



2008 FREE AND OPEN SOURCE  
SOFTWARE FOR GEOSPATIAL CONFERENCE



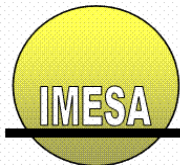
# Development & Implementation of an FOSS Based Internet Accessible WQMS for Improving the Quality of Water Services in SA

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**water & forestry**

Department:  
Water Affairs and Forestry  
REPUBLIC OF SOUTH AFRICA



# Presentation Roadmap...

- Background: South African WQM
- Considerations when implementing an IT based system: South African experience
- eWQMS
- WQM: Business capability model
- Case Studies: derived benefits from use of eWQMS
- Conclusions



# Background: SA WQM...

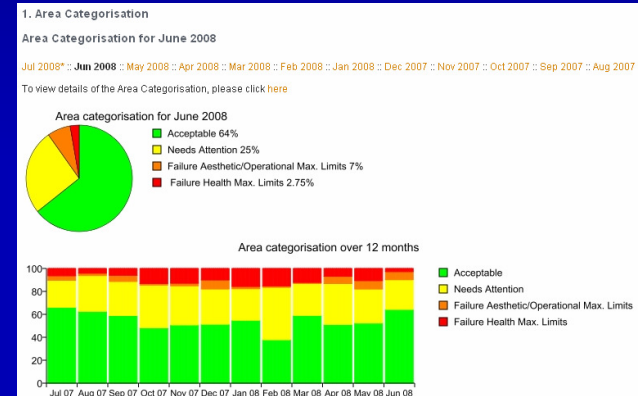
- SA has good legislative framework
  - Considerable success in addressing backlogs
  - Challenge → sustainable, safe water services
  - Many municipalities → inadequate water and effluent treatment and associated management
  - Various sector initiatives to assist municipalities
  - Need for a WQ data capture/information tool
    - Roll-out DWAF/IMESA/SALGA eWQMS to all 166 Water Services Authorities in SA
- Sector utilise information to formulate strategies & implement actions to address issues of concern**

# **IT based WQM System Implementation in SA...**

- Ensure raised awareness (e.g. increased budget)
- Build on existing Good Practice (i.e. not be counter-productive)
- Bottom-up approach (i.e. useful to municipalities)
- Easy to use, robust, reliable and low cost (FOSS)
- Enable intervention in areas facing health threats
- Provide strategic data to municipalities, DWAF, etc
- Satisfy municipal Governance Requirements
- Support DWAFs and other role player requirements
- Undergo iterative enhancements (via feedback)

# eWQMS...

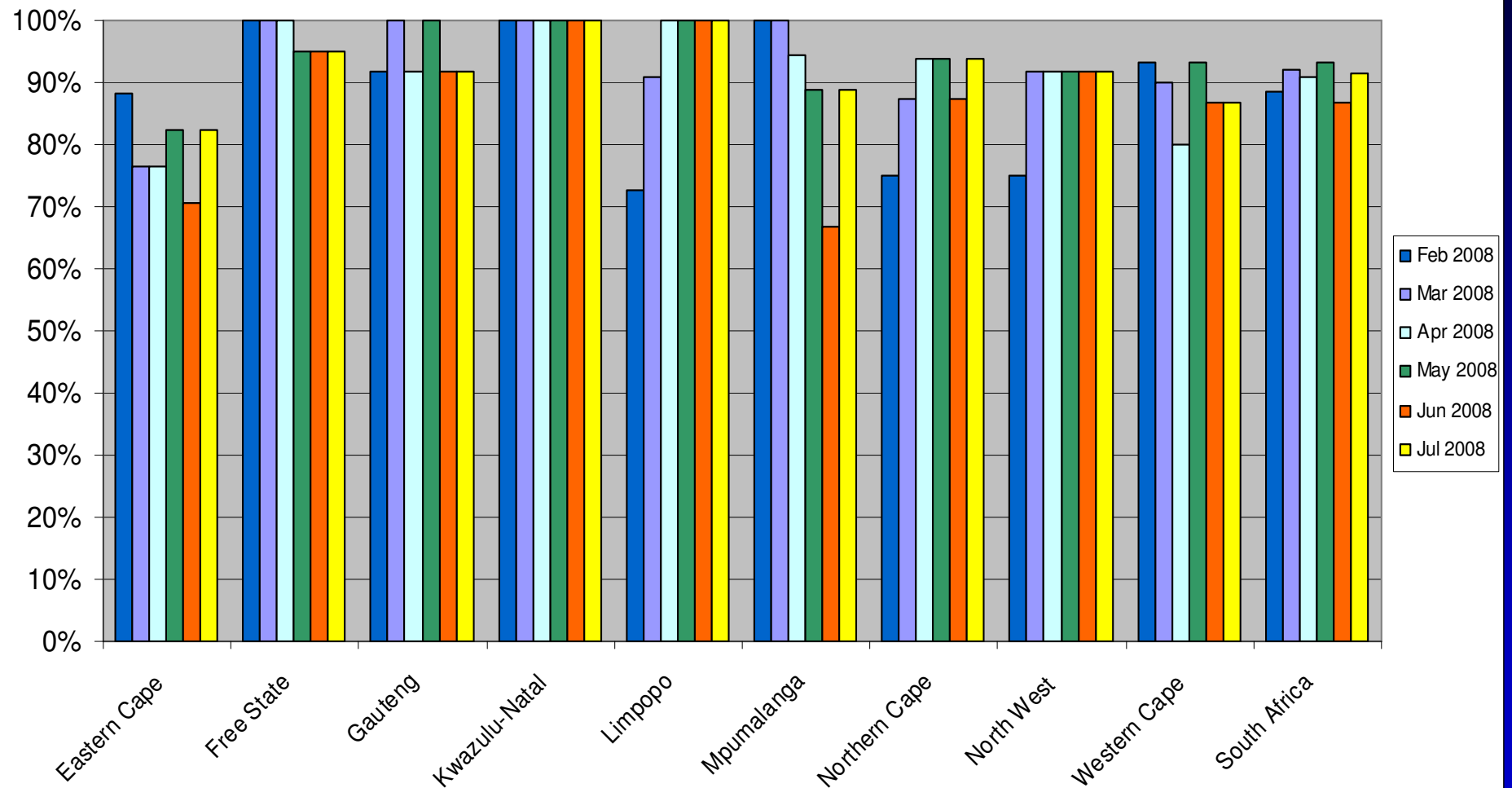
- Open Source Software based system
  - Operating System: Linux
  - Database: MySQL & ZODB (Zope Object Database)
  - Programming Languages: Python, C
  - Application Server: Zope
  - Web Server: Apache
- [www.wqms.co.za](http://www.wqms.co.za)
- Various role players can track & review WQ
- Developed in a “bottom up” approach



# eWQMS Features...

- Management Dashboard (key issues)
- Overview (summary of compliance)
- Data Analysis (tables and graphs)
- Reports (archive of automatically generated reports)
- Information (water related info and references)
- Infrastructure (capture details of water system)
- Administration (configure and manage system set-up)
- Risk Toolbox (municipal self-assessment)

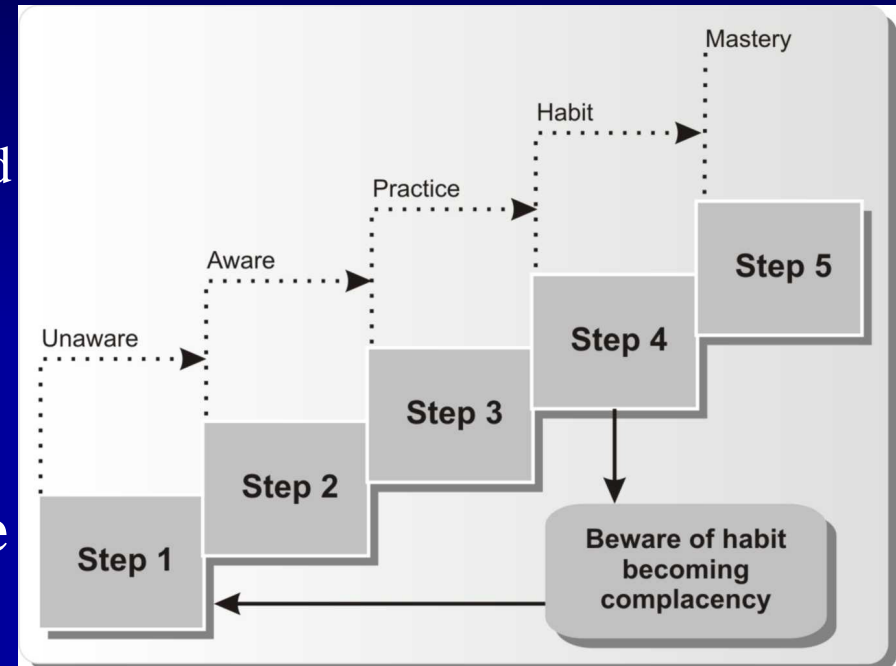
# National Progress...



- July 2008 → 152 out of 166 (92%) WSAs

# Business Capability Model...

- **Step 1: Unconscious incompetence**
  - Unaware of what they don't know
- **Step 2: Conscious Incompetence**
  - Aware of what they don't know **BUT** don't know how to implement/respond
- **Step 3: Conscious Competence**
  - Aware of how to do things properly **BUT** have to concentrate/practice
- **Step 4: Unconscious Competence**
  - Do things automatically
  - Continuous improvement/benchmarking
- **Step 5: Mastery**
  - Optimized total water management cycle
  - Very proactive

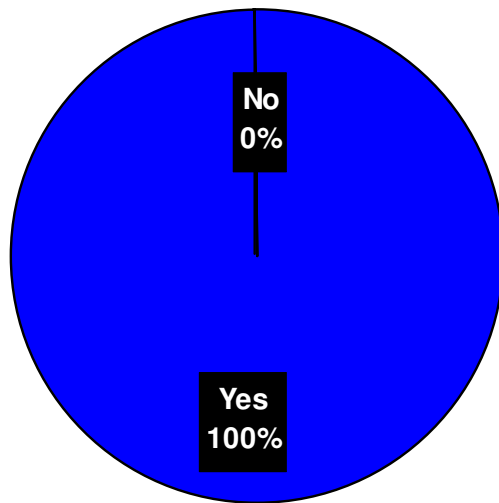




# Derived Benefits from using eWQMS...

- Step 1: Unaware
- “They don’t know that they don’t know”

Are You Providing A Good Quality Drinking-Water In Major Towns?



## Drinking Water Quality Summary

Bacteriological :: Physical :: Chemical

Area	Total Coliforms		Faecal Coliforms	
	Samples	Compliance (%)	Samples	Compliance (%)
Western Cape (Masibambane)	162	58	162	81
Boland DM	30	47	30	90
Central Karoo DM	24	58	24	67
Eden DM	48	71	48	85
Overberg DM	30	53	30	73
West Coast DM	30	53	30	83

# eWQMS Information...

Water Quality Management System

## Microbiological Parameters

### *E.coli*

*Escherichia coli* (*E.coli*) is used as an indicator of faecal pollution by warm blooded animals (often interpreted as human faecal pollution). The presence of faecal pollution by warm animals may indicate the presence of pathogens responsible for infectious disease such as gastroenteritis, cholera, dysentery and typhoid fever after ingestion of contaminated water.

#### *Effect and possible implications of failure*

- ◆ Health

The risks of being infected correlates with the level of contamination of the water and the amount of contaminated water consumed. Higher concentrations of *E.coli* in water will indicate a higher risk of contracting waterborne disease, even if small amounts of water are consumed. Any bacteriological failure with regards to *E.coli* can therefore be considered a direct risk to health.

#### *SANS 241 Standards*

- ◆ SANS 241 Table 1 (Microbiological safety requirements) column 3 Allowable Compliance Contribution (95% of samples min) Upper Limit: Not detected (count per 100 ml)
- ◆ SANS 241 Table 1 (Microbiological safety requirements) column 4 Allowable Compliance Contribution (4% of samples max) Upper Limit: Not detected (count per 100 ml)
- ◆ **SANS 241 Table 1 (Microbiological safety requirements) column 5 Allowable Compliance Contribution (1% of samples max) Upper Limit: 1 (count per 100 ml)**

#### *Possible reason/s for failure*

- ◆ No disinfection (e.g. no chlorine dosing, no ozone dosing, no UV system)
- ◆ No residual chlorine or low level of residual chlorine (e.g. chlorine not added at plant, residual chlorine below 0.2 mg/L at point of consumption)
- ◆ Contamination (e.g. from pipe breaks and bursts, from repairs to network, infiltration or seepage from a contaminated source, sewage near groundwater sources, contamination of pit latrines/septic tanks, rubbish and faecal matter around standpipes)
- ◆ Lack of maintenance (e.g. reservoirs and pipes not cleaned/flushed)
- ◆ Poor design (e.g. long retention times in reservoir and distribution network, open reservoirs, large reticulation network with no additional chlorine dosing at reservoirs)
- ◆ Sabotage/vandalism

**Don't need login details to access**

# Data Loading...

- Direct via internet
- Spreadsheet e-mailing
- Data import (LIMS)

Kor Plaatje Municipality Water Quality Management System - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

Address bar: <http://www.wqms.co.za/admin/>

Customize Links Free Hotmail Windows Marketplace Windows Media Windows

import data  
import sample points

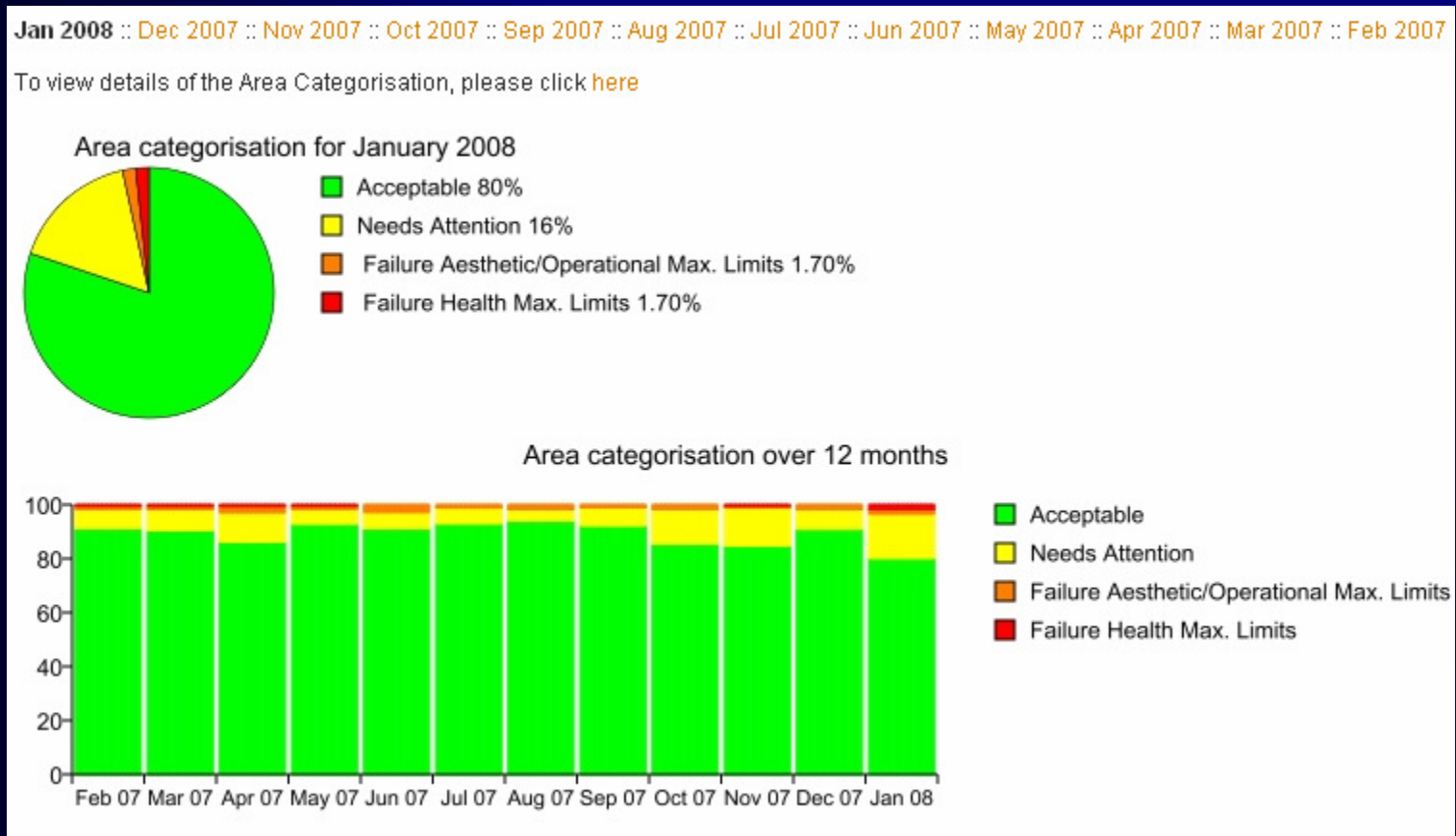
Date Analysed (optional)	<input type="text"/>
Lab Number (optional)	<input type="text"/>
Type (optional)	Not applicable <input checked="" type="button" value="v"/>
Comments (optional)	Poor disinfection efficiency. Issue has been addressed. Re-sampling indicated that water is safe to drink. Issue has been resolved. Mr Manager (date)

Determinant	Value	Unit	Reason for no value
Aluminium (health)	0.15	mg/L as Al	None
E.coli (health)	10	count per 100 mL	None
Electrical Conductivity (aesthetic)		mS/m	Analysis not carried out
Fluoride (health)		mg/L as F-	Analysis not carried out
Free Chlorine Residual (operational)	0	mg/L	None
Iron (aesthetic/operational)	0.15	mg/L as Fe	None
Nitrates and Nitrites (health)	0	mg/L as N	None
pH (aesthetic/operational)	7.6	pH units	None
Total Coliforms (operational)	25	count per 100 mL	None
Turbidity (aesthetic/operational/indirect health)	4.5	NTU	None

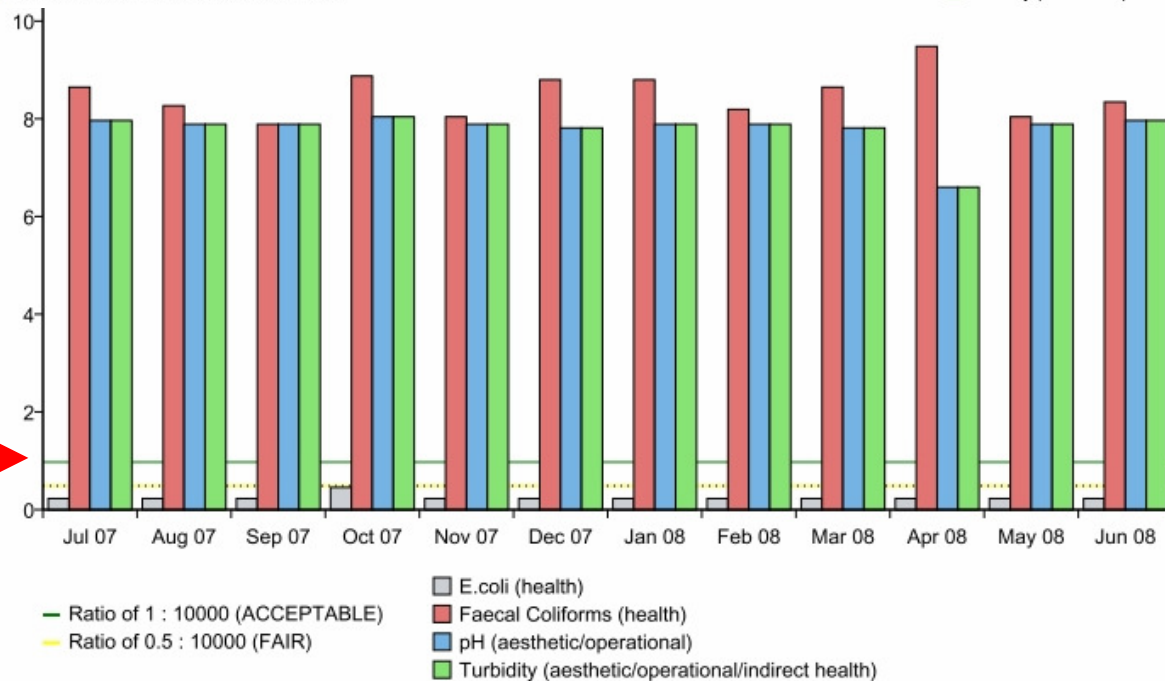
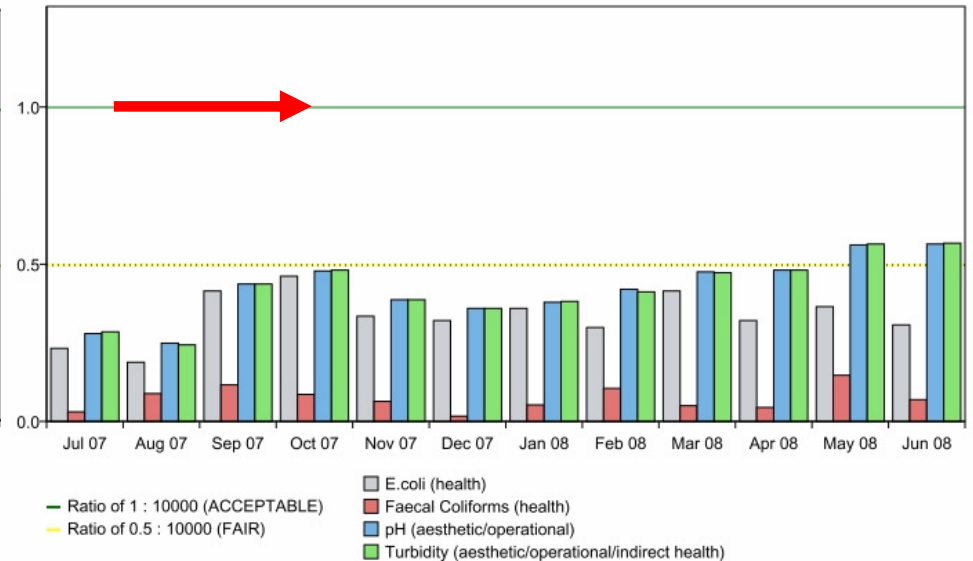
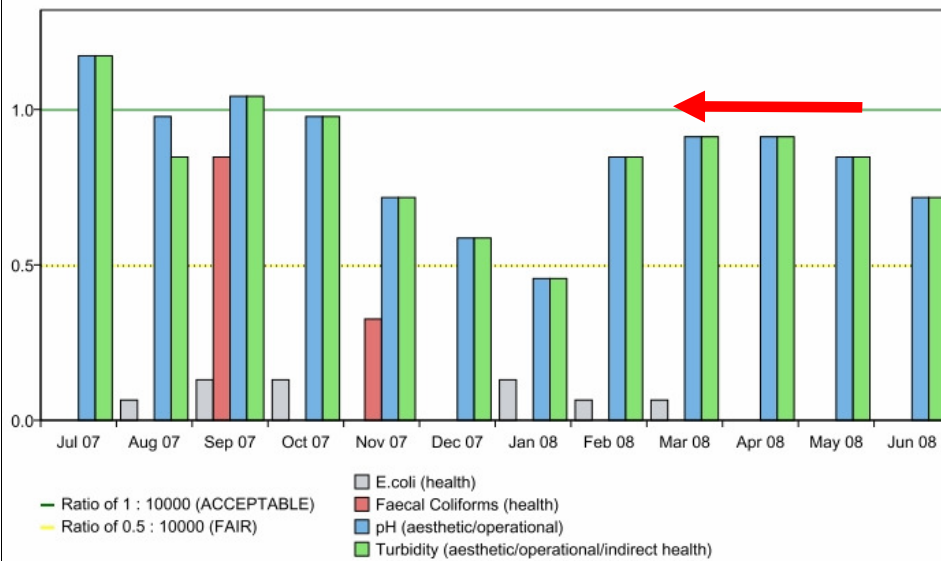
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# Derived Benefits from using eWQMS...

- Step 2: Aware
- Use colour coding to guide municipalities



# Am I collecting sufficient samples?

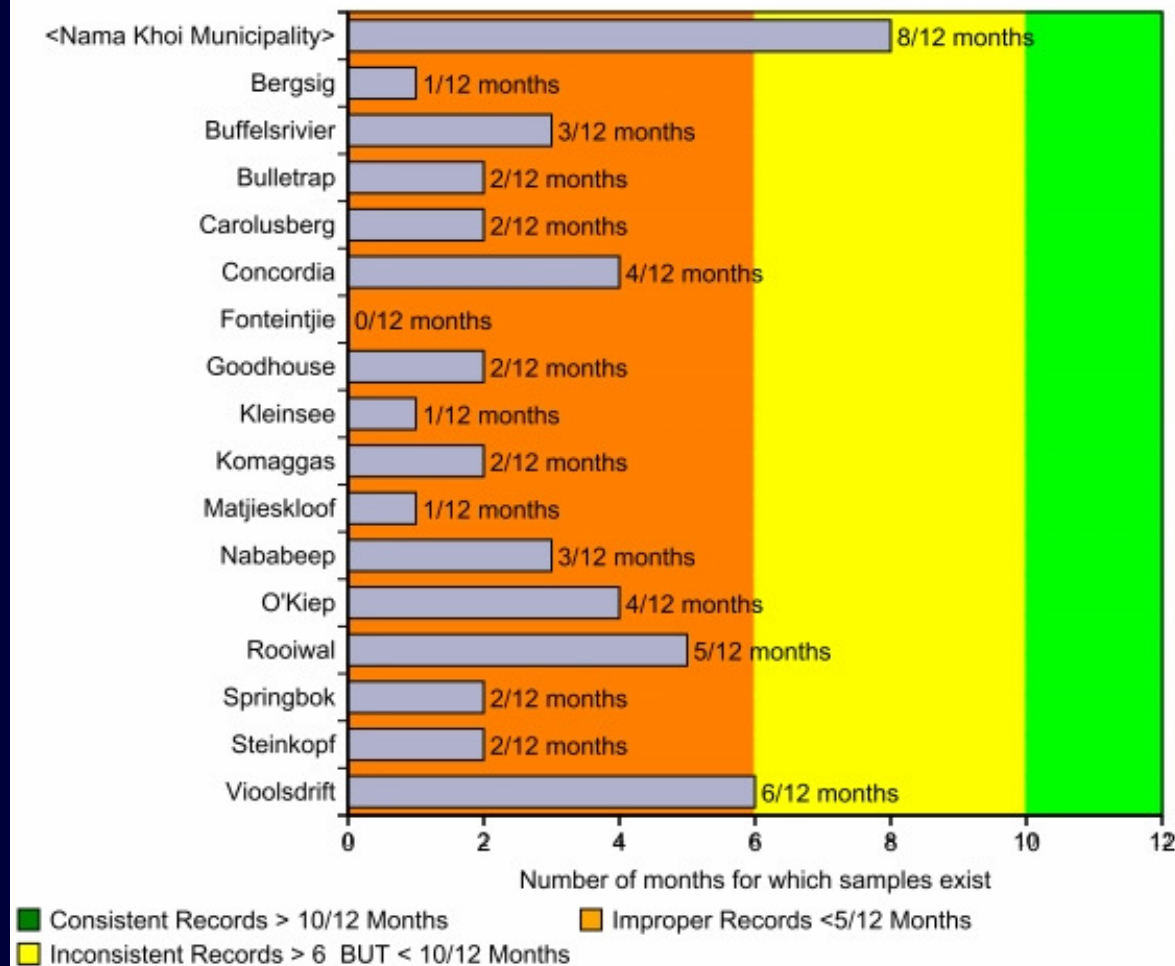


# Am I monitoring all of my areas?

To view details of how the consistency of records are characterized, please click [here](#)

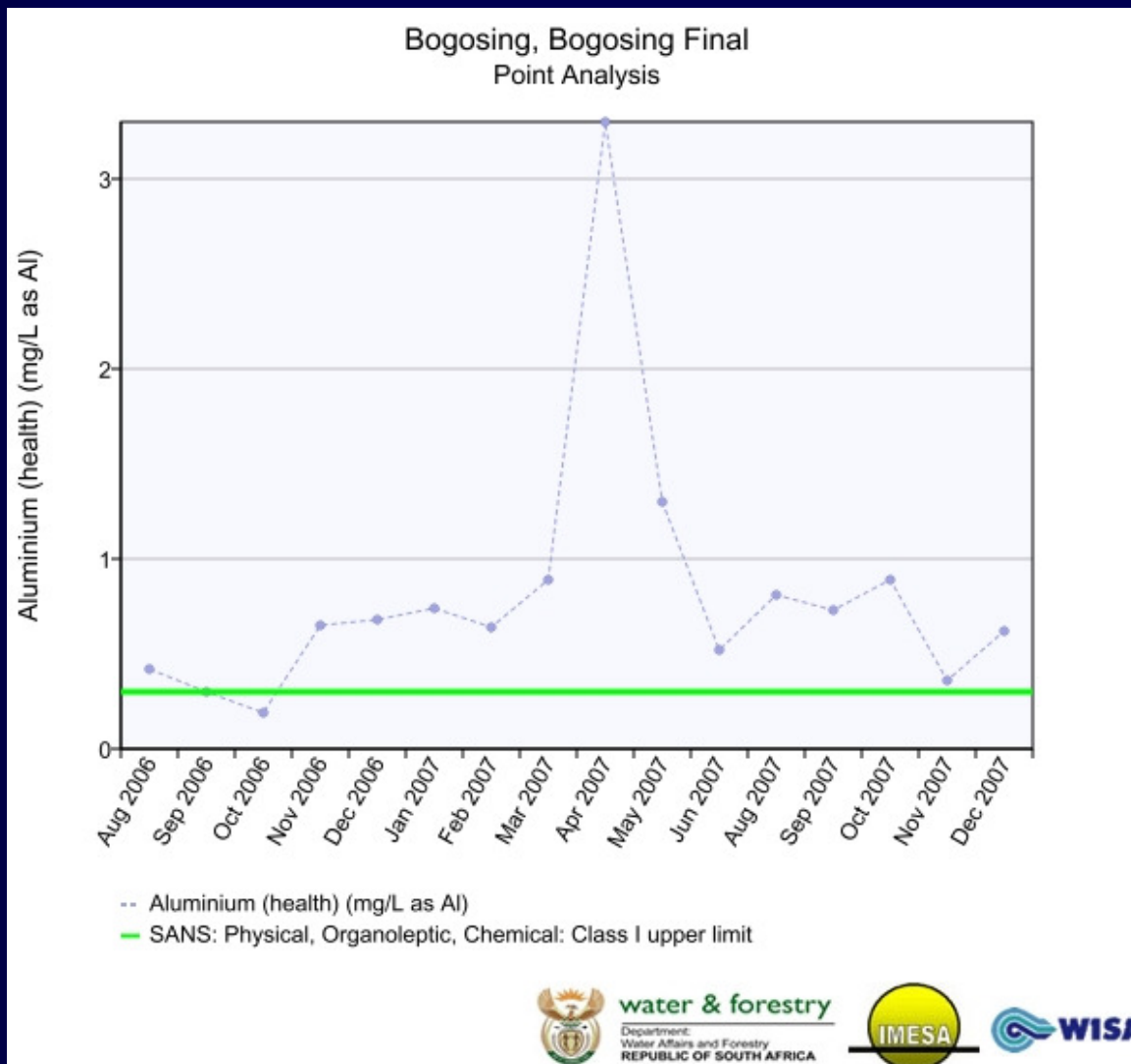
## Consistency of Monthly Sample Collection for Nama Khoi Municipality

from February 2007 to January 2008





# What standard should I be maintaining?



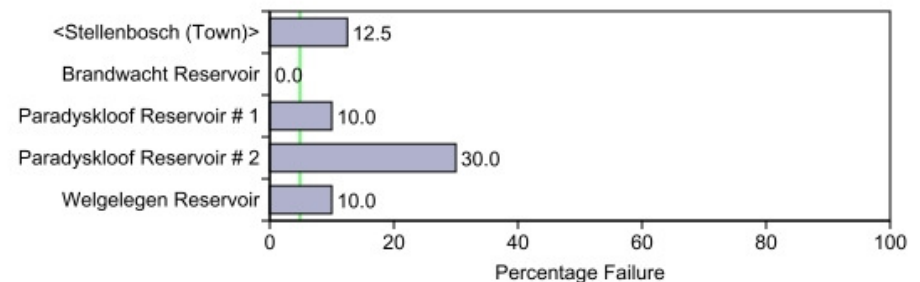
# Derived Benefits from using eWQMS...

- Step 3: Practice

2006

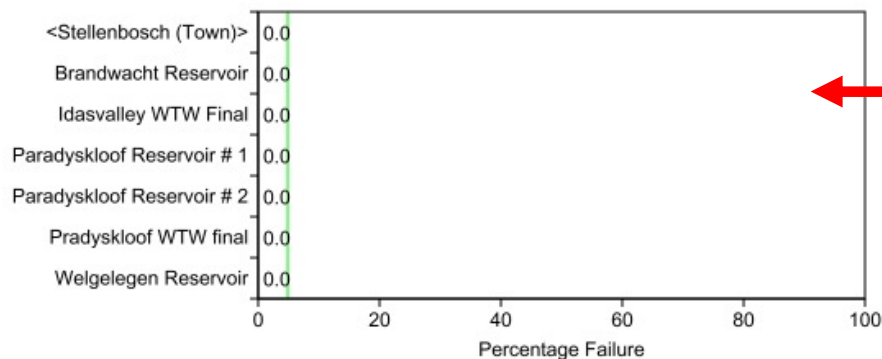


% Failure for Aluminium (health)  
for Stellenbosch (Town)  
from 2006/1/1 to 2006/12/31



Samples  
analysed by **CSIR**  
SANAS accredited testing laboratory

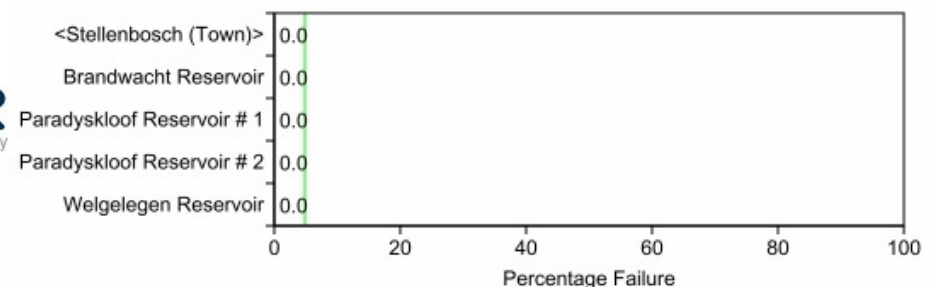
% Failure for Aluminium (health)  
for Stellenbosch (Town)  
from 2007/1/1 to 2007/12/31



2007



% Failure for Aluminium (health)  
for Stellenbosch (Town)  
from 2008/1/1 to 2008/5/31



Samples  
analysed by **CSIR**  
SANAS accredited testing laboratory

2008



Samples  
analysed by **CSIR**  
SANAS accredited testing laboratory



# Derived Benefits from using eWQMS...

- Step 4: Habit
- Automatic reports

## Official Drinking Water Reports

The following section is an archive of water quality management reports. All reports are available for download.  
[Select a different Area](#)

### Showing Reports for City of Johannesburg

#### Published in 2008

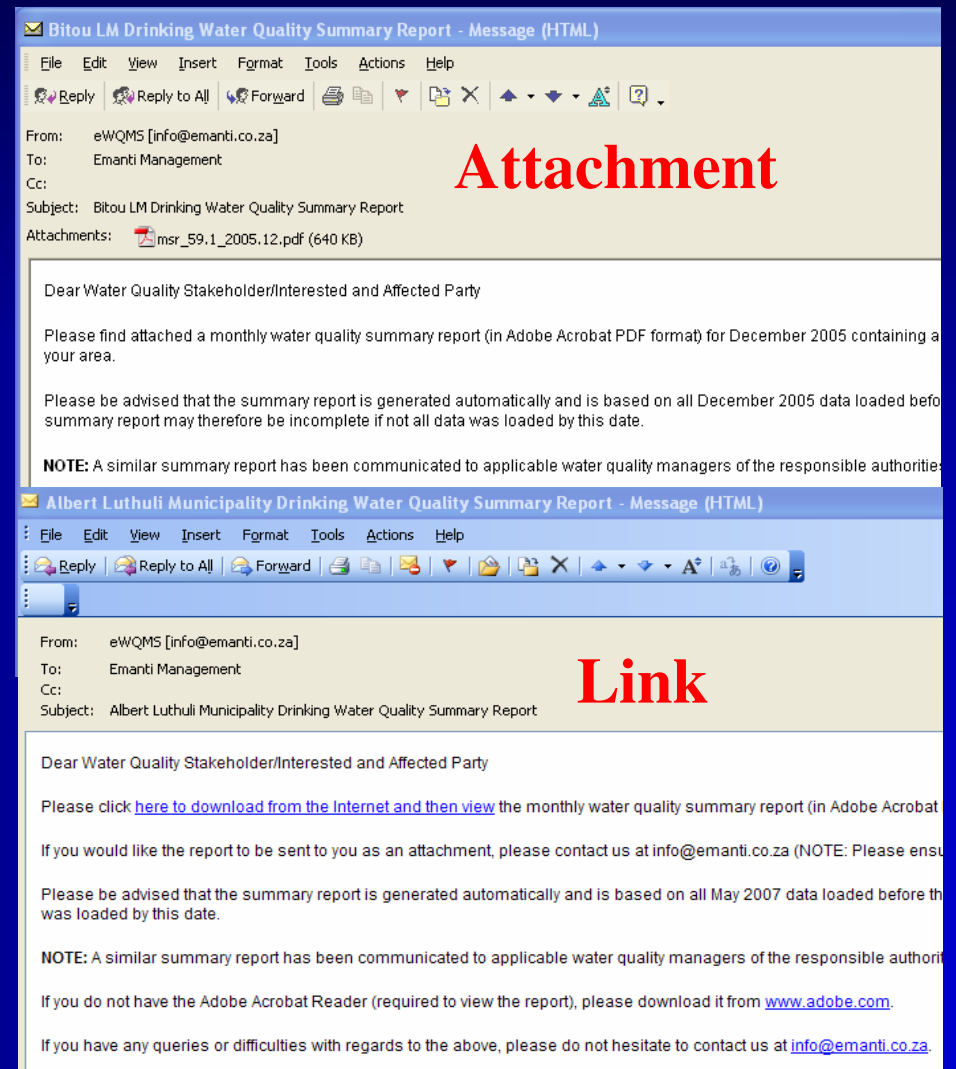
- ◆ DWQM - Summary Report - January 2008
- ◆ DWQM - Summary Report - December 2007

#### Published in 2007

- ◆ DWQM - Summary Report - November 2007
- ◆ DWQM - Summary Report - October 2007
- ◆ DWQM - Summary Report - September 2007
- ◆ DWQM - Summary Report - August 2007
- ◆ DWQM - Summary Report - July 2007
- ◆ DWQM - Summary Report - June 2007
- ◆ DWQM - Summary Report - May 2007
- ◆ DWQM - Summary Report - April 2007
- ◆ DWQM - Summary Report - March 2007
- ◆ DWQM - Summary Report - February 2007
- ◆ Drinking-Water Quality - January 2007

#### Published in 2006

- ◆ Drinking-Water Quality - December 2006
- ◆ Drinking-Water Quality - November 2006

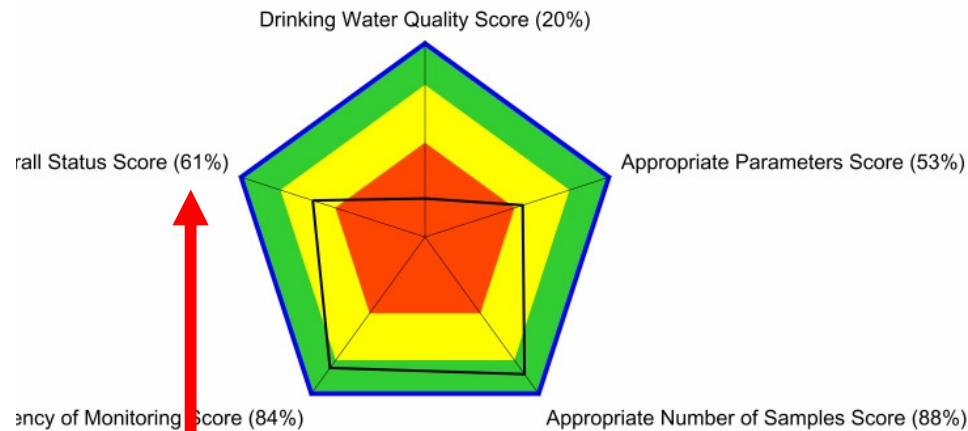


## Performance Assessment

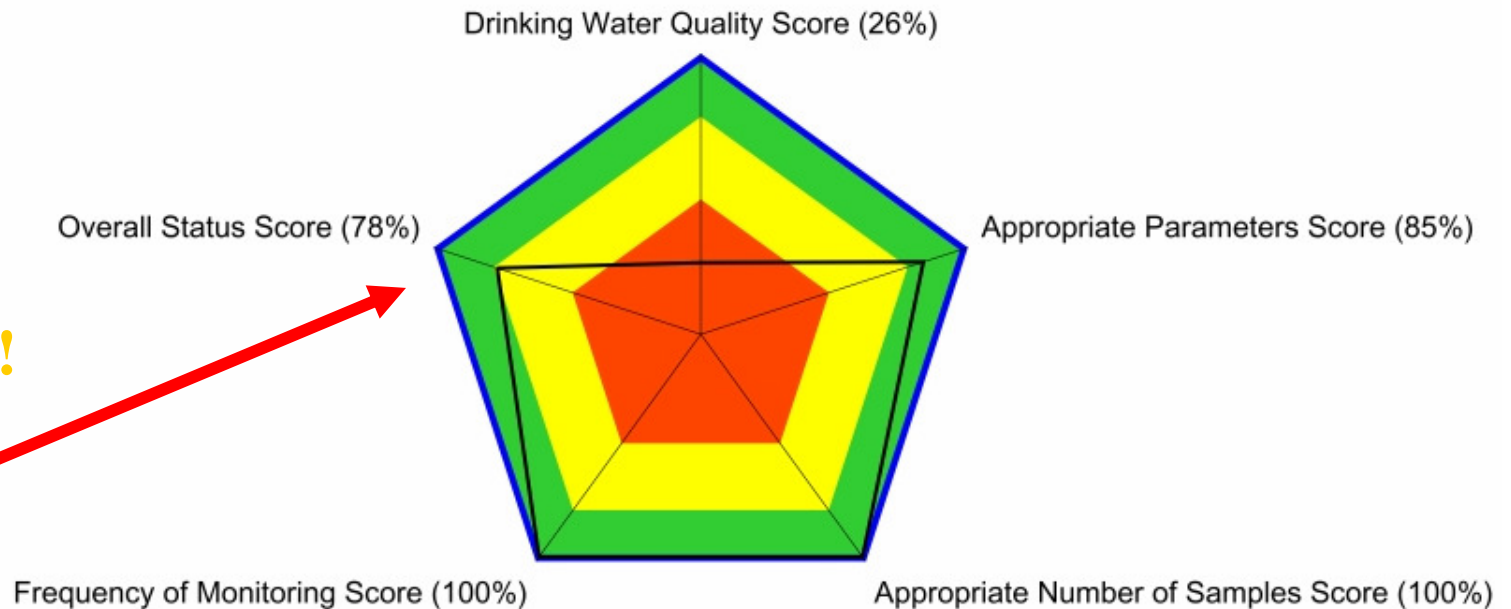
of how the DWQM Performance Assessment is calculated, please click [here](#)

Overall Score		Drinking Water Quality Score		Appropriate Parameters Score		Appropriate # of Samples Score		Frequency of Monitoring Score	
Index	%	Index	%	Index	%	Index	%	Index	%
2.3 / 4	58.08%	0.5 / 1	45.05%	0.6 / 1	63.25%	0.4 / 1	39.3%	0.8 / 1	84.73%
2.5 / 4	61.35%	0.2 / 1	20.0%	0.5 / 1	53.4%	0.9 / 1	88.0%	0.8 / 1	84.0%

DWQM Performance Assessment for Northern Cape for the last 12 months



DWQM Performance Assessment for Northern Cape for the last 12 months



Dec 2007

**Improvement!**

June 2008

# Assessment of DWQM Programme

- Desire to benchmark performance

# Compliance Overview...

- Compliance for last 12 months
- Benchmarking and tracking elements

## Drinking Water Quality Summary

Microbiological Safety :: Microbiological Operational :: Physical :: Chemical

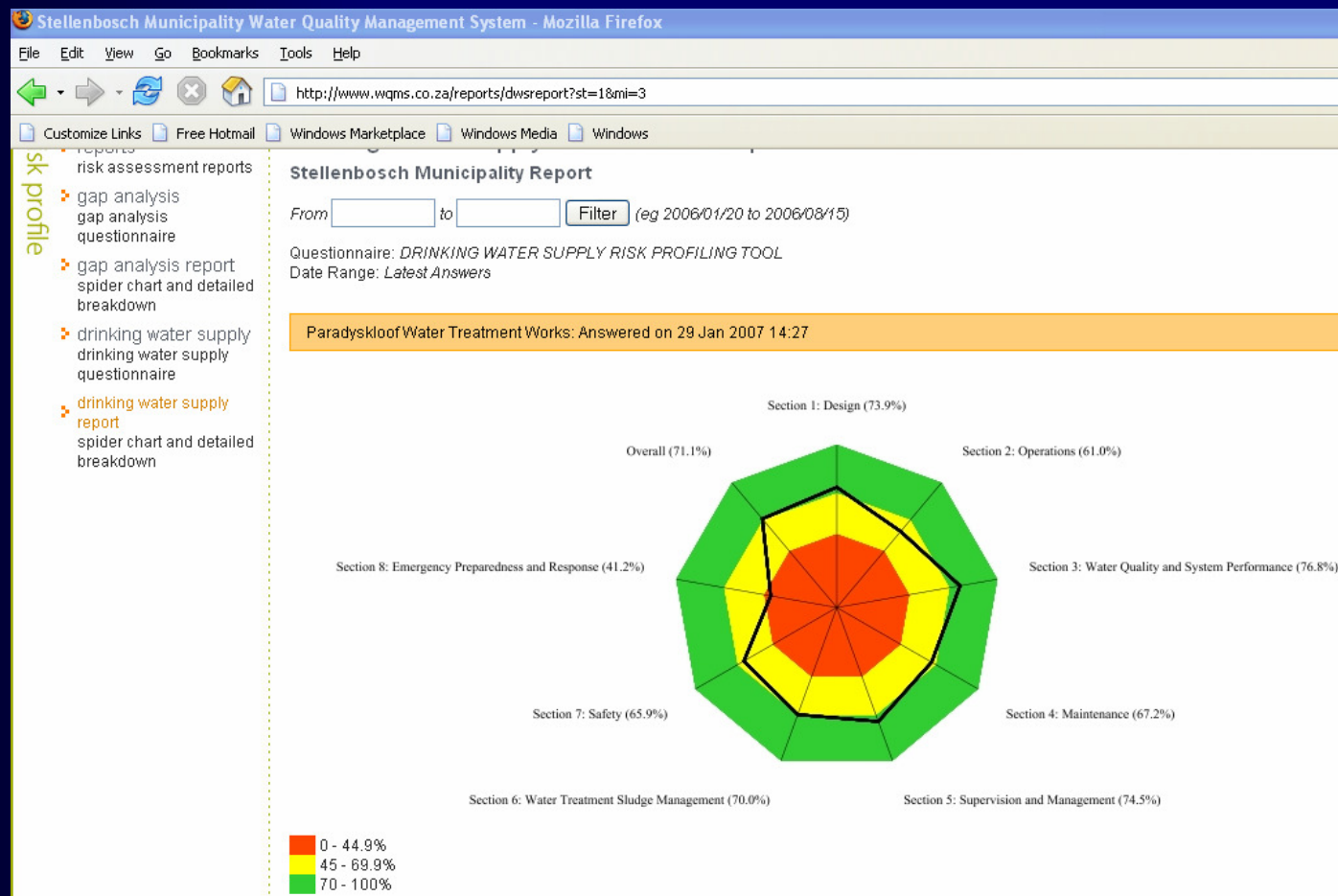
Configure Parameters			E.coli (health)	
Area	Population	Suggested Min Samples	SampleCount	Compliance %
South Africa	48606643	58328	35337	95.9 <a href="#">view</a>
Northern Cape	1076830	3145	2244	93.3 <a href="#">view</a>
Pietermaritzburg District Municipality	173865	660	418	93.1 <a href="#">view</a>
Emthanjeni Municipality	35207	168	86	88.4 <a href="#">view</a>
Kareeberg Municipality	8740	48	37	100.0 <a href="#">view</a>
Renosterberg Municipality	9648	60	92	95.7 <a href="#">view</a>
Siyancuma Municipality	42113	96	37	97.3 <a href="#">view</a>
Siyathemba Municipality	18096	60	12	91.7 <a href="#">view</a>
Thembelihle Municipality	15491	60	71	88.7 <a href="#">view</a>
Ubuntu Municipality	17133	84	26	92.3 <a href="#">view</a>
Umsobomvu Municipality	24409	72	57	94.7 <a href="#">view</a>
Data Period	2007/02/01 to 2008/02/01			



Quality of Water System	Microbiological requirement
	Column 5 of Table 1
Excellent	>= 99%
Good	>= 98%
Fair	>= 97%
Poor	< 97%

# Municipal Self-Assessments...

- Where are the major risks at my water treatment plant?



# E.g. Analysis of Improvements in the Northern Cape

<b>2006</b>	<b>Part A: Water Legislation, Policies and Regulations</b>				<b>Part C: Drinking Water Quality Monitoring, Laboratories and Logistics</b>			
	<b>Accep</b>	<b>Mar</b>	<b>Poor</b>	<b>N/D</b>	<b>Accep</b>	<b>Mar</b>	<b>Poor</b>	<b>N/D</b>
NC	25%	22%	47%	6%	6%	25%	63%	6%

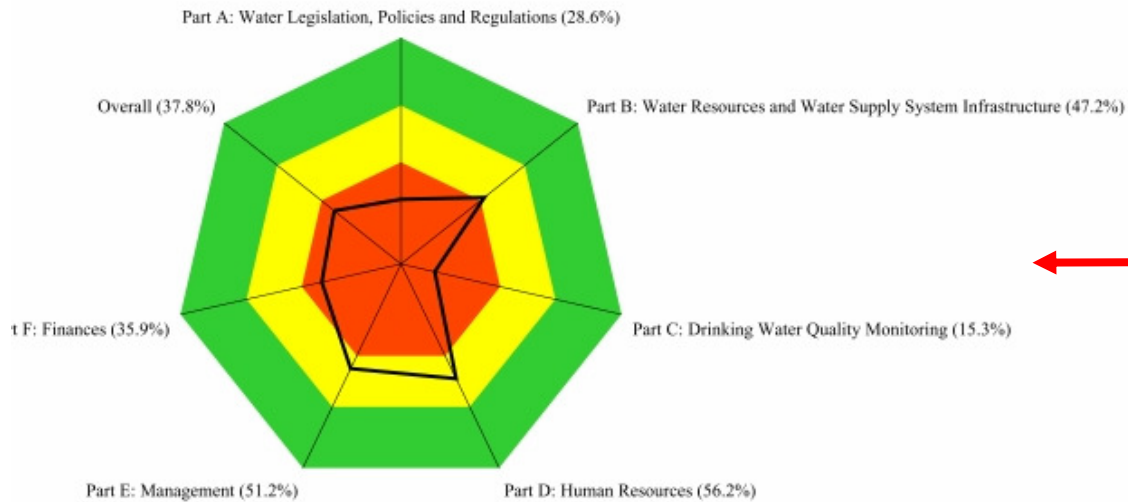
  

<b>2007</b>	<b>Part A</b>				<b>Part C</b>			
	<b>Accep</b>	<b>Mar</b>	<b>Poor</b>	<b>N/D</b>	<b>Accep</b>	<b>Mar</b>	<b>Poor</b>	<b>N/D</b>
NC	53%	25%	22%	0%	28%	66%	6%	0%

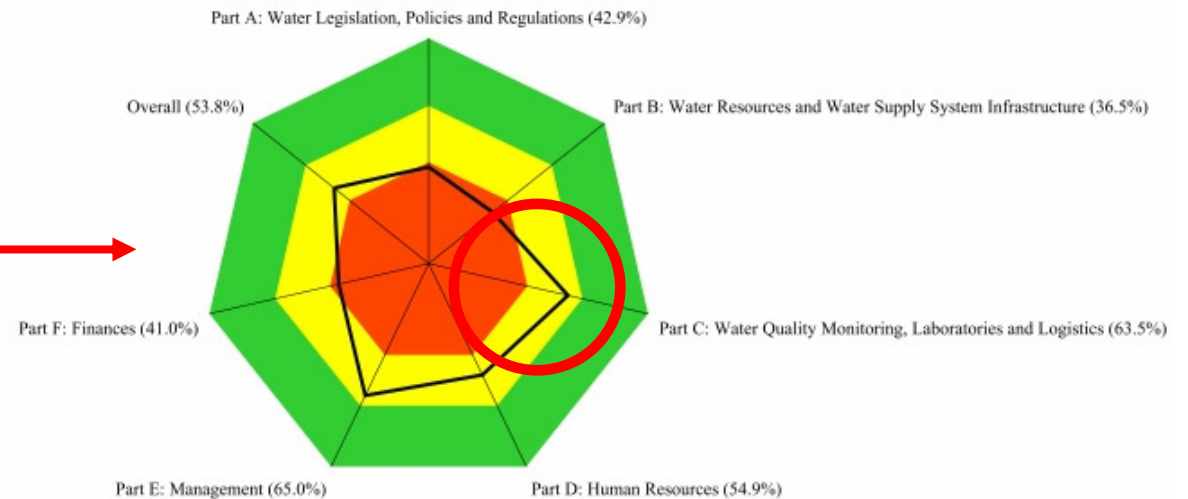
# Kamiesberg (NCape)



2006



2007





# Conclusions...

- eWQMS has:
  - Created improved awareness
  - Driven progressive improvement in WQ
  - Provided real-time reporting of WQ
  - Enabled early intervention
  - Provided strategic data for water services
- eWQMS alone cannot solve issues
  - Need awareness and prioritisation, on-going communications between role players, operational test equipment and proficiency therewith, WQ data collection and assessment, and ongoing support
- **eWQMS highlights issues → work “smarter”**





# THANK YOU!

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**Tel: +27 21 880 2932**