# Integrated Water Quality Management:
# A MINDSET CHANGE

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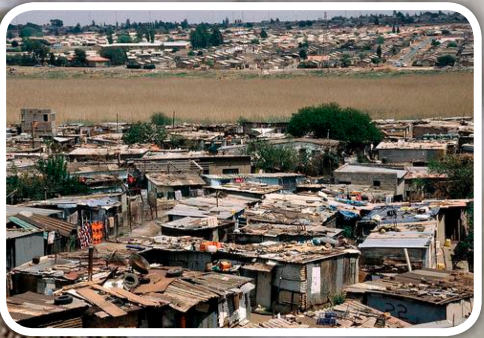

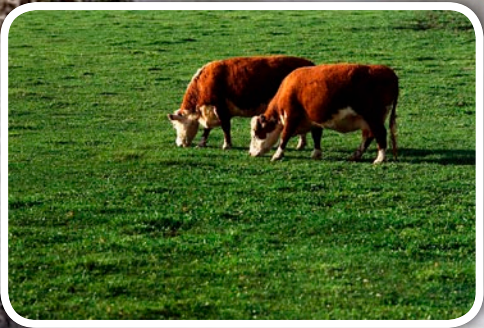

WATER RESEARCH COMMISSION

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# Integrated Water Quality Management: a mindset change

Report to the

Water Research Commission

by

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# Overview

The aims of the project were to develop a conceptual model for aligning the management of the quality of water resources with that of drinking water quality in order to support the effective management of water use in the interest of all water users. In other words, to ensure management of water in a catchment-to-consumer approach.

A literature review which is included on the CD attached to this report, was undertaken to identify international integration mechanisms, as well as to identify gaps in the current South African water quality management framework. The literature review therefore included both local and international literature and considered the current water policy and related legislation in terms of its compatibility for use in an aligned water quality management approach.

In developing countries in general – particularly in South Africa – implementation of national legislation and enforcement of its provisions is an acknowledged area of weakness.

Currently, national level systems for the management of water quality are highly complex and positioned at a very high level, nationally (in the case of water resource quality), and at municipal level (in the case of drinking water quality). An added complication is that regulation of drinking water quality takes place at a national level. Accountability for good water quality is therefore also at a high level, at the end of a relatively long management chain.

Four initial stakeholder workshops were held around South Africa in March 2008 and at the WISA Conference in May 2008. A second round of national workshops was held in October and November 2008 to refine the conceptual framework identified as a result of the first round workshops.

Assimilation of the initial workshop feedback highlighted the need for an amendment of the fundamental concept of this project: the catchment-to-consumer cycle. The structure of the catchment-to-consumer cycle initially used to underpin the conceptual framework, relates more to the management of drinking water quality by water services delivery institutions, than to integrated water quality management.

Following the first round of workshops, the catchment-to-consumer cycle was annotated to include the impacts of land use, as well as the activities of raw water consumers. Considering this further however, the catchment-to-consumer cycle was still not really depicted as a cycle as the approach remained focussed on drinking water quality, with the consumer of treated water at one “end” and the resource at the other. Bearing in mind that the catchment-to-consumer approach recognises that the management of water resource quality and that of drinking water quality are inextricable – and taking into account the impact of land use as a context to the cycle and also the activities of raw water consumers – a cycle of water use underpins the conceptual framework for integrated water quality management (IWQM).

### *The conceptual framework*

In developing the IWQM model, three main components were identified and are:

- *Defining principles* which are defined as being generalisations that are accepted as true and that can be used as a basis for reasoning or conduct, such as water must be properly valued (there is not enough water);
- *Background conditions* which are defined as those conditions external to water quality which support the implementation of this framework and therefore indirectly impact on water quality, such as management systems and tools; and

- *Management units* which are defined as a geographical area that could be managed as a unit owing to common water use characteristics at the "lower" levels and to institutional responsibilities with regard to the management of water quality at the "higher" levels.

The ultimate goal of IWQM is to achieve specific objectives at a particular management unit taking into consideration the defining principles and background conditions relevant to that specific management unit. How this is done may be through various tools that may include, for example, a Water Safety Plan (WaSP) for a municipality or an integrated water and waste management plan (IWWMP) for an industry. There are, however, specific elements that must be included in each of the tools:

- Water use cycle elements' identification;
- Hazard assessment/risk analysis;
- Risk management; and
- Contingency planning.

In the context of the IWQM model water use cycle elements' identification will incorporate critical control points (CCPs) for each of the elements identified in the management units – there may be one or several.

In view of the above, the business process proposed for the IWQM conceptual model is generic in the sense that its various elements apply at every "level" of management, or rather, to every management unit, and therefore each aspect must be in place in every management unit. The details of each element will vary according to the management unit in question.

The basic premise is to break down the challenge of IWQM into manageable areas in order to reduce the reporting between management units to a simple "Yes" (quality and quantity parameters are being met) or "No" (they are not). This approach demands effective auditing processes, but it is structured in such a way that management units next to each other audit each other, that is, that the management unit is responsible for auditing the quality of the water entering its geographical area and then reporting on that to the next level of management as well as the management unit where the water came from.

### *Conclusions and recommendations*

The review of international literature indicated that some countries have moved towards a catchment-wide approach. However, many strategies (and in particularly in developing countries) remain focussed on the quality of water at the waterworks.

The current South African legislative and legislation/regulation/institutional framework does not address the integrated water quality management cycle (water use cycle).

The conceptual model is based on the premise that good water quality is in everyone's best interests. Current management approaches, however, attach responsibility for good water quality at a level that does not idenitfy this premise. Thus the management approach is institutionally based at relatively high levels of government and does not include potential community structures which should have responsibility for the water that they use. It should be noted that the term "community" is used here in the sense of a group of people or organisations with common interests, in this case, regarding the quality and quanitity of the water within their geographical area.

The IWQM management approach "breaks down" the management of water quality into smaller management units. At the same time, both a horizontal and vertical reporting framework is established. This structure is aimed at addressing the problem of implementation of quality standards across the country, and also improving enforcement by reducing the volume of reports that should highlight problem areas and allow for prioritisation of regulatory or remedial action.

A further benefit of the IWQM management framework is that responsibility for water quality is based on significantly smaller geographical areas, and accountability to the adjoining areas (horizontal accountability) and to the next level of management (vertical accountability) is established with the establishment of the management unit. This allows accountability for water quality to be focussed on smaller management units rather than diffused up ever higher levels of management.

The IWQM management approach therefore addresses the magnitude of the water quality issue by breaking it down into focussed geographical areas of management responsibility. In other words, by making all water users aware of their own responsibility to the protection of South Africa's water resources and accountable for the impacts that they have on the resource.

Finally, the IWQM approach allows water quality information to be packaged for a broader audience, as reporting is simplified to provide information on whether or not a management unit is with specifications of its CCPs or not, rather than extensive technical reports to national level through the management chain. This addresses the issue of the raising of awareness in the broader community of the basic premise that good water quality is in everyone's best interests, while providing for "everyone's" involvement in its management through the allocation of responsibility at more localised level.

Recommendations from the first phase include:

- Establishment of management units;
- Clearly defined responsibilities for the insitutional framework within each management unit; and
- Establishment of communications mechanisms at the interface between each management unit.

The second phase of the project would need to:

- Involve the streamlining of the conceptual framework through the implementation of case studies at each of the management units including catchment level, Water Services Authority level and community level which includes industrial development zones;
- Link the model with relevant tools that must be used for implementation in the management units, i.e. link to existing tools or identify where gaps exist and what tools could be used;
- Identify risks, constraints and gaps in the model for each management unit; and
- Document the proposed model and its implementation framework, for each management unit.

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The Reference Group responsible for this project consisted of the following persons:

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# BACKGROUND TO THE PROJECT

The aim of the project was to develop a conceptual framework for aligning the management of the quality of water resources with that of drinking water quality in order to support the effective management of water use in the interest of all water users.

The catchment-to-consumer approach suggests that the management of water resource quality and that of drinking water quality are inextricable and as such, the legislative instruments, institutional frameworks and management processes must be fully integrated.

## Objectives of the project

The objectives of the project as set out in the Terms of Reference were as follows:

- Review of existing national water policy, legislation and the water resources strategy in order to assess compatibility with an integrated drinking water quality management approach and make recommendations for changes where necessary. Review of international best practise in terms of regulating the drinking water supply system from catchment-to-consumer and source-to-sea;
- Evaluation and improvement of the DWA Drinking Water Quality Framework and Drinking Water Quality Regulatory Strategy, including latest developments, in terms of its suitability to form part of a national integrated water quality regulatory strategy;
- Using a multi-stakeholder consultation process and develop models for the implementation of the integrated, preventive management approach in line with the fundamental principles of the national water policy;
- Develop a conceptual framework for a governance structure for the regulation of the framework. This should include specific details on the institutional roles, responsibilities and accountabilities of the various regulatory stakeholders at national, provincial and local levels; and
- Produce a concise, integrated Final Report, including all of the above aims in the report.

The report to follow is set out in two parts. The literature review that was undertaken and is included in the attached CD, and the main report which describes the integrated water quality management model and is in hard copy.

## Summary of international approaches

In general, and based on the literature reviewed (included on the CD attached to this document), while the developed countries talk about managing drinking water from catchment-to-consumer, the focus of the strategies being implemented is often still the quality of the water at the waterworks. The United Kingdom however considers land use impacts and ecological facets as a major part of their strategy on water management.

The focus on drinking water quality is especially notable in developing nations, where just achieving an acceptable water quality is priority.

In the Australian situation it is recognised that the range of agencies involved in individual water supply systems will need to be determined. Relevant agencies need to be encouraged to recognise their roles and responsibilities within the framework, and to support drinking water suppliers through partnership agreements. The breadth and depth of partnership arrangements between agencies and the mechanisms by which they operate will vary between different jurisdictions, depending on the division of responsibilities and legislative authorities. If possible, a state- or territory-wide commitment to drinking water quality management and a formal co-ordination of responsible agencies will be developed.

In the New Zealand matrix approach, by selecting the modules that apply to their particular circumstances, each drinking-water supplier can develop a risk management plan for the whole of their supply that identifies their specific risks and the associated controls. From this the management priorities for the supply can be established, taking into account the overall benefits and costs. Guidance for this stage of the development of the public health risk management for the supply of potable water is provided in an overview document titled *How to prepare and develop public health risk management plans for drinking-water supplies* (Ministry of Health 2001b). The 39 public health risk management plan guides were trialled by desk exercises in the four major centres and given three months' public consultation before being published. The guides are intended to be living documents and will be updated as new information becomes available.

The Canadian Water Safety Act allows for the development of DWMPs by the different regions. The DWMP uses an adaptive management approach to identify and respond to new challenges and to pursue new opportunities. The approached used are aligned to providing clean, safe drinking water; ensuring sustainable use of water; and ensuring sufficient supply of water.

The Water Framework Directive for the European Union provides the machinery for advancing water quality and for developing a holistic approach to managing water. Its quality objectives are based on ecological quality standards.

One key benefit of the Water Framework Directive is in achieving better integration of the current large number of separate local or regional river plans, including those covering environmental improvements, abstraction and flooding. It is intended to work towards a significantly more integrated approach to river basin planning, in order to ensure that multiple benefits are achieved in the most cost-effective way, and to achieve better and more transparent working with stakeholders.

The concept of risk assessment and risk management during the production and distribution of drinking water was introduced by the WHO in the 2004 Guidelines for Drinking Water Quality. This concept was introduced in the context of Water Safety Plans. The methodology is still under study by the Commission. By taking on board this approach, the quality surveillance of the drinking water would shift from the current control of drinking water at the tap towards quality management along the production and distribution cycle from capture to tap.

As many aspects of drinking water quality management are often outside the direct responsibility of the water supplier, it is essential that a collaborative multi-agency approach be adopted to ensure that agencies with responsibility for specific areas within the water cycle are involved in the management of water quality. In this respect the World Health Organisation (WHO) has developed a Water Safety Plan which covers the whole system from catchment-to-consumer.

## Gaps in current national approaches

The national Drinking Water Quality Framework advocates a proactive management approach, which "focus[es] on reducing the likelihood of contaminants entering raw water supplies". The current legislative framework, while there are significant provisions relating to both drinking water and raw water quality, is focused on the monitoring of drinking water quality.

The primary focus of the management framework under current legislation is on the monitoring of both raw water and drinking water quality, and most of the regulatory instruments pertain to reporting on monitoring against standards. However, a significant limitation of the compliance monitoring approach to drinking water quality management is that by the time health-related contaminants are indicated as being present, public health will already have been affected.

Under the current legislative framework, the catchment-to-consumer cycle is essentially divided in two, as set out in Section 6 of the detailed literature review on the CD. Furthermore, ultimate management responsibility is divided between water resources and water services, governed by different Acts.

The Drinking Water Quality framework advocates water supply system analysis, with hazard identification and assessment of risks “from catchment-to-consumer”, through the mechanism of a Water Safety Plan, the latter which is being adapted for the South African situation by the Water Research Commission.  However, under the current legislative framework, WSIs are under no obligation to compile a Water Safety Plan.

There are a variety of guideline documents to assist WSIs in the compilation of these plans, but the model for the Water Safety Plan does not include requirements or guidelines from the consumer to the resource. Given that these aspects of the cycle are also managed under a different framework, and at the time of this study by different sections in Department of Water Affairs (DWA), from the resource to consumer aspects, this is a significant gap in both the current legislative framework, and in the drinking water quality framework. It must be noted that operational changes that may be a start to removing these gaps are currently occurring within the DWA.

The current management framework also does not address reporting requirements between water resources and water services. There are no required reporting mechanisms between the two provided for in legislation, although this is addressed to some extent in principle in the National Water Resources Strategy (NWRS) Chapter 3 (Part 6) through requirements for information systems. The quality of raw water significantly affects the required treatment processes, and reporting between DWA Water Resources and Water Services on the national monitoring programmes and the publication of these results should therefore be a requirement in an integrated regulatory framework.

Water Services Institutions (WSIs) are responsible for the management of wastewater treatment works, a critical point in the “consumer-to-resource” aspect of the cycle.  However, effluent discharge is managed primarily by DWA Water Resources, and reporting mechanisms between WSIs and DWA Water Resources are ill-defined in the legislation. Consequently, many WSIs are not reporting adequately against the National water Act (NWA) section 21 water uses authorisation conditions.

Since reporting frameworks between DWA Water Resources and DWA Water Services regarding effluent discharge are not adequately defined, the regulatory framework and therefore the integrated management of a critical aspect of the cycle is indistinct. Given that effluent discharge could be a significant factor in the identification of hazards in the whole catchment-to-consumer cycle; this is a substantial gap in the current framework.

Evaluated against the integrated catchment-to-consumer cycle, the management framework under current legislation is inadequate. The most significant issue is the regulation of wastewater treatment, in terms of the current “blurred” regulatory processes and reporting mechanisms.

The current management framework is also focussed primarily on the monitoring of both raw water quality and drinking water quality, and therefore is a reactive, rather than proactive management framework.

These critical issues must be addressed if the management framework is to be fully integrated.

# 1 INTRODUCTION TO A CONCEPTUAL MODEL FOR INTEGRATED WATER QUALITY MANAGEMENT

After the literature review was undertaken and the gaps in the national literature identified, a conceptual model for integrated water quality management was investigated.

**Considering the complex nature of both the water services and water resources sectors; and the current 'siloistic' regulatory approach that is followed in South Africa; it must be noted upfront that the concepts to follow will require a mindset change at various levels.**

## 1.1 Methodology and approach

The approach to the development of the conceptual model for integrated water quality management was to use an interactive forum with relevant stakeholders from both the water services and the water resources sectors. The stakeholders included:

- Department of Water Affairs (National and Regional Offices);
- Provincial Department of Environment;
- Provincial Department of Health;
- Local Municipalities (water and wastewater);
- Municipal Health Services;
- Catchment Management Forums;
- Water User Associations;
- Water Boards;
- Industry;
- Researchers; and
- Non Government Organisations.

In this respect two rounds of industry-type workshops were held with relevant stakeholders at various venues throughout the country. First round workshops were held in March 2008 and at the WISA Conference in May 2008. Second round workshops were held in October and November 2008 to refine the conceptual framework identified as a result of the first round workshops. Invitations and attendance registers for the workshops are attached as Appendices A and B.

The sections to follow outline the thinking that has informed the development of the conceptual model for integrated water quality management.

# 2 THE WATER USE CYCLE

## 2.1 Rationale for amendment of the catchment-to-consumer cycle

Assimilation of the workshop feedback highlighted the need for an amendment of the fundamental concept of this project: the catchment-to-consumer cycle. This has been developed into an integrated water quality management approach that the management framework must address.

The structure of the catchment-to-consumer cycle that was initially used to underpin the conceptual framework is indicated in **Error! Reference source not found.** in the literature review contained in the CD. However, the approach illustrated in **Error! Reference source not found.** of the literature review relates more specifically to the management of drinking water quality by water services delivery institutions, than to integrated water quality management. Following the first round of workshops, this approach was annotated to include the impacts of land use, as well as the activities of raw water consumers. Considering this further however, the catchment-to-consumer cycle was still not really depicted as a cycle. The approach remained focussed on drinking water quality, with the consumer of treated water at one "end" and the resource at the other (Figure 1).

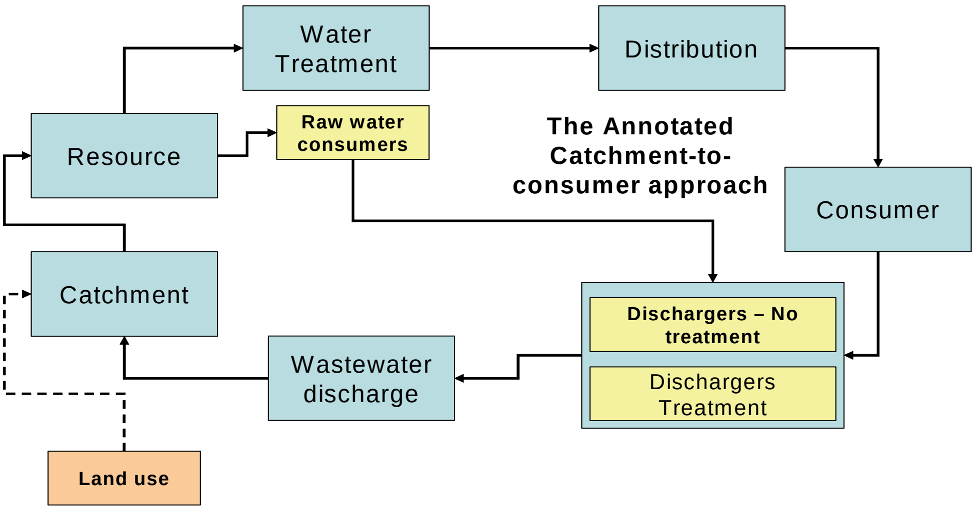



**Figure 1: Annotated catchment-to-consumer cycle**

If it is understood that the catchment-to-consumer approach recognises that the management of water resource quality and that of drinking water quality are inextricable, the catchment-to-consumer cycle must move away from the above approach.

Figure 2 indicates the impact of land use as a context to the cycle and also takes into account the activities of raw water consumers. It is this approach, or rather, this iteration of the cycle, which forms the underpinning concept to the development of the conceptual framework for integrated water quality management (IWQM). This approach is based on the integration of the management of the various critical components of the cycle of water use.

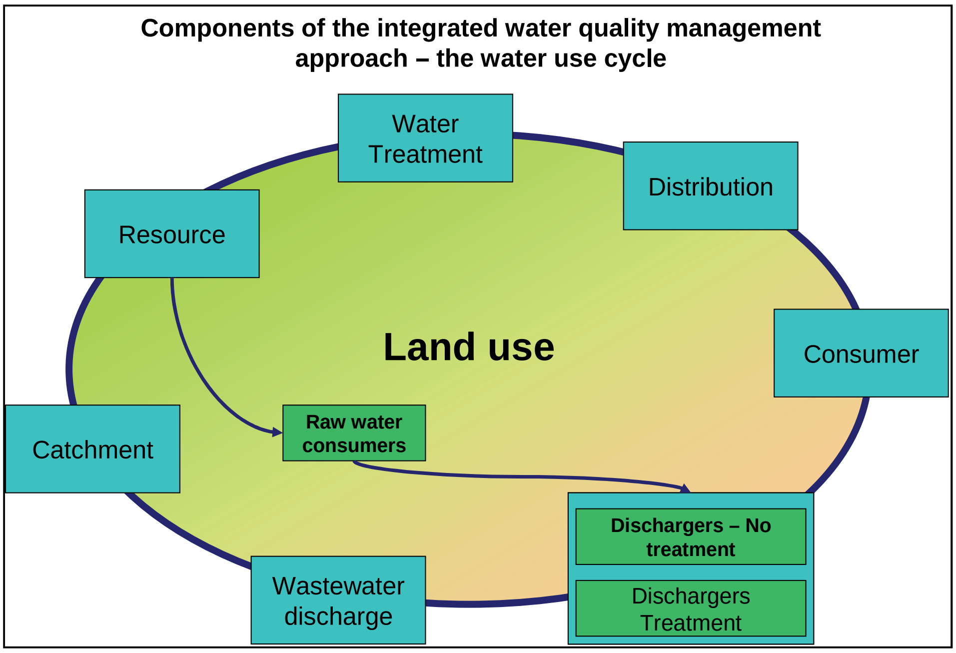



**Figure 2: The water use cycle**

The conceptual model for integrated water quality management must therefore address the approach outlined above.

The aspects of this approach are carried through into the management context as described in the section to follow.

# 3 KEY ELEMENTS OF INTEGRATED WATER QUALITY MANAGEMENT

In this section the various “contributors” to integrated water quality management are indentified. It is these contributors that form the basis for the formation of the management units which make up the basic building blocks of the management context. The management approach in South Africa was found to be broad and established at higher levels of government; therefore divided through the catchment-to-consumer cycle (necessarily because of the level at which it is established).

In order to address this weakness, the concept of management units (geographical or functional units) has been developed.

A management unit in this context is a geographical area that could be managed as a unit owing to common water use characteristics at the “lower” levels and to institutional responsibilities with regard to the management of water quality at the “higher” levels.

The ultimate goal of integrated water quality management (IWQM) is to achieve specific objectives at a particular management unit.

How this is done may be through various tools. These may include for example, a Water Safety Plan (WaSP) for a municipality or an integrated water and waste management plan (IWWMP) for an industry.

There are however, specific elements that must be included in each of the tools. These are:

- Water use cycle elements identification per management unit;
- Hazard assessment /risk analysis;
- Risk management; and
- Contingency plans.

## 3.1 Water use cycle elements identification

While a hazard assessment/risk analysis could be undertaken on the larger catchment area, it is more feasible to:

First identify the various elements of a particular management unit that are related to the water use cycle (Figure 2).

In other words, get to know your management unit. An example of elements that may be identified within a municipal area may include for example:

- A sewage works;
- Pump stations;
- An industrial area;
- A water treatment works; and
- An informal settlement.

Whereas, the industrial area may be a management unit on its own and could be composed of the following smaller elements:

- An abattoir;
- A metal plating industry; or
- A panel beater.

And digging even deeper the specific industries would each have their own elements relating to the water use cycle, such as:

- A pump abstracting water;
- A discharge point; or
- Pollution control dams.

Hazard assessment/risk analysis can now be undertaken on each element identified.

## 3.2 Hazard assessment/risk analysis

Risk is a concept that denotes the precise probability of specific eventualities. Technically, the notion of risk is independent from the notion of value; and as such, eventualities may have both beneficial and adverse consequences. However, in general usage, the convention is to focus only on potential negative impact to some characteristic of value that may arise from a future event.

Hazard assessment/risk analysis is the evaluation and ranking of potential hazards based on estimated frequency and intensity, and then determining a margin of safety. In other words hazard assessment/risk analysis must include:

- An event;
- The probability that the event will occur; and
- The impact it will have if it happens.


In the context of the IWQM model this will be the identification of critical control points (CCPs) for each of the elements identified in the management units.

In terms of a quantitative risk assessment, the assessment could be based on probability of occurrence; consequence of occurrence; intensity of the impact; and significance level of the risk posed.

***Probability of occurrence*** describes the likelihood of the impact actually occurring and may be indicated as:

- Improbable, i.e. the likelihood of the impact is very low;
- Probable, i.e. there is a definite possibility of the impact occurring;
- Highly probable, i.e. it is very likely that the impact will occur; and
- Definite, i.e. where the impact will occur regardless of any management measure.

***Consequence of occurrence*** describes:

- The nature of the impact;
- The extent of the impact; such as whether the impact will be local, regional, national or across international borders;
- The duration of the impact, i.e. whether the impact will be short term (0-5 years); medium term (6-15 years); long-term (the impact will cease after the operational life of the activity); or permanent; where mitigation by natural processes or human intervention will not occur.

***Intensity of the impact*** describes the magnitude of the impact on the natural, cultural and social functions and processes.

***Significance level of the risk posed*** then signifies the combination of these factors. It is determined through a combination of the probability of occurrence and consequence of occurrence. Significance points (SP) can be determined by using the formula below and the ranking scales set out in Table1.

***SP = [magnitude (Mag) + duration (D) + scale (S)] x probability***

Where the maximum value of significance points (SP) is 100

**Table 1: Risk ranking scales**

| **PROBABILITY = P** | **DURATION = D** |
|---|---|
| 5 – Definite / don't know<br>4 – High probability<br>3 – Medium probability<br>2 – Low probability<br>1 – Improbable<br>0 – None | 5 – Permanent<br>4 – Long-term (ceases with operational life)<br>3 – Medium-term (6-15 years)<br>2 – Short-term (0-5 years)<br>1 – Immediate |
| **SCALE = S** | **MAGNITUDE = Mag** |
| 5 – International<br>4 – National<br>3 – Regional<br>2 – Local<br>1 – Specific to the site<br>0 – None | 10 – Very high / Don't know<br>8 – High<br>6 – Moderate<br>4 – Low<br>2 – Minor |
| Risk can therefore be rated as either high (H), moderate (M), or low (L) on the following basis: | |

| **Point scored** | **Risk description** |
|---|---|
| > 60 | high (H) |
| 30-60 | moderate (M) |
| < 60 | low (L) |

This will then aid in the prioritisation of risks and the implementation of risk management.

## 3.3 Risk management

Risk management is the activity directed towards managing the outcomes of the hazard/risk assessment. In other words putting in place mitigation that will reduce the risk to an acceptable level and monitoring programmes that will measure whether mitigation is working or not.

### 3.3.1 Contingency plans

The definition of *contingency* is: a contingent event or condition as:

- (a): an event (as an emergency) that may but is not certain to occur (trying to provide for every *contingency*) or
- (b): something liable to happen as an adjunct (addition) to or result of something else.
- A contingency plan can therefore be defined as:
- An alternative for action if things do not go as planned or if an expected result fails to materialize; or
- A plan that provides resources for problem solving in the event that something happens by chance.

In other words, where a risk has been identified as a priority (in the context of IWQM these are the CCPs) then a contingency plan must be put in place for the possibility of failure.

A simple example is discussed in the box below where a sewage works has been identified as a management unit component and a risk/hazard assessment undertaken.

**Box 1*: Example of a risk/hazard assessment for a sewage works***

A sewage works discharging good quality effluent to a river is located in an area that experiences high rainfall events over short timeframes, has been identified as an element of the water use cycle in a management unit. The sewage works is located upstream of an informal settlement.

**i.e. SP = (magnitude (M) + duration (D) + scale (S) ) x probability**

- magnitude (M) = 8 (high probability that the downstream community will be affected);
- duration (D) = 4 (long-term that will only cease with operational life);
- scale (S) = 2 (**l**ocal); and
- probability = 4 (very likely that the impact will occur)

**= (8 + 4 + 2) x 4 = 56**

So, while the sewage works is discharging a good quality effluent, should increased flows reach the sewage works due to a storm event for example, the resultant effluent may be sub-standard and could therefore have a health impact on the informal community living downstream who are using the water for domestic/recreational purposes. Mitigation that could be put in place in this instance is to have an emergency dam to which the excess flow can be diverted until the flow decreases and the excess can then be pumped to the inlet again and treated for discharge.

# 4 THE INTEGRATED WATER QUALITY MANAGEMENT CONCEPTUAL MODEL

## 4.1 Components of the model

In addressing the integrated water quality management cycle, the conceptual model needs to address the weakness in current approaches and other established frameworks.

The model is composed of a number of components; defining principles; background conditions; and management units; that are described in the following sub-sections.

### 4.1.1 Defining principles

The following principles were prioritised based on the frequency with which they were raised in the consultation process. In this report principles are defined as being generalisations that are accepted as true and that can be used as a basis for reasoning or conduct. These principles therefore underpin the conceptual model for integrated water quality management in the South African context.

***Defining Principles:***


✓ Water must be properly valued (there is not enough water);

✓ Institutions responsible for managing water must be accountable for water quality;

✓ Water quantity and water quality are inextricably linked;

✓ The Polluter Pays Principle must be applied to the true cost of water pollution;

✓ Short-term economic gain at the cost of increasingly deteriorating water quality is not acceptable; and

✓ Everyone should have access to water quality information (not data).

**Water must be properly valued**

It is not only important to ascribe value to water based on water availability and increasing water scarcity. The concept of value in the context of water should include:

- Downstream costs of pollution;
- Social and economic value of water;
- Value of wastewater;
- Significance of clean water in terms of public health; and
- The price of not having water.

Therefore, the principle of *there is not enough water* should encompass an understanding of the different values of water, and not be limited to the fact that there is not enough water.

Appropriate valuing of water (and wastewater) also raises the issue of ring-fencing the revenue from water sales (both raw and treated water), so that the funds derived can be used for the management of water, as opposed to elsewhere in the organisation. The concept of ring-fencing could extend to the benefits of better water quality as explained in the example below.

**Example: Ring fencing the economic benefits derived from better water quality.** ***An example:***

A municipality implementing integrated water quality management could derive an economic benefit such as lower treatment costs at a particular works, from improved water quality at the incoming critical control point.

These funds could be used for other water management projects in the municipal area, for example, raising awareness among consumers or establishing smaller management units in the municipal area.

**Institutions responsible for managing water must be accountable for water quality**

Accountability is the obligation to demonstrate and take responsibility for performance in light of commitments and expected outcomes. In the case of water quality, under our current framework, accountability is not clear because of the complex institutional framework and the current understanding of co-operative governance (Box 3). Accountability implies that someone is accountable to someone else, for something. It is therefore important to ensure that responsibilities are clearly defined, and that those to whom institutions are accountable, clearly understand the standards at which water must be managed, in order that they can assess whether institutions are fulfilling their obligations with regard to water quality. Finally, commitment to management practises that will ensure good quality water must be evident at all levels both within and across the spectrum of water management institutions.

**Box 3: What is cooperative governance?**

A formal definition for cooperative governance could not be found, although principles exist which define cooperative GOVERNMENT (rather than governance).

These can be accessed at the following website:
http://www.info.gov.za/documents/constitution/1996/96cons3.htm

The Intergovernmental Relations Act of 2005 does not contain an interpretation of the phrase "cooperative governance". The Act can be downloaded at:
http://www.info.gov.za/aboutgovt/coopgov/structures.htm

Because it is important that this phrase is defined, since the management framework will only be effectively implemented under a cooperative governance framework, cooperative governance is defined in the context of this project, as follows:

> *"South African government institutions or organs of state acting or operating jointly to make decisions that define expectations, grant power or verify performance. "*

This would imply that there must be accountability between institutions or organisations responsible for carrying out management activities.

Therefore, the IWQM management framework works under the policy of cooperative governance in that it supports the dynamic distribution of power, learning and benefits among the stakeholders in the water management value chain. The implication of this is that the stakeholders in the water management value chain are accountable to each other for their responsibilities with respect to water management. These responsibilities are identified in the management framework (Figure 3), through the business process (Figure 8).

**Water quantity and water quality are inextricably linked**

It is important to ensure that the above statement is consistently recognised in all aspects of water management.

Poor quality water will reduce the quantity of water available for use, and less wa increase the impact of contaminants in water.

While this seems to be stating the obvious, much of the documentation, legislation, regulation and research addresses either water quantity or water quality.

**The Polluter Pays Principle must be applied to the true cost of water pollution**

The Polluter Pays Principle is a well-known and widely accepted environmental policy principle which is applied internationally through various mechanisms. It does, however, raise the question: “pays what?” In the case of water pollution, there are always “downstream costs” of a pollution incident. The term “downstream costs” must be understood in both its literal and figurative sense. There may be costs to water users physically downstream of a pollution incident, and there may be significant costs over time owing to environmental deterioration at the site and physically downstream of an incident. Furthermore, “downstream costs” could refer to indirect costs such as the cost of a community not being able to develop as a result of a lack of availability of clean water. It is important therefore, that the polluter pays principle encompasses the expanded definition of “pays what?”

***Example: Polluter pays***

A water supplier had to upgrade infrastructure to address polluted water abstracted, however, water supplier had to bear that cost. In terms of the Polluter Pays Principle the water supplier should have been subsidised by DWA as the regulator who should recover the money from the polluter(s).

**Short-term economic gain at the cost of increasingly deteriorating water quality is not acceptable**

This principle refers mainly to the fees levied on dischargers of wastewater to sewer, the discharge which then has an impact on the wastewater treatment works and its capacity to operate optimally.

It is not acceptable that the discharger simply pays increasing fees when the “downstream” cost of discharging is creating a serious long-term impact on the water resource. The short-term economic gain received by those levying charges must be balanced against the total cost of wastewater entering the resourc This principle is closely related to the appropriate valuing of water.


**Everyone should have access to water quality information (not data)**

Everyone who uses water has some responsibility for water quality. Because water quality is a largely technical issue, most of the “information” disseminated about it, is technical. While this is necessary at certain levels of responsibility, new and innovative ways to package information about water quality need to be found. It is important that there is some understanding about water quality at all levels, and this will require a “rolling-up” of water quality data into more broadly understood formats.

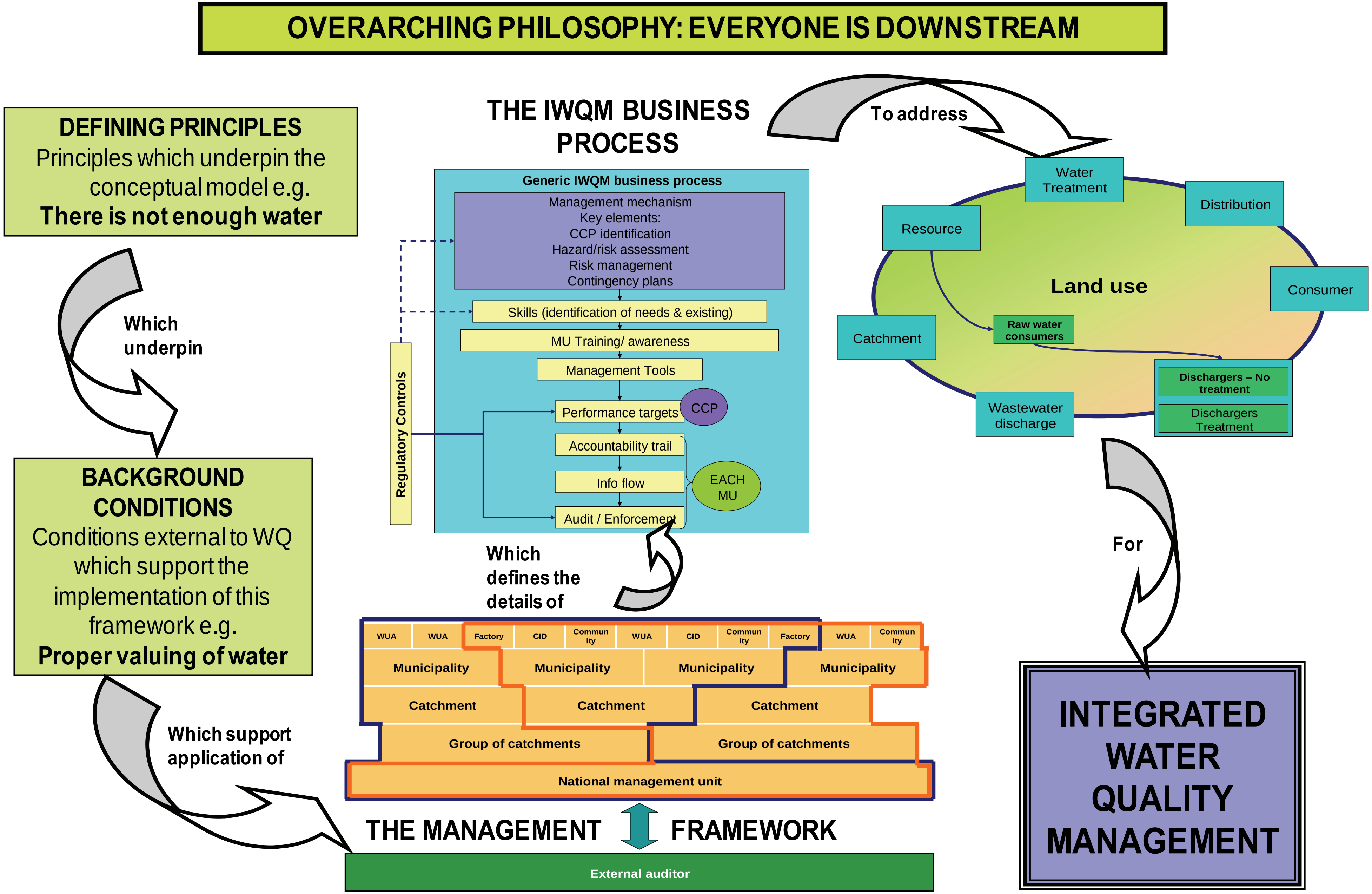



Figure 3: The integrated water quality management conceptual model

## 4.2 Background Conditions

Background conditions are those conditions external to water quality which support the implementation of this framework and therefore indirectly impact on water quality.

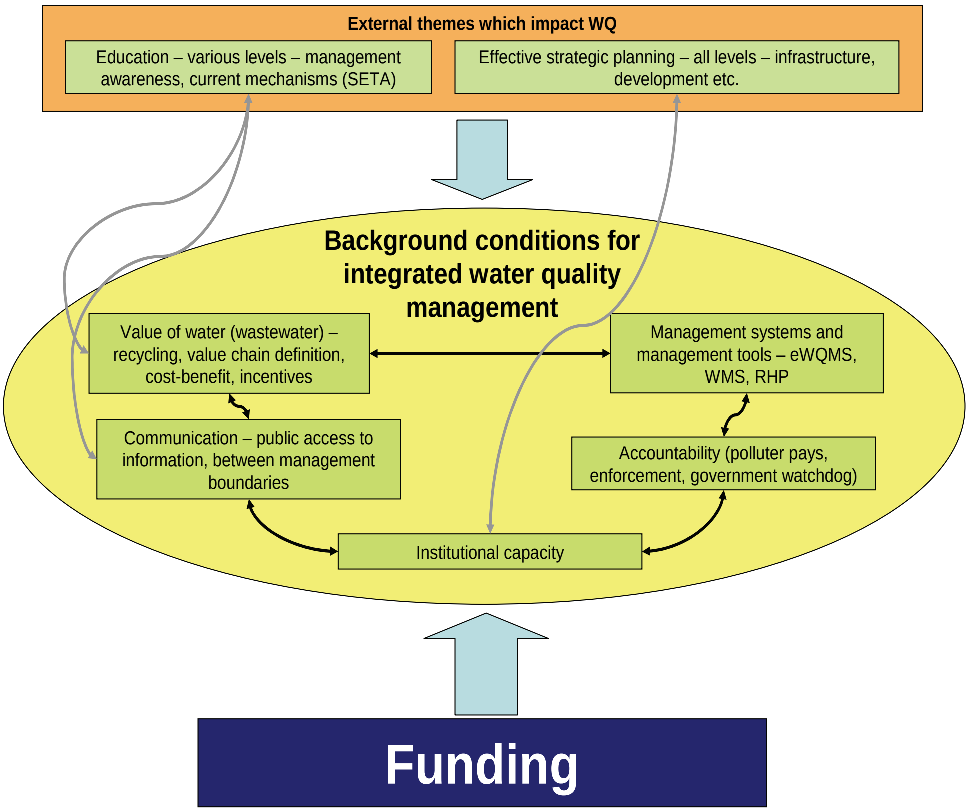



**Figure 4: Flow diagram showing the links of the Background Conditions**

Background conditions have been categorised as eight major themes under which broad programmes or initiatives, that need to be put in place to improve the implementation of an integrated water quality management framework, would be identified.

1. The value of water (including wastewater) incorporating issues such as cost-benefit incentives and recycling initiatives;
2. Management systems and tools (applicable to the various “levels”) such as eWQMS, River Health Programme and Water Management Systems (WMS);
3. Communication between management units and also public access to information;
4. Accountability including aspects such as polluter pays, enforcement and the implementation of a government watchdog;
5. Institutional capacity;
6. Education;
7. Effective strategic planning which needs to be undertaken at various levels; and
8. Funding seen as a supporting condition for integrated water quality management.

Two additional conditions that would have an impact on integrated water quality management however that do not fit into the eight main categories are:

- Understanding the final catchment management structure within the current 19 Water Management Areas and how it relates to roles and responsibilities; and
- Research which would include research into alternative and appropriate technologies as well as re-assessment of certain established parameters such as Resource Quality Objectives (RQOs) which may not apply to the whole catchment.

## 4.3 The management context

***The establishment of management units***

The cycle of water use as identified in Figure 2, relates in real terms, to particular types of water users. Figure 5 identifies various users as they would exist in a catchment. It is also important to recognise that catchments adjoin one another, and that water user groups may occur across catchment boundaries.

To address the complexity of the catchment, therefore, it is important to divide larger "user groups", such as the catchment or a municipality, into ever smaller groups. Each of these user groups then forms a management unit.

The "smallest" management unit may be a:

- Factory;
- Group of industries;
- Community, or
- Combination of these users.

The largest would be a national management unit. Many of the management units identified align with existing established institutions such as:

- Municipalities;
- Catchment management agencies; or
- Water user associations.

It is important however, to note that the establishment of a management unit at whatever scale, is not dependent on whether a legislatively established institution exists at that level.

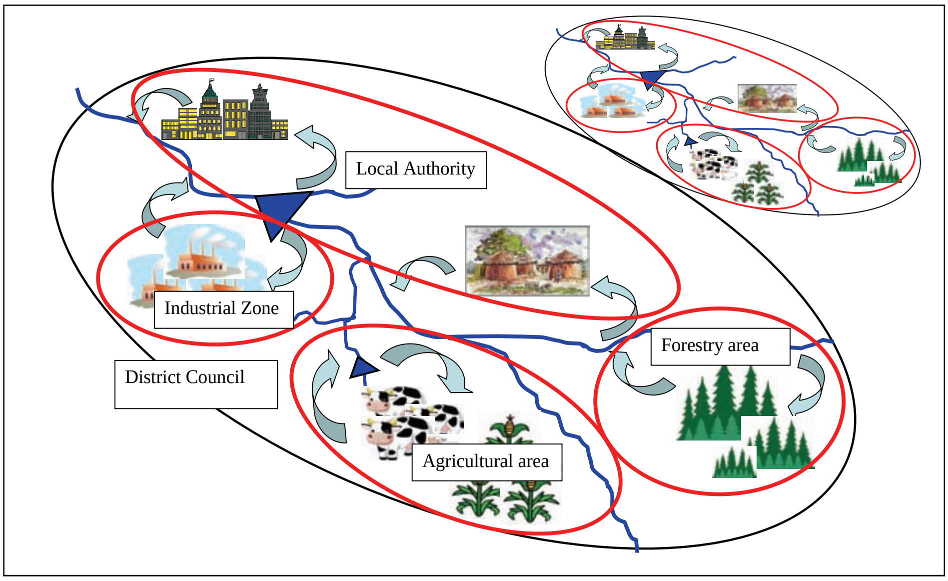



**Figure 5: Illustration showing examples of possible types of management units**

Figure 6 indicates how the water user groups (management units) are represented in the integrated management context and indicates the overlapping management "chains" from the smallest management unit to the largest at a national level. A single full IWQM management chain is illustrated in Figure7. This model shows how the various management units (made up of water users or water user groups) relate to each other. This structure also addresses those instances where management units may occur across municipal or catchment boundaries.

The basic premise is to break down the challenge of IWQM into manageable areas, in order to reduce the reporting between management units to a simple "Yes" (quality and quantity parameters are being met) or "No" (they are not).  This approach demands effective auditing processes, but it is structured in such a way that management units next to each other audit each other, that is, **that the management unit is responsible for auditing the quality of the water entering its geographical area and then reporting on that to the next level of management as well as the management unit where the water came from.**

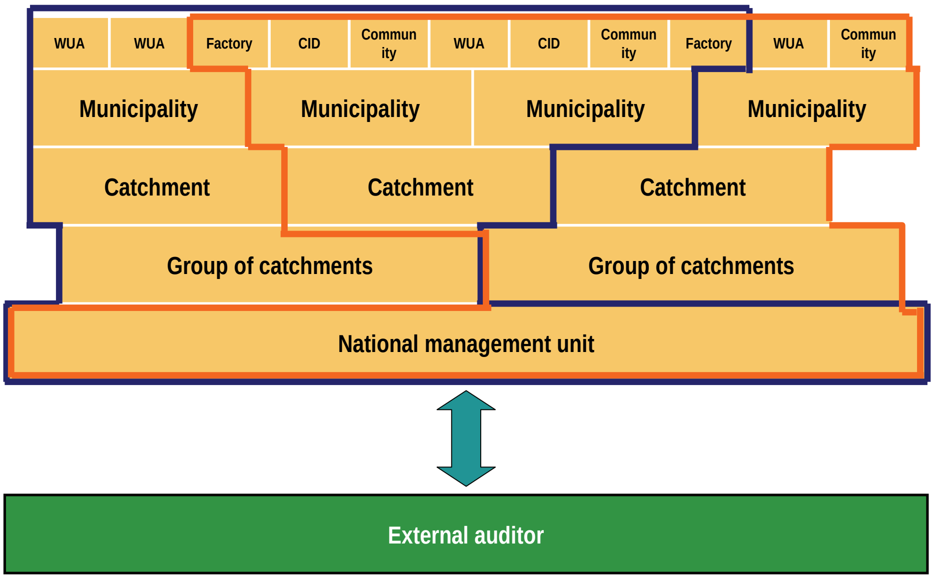



**Figure 6: Overlapping management units in an integrated management context**

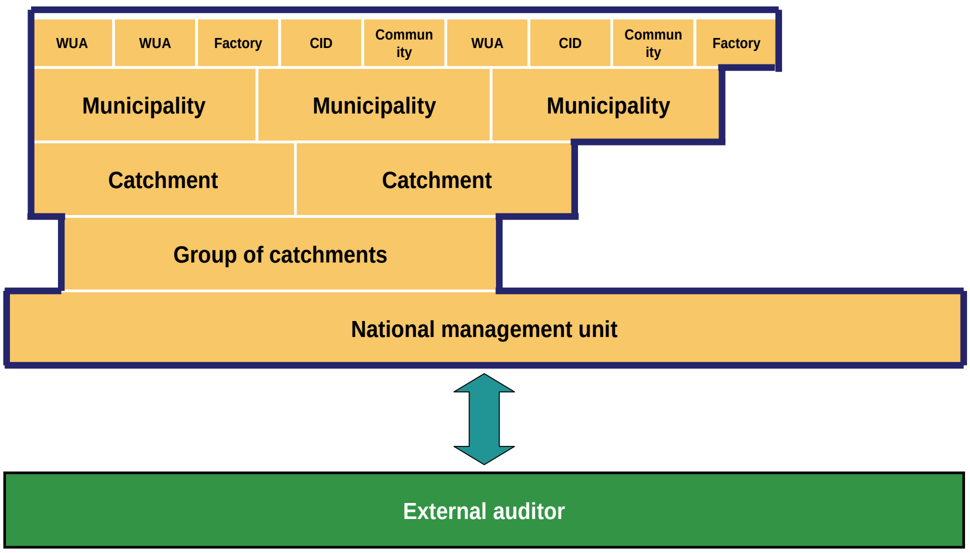



**Figure 7: A single IWQM management chain**

## 4.4 The business process

With management units having been established, it is important to identify a generic business process for IWQM across all levels of management. This business process defines various aspects which must be in place in each management unit at each "level" of management.

A business process can be defined as a process for carrying out a particular activity. In this case, the activity is integrated water quality management.

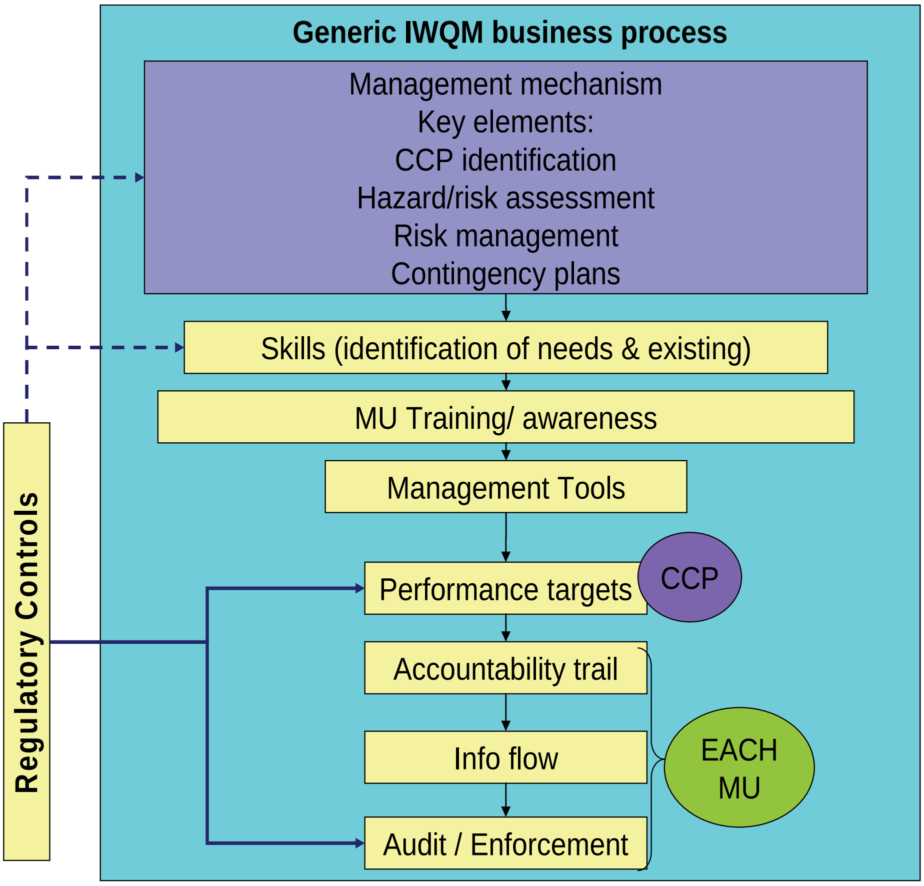



**Figure 8: Generic integrated water quality management business process**

**The IWQM business process is generic in the sense that its various elements apply at every "level" of management, or rather, to every management unit, and therefore each aspect must be in place in every management unit.**

The details of each element will vary according to the management unit in question. The generic IWQM business process is shown in Figure **8**.

Firstly, it is important to establish a management mechanism. With regard to IWQM, the management mechanism must contain specific elements. These are derived from the WHO Water Safety Plan (WaSP). However, as mentioned previously, the WaSP is not applicable to every case in the management context. Therefore, the following elements of a preventative management approach have been identified as being essential to be addressed by whatever management mechanism is applicable at each management unit:

- Water use cycle elements identification;

- Hazard/risk assessment;
- Risk management; and
- Contingency plans

Hazard/risk assessment will include the identification of critical control points (CCPs). See Figure 9 for an example of potential CCP identification in a Water Services Authority area and Figure 10 for type of information relevant to each CCP.

For example, the WaSP addresses all the above elements and is viable at municipality level. It is therefore an applicable management mechanism for municipalities. It is unlikely, however, that a community A will have the resources; human, technical and financial to implement a WaSP in a smaller management unit. Moreover, it may not be necessary owing to the existence of few critical control points. However, it is essential that the community A management mechanism contain the vital elements identified above, and therefore a community A might devise (possibly with support from the next management (B) level) an IWQM plan which is a streamlined and simplified version of the WaSP, but which covers the essential requirements of an IWQM management mechanism.

To perform the tasks essential to the management mechanism certain skills are required. If these skills do not exist within the management unit, **it is important that the next level management unit provides support** if it is not viable to provide training. In all cases, when a management unit is established, it will be necessary to raise awareness around both IWQM generally, and around the processes being implemented in the particular management unit. A skills assessment will determine where training and support is required, and the form which the awareness campaign will take.

The specifics of the management unit will also determine the nature of the management tools which will be required to manage water quality to the performance targets which must be established for each CCP in the physical area of the management unit. In the larger management units, the CCPs will occur at the boundaries of the smaller management units within it.

For example, a municipal management unit will set CCPs at community or WUA management unit boundaries, rather than be required to manage all CCPs within the smaller units.

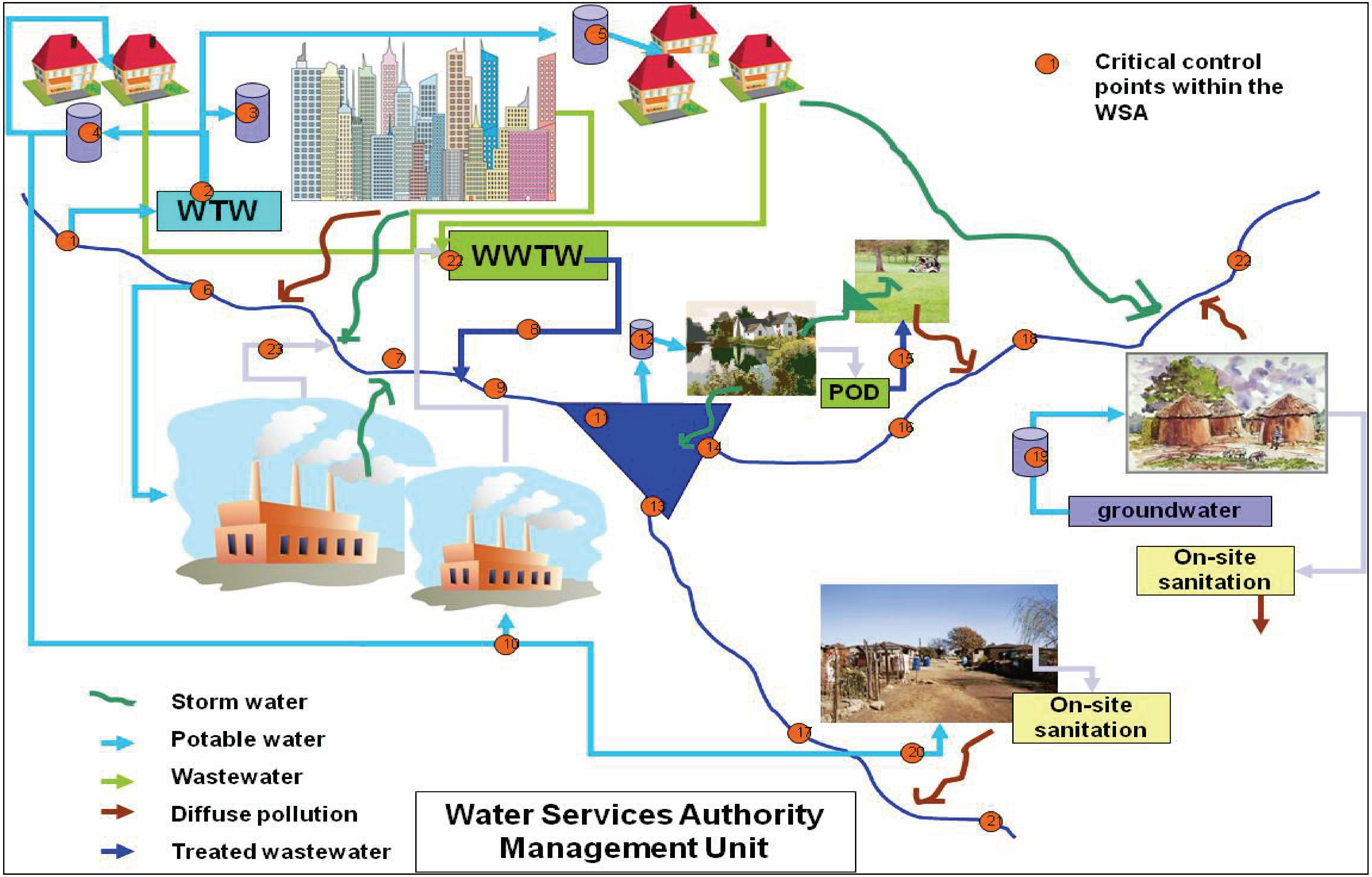
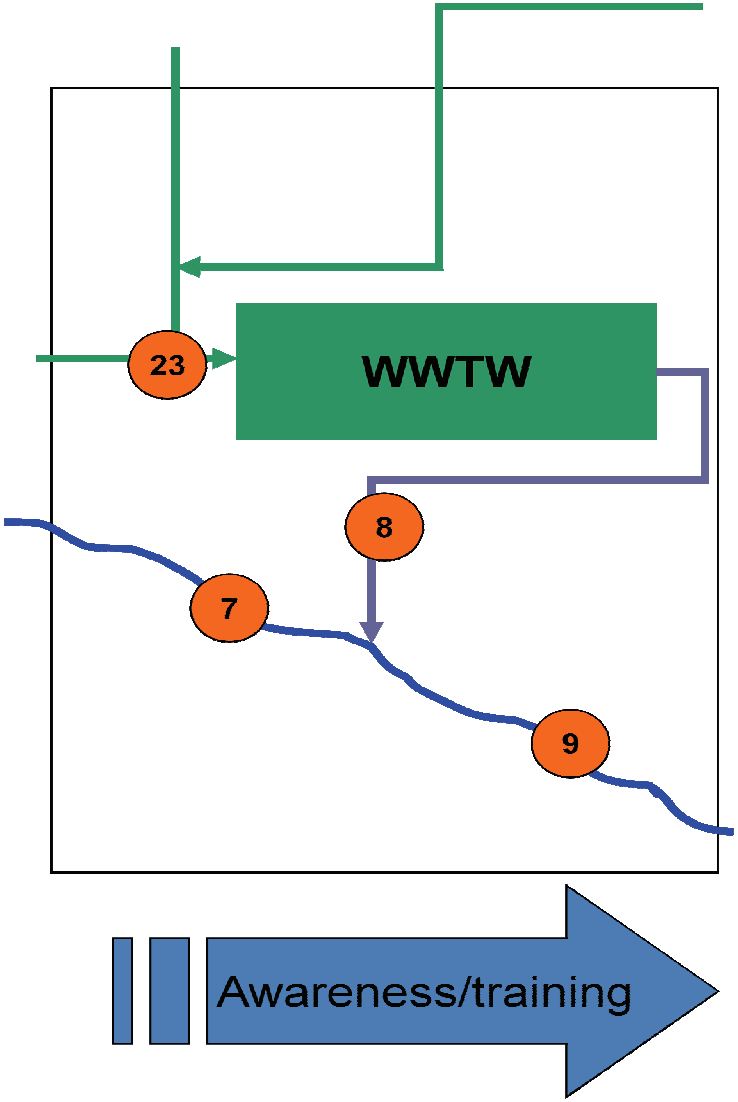



Figure 9: Example of potential CCP identification within a Water Services Authority




| Critical Control Point (CCP) | 23 | 7 | 8 | 9 |
|---|---|---|---|---|
| Description of CCP | Wastewater inflow | River upstream of WWTW | Treated wastewater | River downstream of WWTW |
| Regulatory controls | • National Water Act<br>• Water Service Act<br>• Municipal by-laws | | | |
| Management tools | • Water Use Authorisation<br>• Audit tracking system | | | |
| Communication mechanisms | • Daily plant performance measurements to supervisor<br>• Monthly compliance reports to the DWAF | | | |
| Audit mechanisms | • Monthly internal audits<br>• Annual external audits | | | |
| Performance targets | Water use authorisation conditions; industrial effluent standards stipulated in by-laws | Resource Water Quality Objectives | Stipulated in water use authorisation | Resource Water Quality Objectives |
| Reporting framework | Yes/No | Yes/No | Yes/No | Yes/No |
| Accountability "trail" | For example, the Municipal Manager | | | |

**Figure 10: Type of information relevant to each CCP**

The Yes/No answers provided here would then go forward to the next management unit level.

# 5 IMPLICATIONS OF IMPLEMENTATION OF THE IWQM BUSINESS PROCESS FOR THE MANAGEMENT CONTEXT

The implications of implementing the IWQM business process within the various management units would entail the answering of the following five questions in relation to the generic business process set out in Figure **8**8, and once the risk/hazard assessment has been undertaken, which would mean that the CCPs have been identified.

**Table 2: Generic business process questions**

| Question | | Notes |
|---|---|---|
| 1 | What do you (the Management Unit) need to know? | • Information/data flow from the adjacent management units, or smaller units within your MU; and<br>• Information/data requirements at each CCP:<br>- performance targets;<br>- management tools;<br>- reporting requirements;<br>- audit requirements;<br>- regulatory requirements; and<br>- contingency plans. |
| 2 | Who needs to tell you and what? | • Information flow;<br>• Organisations within the MUs;<br>• Information/data format ; and<br>• Regulatory framework. |
| 3 | Who and what do you need do you need to tell? | • Information flow from you (the MU) to the adjacent or internal MUs;<br>• Information content; and<br>• Information format; |
| 4 | What do we need to achieve this? | • Management tools (existing/new);<br>• Relevant posts (existing/new);<br>• Skills (existing/new); and<br>• Training/awareness programmes. |

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# Appendix A
## Initial workshops

## WRC Project K5/1769

**Development of a conceptual framework for the regulation of water quality within the context of an integrated, preventative management approach**

## INVITATION TO ATTEND A STAKEHOLDER WORKSHOP

**Dear Stakeholder,**

You are invited to participate in a workshop to start the development of a model that will ultimately align the management of the quality of water resources with that of drinking water quality in order to support the effective management of water use in the interest of all water users.

### 1 Introduction

Currently, the linkages between water resources management and drinking water quality management are not strongly followed nor addressed within the South African regulatory framework. The Water Research Commission has initiated a project with the aim to:

- *develop a conceptual framework for aligning the management of the quality of water resources with that of drinking water quality in order to support the effective management of water use in the interest of all water users, i.e. from catchment-to-consumer.*

#### *1.1 Sustainability of South Africa's water*

In order to sustain South Africa's water resources and supply, the following principles need to be highlighted:

- SA must preserve the principles of the National Water Act, 1998 (Act 36 of 1998);
- All South Africans must recognize that there are limits to the available water resources.
- SA's water resources must be managed within the capacity of individual catchments.
- Communities, industry[1] and government must share responsibility for water management in SA and work together to improve conditions within the catchments.
- Knowledge of SA's water supply and water quality (source and resource) is the foundation for effective decision-making.
- South Africans must become leaders at using water more effectively and efficiently, so as to use and reuse water wisely and responsibly.
- Healthy aquatic ecosystems are vital to a high quality of life for South Africans and must be preserved.
- Groundwater and surface water quality must be preserved in pursuing economic and community development.
- SA must continue to be a leader in drinking water quality and standards to ensure all South Africans have safe, secure water.

#### *1.2 Benefits of a framework for regulation of water quality within the context of an aligned management approach.*

Management of water quality through a comprehensive preventative strategy will

[1] Industry includes mining, agriculture and other industries such as the power generation sector

benefit the water industry by providing an overall framework that will:

- promote public health by assuring safer drinking water for consumers;
- enable an in-depth systematic evaluation of water systems, the identification of hazards and the assessment of risk within those water systems;
- help to foster a holistic approach to, and an understanding of, management of water quality;
- emphasise prevention and place drinking water quality monitoring in an appropriate verification role;
- introduce a common and standard approach throughout the industry that will aid in establishing due diligence and credibility;
- provide the opportunity for various institutions and stakeholders to identify their areas of responsibility and become involved;
- offer the outcome of a co-operative and co-ordinated approach with improved understanding of the responsibilities of all parties;
- provide a framework for communication for all parties involved in the water system;
- address the uncertainties in setting accurate guideline values when insufficient scientific data is available;
- identify future research needs for individual catchments and water supply systems and assist in the development of improved risk assessment for specific hazards.

## 2 Problem statement

In the current regulatory context:

- Local Government is mandated to provide water services.
- National Government is mandated to protect the water resources.
- Failing water services have an impact on the water resources.
- Poor water quality in the water resource impacts on the quality of potable water delivered.

Simplified, the current reality is that there is a vicious circle in which the local authorities are not taking responsibility for the resources as it is seen as a national mandate and national government on the other hand is also frustrated in that a great deal of the pollution is coming from the service delivery issues within the local authorities.

What is needed is a model that will allow for the co-ordination of the various aspects of all water related issues i.e. not a DWAF vs LG situation that seems to currently exist.

---

## 3 When and where?

Workshops will be held in the following areas:

| Province | Date | Venue |
|---|---|---|
| Western Cape, Cape Town | 26 February 2008 | To be advised |
| Gauteng, Pretoria | 27 February 2008 | To be advised |
| KwaZulu-Natal, Pietermaritsburg | 4 March 2008 | To be advised |

- No registration fees apply however please note that no provisions has been made to compensate delegates financially for attending the workshop.
- Delegates must carry their own transport and accommodation costs.

Please complete the attached reply form and fax/e-mail to:
**Ms Wilheminah Mosupye**:
Zitholele Consulting (Pty) Ltd.
**Phone:** (+27)(0)11 254 4901
**Fax**: (+27)(0)11 805 2100
**E-mail**: wmosupye@zitholele.co.za

# REPLY SHEET

**Development of a conceptual framework for the regulation of water quality within the context of an integrated, preventative management approach**

***Stakeholder Workshop***

**Please complete by 31 January 2008 and *return to:***
Wilheminah Mosupye, Zitholele Consulting (Pty) Ltd
P O Box 6002, Halfway House, 1685, Tel: (011) 254 4901, Fax: (011) 805 2100
E-mail: wmosupye@zitholele.co.za

| | | | |
|---|---|---|---|
| **TITLE** | | **FIRST NAME** | |
| **INITIALS** | | **SURNAME** | |
| **ORGANISATION** | | | |
| **POSITION** | | | |
| **ADDRESS** | | | |
| | | **POSTAL CODE** | |
| **TEL NO** | | **FAX NO** | |
| **EMAIL** | | | |

| | | | |
|---|---|---|---|
| **I will attend a stakeholder workshop (please tick appropriate box) (You will receive further details on the selected workshop).** | Western Cape | 26 February 2008 | |
| | Gauteng | 27 February 2008 | |
| | KwaZulu-Natal | 4 March 2008 | |

Comment on specific issues that you would like to see addressed in the workshop:

______________________________________________________________________
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***THANK YOU FOR YOUR RESPONSE AND COMMENTS***

# Development of a conceptual framework for the regulation of water quality within the context of an integrated, preventative management approach

## WRC Project K5/1769

## AGENDA

| | | |
|---|---|---|
| **09:30** | **Registration and tea** | **Presenter / facilitator** |
| 10:00-11:15 | • Introduction to the project<br>• Current situation regarding drinking water quality in South Africa<br>• Current situation regarding catchment management in South Africa<br>• International experience | Lee Boyd<br><br>Leonardo Manus<br><br>Robyn Tompkins<br>Lee Boyd |
| **11:15** | **Break** | |
| 11:20 | Plenary session to formulate issues for discussion | |
| 11:40 | Group discussion session | |
| 13:20 | Way forward | |
| **13:30** | **Lunch** | |

# Appendix B

## Second round workshops

**WRC Project K5/1769**

# Development of a conceptual framework for the regulation of water quality within the context of an integrated, preventative management approach

**REMEMBER *EVERYONE LIVES DOWNSTREAM*, SO THIS AFFECTS**

**YOUR INPUT IS VALUED!!**

# INVITATION TO ATTEND A STAKEHOLDER WORKSHOP AT WISA 2008
# Tuesday 20th May from 13h40 to 16h30

**Dear Stakeholder,**

You are invited to participate in a workshop to continue the development of a model that will ultimately align the management of the quality of water resources with that of drinking water quality in order to support the effective management of water use in the interest of all water users.

## 1 Introduction

Currently, the linkages between water resources management and drinking water quality management are not strongly followed nor addressed within the South African regulatory framework. The Water Research Commission has initiated a project with the aim to:

- *develop a conceptual framework for aligning the management of the quality of water resources with that of drinking water quality in order to support the effective management of water use in the interest of all water users, i.e. from catchment-to-consumer.*

## 2 Problem statement

In the current regulatory context:

- Local Government is mandated to provide water services.
- National Government is mandated to protect the water resources.
- Failing water services have an impact on the water resources.
- Poor water quality in the water resource impacts on the quality of potable water delivered.

Simplified, the current reality is that there is a vicious circle in which the local authorities are not taking responsibility for the resources as it is seen as a national mandate and national government on the other hand is also frustrated in that a great deal of the pollution is coming from the service delivery issues within the local authorities.

What is needed is a model that will allow for the co-ordination of the various aspects of all water related issues i.e. not a DWAF vs LG situation that seems to currently exist.

## 3 Benefits of a framework for regulation of water quality within the context of an aligned management approach.

Management of water quality through a comprehensive preventative strategy will benefit the water industry[1] by providing an overall framework that will:

- promote public health by assuring safer drinking water for consumers;
- enable an in-depth systematic evaluation of water systems, the identification of hazards

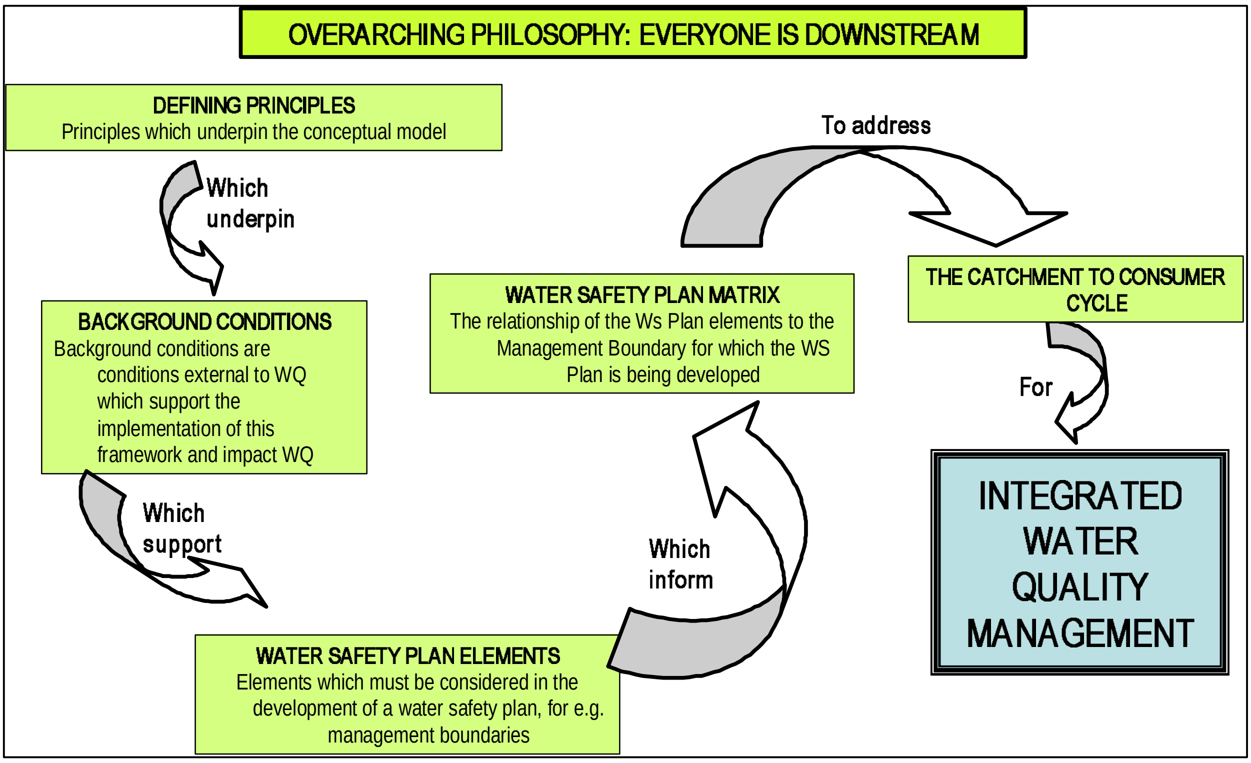
[1] Water industry includes all water users in the water cycle

and the assessment of risk within those water systems;

- help to foster a holistic approach to, and an understanding of, management of water quality;
- emphasise prevention and place drinking water quality monitoring in an appropriate verification role;
- introduce a common and standard approach throughout the industry that will aid in establishing due diligence and credibility;
- provide the opportunity for various institutions and stakeholders to identify their areas of responsibility and become involved;
- offer the outcome of a co-operative and co-ordinated approach with improved understanding of the responsibilities of all parties;
- provide a framework for communication for all parties involved in the water system;
- address the uncertainties in setting accurate guideline values when insufficient scientific data is available;
- identify future research needs for individual catchments and water supply systems and assist in the development of improved risk assessment for specific hazards.

## 4 STAKEHOLDER WORKSHOPS

The overall outcome of three stakeholder workshops held in February/March 2008 is schematically presented in the framework below, the details of which will be presented , discussed and expanded on at a workshop to be held at WISA 2008.




**Conceptual framework for the regulation of water quality within the context of an integrated, preventative management approach**

A number of institutions are relevant to the implementation of the framework. They are categorised as follows:

**Existing:**

- National
- Regional or area/specific

**Proposed or potential**

- External
- Those specific to the requirements of the WS Plan

# WRC Project K5/1769

**Development of a conceptual framework for the regulation of water quality within the context of an integrated, preventative management approach**

## INVITATION TO ATTEND THE THIRD STAKEHOLDER WORKSHOP

**Dear Stakeholder,**

As discused at the earlier workshops the project aims to develop a conceptual model for aligning the management of the quality of water resources with that of drinking water quality in order to support the effective management of water use in the interest of all water users. In other words, to ensure management of water in a catchment-to-consumer approach. To date the project has yielded a draft structured conceptual model for integrating water quality management taking into account the current legislative gaps, as well as indicating required changes to the legislative framework that will strengthen the regulatory framework for integrated management.

Attached, please find a summary document containing the results of the study to date. You are invited to participate in a workshop to give comment on the process so far and positive input into the conceptual model.

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### When and where?

Workshops will be held in the following areas:

| Province | Date | Venue |
|---|---|---|
| Free State | 28 October 2008 | To be advised |
| KwaZulu-Natal | 5 November 2008 | To be advised |
| Gauteng | 11 November 2008 | To be advised |
| Eastern Cape | 12 November 2008 | To be advised |
| Western Cape | 13 November 2008 | To be advised |

- No registration fees apply however please note that no provisions has been made to compensate delegates financially for attending the workshop.
- Delegates must carry their own transport and accommodation costs**.**

Please complete the attached reply form and fax/e-mail to:

**Ms Wilheminah Mosupye**:
Zitholele Consulting (Pty) Ltd.
**Phone:** (+27)(0)11 254 4901
**Fax**: (+27)(0)11 805 2100
**E-mail**: wmosupye@zitholele.co.za

# REPLY SHEET

**Development of a conceptual framework for the regulation of water quality within the context of an integrated, preventative management approach**

***Stakeholder Workshop***

**Please complete by 1st September 2008 and *return to:***
Wilheminah Mosupye, Zitholele Consulting (Pty) Ltd
P O Box 6002, Halfway House, 1685, Tel: (011) 254 4901, Fax: (011) 805 2100
E-mail: wmosupye@zitholele.co.za

| | | | |
|---|---|---|---|
| **TITLE** | | **FIRST NAME** | |
| **INITIALS** | | **SURNAME** | |
| **ORGANISATION** | | | |
| **POSITION** | | | |
| **ADDRESS** | | | |
| | | **POSTAL CODE** | |
| **TEL NO** | | **FAX NO** | |
| **EMAIL** | | | |

| | | | |
|---|---|---|---|
| **I will attend a stakeholder workshop (please tick appropriate box)**<br><br>**(You will receive further details on the selected workshop).** | Free State | 28 October 2008 | |
| | KwaZulu-Natal | 5 November 2008 | |
| | Gauteng | 11 November 2008 | |
| | Eastern Cape | 12 November 2008 | |
| | Western Cape | 13 November 2008 | |

Comment on specific issues that you would like to see addressed in the workshop:

______________________________________________________________________
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***THANK YOU FOR YOUR RESPONSE AND COMMENTS***

# Appendix C

Stakeholders who contributed to this project

| NAME | INSTITUTION |
|---|---|
| Abbott, Henry | Department of Water Affairs and Forestry |
| Abrahams, Manie | Provincial Health Western Cape |
| Agenbag, Mike | Ukhahlamba District Municipality |
| Albertus, Martin | CapeWinelands District Municipality |
| Archer, Colleen | Pollution Research Group; University of KwaZulu-Natal |
| Ashe, Bryan | Earthlife Africa (South African Water Caucus) |
| Balfour, Faye | Jeffares & Green Consultants (Pty) Ltd |
| Barnes, Garth | Wildlife and Environment Society of South Africa (WESSA) |
| Bekink, Melanie | Umgeni Water |
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| Daneel, Dr Richard | EnviroservWaste Management |
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| De Souza, Philip | Emanti Management |
| De Vos, Mornay | East RandWater (ERWAT) |
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| Dywili, Sam | Department of Water Affairs and Forestry |
| Erasmus, Dr Petro | Department of Water Affairs and Forestry |
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| Genthe, Bettina | CSIR Stellenbosch |
| Goosen, Johan | Provincial Administration Western Cape |
| Haskins, Candice | City of Cape Town Metropolitan Municipality |

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| Khan, Rashid | Department of Water Affairs and Forestry |
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| Lourens, Dirk | Ukhahlamba District Municipality |
| Mabogo, Rudzani | Department of Water Affairs and Forestry |
| Makhado, Patrick | Department of Water Affairs and Forestry |
| Makhubele, Kenneth | Department of Water Affairs and Forestry |
| Malan, Jacobus | Anglo Platinum |
| Mamabolo, Florah | Department of Water Affairs and Forestry |
| Mander, Myles | Futureworks |
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| Masindi, Thivhonali | Department of Water Affairs and Forestry |
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| Shoba, Jerome | Sukuma Uzenzele |
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| Terry, Steve | Umgeni Water |
| Theron, Jan | Arcelor Mittal |
| Tompkins, Robyn | Jeffares & Green Consultants (Pty) Ltd |
| Trollip, Deborah | Umgeni Water |
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| Van Heerden, Conrad | Theewaterskloof Local Municipality |
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| Van Rooyen, Lester | Amatole District Municipality |
| Van Rooyen, Stanley | Cederberg Local Municipality |
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