measures to fit flow seasonality to water demand seasonality.
(2) Land-cover changes influencing soil permeability and rainwater partitioning, and consequently runoff generation.
(3) Water withdrawals and after-use alterations in terms of consumptive water use and pollution load respectively.

Drawing on the conceptualisations of both Broman et al. (2000) and Falkenmark (2003), it is evident that ensuring the sustainability of water resources will depend on the willingness and ability of humans not to subject water resources to the:
(1) Accumulation of material from the earth's crust (after-use alterations and pollution load).
(2) Accumulation of man-made material (after-use alterations and pollution load).
(3) Impoverishing physical manipulation (flow-control measures).
(4) Over-abstraction (water withdrawals).

When applying the System Conditions for Sustainability to water, the following emerges:
(a) An increase in concentration of materials from the earth's crust results in pollution from primarily cations, anions and trace metals causing eutrophication, acidification, and salinisation.
(b) An increase in concentration of man-made materials results in pollution from biocides, pharmaceuticals, persistent organic pollutants (POPs) and litter (including electronic litter).

(c) Impoverishing physical manipulation of the resource disrupts the water cycle as a result of the canalisation of rivers, construction of dams and removal of vegetation, especially riparian vegetation.
(d) Over-harvesting through over-abstracting and not providing for environmental flows.

Taken together, the four system conditions constitute a framework for the sustainability of water resources. All four conditions must be met since they do not overlap. Scientific methods exist to determine the state of any water resource of each of the conditions. Many of the scientific methods were developed with funding from the Water Research Commission (WRC), Pretoria, South Africa.

2.3.2. Access

Access means “the right or opportunity to use something or see someone” (*Oxford English Dictionary*). In the case of water “the right or opportunity to use something” means the right or opportunity to use water. Access does not refer to the right or opportunity, but to the right and opportunity. Often a situation arises where although the right to access in South Africa is “guaranteed”, the opportunity to use water might not be possible because of the inaccessibility of water for a number of reasons. Water is used for different purposes; this implies that different “types” of access exist. The first type of access would be access to water for basic human needs. This is water for drinking, cooking, personal hygiene and laundry. Normally when reference is made to access to water, access to water for basic human needs is inferred. Another use for which access is required is water for productive purposes. This includes water for agriculture, industry, power generation and mining. A third type of access is access to the economic opportunity afforded by water. These opportunities are of different kinds. For example, if a municipality expands its reticulation network or installs a new water reticulation network, an opportunity is created within the municipality for a plumber to install and maintain the infrastructure. The lake created by the impoundment might afford opportunities for fishing and recreation. A fourth type of access is access to water for cultural purposes. Examples of where water is used for spiritual purposes is in the tea ceremony in Japan, blessing of the harvest in Bali, initiation of the Shinto priests in Japan, baptism at the Jordan River and funeral rites at Varanasi. Each of these events are shown as short (approximate 3 minutes) video clips on a CD titled *Water: The Drop of Life* produced by UNESCO-IHE, Cap-Net, Taiwan International Institute for Water Education, World Bank Institute UNESCO and UNU/INWEH. The four dimensions of access to water, namely access for basic human needs, access to water for productive purposes, access to the economic opportunities afforded by water, and access to water for cultural purposes are the access equivalence to the four system conditions for sustainability.

2.4. Activities to achieve integrated water resource management

Integration means the “action of combining things to form a whole” and in Chapter 2 it is argued that in water resource management what needs to be combined is providing access to water while at the same time ensuring the sustainability of the resource. The access-sustainability trade-off sufficiently addresses the issue of integration. By achieving the twin objectives of access and sustainability through integrated water resource management it is hoped that there will be a significant improvement in the quality of life of especially the marginalised groups in society. Despite having access to water, many communities and households remain vulnerable to the consequences of water scarcity. Because of the persistence of vulnerability there are expectations that integrated water resource management will translate into increased equity, reduced vulnerability and enhanced resilience, succeeding where in the past traditional water resource management has failed. To achieve integrated water resource management, water users should focus their activities on the following four domains:

The first domain is resource protection. Ensuring that a sufficient volume of water of good quality is available to provide access and ensure sustainability places an obligation on society to protect water resources. Water resources can be protected by taking actions directed at the resource. In addition, resource protection can also be achieved by actions directed at the source of the problem. Resource protection is therefore a critical activity in water resource management. The key question that water users should ask themselves is: what are the required actions to ensure that water resources are protected from abuse?

The second domain is appropriate land use. Water use is inextricably linked to land use. This implies that more often than not, in order to address the water-management issues appropriately, the land-management issues must be taken care of as well. Natural environments have evolved over millions of years and it is accepted in conservation biology that ecosystems with higher biodiversity are more resilient than ecosystems with lower diversity. In modern times, land use and land-use changes are geared towards improving the livelihoods and the quality of life within the social system. Often, the land-use change decreases biodiversity and thus ecosystem resilience. Land-use changes also change catchment characteristics and this has a major influence on surface runoff, infiltration and sub-surface flows and thus access and sustainability. The river continuum concept proposes that the state of the river at a particular point is a function of the state of the catchment upstream of that particular point. The implication of this is that whilst land-use practices might seem to have very limited in situ impact on the water resource at specific places in the catchment, the cumulative impact might be devastating. The key question that water users

should ask is: What are the land-use practices that compromise the sustainability of water resources in a catchment; and at what stage in the life of a catchment do my land-use practices cause the compromises to be irreversible?

The third domain is optimal water use. The efficient use of water contributes to providing access and ensuring sustainability in that more can be done with the same volume of water. Water-use efficiency refers either to efficient use or to efficient allocation. Efficient use is about using water sparingly by employing water conservation and water demand management measures in every water use. Efficient allocation is about giving water to the user that generates the highest value from a given volume of water. A common example is the water-use efficiency of agriculture compared to, say, industry. The economic value derived from a volume of water in industry is claimed to be more than the value derived from the same volume in agriculture. Collectively we speak of optimal water use. The key question water users should ask is: Am I using water conservation and water demand management tools to optimise my water use and is my water use the most efficient possible?

The fourth domain is governance. Governance is a major issue in water management. Previously, governance was understood to mean “what governments do” (Rhodes, 1996). However, water governance by governments was perceived to have become inefficient and ineffective and the belief grew that new ways of governing water needed to be found. This study accepts governance to have two meanings. One is resource governance (especially natural resource governance) which entails “the state making and enforcing laws (legitimate coercive power/exercising control), giving some direction to citizens’ behaviour (maintain public order and facilitate collective action/coordination) and providing services to citizens (authoritatively allocate resources)” (Jonker et al., 2010). The second is corporate governance which often in the water sector is referred to as good governance. Corporate governance deals with issues of transparency and accountability (Jonker et al., 2010). The key question water users should ask is: What approaches to water governance will facilitate the provision of access and ensure sustainability?

2.5. Conclusion

At the heart of successful water management is the need to strike a balance between access to water and sustainability of the resource as set out in Chapter 18 of Agenda 21 and agreed on by the international community. In a scenario of increasing anthropogenic demand on water resources and the concomitant increase in water scarcity, these two demands on the resource appear to be contradictory.

Conceptualising integrated water resource management as the access-sustainability trade-off with four domains of resource protection, appropriate land use, optimal water and governance, allows for the different water sub-sectors to remain focused on what is best for that particular sub-sector while at the same time providing sufficient guidance on how to achieve the water management outcomes. For example, two water sub-sectors might need different resource protection measures, different land-use practices, different water-use efficiency measures and different governance arrangements. Because their objectives are the same, integration is achieved since the outcomes (providing water for basic human needs within its area of jurisdiction, providing water for productive purposes, providing access to the economic opportunities afforded by water and ensuring sustainability by preventing the accumulation of materials from the earth's crust in the resource, preventing the accumulation of man-made materials in the resource, preventing impoverishing physical manipulation of the resource and preventing over-abstraction) of their water management practices will be the same.

CHAPTER 3

Integrated water resource management: attempting to implement the impossible

3.1. Introduction

Although IWRM, according to some authors (Biswas, 2004; Snellen and Schrevel, 1999), is an idea that has been around in water management for approximately 60 years, it was placed firmly on the water management agenda in January 1992 at the International Conference on Water and the Environment in Dublin (ICWE, 1992). The prominence of IWRM as an approach to water management was given further impetus at the Earth Summit in July 1992 in Rio de Janeiro and by the subsequent establishment of the World Water Council and the Global Water Partnership in 1996. The momentum was maintained through the tri-annual World Water Forums. By the year 2000 IWRM appeared to have been generally accepted internationally by stakeholders in the water sector as the preferred approach to water resource management.

During the same time South Africa experienced a quantum shift in its political landscape. Soon after coming into power in April 1994, the new government embarked on a water law review process that culminated in the publishing of the Water Supply and Sanitation Policy in November 1994, the White Paper on a National Water Policy for South Africa in 1997, promulgation of the Water Services Act (Act 108 of 1997) in 1997 and the National Water Act (Act 36 of 1998) in 1998. The ultimate goal of water management in South Africa as contained in the four documents is summarised on page 5 of the White Paper on a National Water Policy for South Africa as follows: "Some, For All, For Ever, which sums up the goals of: access to a limited resource (some), on an equitable basis (for all), in a sustainable manner, now and in the future (for ever)". This equal emphasis on access and sustainability places the water management regime of South Africa firmly under the banner of IWRM (integrated water resource management).

After the promulgation of the Act the Department of Water Affairs and Forestry set about implementing the policy. This entailed deciding on the boundaries of the water management areas (19 water management areas were originally agreed on (RoSA, 1999)); establishing catchment management agencies (CMAs) (an extensive public participation process was embarked upon culminating in the establishment of nine catchment management agencies of which two were operationalised before the decision was taken to reduce the number of CMAs to nine); developing the National Water Resource Strategy (the First Edition was published in September 2004); formulating regulations and developing methodologies for the

different imperatives of the National Water Act (methodologies to assess river health, to determine environmental flows, to determine the resource quality objectives, and incentive-based regulations such as the Green Drop and Blue Drop Programmes).

As South Africa was embarking on the extensive and extended process of implementing its water policy, questions about the utility of IWRM as an approach to water management was raised in a number of publications (Walther, 1987; White, 1998; Jewitt, 2002; Biswas, 2004). In addition, persistently high numbers of people without access to safe drinking water or decent sanitation and continuous reports of degradation in the quality of water resources in those countries that embraced the IWRM philosophy, lend credence to the increasing discourse on the failure of IWRM of being the solution to the water management problems.

Questions about the utility of IWRM as an approach to water management have been raised in reports on service delivery protests where communities have gone to the streets to assert their right of access to water, in reports on pollution of water resources, as well as in a number of academic publications (Walther, 1987; White, 1998; Jewitt, 2002; Biswas, 2004; Merrey, 2008). Merrey feels so strongly about IWRM not being a useful approach to water resource management that he wrote: “it is time to abandon Integrated Water Resources Management (IWRM) as a guide for implementation” (Merrey, 2008:899). This opinion of Merrey is significant because in a previous article (Merrey et al., 2005) he still thought that IWRM could be implemented. However, these calls to abandon IWRM as an approach come in the absence of any assessment of the implementation of IWRM. White (1998) wrote: “it is a sad fact that the number of truly incisive and comprehensive post-audits of completed water management efforts is very small”. Biswas (2004:255) echoes this view and states “What is now needed is an objective, impartial and non-dogmatic assessment of the applicability of integrated water resource management”. Within a context where the policy, legislative and regulatory environment seem to be enabling for achieving integration (simultaneous pursuit of access and sustainability as conceptualised in Chapter 2) in water resource management and the simultaneous perceptions of the failure of IWRM being implemented, the two questions are:

(a) Is integrated water resource management as an approach to water resource management not being implemented because of being inherently impossible to implement (similar to the construction of a perpetual motion machine)?
(b) Are there other reasons (lack of funding, inadequate human capacity, for example) for IWRM seemingly not being implemented?

To answer these questions, in the words of White (1998), a "(truly) incisive and comprehensive audit(s) of completed water management efforts", or in the words of Biswas (2004), "an objective, impartial and non-dogmatic assessment of the applicability of integrated water resources management" needs to be done. Since 1994, water resource management in South Africa has been transformed from the traditional approach to an approach that has been claimed to be integrated water resource management. Post-1994 water management in South Africa would therefore be an appropriate place to do an audit (White, 1998) or an assessment (Biswas, 2004) of IWRM.

As part of the water reforms, South Africa has been divided into 19 water management areas, each of whom is centred on a major catchment and water within that water management area is to be managed as a whole. The choice of water management area as the unit of analysis is the result of constructing a naïve model of the organisational arrangements in the South African water sector. Selecting the water management area as the unit of analysis, 19 possible cases become available on which to perform an audit. Applying a consistent analytical framework across the same unit of analysis with different characteristics should give an indication of whether integration is achievable in water resource management. The water management area selected for audit in this project is the Olifants-Doorn Water Management Area. The choice of water management area was opportunistic and was guided by the fact that the Department of Water Affairs often uses the Olifants-Doorn Water Management Area as a site to test many of its strategies and methodologies, and also because the author knows the area by virtue of having participated in many of the public meetings called by the Department of Water Affairs in the Olifants-Doorn Water Management Area. Within the conceptualisation of integration, i.e. achieving the twin objectives of access and sustainability (providing people access to water while simultaneously ensuring sustainability of the resource), successful implementation of IWRM would be achieved when people in the Olifants-Doorn have access to water and the resource is sustainable. Is this happening?

3.2. Questioning the utility of integrated water resource management

At the international level as an outcome of the environmental conference in Rio de Janeiro in 1992 the Global Water Partnership was established in 1996 "tasked with creating the analytical framework for the water sector to promote sustainable water resource management" (http://www.gwp.org/en/About-GWP/History/). The GWP approached its task of promoting IWRM following two strategies. One was the development of the conceptual basis of IWRM and the other was the establishment of regional water partnerships (13 regions) to drive its advocacy role in the different regions. A key publication is a technical

report, entitled *Integrated Water Resources Management* (Agarwal et al., 2000) in which a conceptualisation of integrated water resource management is given.

At the regional level the Global Water Partnership – Southern Africa (GWPSA) was established in 2000 with the purpose of assisting countries in the Southern African region to adopt integrated water resource management as the basis of their water management regimes. This is done through advocacy, training and technical assistance in the policy development process. GWPSA works with a range of partners in the region to achieve its objective, one of which is the Southern African Development Community's Water Division. The cooperation with the SADC Water Division ensures consistency in water management approaches across the region.

In South Africa (national level) integrated water resource management was introduced through the Water Law Review Process that was initiated in 1995. This culminated in the publication of the Water Law Principles in 1996, the release of the Water Policy in 1997 and the promulgation of the National Water Act in 1998 (De Coning, 2006). The country was divided into 19 water management areas in 1999 and the process of establishing Catchment Management Agencies started in March 1999 with the proposal to establish the Inkomati Catchment Management Agency (Jonker et al., 2010). The rapid rollout of the water policy slowed down, resulting in nine CMAs established by 2010 with two operationalised by 2005.

While the pro-IWRM narrative was growing at the international, regional and national levels, and while there was hesitant implementation of IWRM, there was a growing narrative that it is impossible to implement IWRM, and that IWRM as a water management regime was a pipe-dream. The narrative doubting the utility of IWRM increased after the publication of a criticism of IWRM by Biswas (2004).

Before attempting an assessment of the implementation of IWRM, an analysis of the criticisms in the literature was done in order to try and unpack the possible reasons why IWRM would not be implementable.

3.3. The criticisms levelled at integrated water resource management

3.3.1. Selecting the sources of criticisms

As IWRM has come under strong criticism in recent years, it was decided to analyse the reasons given by critics. However, it was not easy to select the articles to analyse the criticisms levelled at the application of IWRM or at the IWRM concept. A search in Google Scholar using IWRM as a keyword, resulted in 9 190 titles. To narrow down the number of

search results from which to choose, a secondary search was done using “critique of IWRM” as keywords. The result was 695 titles. From this list, the first article was selected and analysed, searching for reasons why IWRM could not be implemented, then the second article was analysed and so on until no new reasons were identified. This was achieved after 19 articles had been analysed. Data processing was done by compiling a table with the author’s name in the first column and the year the article was published in the second column. Each reason given for why IWRM cannot be implemented becomes a heading of a new column which is added to the table. Once the reason stated by critics has been established, the next article is analysed. If the reason given is the same as those from the previous articles, it is recorded in the appropriate cell of the table. If a new reason is given it becomes a heading of a column.

3.3.2. The criticisms

In total 10 reasons of why IWRM cannot be implemented have been identified. The 10 reasons are: failure to overcome traditional boundaries; impossible to operationalise; does not cover all water management dimensions; lack of measurability; lack of conceptual clarity; inadequate public participation; absence of adaptive management; capacity constraints; problematic IWRM science; and failure to integrate knowledge. The authors and their reasons are depicted in Table 3.1 given below.

Table 3.1: Authors and the reasons why IWRM cannot be implemented

	Author	Year	Failure to overcome traditional boundaries	Cannot be operationalised	Does not cover all water management dimensions	Lack of measurability	Lack of conceptual clarity	Inadequate public participation	Absence of adaptive management	Capacity constraints	Problematic IWRM science	Failure to integrating knowledge	**Total**	Original reasons
1	Antunes et al.	2009	0	1	1	0	0	0	0	0	0	0	2	0
2	Brown	2010	0	0	1	1	0	0	0	0	0	0	2	1
3	Butterworth et al.	2010	1	1	0	0	1	1	1	1	0	0	6	3
4	Chikozho	2008	0	1	0	0	1	0	0	0	0	0	2	0
5	Cook and Spray	2012	1	1	1	0	1	0	0	0	1	1	6	0

	Author	Year	Failure to overcome traditional boundaries	Cannot be operationalised	Does not cover all water management dimensions	Lack of measurability	Lack of conceptual clarity	Inadequate public participation	Absence of adaptive management	Capacity constraints	Problematic IWRM science	Failure to integrating knowledge	**Total**	Original reasons
6	Funke et al.	2007	0	0	0	1	0	0	0	0	0	0	1	0
7	Granit	2012	0	1	0	0	1	0	0	0	1	0	3	0
8	Jeffrey and Gearey	2006	0	1	0	1	0	0	1	0	1	0	4	3
9	Lane	2012	0	1	0	0	1	0	0	0	0	0	2	0
10	Medema et al.	2008	0	1	1	1	1	0	1	1	0	1	7	0
11	Merrey	2008	1	1	1	1	1	0	0	1	0	0	6	1
12	Movik	2012	0	1	0	0	1	0	0	0	0	0	2	0
13	Muller	2010	0	1	0	0	0	0	1	0	0	0	2	0
14	Patrick	2012	0	1	0	0	1	0	0	0	0	0	2	0
15	Pahl-Wostl and Sendzimir	2005	0	1	0	1	1	0	1	0	1	0	5	3
16	Lankford and Cour	undated	0	0	1	0	1	0	0	0	1	0	3	1
17	Merrey et al.	2005	0	0	1	1	0	0	0	0	0	0	2	2
18	Shah and Van Koppen	2006	0	0	0	0	1	0	0	0	0	0	1	0
Total			3	13	7	7	12	1	5	3	5	2	58	14

The data given in Table 3.1 are graphically presented in Figure 3.1.

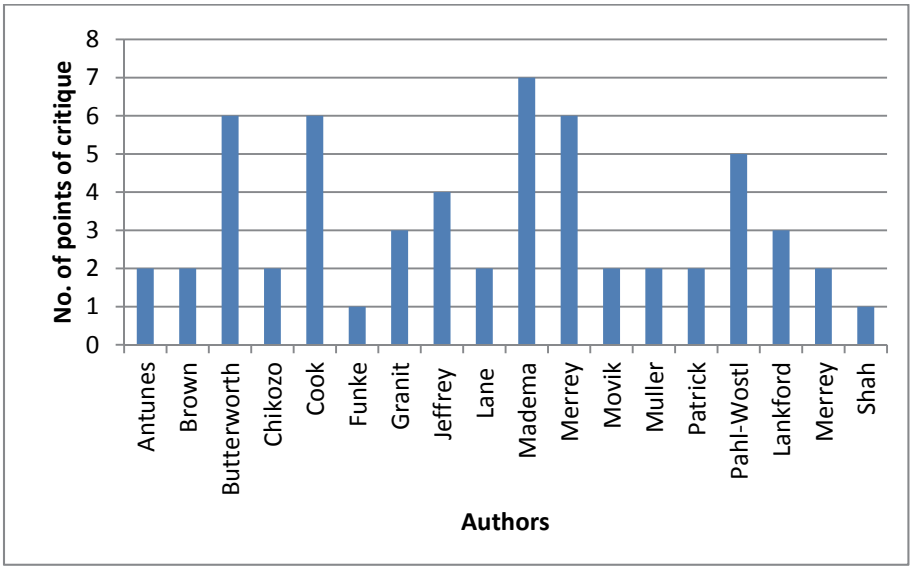


Figure 3.1: Authors and the reasons why IWRM cannot be implemented

From Figure 3.1 the following conclusions are derived:

(a) The most reasons given by any one author is seven (Medema et al., 2008).

(b) Three authors give six reasons (Butterworth et al., 1010; Cook and Spray, 2012; Merrey, 2008)

(c) One author gives five reasons (Pahl-Wostl and Sendzimir, 2005).

(d) One author gives four reasons (Jeffrey and Gearey, 2006).

(e) Two authors give three reasons (Granit, 2012; Lankford and Cour, undated).

(f) Eight authors give two reasons (Antunes et al., 2009; Brown, 2010; Chikozho, 2008; Lane, 2012; Movik, 2012; Muller, 2010; Patrick; 2012; Merrey et al., 2005).

(g) Two authors give one reason (Funke et al., 2007; Shah and Van Koppen, 2006).

The original data table (containing the text from the articles) was analysed to establish how many authors raise unique reasons and how many authors restate reasons stated by others. Seven authors raised original reasons why IWRM cannot be implemented. They are Butterworth et al. (2010), Jeffrey and Gearey (2006), Pahl-Wostl and Sendzimir (2005) with three original reasons; Merrey et al. (2005) with two original reasons; and Granit (2012), Merrey (2008), Lankford and Cour (undated) with one original reason. The 11 remaining authors raised no original reasons.

When ranking the total number of authors per reason, the following emerges:

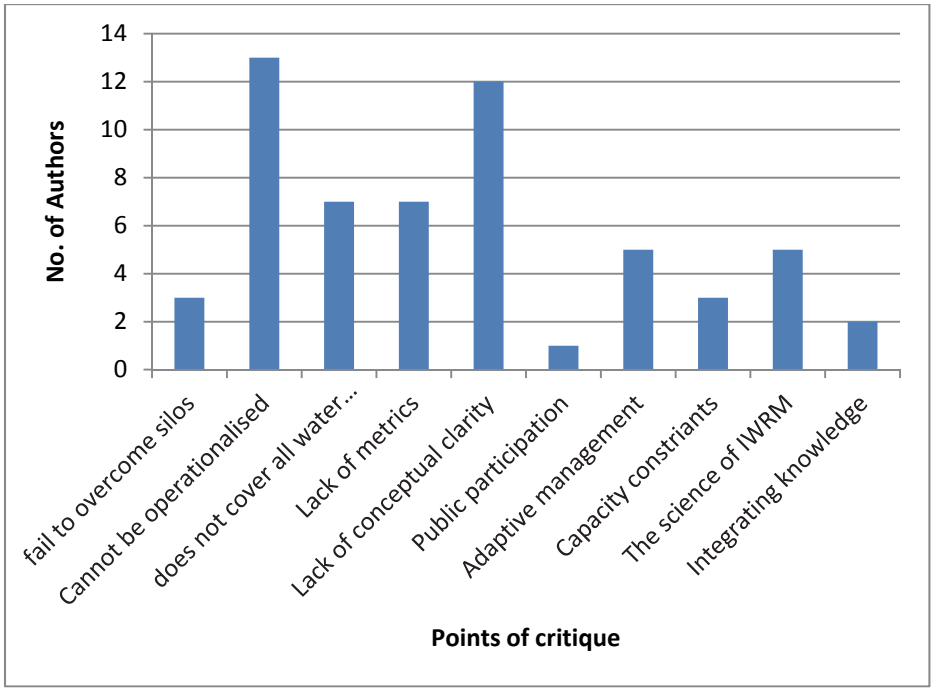


Figure 3.2: Ranking of total number of authors per reason

(a) IWRM cannot be operationalised (13 authors).
(b) Lack of conceptual clarity (12 authors).
(c) Does not cover all water management dimensions and lack of measurability (7 authors each).
(d) Absence of adaptive management and problematic IWRM science (5 authors each).
(e) Failure to overcome boundaries and capacity constraints (3 authors).
(f) Failure to integrate knowledge (2 authors).
(g) Inadequate public participation (1 author).

Of the ten reasons identified from the literature of why there is a failure to implement IWRM, three seem to be inherent to IWRM thereby making it impossible to implement IWRM. The three reasons are: IWRM cannot be operationalised, lack of measurability (IWRM cannot be measured) and problematic IWRM science. The rest of the reasons speak to actions that are to be performed in the process of water management and can therefore be corrected. A reason forwarded as contributing to the failure to implement IWRM is the assertion that IWRM does not cover all water management dimensions. Six authors raise this as a reason and each one conceptualises the water management dimension differently. For Brown (2010) the water management dimensions are the social, economic and environmental dimensions; for Antunes et al. (2009) they are information, assessment and process; for Cook and Spray (2012) they are the natural and human dimensions; for Medema et al. (2008) the dimensions are time, space, multidiscipline and stakeholders; for Merrey (2008)

they are hydrological, ecological, political and developmental; and for Lankford and Cour (undated) the dimensions are problem-focused, service-oriented, responsive and demand-led. The divergent approaches to the conceptualisation of the water management dimension are akin to another reason given for the failure to implement IWRM, namely “lack of conceptual clarity”. Twelve authors list “lack of conceptual clarity” as a reason for the failure to implement IWRM. However, a lack of conceptual clarity can be addressed by deliberately pursuing conceptual rigour as presented in Chapter 2 with the development of the conceptualisation of integrated water resource management. The same could be done with the conceptualisation of water management dimensions. When any reason given for the failure to implement IWRM is conceptual, it should be possible to resolve said reason by pursuing conceptual clarity. When the reason for failure to implement IWRM is systemic, it appears that it would be more difficult to resolve.

The reason “lack of measurability” refers to parameters that must be measured in IWRM and how to measure these parameters. This reason is strongly linked to the reason “problematic IWRM science”. Traditional water resource management is primarily underpinned by natural sciences and hence positivism. Integrated water resource management incorporates knowledge from the natural sciences as well as social sciences. Positivism as a theory of knowledge seems to fall short in dealing with the complexity inherent in water resource management and hence a “new” theory of knowledge to underpin knowledge production in water resource management is needed. It will take some time for any new theory of knowledge to establish itself. This development is not confined to integrated water resource management but is applicable to all transdisciplinary research. As the new theory of knowledge unfolds, the problem of metrics (what to measure) will also be resolved.

Thirteen authors state that “IWRM cannot be operationalised” while 12 authors name “lack of conceptual clarity” as the reasons for the failure to implement IWRM. This is the highest number with the next highest number of authors (7 authors) being in agreement “that IWRM does not cover all water management dimensions and lack of measurability”. A feature of the outcome of the analysis of the number of authors cited per reason shows that 11 of the 13 authors who state that IWRM cannot be operationalised cite the Biswas article published in 2004 and 11 of the 12 authors who state that IWRM suffers from a lack of conceptual clarity cite the same 2004 Biswas article. In the conclusion to the 2004 article, Biswas wrote: “What is now needed is an objective, impartial and non-dogmatic assessment of the applicability of integrated water resource management” (Biswas, 2004:255). Neither Biswas nor any of the 13 and 12 authors gave any indication that their criticism levelled at integrated water resource management was informed by the type of assessment Biswas was demanding in

2004. Rather it appears that Biswas' criticism of IWRM was levelled mainly at the definition of IWRM as proposed by the Global Water Partnership.

3.4. Conclusion

The 18 articles analysed in this study are not all the articles published that are critical of IWRM. Many of the analysed articles cite the reasons stated by other authors in different publications for why IWRM cannot be implemented (at least 36 articles were counted). None of the reasons proposed in the literature to explain the failure to implement IWRM, provide sufficient evidence to conclude that IWRM is impossible to implement.

In the next chapter, the nature of the policy, legislative and regulatory environment is explored to determine whether it is sufficiently enabling to achieve integration in water resource management?

CHAPTER 4
Regulatory framework

4.1. Introduction

The *Oxford English Dictionary* describes enable (enables, enabling, enabled) as “provide with the ability or means to do something” and as “make possible”. For the purpose of this study an enabling policy and regulatory environment means a policy and legislative environment that makes it possible to simultaneously achieve the two seemingly contradictory objectives of providing access and ensuring sustainability.

Prior to 1997, water policy addressed the matter of increasing water scarcity through supply augmentation, as well as water allocation and water resource management as a central bureaucracy through a ministry for water affairs (Backeberg, 1994). At that time the water sector in South Africa was “characterized, amongst others, by an increasing water demand, intensive competition among water uses and users, high rehabilitation requirements for water supply infrastructure, pressing externalities caused by water pollution and the high social cost attached to subsidization of increased water supply” (Backeberg, 2005). What Backeberg had failed to include in the characterisation of the water sector at that time are the gross inequalities in water supply and sanitation services prevalent in South Africa (McDonald and Ruiters, 2005). It is within this context of the above that the post-1994 government of South Africa embarked on the development of a new water policy for water management that addresses the issues of both water services and water quality.

The policy process has been described by De Coning (2006:511) as having gone through the following stages:

- Policy initiation: Water policy development and the political context.
- Policy design: The development of water law principles and objectives (1994).
- Policy analysis: The White Paper on a National Water Policy (1997).
- The statutory phase: Water law drafting and the new National Water Act (1998).
- Policy implementation: Water resource strategies and operational practices.

The transformation of the water law from the process of reviewing the legislation to formulating the fundamental principles and objectives for a new water law to writing a new water policy and finally to promulgating new water legislation was aimed at creating a policy,

legislative and regulatory environment that will effectively address the issues of water services and water quality. At the Second World Water Forum in The Hague, Muller (2000:7) stated:

> "The measure of policy and legislation must be the extent to which it successfully achieves its objectives. To what extent has desirable economic activity been promoted – or hindered; has the state of the environment improved – or deteriorated; have the objectives of equity such as access to services been realised – or has inequity been reinforced*."*

On the policy environment De Coning (2006) writes:

> "It is concluded that the water sector in South Africa has, on the basis of the outcome-based objectives envisaged for water policy and law 10 years ago, met its objectives in establishing the White Paper and National Water Act (1998) and in developing incremental implementation strategies, programmes and institutional arrangements. Respected internationally, very few such fundamental and far reaching policies have been developed anywhere in the world in a democratic context"*.*

From this conclusion an inference would be that by the end of 1998, South Africa had succeeded in creating a policy and legislative environment that would allow it to pursue the developmental, environmental and equity goals (i.e. pursue integration in its water management practices) as expressed by Muller (2000) in The Hague.

However, since about 2004 newspaper reports of increasing dissatisfaction with the level of water provision as well as reports on the deterioration of the quality of South Africa's water resources have raised the question: is the policy, legislative and regulatory environment sufficiently enabling to achieve integration in water resource management?

4.2. Research framework

4.2.1. Approach to the study

The aim of this study is to analyse the policy, legislative and regulatory environment for water resource management. A critical assumption of this study is that governments are ultimately responsible for drafting, promulgating and enforcing legislation, i.e. the responsibility of water governance resides primarily with government (Jonker et al., 2010). These statutory instruments (policies, laws, regulations) are the means through which government communicates to its citizens its intention regarding the management of resources that falls within its ambit (in this study it is water). The data sources for a study

that focuses on the policy, legislative and regulatory environment are primarily texts (documents). The most suitable methodology to analyse data derived from texts seems to be content analysis (Lee and Petersen, 1997). According to Kolbe et al. (1991) “content analysis allows for an unobtrusive appraisal of communications. This unobtrusiveness is particularly valuable in situations in which direct methods of enquiry might yield biased responses”. Morgan (1993) is of the view that a useful feature of content analysis is that it “allows both the quantitative and qualitative analysis of the same text through the use of ‘a consistent set of codes to designate data segments that contain similar material”. It is the occurrence of these codes in a text that can be analysed quantitatively as well as qualitatively (Kondracki et al., 2002). Another benefit of content analysis is that researchers can return to the original text to explore other variables that are identified in the course of the study in order to validate findings (Lee and Petersen, 1997).

The answer to the question “is the policy, legislative and regulatory environment sufficiently enabling to achieve integration in water resource management?” is pursued in the following manner:

(a) Firstly, a coding scheme is devised (White and Marsh, 2006) using keywords (Kondracki, 2002) or key concepts (Hsieh and Shannon, 2005) as variables or categories (Kondracki, 2002; Hsieh and Shannon, 2005; Elo and Kyngas, 2007) and then the data are coded in terms of the coding scheme.

(b) Secondly, the appropriate documents produced by the Department of Water Affairs up to the end of 1998 are analysed in terms of the coding scheme produced in accordance with (a) above and a pronouncement is made on whether the policy environment created up to 1998 was sufficiently enabling to achieve integration in water resource management.

(c) Thirdly, relevant documents produced by the Department of Water Affairs post-1998 are analysed in terms of the coding scheme and a pronouncement is made on whether the post-1998 policy environment is sufficiently enabling to achieve integration in water resource management.

(d) Finally, the 1998 and post-1998 policy environments are compared in terms of whether they are enabling to achieve integration in water resource management.

4.2.2. Analytical framework

Devising the coding scheme requires keywords or key concepts. The first concept is integration. According to the *Oxford English Dictionary,* integration means “action of combining things to form a whole”. In water resource management the two “things” that are combined is access and sustainability as elaborated in Chapter 2. The second concept that

needs elaboration is enabling environment, because it will guide which text to sample. The conceptualisation of what an enabling environment entails is derived from the work of Lusthaus et al. (2002) who posit that the performance of an organisation is a function of its operational environment. The operational environment can be regarded as either enabling or disabling. If the operational environment is enabling, the organisation should be successful whereas if the operational environment is disabling the organisation will fail. With this conceptualisation of an operational environment, a measure has been created with which to interrogate the nature of an organisation's operational environment.

The analytical framework is derived and adapted from the description of the enabling environment by Lusthaus et al. (2002). The operational environment of any organisation is shaped by three factors namely rules, capabilities and ethos. Rules refer to policies, laws and regulations of society that govern the actions of people. For our purposes we recognise four indicators pertaining to rules, namely political rules, operational rules, credibility of rules and enforcement of rules. Political rules can also be referred to as statutory instruments and the operational rules referred to as non-statutory instruments. Capabilities refer to the combination of resources that allows an organisation to function. For the purposes of this project we recognise five resource types namely human resources, financial resources, capacity building, appropriate technologies and good corporate governance. Ethos refers to the informal rules that operate in organisations and which often determine the manner in which people in organisations behave. For the purposes of this study we recognise two indicators under ethos namely culture and enforcement of culture.

Together the above provide a set of indicators that allows us to understand the contribution of rules and regulations, resource availability and the behaviour of its people on the functioning of an organisation, i.e. whether the operational environment is enabling or disabling. Because the indicators are applicable to general as well as specific environments, it also allows us to compare the operational environments of different and diverse organisations. The factors determining the nature of the organisational environment are depicted in Table 4.1.

Table 4.1: Factors and indicators to assess the operational environment of organisations

Factors	Indicator	Description
Rules	Political rules	Policies, legislation, regulations
	Operational rules	Strategies, plans and methodologies
	Credibility of rules	Acceptance of rules as being fair
	Enforcement of rules	Mechanisms available to implement rules
Capabilities	Human resources	Sufficient and appropriately qualified staff
	Financial resources	Sufficient budgetary provision
	HR development plans	Plans and systems in place to train staff
	Appropriate technology	Required infrastructure in place
	Good corporate governance	Management control systems in place
Ethos	Culture	Values, unwritten rules, work ethic
	Enforcement of culture	Who enforces and how is the culture enforced?

4.2.3. Data analysis

To determine the nature of the policy environment by the end of 1998, four texts were analysed. These were the Water Supply and Sanitation Policy (Department of Water Affairs and Forestry, 1994); the White Paper on National Water Policy (Department of Water Affairs and Forestry, 1997); the Water Services Act (Republic of South Africa, 1997) and the National Water Act (Republic of South Africa, 1998). For the post-1998 policy environment a number of strategy documents were analysed. This was decided on as no new policy documents were released or new acts promulgated after 1998. To determine whether the 1998 and post-1998 policy environments are sufficiently enabling to achieve integration in water resource management, the documents will be assessed in terms of the rules of the operational environment framework. Each document was analysed to ascertain whether it simultaneously speaks to issues of access and sustainability.

4.3. Results and discussion

4. 3.1. Political rules

Document	Year published	Access	Sustainability
Water Supply and Sanitation Policy	1994	√	√
White Paper on National Water Policy	1997	√	√
Water Services Act	1997	√	√
National Water Act	1998	√	√

4.3.2. Water services

The water supply and sanitation rules as contained in the Water Supply and Sanitation Policy and the Water Services Act are clear. The Water Supply and Sanitation Policy states (Department of Water Affairs and Forestry, 1994):

> *South Africa is a land of contradictions and extremes. Nowhere is this clearer than in the distribution of basic services. In a country with nuclear power, cellular*

telephones and vast inter-catchment water transfer schemes, more than 12 million people do not have access to an adequate supply of potable water; nearly 21 million lack basic sanitation. Public action is needed to remedy this unacceptable situation, but it must be action based on a clear policy which is premised on the rights of all people to determine their own future. The goal of Government is thus to ensure that all South Africans have access to essential basic water supply and sanitation services at a cost which is affordable both to the household and to the country as a whole.

The purpose of the Water Services Act is formulated as follows (Republic of South Africa, 1997):

To provide for the rights of access to basic water supply and basic sanitation; to provide for the setting of national standards and of norms and standards for tariffs; to provide for water services development plans; to provide a regulatory framework for water services institutions and water services intermediaries; to provide for the establishment and disestablishment of water boards and water services committees and their powers and duties; to provide for the monitoring of water services and intervention by the Minister or by the relevant Province; to provide for financial assistance to water services institutions; to provide for certain general powers of the Minister; to provide for the gathering of information in a national information system and the distribution of that information; to repeal certain laws; and to provide for matters connected therewith.

The water supply and sanitation policy sets out in detail the South African government's intention pertaining to the provision of water and sanitation services. It addresses, among others, the matter of the quantity of water each household is entitled to (25 litres per person per day) and the maximum distance (within 200 m of a household) water should be carried to the home, the matter of tariffs and tariff options (uniform tariffs, lifeline tariffs, sliding scale tariffs), the matter of service level (waterborne sanitation or Ventilated Improved Pit (VIP) latrine), and the matter of institutional arrangement (who is responsible for what). The pronouncements on access to water supply and sanitation are strong and unequivocal. This is to be expected since this is the National Policy on Water Supply and Sanitation. What is, however, surprising is the strong pronouncement in the policy on sustainability of water resources. The policy is structured on eight policy principles. The eighth principle sets the tone on balancing access with sustainability concerns. Principle eight reads: "It is necessary to ensure that the environment is considered and protected in all developmental activities". This notion of protecting the environment is further expanded on when referring to water.

The policy states: “The Department of Water Affairs and Forestry’s policy on the environment is based on the unity and indivisibility of all aspects of human life and the total environment in which human development occurs. It is therefore a contradiction to talk of sustainable development from the perspective of service provision without ensuring that the environment from which the resource is derived is protected and sustained. In this regard the “indivisibility” of water as a natural resource is clearly evident – each activity or call on the resource has an impact and an effect. Even the simplest and smallest of projects thus requires attention. The concept of water as having economic value should therefore be extended to it also having intrinsic environmental value”.

Not only does the policy make broad pronouncements about sustainability, it also addresses the four system conditions for sustainability fairly explicitly. On over-abstraction the policy states that “abstraction should be sustainable and does not degrade the resource” and that water conservation and demand measures should be part of all developmental proposals “to reduce water usage and the stress on resources”. The other system conditions for sustainability, namely accumulation of materials from the earth’s crust, accumulation of man-made materials, and impoverishing physical manipulation, are addressed in the policy through strong statements on pollution. Examples of such statements are:

- “The environment should not therefore be regarded as a “user” of water in competition with other users, but as the base from which the resource is derived and without which no development is sustainable. Protection and conservation of the natural resource base is therefore imperative”.
- “The contribution of water and sanitation services to development is of course far wider than their impact on households. Water is a key factor of production in manufacturing industry, power generation, mining and agriculture. It sustains the natural environment which is why it is not only the quantity of water available which is critical but also its quality, its fitness for use. For this reason, both sanitation services and economic activities which can pollute water and render it unfit for use must be controlled”.
- Impoverishing physical manipulation is addressed in the policy when pointing out that the sanitation options that require the possible extent of pollution must be assessed

The Water Supply and Sanitation Policy was formulated to create an enabling policy and regulatory environment for providing access to primarily water for basic human needs. The formulation of measures to address over-abstraction and pollution is such that it also creates an enabling environment for integration to be achieved in water resource management.

The rules contained in the Water Services Act have been formulated to address access, primarily access to water for basic human needs. They do, however, demonstrate an awareness of a responsibility pertaining to the protection of the environment by the Department of Water Affairs and Forestry in the role as custodian of the nation's water resources. The Water Services Act also cautions us to be careful when taking water from the resource so as not to leave an environment that is harmful to health or well-being. Furthermore, the Water Services Act addresses the matter of the disposal of effluent on a number of occasions showing the importance attached to the quality of the water resource. However, by far the greatest concern pertaining to sustainability found in the Water Services Act is related to over-abstraction. This is done by calls for water conservation and water demand management measures to be implemented in numerous places in the Act. The Act sees water conservation as so important that it provides for a portion of the tariffs to be used to promote conservation and demand management. Finally the Act emphasises the importance of recycling to reduce demand for water from the resource. From the above it seems clear that although the Water Services Act was formulated to address the matter of inequitable access to water, it expresses the need to achieve sustainability consistently throughout the Act. Because of directing provision of access and simultaneously pushing for ensuring sustainability, it contributes to creating an enabling environment for integration to be achieved.

4.3.3. Water resources

The goal of providing access and ensuring sustainability is stated in the White Paper on a National Water Policy for South Africa (Department of Water Affairs and Forestry, 1997). This goal is captured in the slogan of the Department of Water Affairs and Forestry whose staff members have committed themselves to ensuring: "Some, For All, For Ever", which sums up the goals of:

- access to a limited resource (some)
- on an equitable basis (for all)
- in a sustainable manner, now and in the future (for ever)

The section quoted below and taken from the White paper on a National Water Policy for South Africa spells out the new approach to water resource management. "The National Government is committed to carry out its public trust obligations in a way which:

- guarantees access to sufficient water for basic domestic needs;
- makes sure that the requirements of the environment are met;

- takes into account the interconnected nature of the water cycle – a process on which the sustainability and renewability of the resource depends;
- makes provision for the transfer of water between catchments;
- respects South Africa's obligations to its neighbours; and
- fulfils its commitment as custodian of the nation's water"

The integration requirement of simultaneous access and sustainability is implicit in the quoted extract.

Water for basic needs and environmental requirements is envisaged in the policy to be guaranteed and is thus recognised as a right and is defined as the "Reserve". The concept environmental Reserve speaks to issues of water quantity and water of appropriate quality and for ensuring sustainability in the conceptualisation of integrated water resource management, addresses the matters of over-abstraction, accumulation of materials from the earth's crust and man-made material. The water policy describes in detail the measures that will be legislated to protect water resources. It identifies two categories of measures, namely resource-directed measures and source-directed controls. Resource-directed measures are activities and actions that focus on the resource such as ensuring that sufficient water remains in the resource, that the water quality is in its natural condition or as close as possible to its natural condition and that the bio-geophysical condition of the resource remains undisturbed. Source-directed controls are focused on those human activities that have an impact (normally negative) on the resource. The human activities that negatively impact on water resources are usually those that produce some effluent and physical changes to the resource.

Apart from access to water for basic human needs, the water policy identifies the user sectors for water required for productive purposes. These sectors are agriculture, industry, domestic and municipal users, and recreational and ecotourism uses. The policy is not prescriptive on the measures that should be pursued but argues persuasively that each sector requires a policy framework to ensure that they use water optimally. The linkage between access and sustainability is described in the water policy as follows "New approaches to water management will be needed. These will have to focus on the way in which water is used (efficiency, effectiveness and demand management) in each user sector rather than simply on predicting, planning and supplying its water needs. It will also require a systematic approach to resource conservation, linked to the resource protection policy".

The National Water Act of 1998 gave legislative effect to the content of the water policy. Chapter 3 of the National Water Act is entitled: Protection of Water Resources, and contains the prescriptions on the classification system, classification of water resources and resource quality objectives, the Reserve, and pollution prevention. All of these measures ensure the sustainability of the resource. Chapter 4 of the National Water Act is entitled: Use of Water, and contains the general principles for regulating water use. This is equivalent to being the general principles for regulating access to water for productive purposes and to the economic opportunities afforded by water. The National Water Act is silent on the matter of access to water for cultural purposes.

4.3.4. Meeting the statutory conditions for integration

The focus of the Water Services Act is on providing access to water whereas the focus of the National Water Act is on ensuring sustainability. When looking at these two Acts in combination the access-sustainability linkage is clearly observed. One could thus argue that the conditions for integration have been met and that the policy and regulatory environment create an enabling environment to achieve integration in water resource management. However, the evidence for the access-sustainability link is much stronger than between the Acts in combination. The National Water Services Act speaks to the access and also emphasises sustainability whereas the National Water Act speaks to sustainability and also emphasises access.

In March 2000 at the Second World Water Forum in The Hague, Muller (2000) observed: “A definitive evaluation of such impacts in a field as complex and diverse as water legislation can necessarily only be made over a long period. The preliminary indicators of the response to South Africa’s new water legislation are however encouraging”. The above shows that by August 1998 the policy and legislative environment (political rules) was enabling for integration to be achieved in water management practices in South Africa. This conclusion is consistent with Muller’s assessment at the Second World Water Forum in The Hague.

If the policy and legislative environment were indeed enabling for integration to be achieved, what are the factors that caused the increasing dissatisfaction with the level of water provision and the deterioration in the quality of South Africa’s water resources? Was it a change in the policy environment or did the policy environment not keep track with the political changes, or could there be another explanation? To assess the policy, legislative and regulatory environment post-2004, an analysis of the operational rules must be carried out.

4.4. Operational rules

4.4.1. Introduction

The analytical framework for the sustainability of water resources given in Section 2.3 of this report demands not only political rules for an enabling environment but that there should be appropriate operational rules. A critical operational rule, the National Water Resource Strategy (Department of Water Affairs and Forestry, 2004), was mandated by the National Water Act, Chapter 2, Part 1 (Republic of South Africa, 1998). It took DWAF six years to produce the First Edition of the National Water Resource Strategy. After the publication of the National Water Resource Strategy, new strategies and methodologies, addressing among others, issues of water allocation reform, and growth and development, to operationalise the policy and legislation, were produced at a steady rate.

Four strategy documents have been analysed. Three of these, namely the National Water Resource Strategy, the Strategy for Water Allocation Reform in South Africa and the Water for Growth and Development Framework, address access and sustainability simultaneously and comprehensively.

Document	Year published	Access	Sustainability
National Water Resource Strategy	2004	√	√
A Strategy for Water Allocation Reform in South Africa	2006	√	√
Water for Growth and Development Framework	2007	√	√
Strategic Planning for Water Resources in South Africa	2009	√	√

4.4.2. The National Water Resource Strategy (NWRS)

The National Water Resource Strategy is a non-statutory instrument and its development is mandated by the National Water Act of 1998. The NWRS takes the dictates in the National Water Act and creates a framework to ensure consistent development and management of water resources across the country in demarcated water management areas “in accordance with the requirements of the law” (DWAF, 2004).The NWRS summarises the approach to water resource management as follows: “To give effect to the interrelated objectives of sustainability and equity an approach to managing water resources has been adopted that introduces measures to protect water resources by setting objectives for the desired condition of resources, and putting measures in place to control water use to limit impacts to acceptable levels” (DWAF, 2004). The NWRS displays an appreciation for the twin objectives of access and sustainability when it refers to “interrelated objectives of sustainability and equity”. This approach to water resource management set out in the

NWRS is consistent with the conceptualisation of integration. Not only does the NWRS state that the pursuit is integrated water resource management, it also describes “the strategies, objectives, plans, guidelines and procedures required to implement the provisions of the National Water Act” (DWAF, 2004). The NWRS also states that “This [water resource management] must be done in a manner that ensures that we achieve an acceptable balance between the use of our water resources [access] and the protection of the integrity and diversity of the aquatic environment [sustainability]”.

4.4.3. A Strategy for Water Allocation Reform in South Africa

In the foreword of the document entitled “A Strategy for Water Allocation Reform in South Africa” (Department of Water Affairs and Forestry, 2006), it is declared: “As custodians of the national water resource, the Department of Water Affairs and Forestry must promote the beneficial use of water in the best interests of all South Africans. In order to do this, water allocations must be carried out in a manner that promotes equity, addresses poverty, supports economic growth and provides opportunities for job creation. Moreover, the water allocation process must allow for the sustainable use of water resources and must promote the efficient and non-wasteful use of water”. The document declares: “A primary focus of water allocation processes is to redress past race and gender imbalances in water use” so one would expect it to set out in detail guidelines for and approaches to the allocation of water for productive purposes and the economic opportunities that accompany the availability of water. It also sets out two conditions that must be fulfilled when addressing this imbalance. The first is “after securing water for basic livelihood needs” and the second is “development needs should not be allowed to compromise sustainability”. The quotes given below illustrate the relationship between the developmental needs and sustainability:

> “The water allocation process must give effect to the protection of water resources as outlined in the National Water Act by promoting the phased attainment of both developmental and environmental objectives.
>
> The water allocation process must ensure that the requirements of the Reserve, Class, and Resource Quality Objectives are met.
>
> The evaluation of applications that support the beneficial use of water in the public interest, and that have little impact on the water resource must be expedited.
>
> Once a Reserve and Class has been determined for the resource, then the allocation of water cannot impinge on these”.

The drafters of the Water Allocation Reform Strategy show an appreciation of the importance of expressing a strong opinion on sustainability in a document that is largely written to expedite access. This indicates very clearly that in 2006 the policy and regulatory environment were enabling for integration in water resource management.

4.4.4. Water for Growth and Development Framework

The Department of Water Affairs and Forestry published the "Water for Growth and Development Framework" in 2010. The framework sets out the Department's view on the relationship between water and social development, and water and the myriad of economic activities that is dependent on water. In connection with the relationship between water and economic activity the document states: "The Department's position is that the country's economic growth target cannot be achieved at the expense of the ecological sustainability of water resources or meeting people's human needs". This statement confirms the pronouncements in the policy and the Act of the Reserve (basic human needs and the needs of the environment) being the only right to water. In the 46 pages of the document there are 13 statements on different aspects of social and/or economic development. Each of the 13 statements is linked to a statement on the sustainability of water resources. Some examples are herewith cited as illustration:

> *Government is constantly balancing the escalating and competing demands on the country's limited water resources, ever mindful of the fact that water for social development and economic growth and environmental sustainability are equally important for the success of this country.*
>
> *Sufficient supply of water is a requirement for the country to achieve its economic growth targets. The provision of potable water to every person in South Africa is also a fundamental developmental goal that needs to be facilitated by the department's framework. These two goals must be achieved without compromising the ecological sustainability of water resources.*
>
> *For water to support economic growth without compromising primary needs or ecological sustainability requires adequate planning at a strategic level and in an integrated manner.*

> *The mining sector, a major contributor to the South African economy, presents particular challenges in reconciling the needs for growth with the protection and sustainability of water resources.*

The Water for Growth and Development Framework (Department of Water Affairs and Forestry, undated) probably is the document that explicitly and consistently links a range of social and economic water needs to resource and environmental sustainability, thereby confirming that the policy and regulatory environment is enabling for integration in water resource management.

4.4.5. Strategic planning for water resources in South Africa

The situation analysis contained in the Strategic Planning for Water Resources in South Africa (Van Rooyen and Versfeld, 2009) states the following about sustainability:

> *The water requirements for the ecological Reserve and for basic human needs must be factored into all planning activities, both within the Department and by all other authorities where planned development projects require water. The National Water Act (NWA) and the National Water Resource Strategy (NWRS) make provision for the basic water needs of both people and the environment. It is recognised that making water available only to meet basic requirements is not enough and that improved quality of life must be provided for. Water is needed to grow and sustain the economy, but also to sustain people and livelihoods in achieving a healthy and happy South African society.* (p. 2)

and

> *(iii) Meeting the needs of the environment*
> *The National Water Act demands that environmental standards of rivers be upheld for the sustainability of water resources, and this water requirement must be understood and accepted.* (p.15)

As can be seen from the above, the document acknowledges the importance of sustainability. However, it then proceeds to address future access for the identified growth areas in South Africa without addressing the concomitant sustainability issues.

4.4.6 Operational rules and integration

Four strategy documents published between 2004 and 2009 were analysed to determine whether there has been shift in the water policy in response to the critical reviews of

integrated water resource management and the seeming failure of integrated water resource management as published in the newspapers almost on a daily basis. The National Water Resource Strategy is mandated in the National Water Act and must therefore reflect the directions as contained in the Act. It is thus no surprise that the National Water Resource Strategy simultaneously addresses access and sustainability. The main focus of the other three strategies is on access. The Strategy for Water Allocation Reform focuses on the inequity in access to water for productive purposes and on guidelines and approaches to redress the imbalances. The Water for Growth and Development Framework focuses on access to water for social and economic development. A situational analysis contained in the Strategic Planning for Water Resources in South Africa (Van Rooyen and Versfeld, 2009) reflects the water situation for all major development centres. The Strategic Planning for Water Resources in South Africa contains statements referring to sustainability on two pages and the rest of the document addresses access issues in the major development centres. The Strategy for Water Allocation Reform and Water for Growth and Development Framework contain as many references to access as to sustainability and one can conclude that they address access and sustainability simultaneously. Indications are thus that, in general, the operational rules as contained in some strategy documents of the Department of Water Affairs are sufficiently enabling for integration to happen in water resource management.

4.5. Conclusion

The analysis seems to confirm the generally accepted impression that the South African political and operational rules create an environment that is enabling for integration to occur in water resource management. However, the number of service delivery protests (of which lack of water services forms a part), almost daily newspaper reports of deteriorating water quality of rivers as well as the Department's own Blue Drop and Green Drop reports, indicate that water resource management is failing. The disjuncture between the enabling environment created by the rules and the observed reality seems to indicate that there is more to making the operational environment enabling than rules. The outcome of this assessment seems to justify the two additional factors (capabilities and ethos) in the assessment of the operational environment of water management organisations.

In answering the one question on the enabling nature of the policy and legislation environment, a number of questions about other factors determining whether the operational environment for water management in South Africa is enabling or disabling. These questions pertain to:

1. The need to assess the nature (as enabling or disabling) of the operational environment of not only the Department of Water Affairs but also those of other government departments whose mandate includes some water management function. Because DWA is the custodian of the country's water, the operational environment it creates is applicable to itself as well as all other government departments with a water management function. An overarching enabling environment is a necessary but not sufficient condition for integration in water resource management to be achieved. The enabling environment needs to be replicated in the Department of Agriculture (agricultural water use), Department of Mineral Resources (mining), Department of Energy (power production), Department of Industry (other industrial water use), Department of Tourism (recreation and tourism), Department of Environmental Affairs (environmental use) and the Department of Cooperate Governance and Traditional Affairs and local authorities (domestic water use). The logic here is that IWRM will direct each of these departments to provide access to water for the four purposes within the water sector under its jurisdiction and ensure sustainability in terms of the System Conditions for Sustainability.

2. To formulate and apply the rules the department needs to have the capability. A study of the capabilities available in each chief directorate and in the regional offices seems necessary in order to make a complete assessment of whether the operational environment is enabling or not. This project did not assess the human resources capabilities of the Department of Water Affairs. However, since the governance model of the Department Water Affairs makes provision for bureaucratic governance (doing it themselves), cooperative governance (doing it together with other government departments) and delegated governance (asking someone else to do it), the delegated governance component allows the Department of Water Affairs to buy in expertise from the private sector should they lack the required expertise (Jonker et al., 2010This implies that it should be possible for the Department of Water Affairs to source expertise whenever and for whatever it is required.

3. Since the current Department of Water Affairs in South Africa is a relatively "new creation" (1994), one expects the ethos to be "young" and that it would be shaped over time by the leadership. However, since 1994 the Department has had 5 ministers, two of whom were replaced in mid-term, and four directors-general, two of whom departed the office before the end of their terms of office and one being acting. Given the constant changes in the top echelons of leadership, one expects the developing and unfolding ethos of the Department to be variable, uncertain and vulnerable. The question here is

whether the ethos is indeed variable, uncertain and vulnerable, or whether the chief directorates are facing challenges in terms of capacity constraints due to high staff turnover, or whether they have managed to retain a historical ethos and influence in the Department.

CHAPTER 5
Implementation of IWRM in the Olifants-Doorn WMA

5.1. Introduction

Biswas (2004, 2008) maintains that it is impossible to implement IWRM. Moriarty et al. (2010) are of the opinion that in developing countries IWRM as conceptualised by GWP cannot be implemented, but that "'light' integrated water resource management (IWRM): that is, IWRM that is opportunistic, adaptive and incremental in nature and clearly focused on sustainable service delivery" can be implemented. This chapter reports on an assessment of the implementation of IWRM by the Department of Water Affairs in South Africa in the Olifants-Doorn Water Management Area. The conceptualisation of IWRM is as described in the White Paper on a National Water Policy for South Africa and legislated for in the National Water Act of 1998.

5.2. Conceptual clarity

The second most stated reason why IWRM cannot be implemented is because of a lack of conceptual clarity. Despite the number of authors who consider that IWRM suffers from a lack of conceptual clarity, the Department of Water Affairs seems to have a clear understanding of the IWRM concept and this understanding is in line with the conceptualisation formulated at the Earth Summit in Rio de Janeiro in 1992. Some extracts from the National Water Act (Republic of South Africa, 1998) are presented to illustrate this.

From the preamble:

Recognising that while water is a natural resource that belongs to all people, the discriminatory laws and practices of the past have prevented equal access to water, and use of water resources;

Recognising that the ultimate aim of water resource management is to achieve the sustainable use of water for the benefit of all users;

Recognising that the protection of the quality of water resources is necessary to ensure sustainability of the nation's water resources in the interests of all water users;

From Chapter 1:

Sustainability and equity are identified as central guiding principles.

These guiding principles recognise the basic human needs of present and future generations, the need to protect water resources,

From Chapter 3:

Parts 1, 2 and 3 of this Chapter lay down a series of measures which are together intended to ensure the comprehensive protection of all water resources.

From Chapter 4:

National Government has overall responsibility for and authority over water resource management, including the equitable allocation and beneficial use of water in the public interest.

The extracts quoted above indicate that the Department of Water Affairs understands IWRM to mean providing people with access to water whilst simultaneously ensuring sustainability of the resource.

5.3. Access

Access to water is more than access to water for basic human needs. It also means access to water for productive purposes, access to the economic opportunities afforded by water, and access to water for cultural needs.

Based on data supplied by Statistics South Africa (2012) Table 5.1 below shows that in the two municipalities (Matzikama and Cederberg) that wholly fall within the boundaries of the Olifants-Doorn Water Management Area, 96.4% of people in the case of the Matzikama Municipality and 97.7% of people in the case of the Cederberg Municipality have access to water for human consumption

Table 5.1: Access to water for human needs (Source: Statistics South Africa, 2012)

	Municipality			
Water source	**Matzikama WC011**		**Cederberg WC012**	
	No. of house holds	**%**	**No. of house holds**	**%**
Piped water inside dwelling/institution	13579	72.1	10148	75.1
Piped water inside yard	3624	19.2	2636	19.5
Piped water on community stand: less than 200 m from dwelling	958	5.1	415	3.1
Piped water on community stand: between 200 m & 500 m from dwelling	122	0.6	74	0.5
Piped water on community stand: between 500 m and 1 km from dwelling	27	0.1	46	0.3

Water source	Municipality			
	Matzikama WC011		**Cederberg WC012**	
Piped water on community stand: greater than 1 000 m from dwelling	9	0.0	69	0.5
No access to piped water	517	2.7	126	0.9
Total	18836	100	13514	100

In the Olifants-Doorn Water Management Area access to water for productive purposes is primarily water for agriculture with small amounts to industry (wine cellars) and mining (Namakwa Sands). The White Paper calls this use beneficial use and states: “In plain language ‘beneficial use’ of water is understood to mean the use of water for productive purposes” (Department of Water Affairs and Forestry, 1997:12). The White Paper goes further and implores that water not only be used beneficially but also “optimally” or for “‘best possible use”. Within the Olifants-Doorn Water Management Area emerging farmers have gained access to water through a project jointly funded by the Department of Water Affairs and the Danish International Development Agency (DANIDA). At least 400 persons in 41 communal projects were given access to water, land and other resources (finance, training, advice). Twenty six of the projects are related to agriculture either for small-scale farming (17 projects), food gardens (5 projects) and livestock production (4 projects). The project started in August 2006 and ended in June 2009. This paragraph is not intended to comment on the continuation of any of the projects beyond their close-out date. What is illustrated is that the Department of Water Affairs addressed or is addressing the matter of access to productive water by emerging (new entry) farmers in the Olifants-Doorn Water Management Area.

Existing lawful water use in the Olifants-Doorn (or use that would probably be subject to licensing) entails the following (Department of Water Affairs and Forestry, 2005):

Table 5.2: Water availability to water users

Scheme	Use	Area irrigated (ha)
Olifants River Government Water Scheme	Irrigation Industry Domestic Mining	11 500
Upper reaches of the Olifants River (small dams)	Irrigation	8 600
Elandskaroo Irrigation Board	Irrigation	350
Oudebasskraal Dam	irrigation	320
Upstream of Clanwilliam Dam (small dams)	Irrigation	10 700
Jan Dissels River	irrigation	500

Commercial agriculture in the form of cultivating grapes, citrus, deciduous fruit and potatoes is mature and access to productive water seems never to have been a problem (apart from periods of drought).

A third category of access to water this project recognises is “access to the economic opportunity afforded by water”. This provision captures the economic opportunities that are connected to the availability of water for domestic and/or productive purposes. For example, where a reticulation system is installed to provide water services to households an economic opportunity is created for the provision of plumbing services. The availability of water for small-scale irrigation agriculture and livestock farming through the DWAF-DANIDA IWRM project in the Olifants-Doorn Water Management Area created a number of such economic opportunities. These opportunities are in training (establishing food gardens; multi-purpose use of fruit trees; water-awareness programmes; community empowerment projects – a total of 4 projects); tap and leak repairs (2 projects); eradication of invasive alien plants and rehabilitation of eroded river reaches (2 project); project management of food gardens in schools and rain-water harvesting facilitation (4 projects); and groundwater monitoring projects (3 projects).

Access to water for cultural purposes seems not to be an issue in this particular water management area.

The above indicates that, in general, people in the Olifants-Doorn Water Management Area have access to water for basic human needs, productive purposes and to the economic opportunities afforded by water.

5.4. Sustainability

5.4.1. Conceptualising sustainability

When assessing sustainability, one compares the four system conditions as measured to the natural or reference conditions. From Chapter 2 in this report the four system conditions for sustainability are:

(1) accumulation of material from the earth’s crust
(2) accumulation of man-made material
(3) impoverishing physical manipulation
(4) over-abstraction

Chapter 3 of the National Water Act places on government the responsibility to put measures in place for the comprehensive protection of all water resources. The protective

measures provided by the National Water Act are the classification system, the Ecological Reserve, resource quality objectives, collectively known as resource-directed measures. As the common name suggests these are measures directed at the water. A second set of measures called source-directed controls is aimed at preventing pollution.

5.4.2. The classification system

One of the earliest records that contain ideas on what a classification system could look like, ideas on setting resource quality objectives and how all these and environmental water requirements fit together can be found in a document (still indicated as in a draft form) authored by MacKay (1998), entitled: “Towards a Classification System for Water Resources in South Africa”. The development of a classification system was initiated in 2005 (Department of Water Affairs and Forestry, 2005a) was finalised in 2007 (Department of Water Affairs and Forestry, 2007), gazetted in 2010 (Republic of South Africa, 2010) and the document entitled “Procedures to Develop and Implement Resource Quality Objectives” was finalised in March 2011 (Department of Water Affairs, 2011).

The classification system establishes three classes, namely Class I which is a water resource that is minimally used, Class II which is a water resource that is moderately used and Class III, which is a water resource that is heavily used. Once a class has been assigned to a water resource, the description of the class must include “(a) the extent of the use of the resource, (b) the Reserve, (c) the resource quality objectives and (d) the determination of the allocable portion of the water resource for use” (Republic of South Africa, 2010). Linking the description requirements with the criteria for sustainability of water resources it seems as though requirement (a) (the extent of the use of the resource) and requirement (d) (the determination of the allocable portion of the water resource for use) primarily address impoverishing physical manipulation (see NWA, Chapter 4, section 21 for the definition of water use); while requirement (b) (the Reserve) primarily to over-abstraction and requirement (c) (the resource quality objectives) primarily address the accumulation of material from the earth’s crust and accumulation of man-made materials (pollution).

Apart from proposing three water resource classes, the key recommendation emanating from the assignment to develop the classification system is a 7-step classification procedure (Department of Water Affairs and Forestry, 2007). Each of the seven steps of the classification procedure comprises any number of sub-steps (ranging from 2 to 10 sub-steps). The seven steps are (Department of Water Affairs and Forestry, 2007):

- *Step 1: Delineate the units of analysis and describe the status quo of the water resources.*
- *Step 2: Link the value and condition of the water resource.*
- *Step 3: Quantify the Ecological Water Requirements and changes in non-water quality Ecosystems Goods, Services and Attributes.*
- *Step 4: Determine the Ecologically Sustainable Base Configuration scenario and establish the starter configuration scenarios.*
- *Step 5: Evaluate scenarios with the Integrated Water Resource Management (IWRM) process.*
- *Step 6: Evaluate the scenarios with stakeholders.*
- *Step 7: Gazette the class configurations.*

5.4.3. Implementing the classification system in the Olifants-Doorn Water Management Area

In October 2010 the Department of Water Affairs initiated a project to determine the management classes for the water resources in the Olifants-Doorn Water Management Area. In their final report, the consultants who did the classification in the Olifants-Doorn Water Management Area wrote: “The Management Class (MC) of an aquatic ecosystem will reflect the future desired condition or health of the system, and will be used to guide the amount and quality of water to be reserved for the ecosystem. Deciding on the MC of a system will involve consideration of a broad range of issues and a set of related processes that will include water resources planning, catchment management planning as well as the Classification Process itself. It is important to understand that the product of a Classification Process is the assignment of a management class to water resources within a catchment, i.e. rivers, wetlands, groundwater and estuary. This outcome may influence the water yield that can be utilised from the resource, and indirectly activities within the catchment such as land use” (Department of Water Affairs, 2012).

The implication of the above is that the ecological Reserve is determined once a class has been assigned to the water resource. If the management class is a Class II, it means that less water will be allocated to the environment than if the management class was a Class I.

For the purposes of the classification process, the Olifants-Doorn catchment was divided into seven integrated units of analysis (IUA), namely the Knersvlakte IUA, the Lower Olifants Irrigation IUA, the Olifants/Doorn Dryland Farming IUA, Upper Olifants Irrigation IUA, the Doring Rangelands IUA, the Koue Bokkeveld IUA and the Sandveld IUA. Because the

Sandveld falls outside the Olifants-Doorn catchment boundary it is excluded from this project. An integrated unit of analysis is a designation for the geographical space that contains the biophysical and socio-economic elements pertaining to a specific water resource. Once the IUAs have been selected and delineated, the class configuration of each IUA is determined, either as Class I, II or III. This classification of the bigger unit subsequently has an effect on the classification (catchment configuration) of the quaternary catchments within the IUA. Factors taken into consideration when determining the management class of each of the IUAs that were identified in the Olifants-Doorn catchment are the quantity of water available, the water quality, aquatic ecosystems, the economic activity of the catchment and social status of the people living in the catchment. The class configuration of the Olifants-Doorn Water Management Area was ultimately shaped by the present ecological state as determined in 2006 and the freshwater ecosystem priority areas in the water management areas as determined in 2011 (Nel et al., 2011).

The management class of each IUA is determined at the outflow of the IUA and a specific combination of the management classes of the quaternary catchment contained in that specific IUA add up to that management class. The management classes for the different IUAs in the Olifants-Doorn are as follows:

- Knersvlakte IUA – Class I
- Lower Olifants Irrigation IUA – Class III
- Olifants/Doorn Dryland Farming IUA Class III
- Upper Olifants Irrigation IUA – Class III
- Doring Rangelands IUA – Class I
- Koue Bokkeveld IUA – Class II

The IUAs and the management classes of the different quaternary catchments are depicted in figure 5.1.in the diagram with the heading ‘Management Class’. The purple dots represent the outflow of each IUA and the probable location of monitoring points.

Estuaries occupy an ambivalent position in water resource management. Indications are that although estuaries are at the bottom end of the river they are being managed as “natural” areas rather than water resources. Be that as it may, estuaries do have a significant influence on water resource management in that they will determine the amount of water required to keep them in a desired state. This is the case in the Olifants-Doorn WMA. The Olifants Estuary is important for a number of reasons and the decision was that it should be maintained in a Category C ecological category. This places certain demands on water requirements which the Olifants River cannot provide, because of historical developments in

the Olifants River. The environmental water requirements of the Olifants Estuary must therefore be met from the Doorn River which in turn places a limit on the developments in the Doorn River catchment. To accommodate the water provision to the estuary from the Doorn River, many of the quaternaries in the Doorn catchment have been assigned a Class I (minimally used) classification compared to the River Health Programme assessment in terms of which a significant number of quaternary catchments were assigned a Category C (moderately modified) ecological category. The difference in the classification outcome from the River Health Programme and the Classification exercise is presented in Figure 5.1 below. In the diagrams blue represents Class I, green Class II and orange Class III.

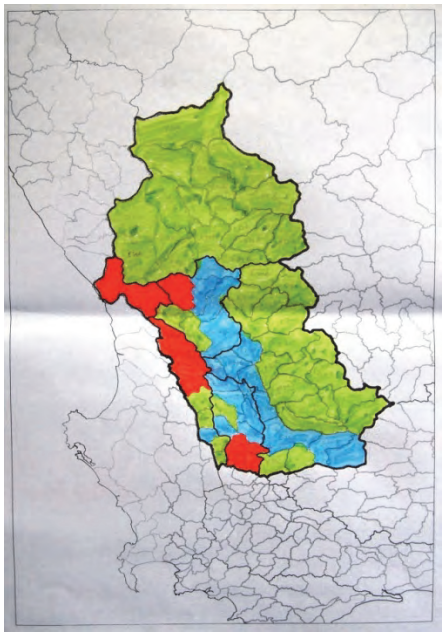
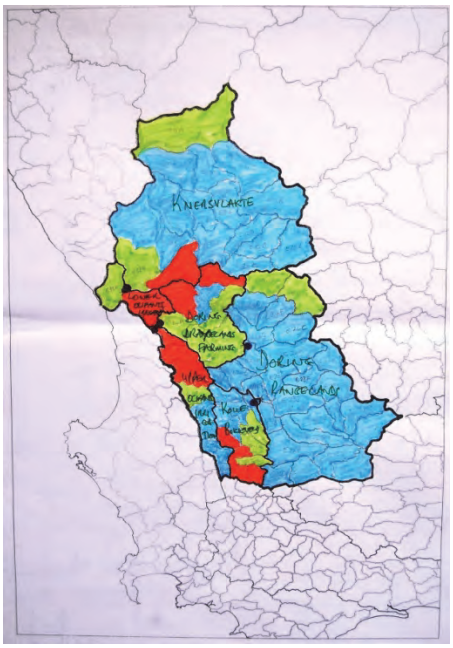
Present ecological state	Management class
	

Figure 5.1: Present ecological state and management class of quaternary catchments. The purple dots represent the outflow of the IUA and the probable location of the monitoring points.

Setting the class of the estuary at a Category C or Class II not only has had an impact on the classification of the resource in the quaternary catchments, it also demands the following special conditions to balance the need to provide access to water to people and the need to ensure sustainability:

- *No large dam or large weir development on the mainstream of the Doorn, Groot and Riet Rivers;*

- *No new licences for water abstraction in summer (low flow) period of the year in the mainstream of the Olifants upstream of the Clanwilliam Dam, Doorn, Groot and Riet Rivers;*
- *Reduction of low-flow abstractions in mainstream of Olifants upstream of the Clanwilliam Dam and increased off-channel storage allowances from 6 000 m^3/ha to 8 000 m^3/ha allocated water use.*

The above special conditions, together with the classification demonstrates an attempt at providing access to productive water (increased off-channel storage, for example) and economic opportunities afforded by water (utilisation of the Olifants Estuary for commercial purposes) whilst at the same time ensuring sustainability (no large dam development) of some parts of the Olifants-Doorn catchment. (For details of the classification process in the Olifants-Doorn WMA, consult the report compiled by Belcher and Grobler (2012) for the Department of Water Affairs).

5.4.4. The River Health Programme

Since 1994, the then Department of Water Affairs and Forestry developed a number of tools to address the issue of sustainability. The River Health Programme initiated in 1994 is one such tool to address the issue of sustainability. The River Health Programme assesses the condition (health) of a river using river-health indices derived from ecological indicator groups. Six such indices have been developed assessing habitat integrity, aquatic invertebrates, riparian vegetation, geomorphology, fish and selected water quality parameters. This classification system created six categories that describe the ecological state and hence the "condition" of a river. The six categories are:

- Category A: Unmodified, or approximates of natural condition.
- Category B: Largely natural with few modifications, but with some loss of natural habitats.
- Category C: Moderately modified, but with some loss of natural habitats.
- Category D: Largely modified. A large loss of natural habitats and basic ecosystem functions has occurred.
- Category E: Seriously modified. The losses of natural habitats and basic ecosystem functions are extensive.
- Category F: Critically modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat.

The outcome of the assessment is interpreted in terms of the criteria given in Table 5.3 and is a measure of the present ecological state of the river (River Health Programme, 2006).

Table 5.3: River Health Categories

River Health Category	Ecological perspective	Management perspective
Natural N	No or negligible modification from natural	Relatively little human impact
Good G	Biodiversity and integrity largely intact	Some human-related disturbances but ecosystems essentially in good state
Fair F	Sensitive species may be lost; tolerant or opportunistic species dominate	Multiple disturbances but ecosystems essentially in good state
Poor P	Mostly tolerant species; alien invasion, disrupted population dynamics; organisms often diseased	High human densities or extensive resource exploitation

The River Health Categories present the first adoption of a classification system to describe the ecological condition of rivers. However, the River Health Programme categories D, E and F are combined into one category in the River Health Categories.

An assessment of the health of the rivers in the Olifants-Doorn Water Management Area was published in 2006 (River Health Programme, 2006). This state of the river report presents the assessment as the current ecological state (EcoStatus) of the river and an envisioned future state (desired state), mostly presenting an improved ecological condition. The EcoStatus and desired state for the Olifants-Doorn Rivers are presented in the figure below:

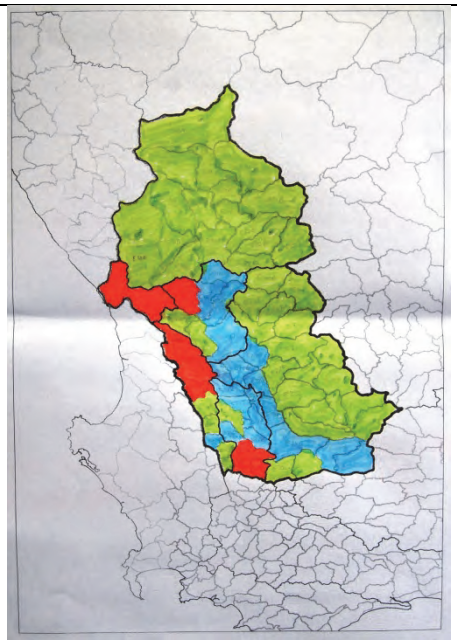
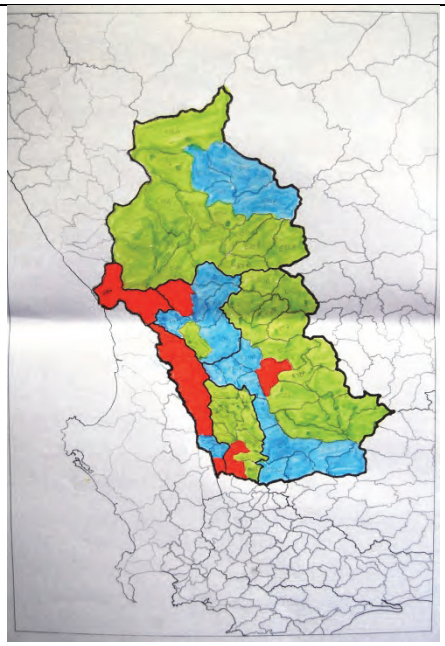
EcoStatus	Desired state
	

Figure 5.2: Comparison of the EcoStatus and desired state of the rivers in the Olifants-Doorn Rivers

In addition to the ecological status of rivers, the state of the river report for the Olifants-Doorn Rivers also identifies the major impacts on the rivers and management actions to counter the impacts. Examples of management actions aimed at the Olifants River are: “reduce the cumulative effects of small farm dams in the catchment; investigate environmental flow release options from the water supply scheme and no further instream dams should be built in the catchment”. Examples of management actions aimed at the Doorn River are: “no further instream dams should be built in this catchment and improve regulation of abstractions in the Doring River tributaries”.

5.5. Achieving integration – implementing integrated water resource management

From the preceding analysis, the following conclusions can be drawn pertaining to achieving integration and thus implementing IWRM in the Olifants-Doorn WMA:

(a) That providing access to basic water is being achieved although in many cases the provision is still from a standpipe more than 200 m away from households. Achieving 96.4% and 97.7% coverage in the Matzikama Municipality and Cederberg Municipality, respectively, is a notable achievement. However, 3.4% and 2.2% of households are without the minimum standard of water supply; although these percentages seem low, they represent 778 and 315 households in the Matzikama and Cederberg Municipalities, respectively. These remain significant inadequacies.

(b) That providing access to productive water is being achieved. For small-scale emerging farmers primarily through general authorisations, and for established commercial farmers through existing lawful use provisions and licences. The sustainability of the emerging farmers remains vulnerable because of the number of participants per project in relation with the size of land allocated to them. This matter must be researched further as a matter of urgency. The classification process also identified additional allocations to certain parts of the Olifants-Doorn WMA that will make a significant contribution to the expansion of agriculture.

(c) The provisions of Chapter 3 have been implemented in that the water resources in the Olifants-Doorn Water Management Area have been classified and the Reserve has been determined. Although the resource quality objectives (RQOs) have not been determined according to the official guidelines on determining the RQOs published in March 2011 (Department of Water Affairs, 2011), indications of what the RQOs could be are included in the Reserve determinations as well as in the report on the classification process. In short, all the elements required by the National Water Act to ensure sustainability of the water resources in the Olifants-Doorn Water Management Area are in place.

(d) No evidence has been found of a systematic implementation of the recommendations contained in the State of the Rivers Report: Olifants/Doring and Sandveld Rivers (River Health Programme, 2006), or the Reserve determinations that were used in the water-licensing process in the Olifants-Doorn Water Management Area since 2006, or that mechanisms to monitor flow and quality have been put in place. This indicates that the progress that is required in identifying the nature and extent of the resource protection measures is not matched by progress in action to implement the protection measures.

In conclusion, there seems to be very little if any evidence that the international criticisms levelled at IWRM, service delivery protests and reports of deteriorating quality of water in rivers have persuaded the Department of Water Affairs that IWRM is not an appropriate approach to water resource management. Although IWRM has been criticised for being a vague and fuzzy concept, the results of this study show that the criticism of the IWRM policy in South Africa is unjustified. The National Water Act of 1998 and the National Water Resource Strategy (Department of Water Affairs and Forestry, 2004) make this clear. There seems to be no evidence that any of the researchers who agree with Biswas (2004) or Biswas himself that IWRM is not implementable, has done “an objective, impartial and non-dogmatic assessment of the applicability of integrated water resources management”. The outcomes of this project show that IWRM is indeed implementable.

However, there is a caveat, as will be discussed in the next section.

5.6. Water resource management and the policy-outcome-continuum

Classification or categorisation is at the core of the search for methodologies or tools for the sustainable management of water resources in South Africa. This is derived from the understanding that different rivers and/or different parts of rivers are in variable condition and hence not all rivers will need the same approach to or level of management, thereby leading to the optimal use of resources allocated to water resource management. The first classification system devised is the one to determine and describe the ecological state/status or condition of rivers.

The similarities between the river health categories and the management classes seem to indicate that the Water Resource Classification System (WRCS) is based on or at the very least, has been significantly influenced by the River Health Programme categories and thus the classification of the ecological status. The similarities are shown in the table below:

Table 5.4: Comparison of the categories of the Water Resource Classification System and the categories of the River Health Programme

Classification System		River Health Programme	
Management class	Description	Description	Category
Class 1: Minimally used	The configuration of ecological categories of the resources within a catchment results in an overall water condition that is minimally altered from its pre-development condition	No or negligible modification from natural Biodiversity and integrity largely intact	Natural (A) Good (B)
Class 2: Moderately used	The configuration of ecological categories of the water resources within a catchment results in an overall water resource condition that is moderately altered from its pre-development condition	Sensitive species may be lost; tolerant or opportunistic species dominate	Fair (C)
Class 3: Heavily used	Configuration of the ecological categories of the water resources within a catchment results in an overall water resource condition that is significantly altered from its pre-development condition	Mostly tolerant species; alien invasion; disrupted population dynamics; organisms often diseased	Poor (D)

The similarities in the categories of the River Health Programme and the management classes of the Water Resource Classification System are further illustrated by the similarities in the outcomes of the assessments based on these systems.

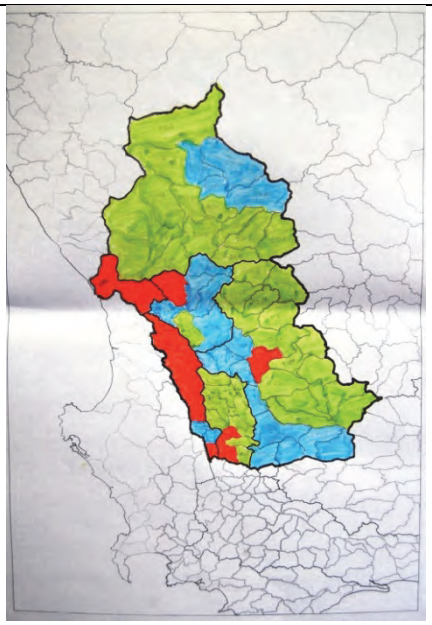
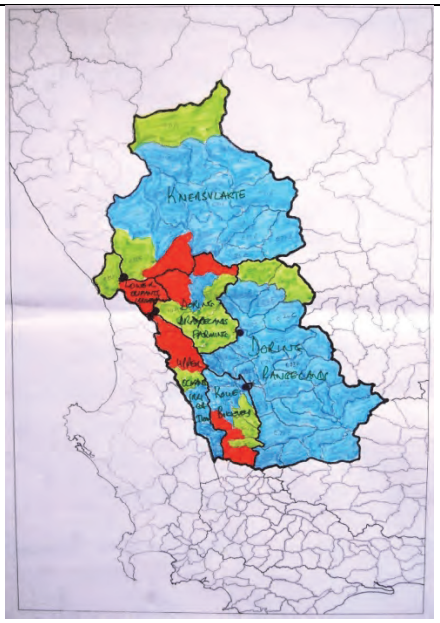
Desired state	Management class
	

Figure 5.3: Comparing the desired ecological state of 2006 with the management classes of 2012

The difference in the Tankwa (sub-catchment of the Doorn) being mostly minimally used according to the Water Resource Classification System and moderately modified in terms of the River Health Programme assessment seems to reside in the fact that the Water Resource Classification System took the freshwater priority areas into consideration whereas the River Health Programme assessment did not (Belcher and Grobler, 2012).

In the Olifants-Doorn, the determination of the Reserve was completed in June 2006 (signed off in July 2008). The River Health Programme developed a classification system which was used in an assessment of the condition of the rivers in the Olifants-Doorn Water Management Area published as a State of Rivers Report in 2006 (River Healt Programme, 2006). This entails an initial classification and resource quality statement. The Water Resource Classification System was completed in 2007 and gazetted in 2010. The completion of the classification in 2012 used the 2010 Water Resource Classification System and the Reserve determinations were based on the environmental flows for the Recommended Ecological Class (as determined in 2006). This varies from an average of 33.5% of MAR for a B category ecological state, to an average of 18.6% of MAR for a C category ecological state, and to an average of 14.5% of MAR for a D category ecological state. “The Olifants-Doorn Catchment was used as a proof-of-concept catchment for the development of the Water Resources Classification System. This means that, although a Classification Process has not been conducted, much of the information required for such a

process has already been generated for the Olifants-Doorn Catchment" (Shippey et al., 2009:35). This long delay between the birth of an idea and the actual realisation of the idea in practice has given rise to the following hypothesis about resource management that requires further research:

1. When confronted with uncertainty, resource managers opt for the more complicated (rather than simple) route as the preferred option. It is as if more complicatedness equals less uncertainty.
2. When encountering uncertainty, resource managers insist on more science to direct decision rather than using the existing science and keep an open mind on possible changes in decisions.
3. When having to deal with uncertainty, the reaction is to formulate guiding principles to impose a semblance of certainty on the context within which decisions have to be made.
4. When faced with uncertainty, resource managers revert to more planning instead of acting.
5. Resource managers have a deep-seated fear of "getting it wrong" hence the phenomenon of continuous technical studies.
6. High turnover of senior staff in government organisations causes uncertainty which leads to paralysis and inaction.

The six hypotheses outlined above led to the construction of a naïve model of how policy is translated into outcomes. In applying the naïve model, the chain of events required to move from policy to outcomes is identified and arranged linearly from policy to outcome. The naïve model reduces complexity and facilitates IWRM implementation within the context of constitutional obligations. The naïve model comprises the following linear imperatives: constitutional prescripts-policy-legislation-regulations-strategies-methodologies-plans-capabilities-ethos-implementation-outcomes. The impediment to not achieving the desired policy outcomes would be situated at one or more of the imperatives of the naïve model. If the weakness can be located, for example either as a policy or legislative or methodological or planning failure, then measures can be devised that focus on strengthening the weakness at the very point of occurrence.

CHAPTER 6
IWRM and naïve models

6.1. Water resources and complexity

One of the reasons put forward as to why IWRM cannot be implemented is because of the science that underpins it (Jeffrey and Gearey, 2006; Pahl-Wostl, 2005; Cook and Spray, 2012; Granit, 2012). Water resources are complex systems but the scientific underpinning is still rooted in modernity. When understanding water as a system, the complexity of water resource management is brought to the fore in a more nuanced way than through a reductionist approach. The reductionist approach has been very effective in expanding knowledge (Stirzaker et al., 2010). However, there is a growing realisation that the reductionist approach falls short in allowing an understanding of complex problems (Berkes et al., 2003; Stirzarker et al, 2010). Stirzaker et al. (2010) express themselves as follows about complex problems: “Complexity refers to the nature of the problem not the degree of difficulty. In short, complex problems comprise a number of components, and at least some of these components have non-linear relationships between them. Although the components may well be understood in themselves, non-linear interactions and feedback between components give the system a degree of unpredictability”. Stirzaker et al. (2010) contend that to make sense of complex systems one should try and identify a “requisite simplicity”. With this is meant peeling away the layers of complexity until a simplified (not simplistic) model remains that is still recognisable as the original system.

6.2. Reducing complexity using naïve models

The complexity of water resource management alluded to above manifests itself in a number of key concepts that are fuzzy and ambiguous. Some examples are enabling environment, governance, IWRM, stakeholders and institutions. The first step in constructing a naïve model entails identifying the largest possible unit of a phenomenon and calling it the system. Subsequent steps entail the progressive identification of layers or sub-systems. In addition to revealing the system structure, simplifying the complexity in this manner also allows for the non-linear relationships to be identified.

6.3. Implementing a naïve model for IWRM

A. Determining the allocation of water

1. Determine the amount of water available in the catchment (water resource assessment).
2. Determine the environmental water requirements (EWR).

3. Determine the basic human needs (BHN) of the people living in the catchment (50 litres per person per day?).

4. Calculate the water available for allocation. Water available for allocation is total water available minus the EWR and water for basic human needs. The water available for allocation to users includes that portion available for inter-basin transfers.

B. Ensuring that the EWRs are met (meeting the sustainability requirement of IWRM)

1. Start with the EWR at the primary catchment outlet (estuarine water requirements?)

2. Then move up the catchment and decide on the contribution each secondary catchment can make to the EWR at the primary catchment outlet.

3. The limit each secondary catchment can make to the EWR of the primary catchment is determined by the EWR at the outflow of each secondary catchment.

4. The process continues upstream up to the tertiary catchments if required.

C. Water quality requirements (meeting the sustainability requirement of IWRM)

1. To meet the national water quality standards for the environment as recommended by the DWA guidelines.

2. The standards get improved by a system of regular monitoring and assessment.

3. Quality is monitored at the same sites where the EWRs are monitored.

D. Water available for allocation (meeting the access requirement of IWRM)

1. Water needed throughout the year for domestic, industrial use and agriculture use means storage is required.

2. Impoundments amount to impoverishing physical manipulation which contravenes a systems condition of sustainability.

3. However, the Berg River Dam has shown that an impoundment can be designed that makes provision for environmental flow releases.

The approach set out above can initially be implemented in a small catchment and once the method has been improved it can be up-scaled to a bigger catchment, etc. Or it can be implemented in a number of tertiary catchments and then up-scaled to the secondary catchment of which the tertiary catchments are part. The approach as set out above allows experimentation with different formats of catchment combinations with increasing complexity and in which the non-linear relationships can be identified, understood and managed.

6.4. Conclusion

The project set out to understand whether IWRM is implementable and if it is, how does one move from theory to practice or from policy to outcomes. What are the factors that facilitate or constrain the implementation of IWRM? Since 1994 South Africa has made great strides in transforming water resource management, and tracing the evolution of IWRM in South Africa, indications are that the Department of Water Affairs has mostly got it right. Measured on the policy-outcome-continuum of constitutional imperatives-policy-legislation-regulations-strategies-plans-methodologies-capabilities-ethos-implementation-outcomes, the dearth of positive outcomes can mostly be laid at the door of the ethos in the Department. Most of the data indicate that there is a hesitancy to implement, a fear of making a mistake. This conclusion seems to be supported by anecdotal evidence (Schreiner, 2013) and by the views of ex-employees of the Department (Jonker et al., 2010).

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