Appendix 1
An Introduction to the Electronic Water Quality Management System (eWQMS)

NOTE: The reader should not be constrained by the current configuration or functionality of the eWQMS. The current eWQMS framework could be easily modified and adapted to meet the requirements of the Adopt-A-River Programme. The eWQMS is therefore used as an example to highlight what can be achieved.

1. Background

WSAs have responsibilities including protection and management of water resources, operation and maintenance of infrastructure, monitoring and management of drinking water quality, reporting to DWAF with regards to the aforementioned, etc. In order to ensure an effective and sustainable water service, the above mentioned aspects must be addressed by WSAs. However, a number of recent surveys have indicated that many WSAs in the South Africa are not effectively monitoring and managing the quality of drinking water. Accordingly, DWAF and other water sector partners (e.g. IMESA, SALGA, WRC) have undertaken various initiatives to assist WSAs with operation and management of water services. In particular, DWAF, together with IMESA have rolled out the eWQMS to all 169 WSAs in South Africa. The eWQMS allows WSAs to interpret water quality data and highlights issues of concern requiring intervention. Data loaded by WSAs onto the eWQMS are transferred to the National Information System (NIS). Recent developments to the eWQMS have further enhanced functionality including the ability of WSAs to conduct self assessments of DWQM, infrastructure, etc.

2. IMESA Lead Iterative Enhancement Process

IMESA's specific roll is as an impartial honest broker ensuring that the eWQMS solution is appropriate and supportive of Municipal Engineering requirements. This is achieved by IMESA participating in both initial municipal interaction forums, and subsequently by IMESA led iterative feedback sessions with municipal users. At these sessions, recent new developments are presented to WSAs, ideas are brainstormed with WSAs, and WSAs are given the opportunity to provide feedback regarding:

- Useful features/functions of the eWQMS
- Features/functions that could be improved/amended
- Future desirable features/functions

WSAs are also asked to rank new and/or desirable features/functions from High to Low.

The above process helps to determine the actual on-the-ground needs at WSAs. Feedback obtained from these sessions is collated and desirable features/functions categorised and ranked. Subsequently, incremental improvements and enhancements are introduced to the tool.

3. Brief Overview of the eWQMS System

The eWQMS tool is a well proven comprehensive Water Quality Management tool, which has an established track record of being successfully used by WSA's, Regional and National DWAF offices, and the public. eWQMS has been set up to assist WSAs to meet the National Drinking Water Quality Management Framework requirements, and is a full management system. In particular, the eWQMS able to guide:

- Regulatory compliance by WSAs
- The timeous supportive intervention in water quality failures (chronic and acute)
- Infrastructure improvement
- Capacity development of municipal staff

The eWQMS is an internet accessible database system (accessible at www.wqms.co.za) utilising **open source** components (mySQL, XML, etc), and has been found following detailed assessment by DWAF's IT support team to be fully compatible with and compliant to DWAF Water Services National Information System and DWAF Regulatory System requirements.

Importantly, the eWQMS has been developed in a "bottom up" approach with WSAs, IMESA, DWAF and the Water Research Commission. Data can be loaded by WSAs onto eWQMS via the internet, spreadsheet or specific import scripts. Furthermore, the eWQMS can provide useful automated regulatory compliance reporting to all WSAs and sector partners. The eWQMS also provides easy access to useful water quality tools and information. Presently, the eWQMS consists of the following main components:

- Login/Logout
- Water Quality
- Infrastructure
- Risk Toolbox
- Administration
- Information

Considering the above, the following main features are described (***NOTE:*** A full demonstration will be gladly provided on request):

- **System Access**
  The system is usually accessible via the internet for full use (including via DBSA's LGNET), providing considerable costs and operational efficiency benefits over local application based systems. Nevertheless, the system can run as an independent local application if required. Information and reference material can be accessed without the need to login (This is especially useful to members of the public (e.g. teachers, students, etc) and saves municipal officials time).

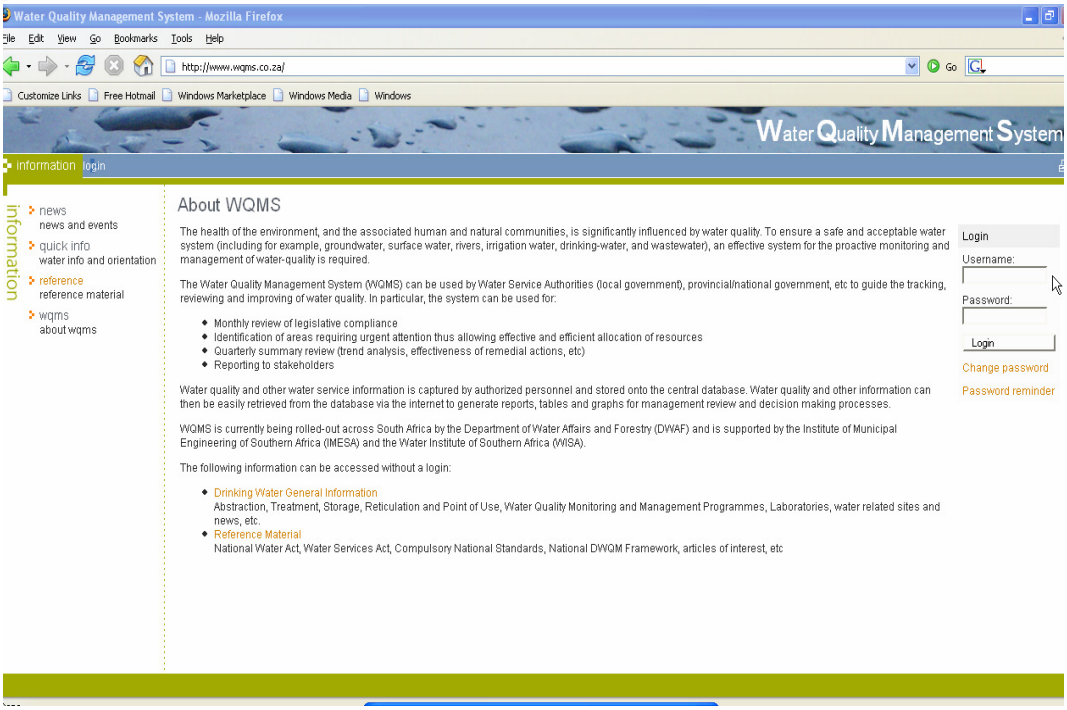

Figure A1: *eWQMS access via the internet*

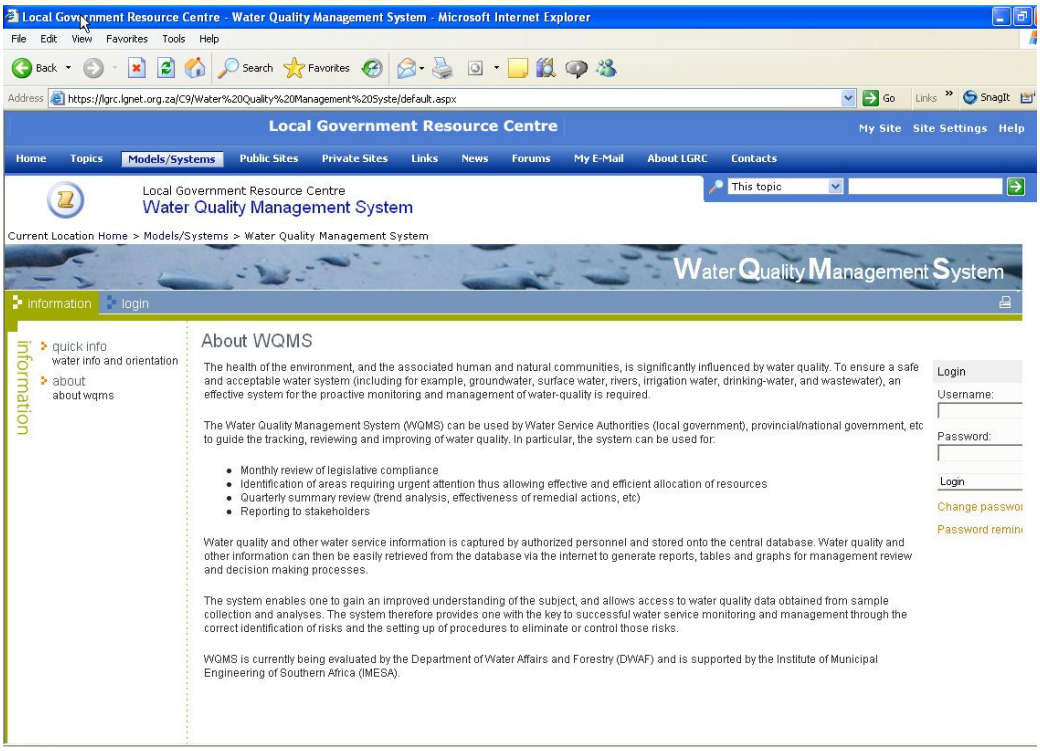

Figure A2: *eWQMS access via DBSA's LGNET*

- **System Compatibility**

  The system can be set up to run off existing water quality management systems, such as

LIMS systems. A number of "import scripts/patches" already exist, and where necessary additional will be written for data import. *E.g. of import scripts/patches includes Johannesburg Water and eThekweni*

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- **Login/logout**

  A user is provided with username and password. A particular user will be provided with a WSA, District, Provincial or National view. Furthermore, limited detail "public" views of DWQ can be set up if required. *E.g. of Provincial view includes Free State; public view includes Stellenbosch.*

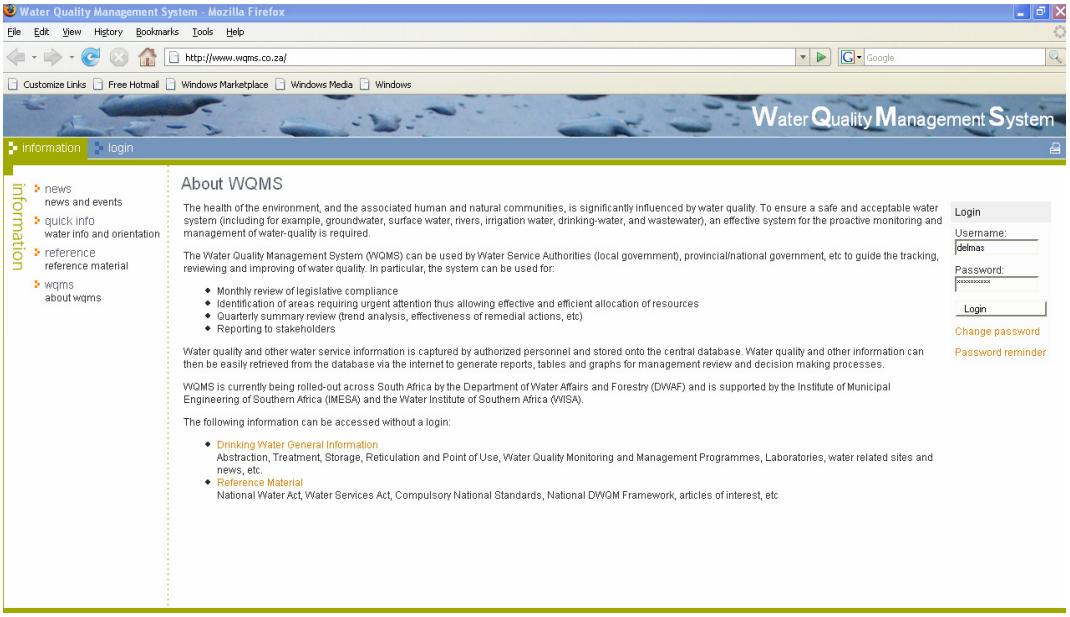


Figure A3: *eWQMS login (Delmas Municipality, Mpumalanga)*

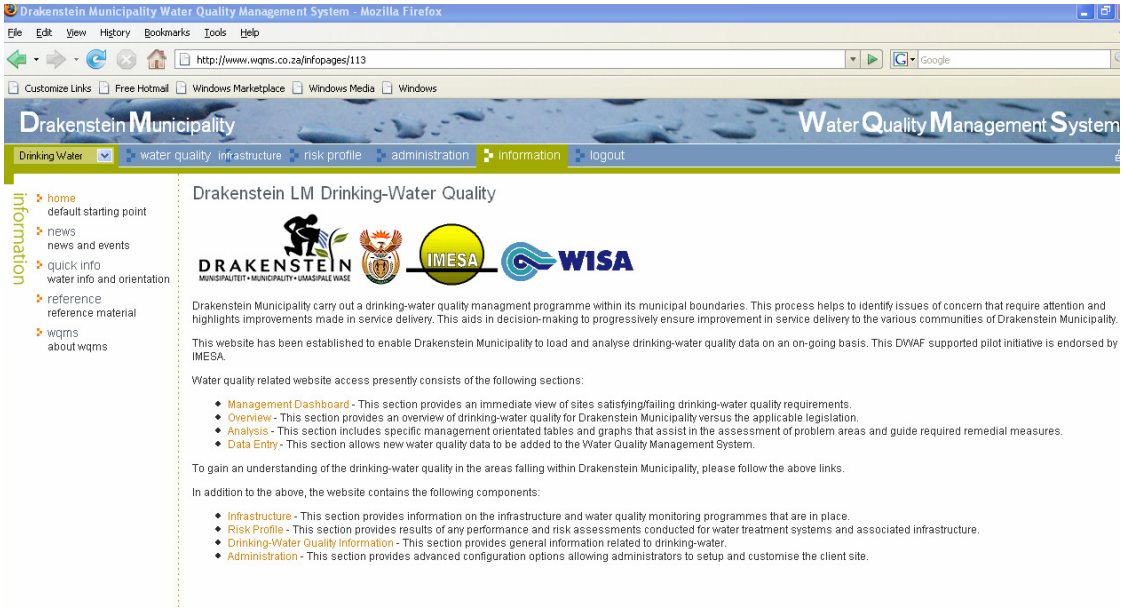


Figure A4: *WSA homepage (Drakenstein Municipality, Western Cape)*

- **Water Quality Management**

  A key functional requirement is easy water quality data loading and interpretation. The system can interpret data against a range of standards, but defaults to SANS 241. The system is capable of interpreting wastewater and river water quality data. Current functionality includes:

  - ***Management Dashboard*** [summarised monthly view of legislative compliance & identification of areas requiring urgent attention; easy colour coding to show compliance (green), failure of SANS 241 class 1 (yellow), and failure of SANS 241 Class 2 (red)].

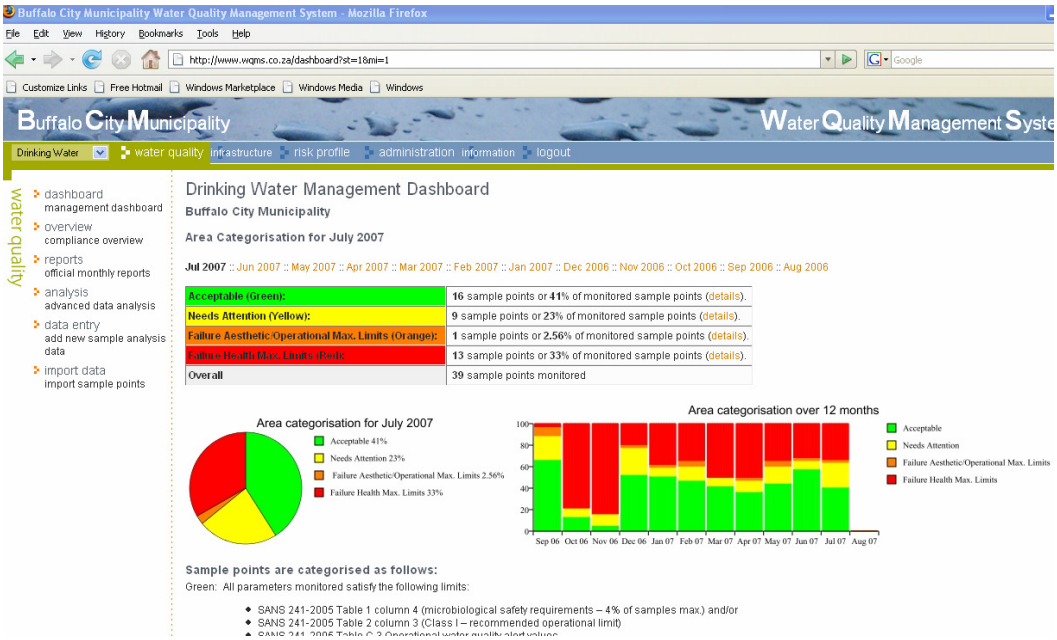


Figure A5: *eWQMS Management Dashboard (Buffalo City, Eastern Cape)*

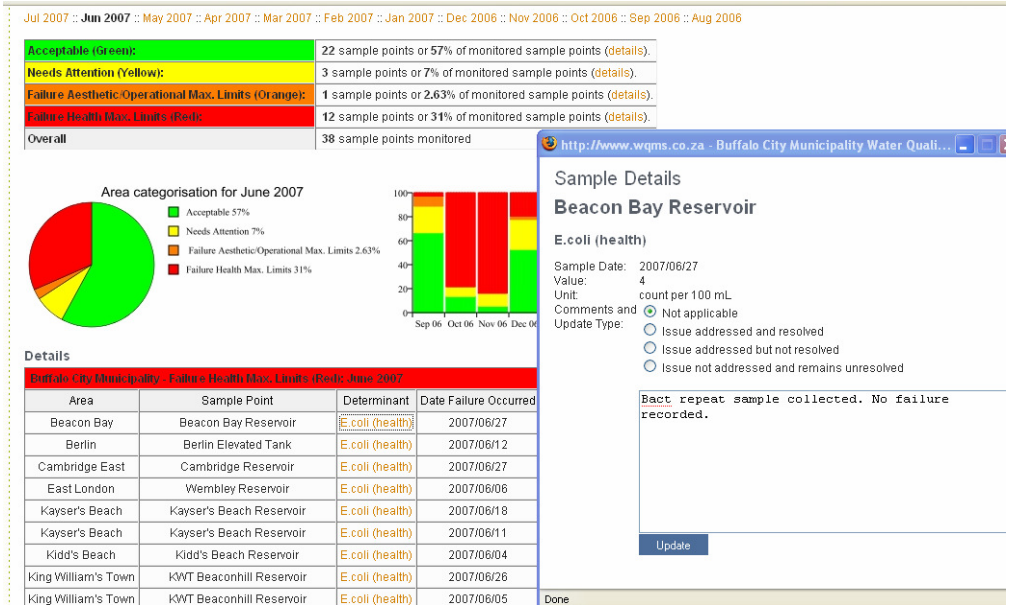


Figure A6: *Detail of "Red" failure and actions taken to address issue of concern (Buffalo City, Eastern Cape)*

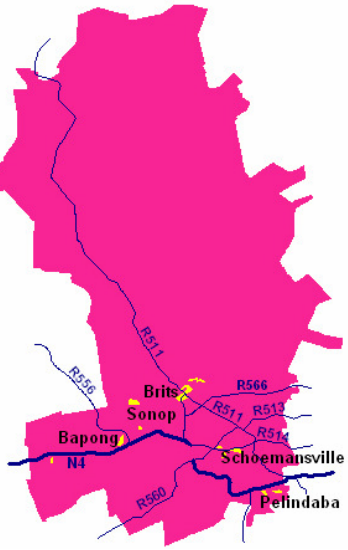
- ***Overview*** (map-based interface with "period based" compliance summary of bacteriological, physical and chemical DWQ).

Drinking Water Overview

Madibeng Municipality

Water Quality Summary
Links to Useful Tables and Graphs

- Brits
- Cosmos East
- Damonsville
- Elandsrand
- Hartbeespoort
- Jericho
- Letlhabile
- Madidi
- Meerhof
- Mmakau
- Mothotlung
- Sonop



Drinking Water Quality Summary

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

Configure Parameters	Faecal Coliforms (health)		E.coli (health)	
Area	SampleCount	Compliance %	SampleCount	Compliance %
South Africa	*11920*	*98 (view)*	*24070*	*96 (view)*
North West	*1295*	*99 (view)*	*1139*	*99 (view)*
Bojanala Platinum District Municipality	*114*	*100 (view)*	*642*	*99 (view)*
Madibeng Municipality			*161*	*100 (view)*
Brits			15	100 (view)
Cosmos East			15	100 (view)
Damonsville			19	100 (view)
Elandsrand			15	100 (view)
Hartbeespoort			17	100 (view)
Jericho			17	100 (view)
Letlhabile			12	100 (view)
Madidi			11	100 (view)
Meerhof			13	100 (view)
Mmakau			14	100 (view)
Sonop			13	100 (view)
Data Period	2006/09/01 to 2007/08/30			

Quality of Water System	Microbiological requirement	Chemical requirement	
	Column 5 of Table 1	Class I	Class II
Excellent	>= 99%	>= 95%	>= 97%
Good	>= 98%	>= 90%	>= 95%
Fair	>= 97%	>= 85%	>= 90%
Poor	< 97%	< 85%	< 90%

Figure A7: *eWQMS Overview (microbiological safety) (Local Municipality of Madibeng, North West)*

Configure Parameters	Aluminium (health)			Iron (aesthetic/operational)		
Area	SampleCount	Compliance %	Median(mg/L as Al)	SampleCount	Compliance %	Median(mg/L as Fe)
South Africa	*1917*	*87 (view)*	*0.07*	*5351*	*85 (view)*	*0.04*
Western Cape	*482*	*76 (view)*	*0.12*	*1142*	*68 (view)*	*0.11*
Knysna Municipality	*67*	*34 (view)*	*0.41*	*67*	*47 (view)*	*0.20*
Buffalo Bay	15	0 (view)	1.14	15	93 (view)	0.06
Karatara	13	100 (view)	0.05	13	69 (view)	0.11
Knysna (Town)	12	50 (view)	0.29	12	41 (view)	0.30
Rheenendal	12	8 (view)	1.30	12	0 (view)	0.40
Sedgefield	15	20 (view)	0.36	15	26 (view)	0.25
Data Period	2006/05/02 to 2007/04/30					

Notes:

- The median value displayed is the median of all samples collected in the particular area. The median value is compared to *SANS 241* an
- The percentage compliance displayed is the percentage of all samples collected in the area falling within *SANS: Physical, Organoleptic,*
- Based on samples taken during the last 12 months.

Applicable Standards

SANS: Physical, Organoleptic, Chemical: Class I
SANS: Physical, Organoleptic, Chemical: Class II
Failure Phys-Organo-Chem: Class II (Aesth/Operat)
SANS: Failure Phys-Organo-Chem: Class II (Health)

SANS 241-2005 Table C.2: Compliance frequency targets in respect of microbiological and chemical requirements that have health implicati

Quality of Water System	Microbiological requirement	Chemical requirement	
	Column 5 of Table 1	Class I	Class II
Excellent	>= 99%	>= 95%	>= 97%
Good	>= 98%	>= 90%	>= 95%
Fair	>= 97%	>= 85%	>= 90%
Poor	< 97%	< 85%	< 90%

Figure A8: *eWQMS Overview (chemical) (Knysna Municipality, Western Cape)*

- ***Quick Analysis*** (quick links to regularly used operational efficiency and legislative compliance tables/graphs and trend analysis)

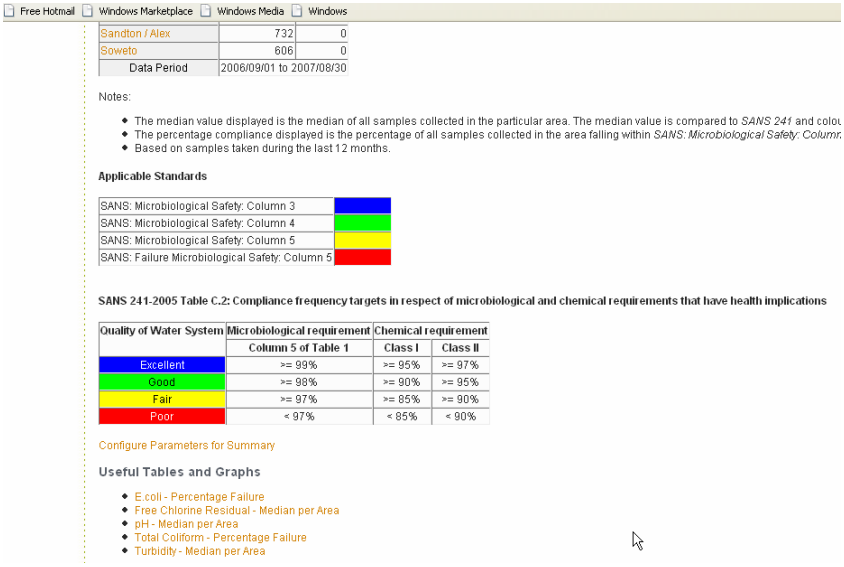


Figure A9: *Example of quick analysis links at the bottom of the Overview*

- ***Detailed Analysis*** (dynamic Tables and Graphs with full flexibility)

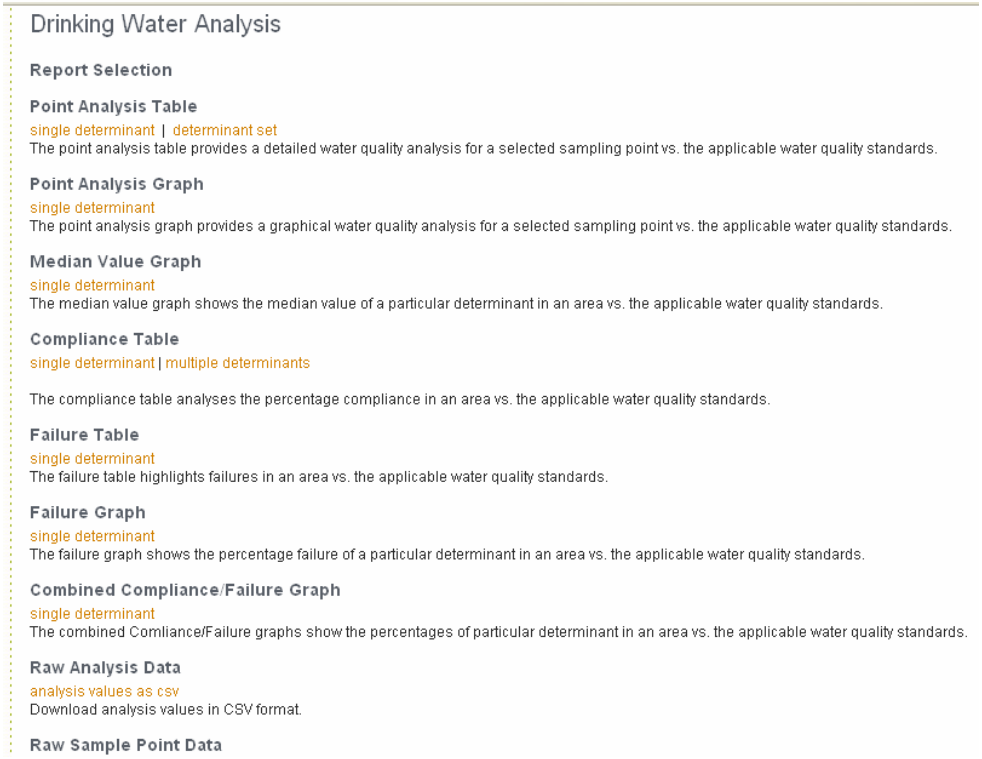


Figure A10: *eWQMS Analysis (tables and graphs)*

Dynamic Drinking Water Reports

Water Quality Compliance Table

E.coli (health) (count per 100 mL) for Central

	June 2006		July 2006		August 2006	
Area	Samples Complied	% Compliance	Samples Complied	% Compliance	Samples Complied	% Compliance
Central	***22 / 22***	***100%***	***22 / 22***	***100%***	***23 / 23***	***100%***
Berea North	2 / 2	100%	2 / 2	100%	2 / 2	100%
Berea South	2 / 2	100%	2 / 2	100%	2 / 2	100%
Bluff	2 / 2	100%	2 / 2	100%	2 / 2	100%
Chatsworth	2 / 2	100%	2 / 2	100%	2 / 2	100%
Durban Centre	2 / 2	100%	2 / 2	100%	2 / 2	100%
Durban North	2 / 2	100%	1 / 1	100%	2 / 2	100%
Merebank	2 / 2	100%	1 / 1	100%	2 / 2	100%
New Germany	2 / 2	100%	2 / 2	100%	2 / 2	100%
Phoenix	1 / 1	100%	2 / 2	100%	2 / 2	100%
Pinetown	2 / 2	100%	2 / 2	100%	2 / 2	100%
Umbilo	2 / 2	100%	3 / 3	100%	2 / 2	100%
Umhlanga	1 / 1	100%	1 / 1	100%	1 / 1	100%

water & forestry
Department:
Water Affairs and Forestry
REPUBLIC OF SOUTH AFRICA
IMESA
WISA

Notes

Figure A11: *Compliance table example (Ethekwini Municipality, KwaZulu-Natal)*

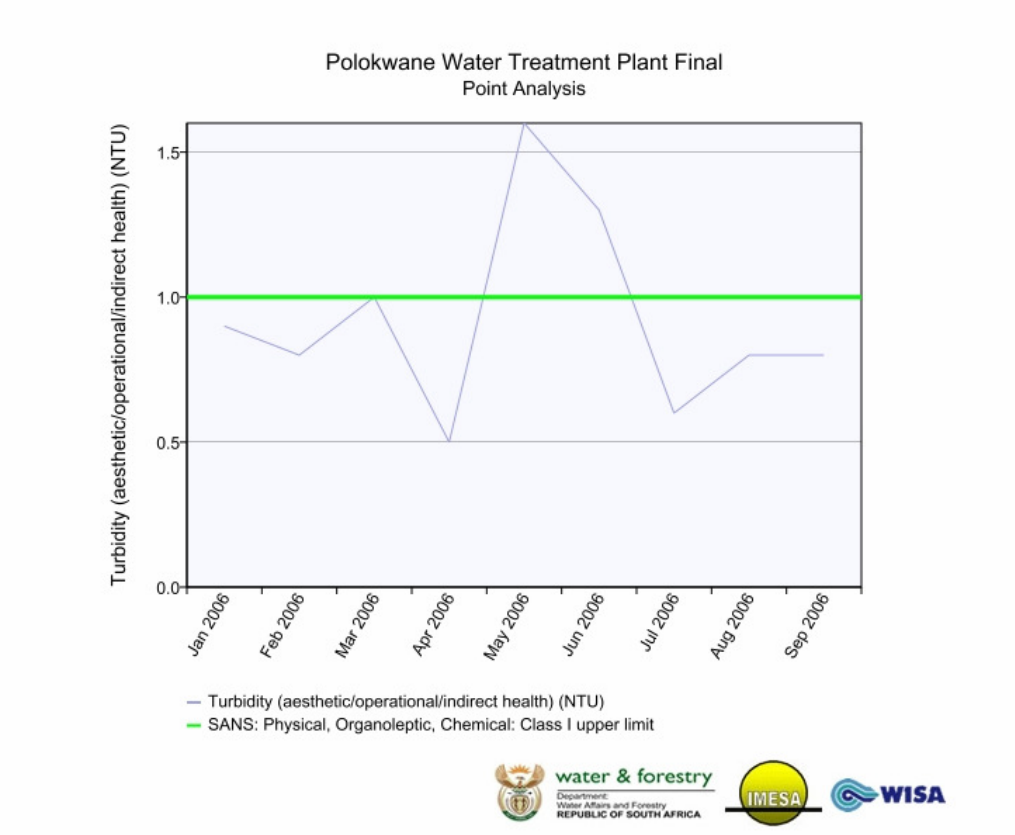


Figure A12: *Point analysis graph example (Polokwane Municipality, Limpopo)*

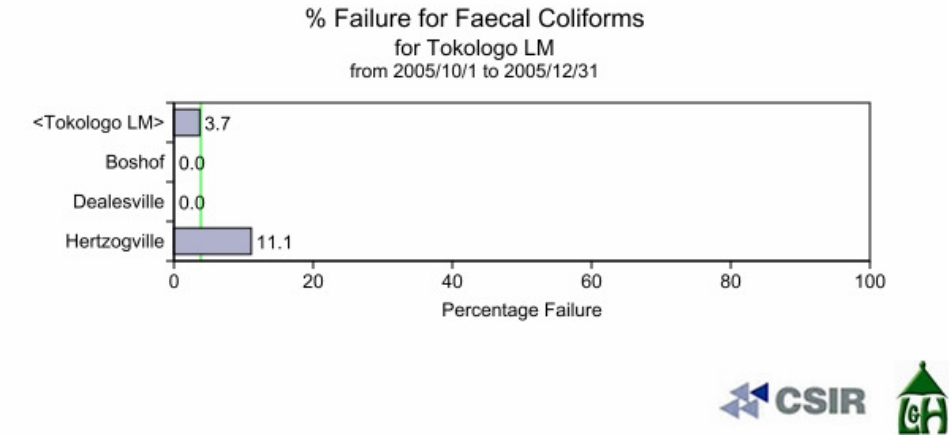


Figure A13: *Percentage failure graph example (Tokologo Municipality, Free State)*

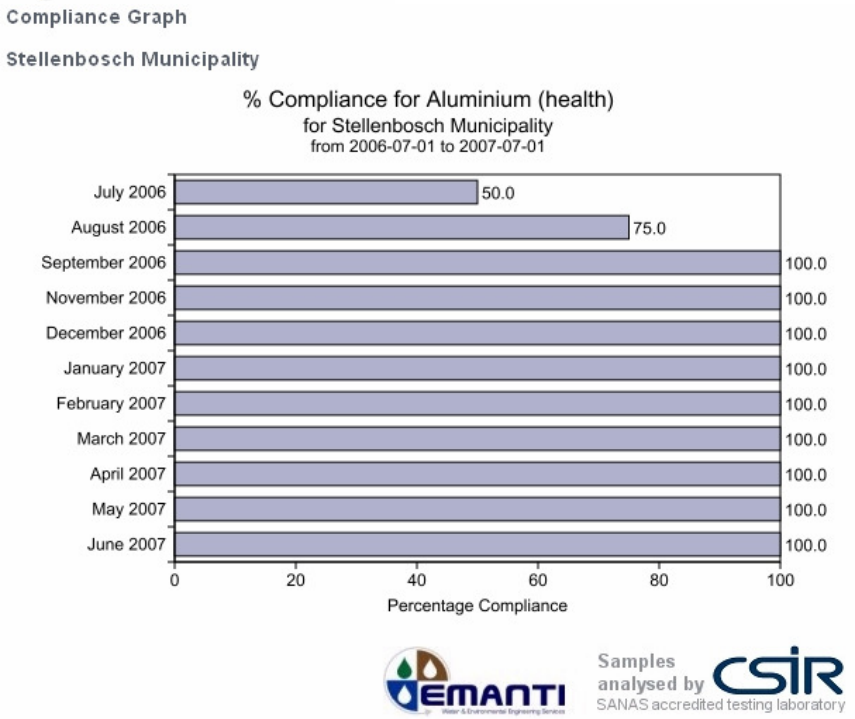


Figure A14: *Area monthly compliance graph (Stellenbosch Municipality, Western Cape)*

- ***Reports*** (archive of water quality management reports in Adobe Acrobat format).

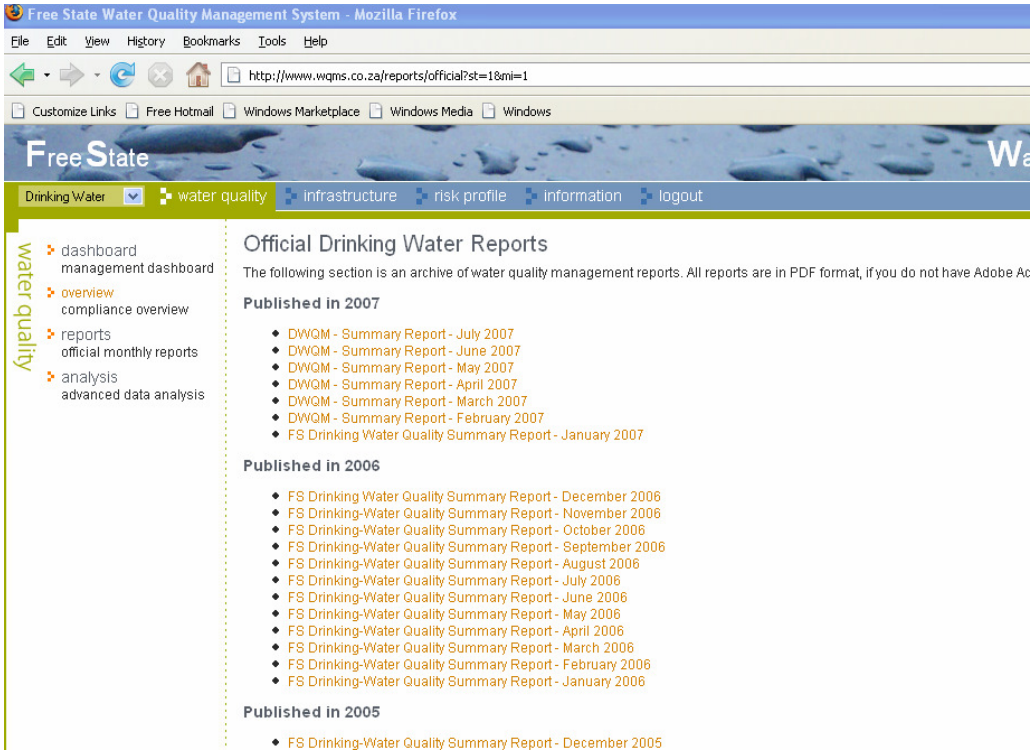


Figure A15: *eWQMS reports (Free State)*

- ***Data Entry*** - mostly via internet and/or Excel, but patches exist and can be developed for to link to existing systems such as LIMS / UNIX / etc for specific clients)

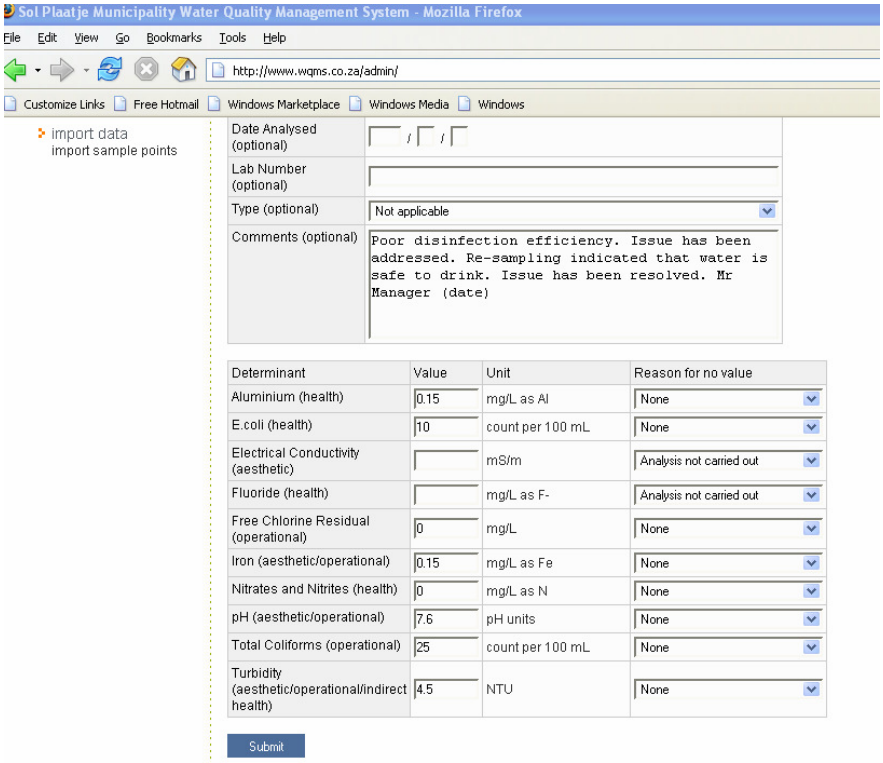


Figure A16: *eWQMS data entry via the internet (Sol Plaatje, Northern Cape)*

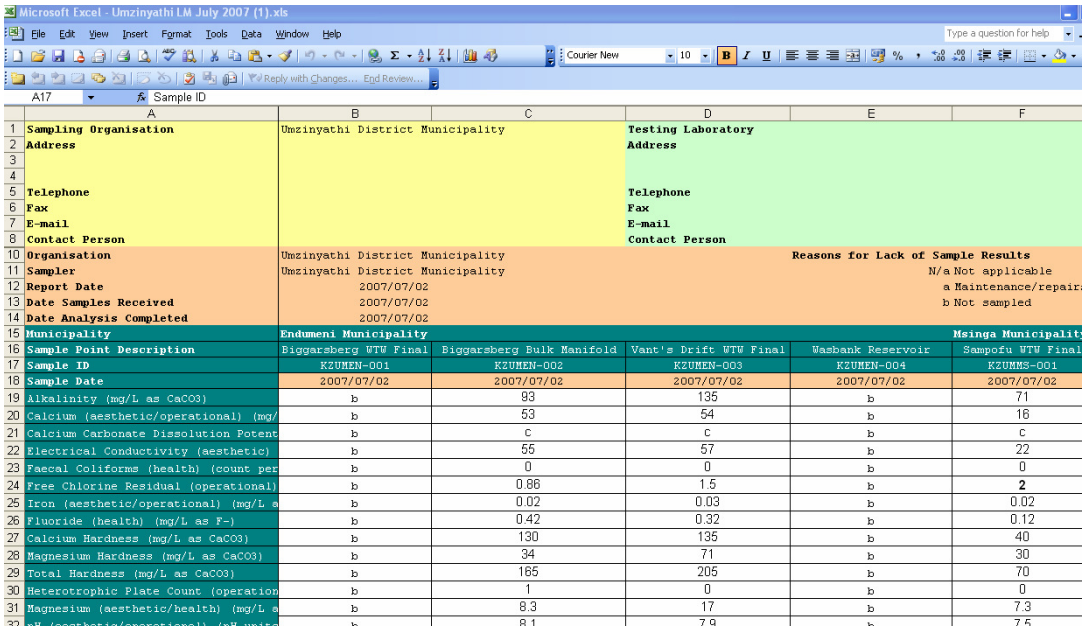


Figure A17: *eWQMS data entry via spreadsheet (submitted via e-mail) (Umzinyathi Municipality, KwaZulu-Natal)*

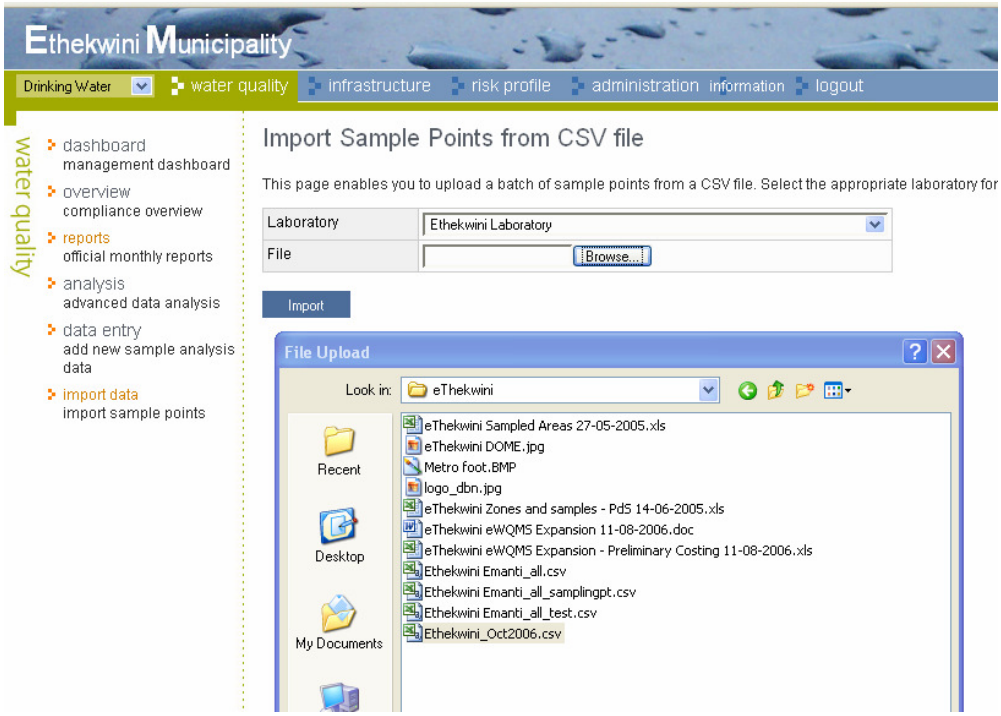


Figure A18: *eWQMS data loading via import script/patch (Ethekwini Municipality, KwaZulu-Natal)*

- ***Automation*** (auto-notification by e-mail of failures, generation of auto-reports and summary reports for feedback to the full range of participating parties)

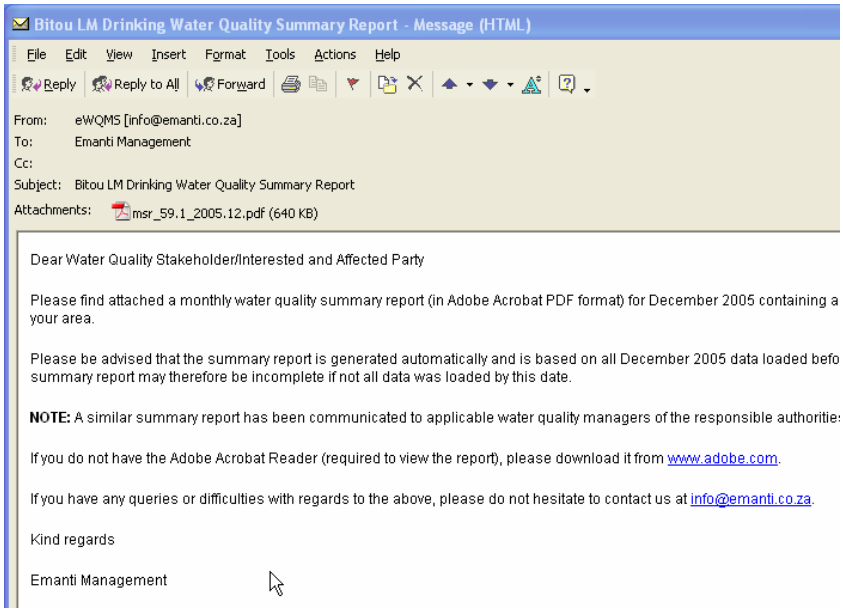
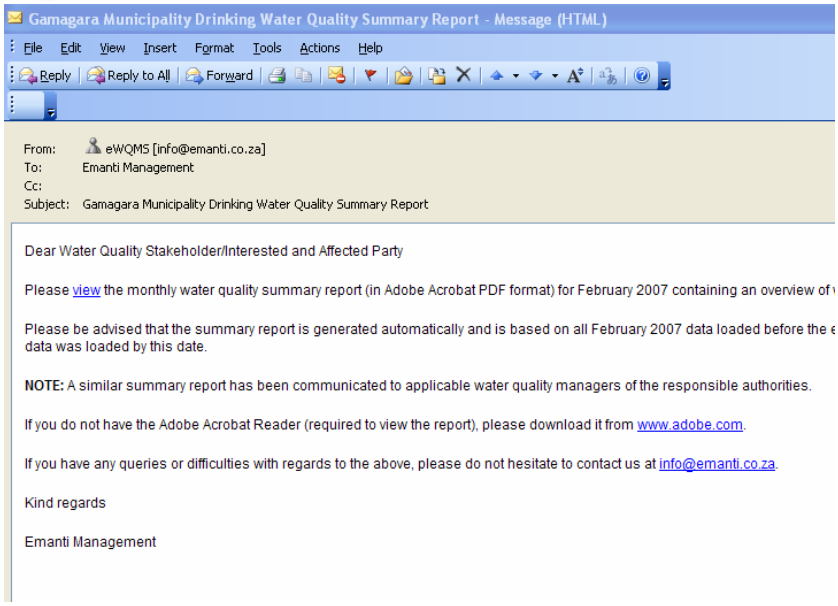


Figure A19: *eWQMS e-mail with report as attachment ((Bitou Municipality, Western Cape)*



Gamagara Municipality Drinking Water Quality Summary Report - Message (HTML)

File Edit View Insert Format Tools Actions Help

Reply | Reply to All | Forward

From: eWQMS [info@emanti.co.za]
To: Emanti Management
Cc:
Subject: Gamagara Municipality Drinking Water Quality Summary Report

Dear Water Quality Stakeholder/Interested and Affected Party

Please view the monthly water quality summary report (in Adobe Acrobat PDF format) for February 2007 containing an overview of

Please be advised that the summary report is generated automatically and is based on all February 2007 data loaded before the
data was loaded by this date.

NOTE: A similar summary report has been communicated to applicable water quality managers of the responsible authorities.

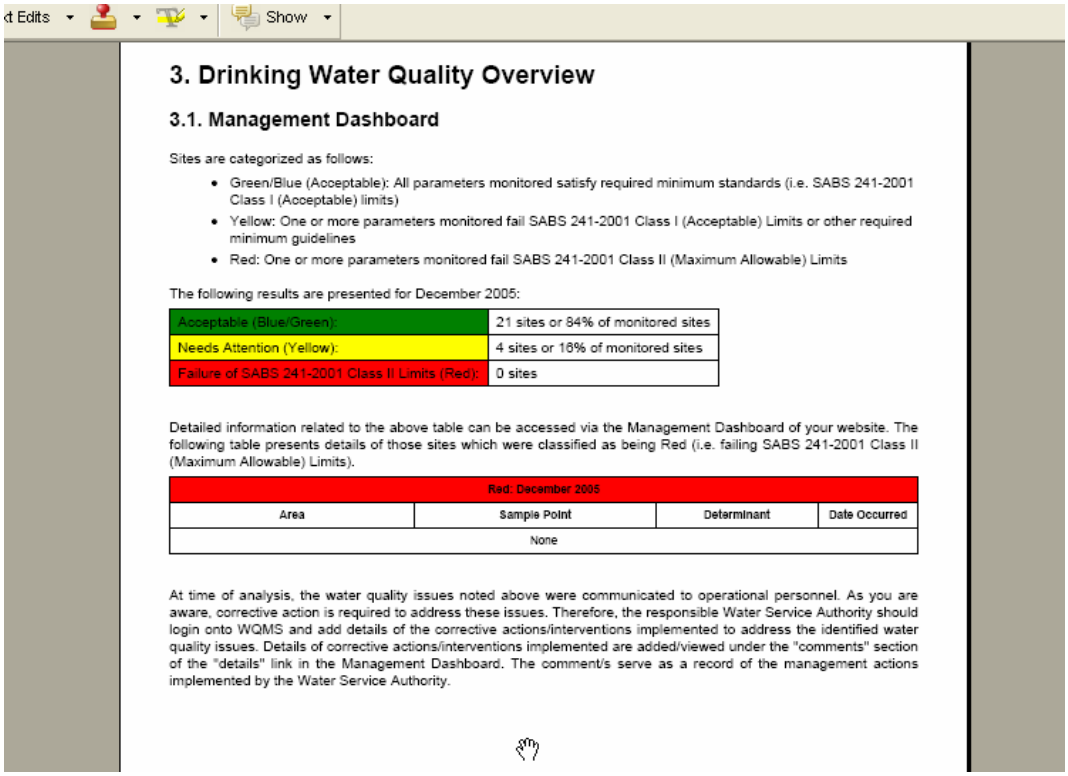
If you do not have the Adobe Acrobat Reader (required to view the report), please download it from www.adobe.com.

If you have any queries or difficulties with regards to the above, please do not hesitate to contact us at info@emanti.co.za.

Kind regards

Emanti Management

Figure A20: *eWQMS e-mail with report accessible via internet link (Gamagara Municipality, Northern Cape)*



t Edits Show

3. Drinking Water Quality Overview

3.1. Management Dashboard

Sites are categorized as follows:

- Green/Blue (Acceptable): All parameters monitored satisfy required minimum standards (i.e. SABS 241-2001 Class I (Acceptable) limits)
- Yellow: One or more parameters monitored fail SABS 241-2001 Class I (Acceptable) Limits or other required minimum guidelines
- Red: One or more parameters monitored fail SABS 241-2001 Class II (Maximum Allowable) Limits

The following results are presented for December 2005:

Acceptable (Blue/Green):	21 sites or 84% of monitored sites
Needs Attention (Yellow):	4 sites or 16% of monitored sites
Failure of SABS 241-2001 Class II Limits (Red):	0 sites

Detailed information related to the above table can be accessed via the Management Dashboard of your website. The following table presents details of those sites which were classified as being Red (i.e. failing SABS 241-2001 Class II (Maximum Allowable) Limits).

Red: December 2005			
Area	Sample Point	Determinant	Date Occurred
None			

At time of analysis, the water quality issues noted above were communicated to operational personnel. As you are aware, corrective action is required to address these issues. Therefore, the responsible Water Service Authority should login onto WQMS and add details of the corrective actions/interventions implemented to address the identified water quality issues. Details of corrective actions/interventions implemented are added/viewed under the "comments" section of the "details" link in the Management Dashboard. The comment/s serve as a record of the management actions implemented by the Water Service Authority.

Figure A21: *Extract from an automatic monthly summary report*

- **Infrastructure**
  Captures WSA infrastructure details related to abstraction points, treatment systems, storage facilities (e.g. reservoirs), reticulation/point of use (e.g. sampling points), DWQM Programmes (frequency of monitoring, parameters, etc) and laboratories utilised.

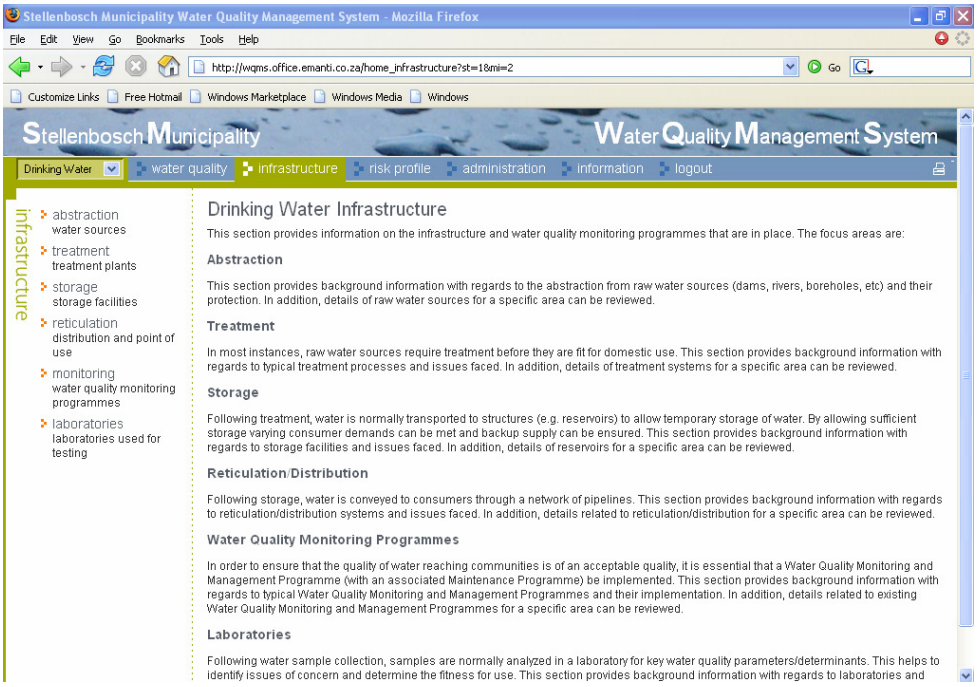


Figure A22: *eWQMS Infrastructure component*

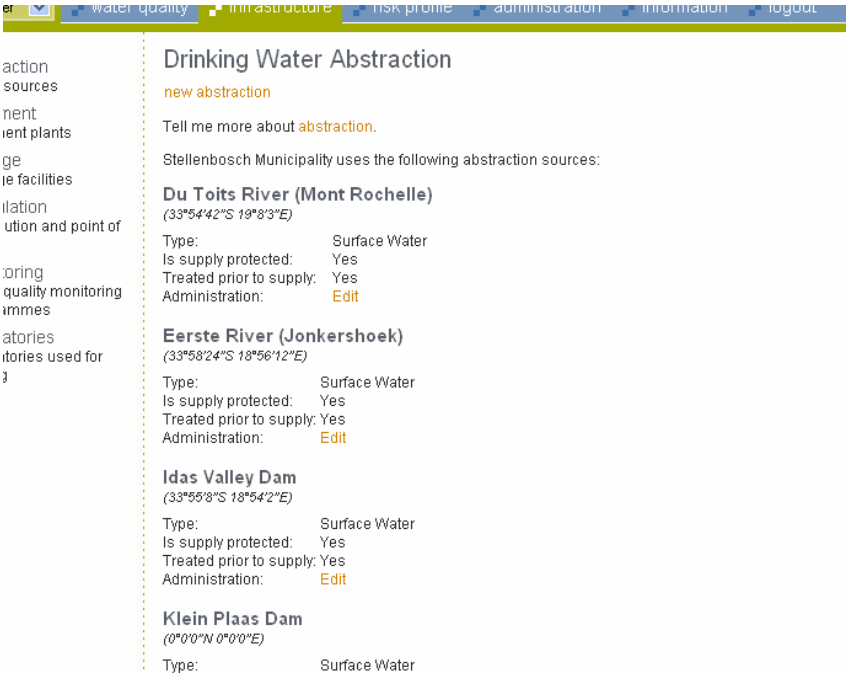
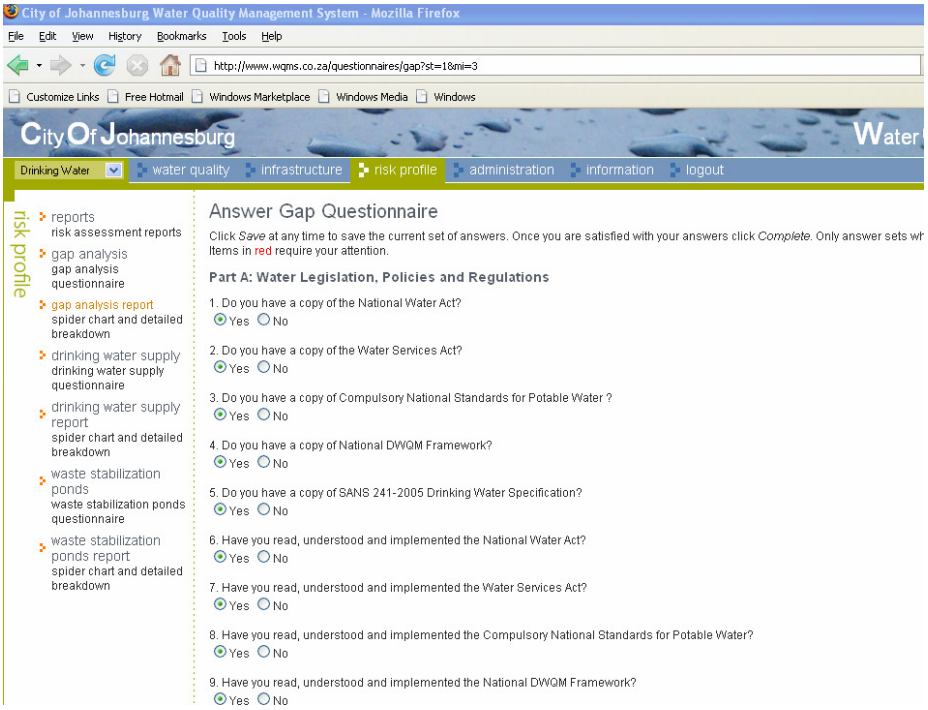


Figure A23: *Example of raw water abstraction details on the eWQMS (Stellenbosch Municipality, Western Cape)*

- **DWQM Risk Profiles**
  Assessment tools have been introduced which allow WSAs to perform a self-assessment of the status of their WSA. Examples include a strategic level WQM Sustainability Analysis (Gap Analysis) and a Water Research Commission "Drinking-Water Treatment Plant and Distribution Network Assessment and Risk Profile" system.



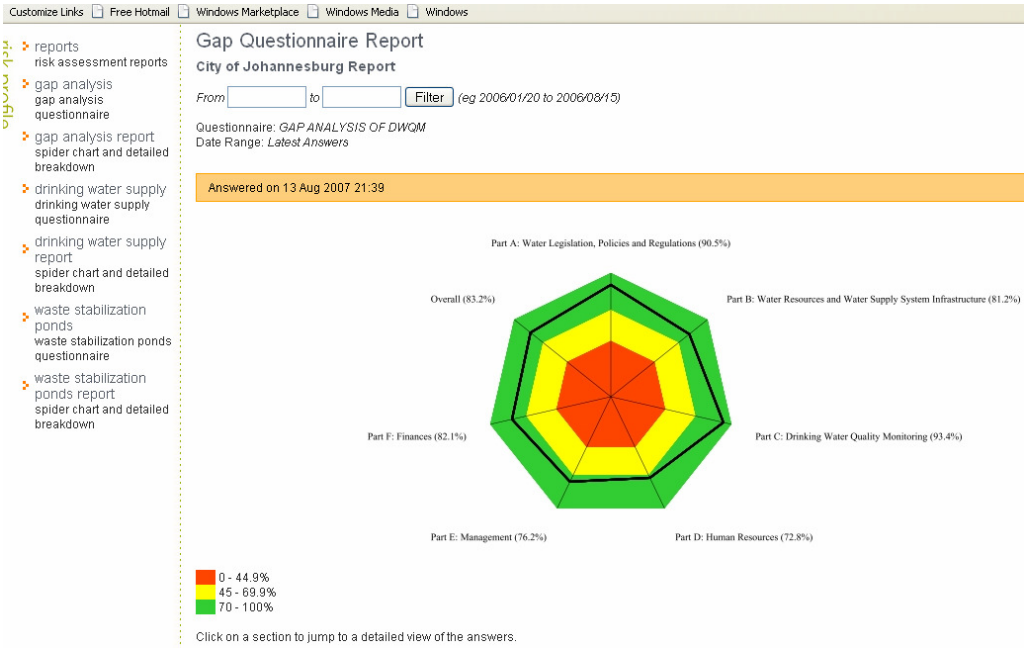


Figure A24: *Gap analysis questionnaire and spider diagram output (City of Johannesburg, Gauteng)*

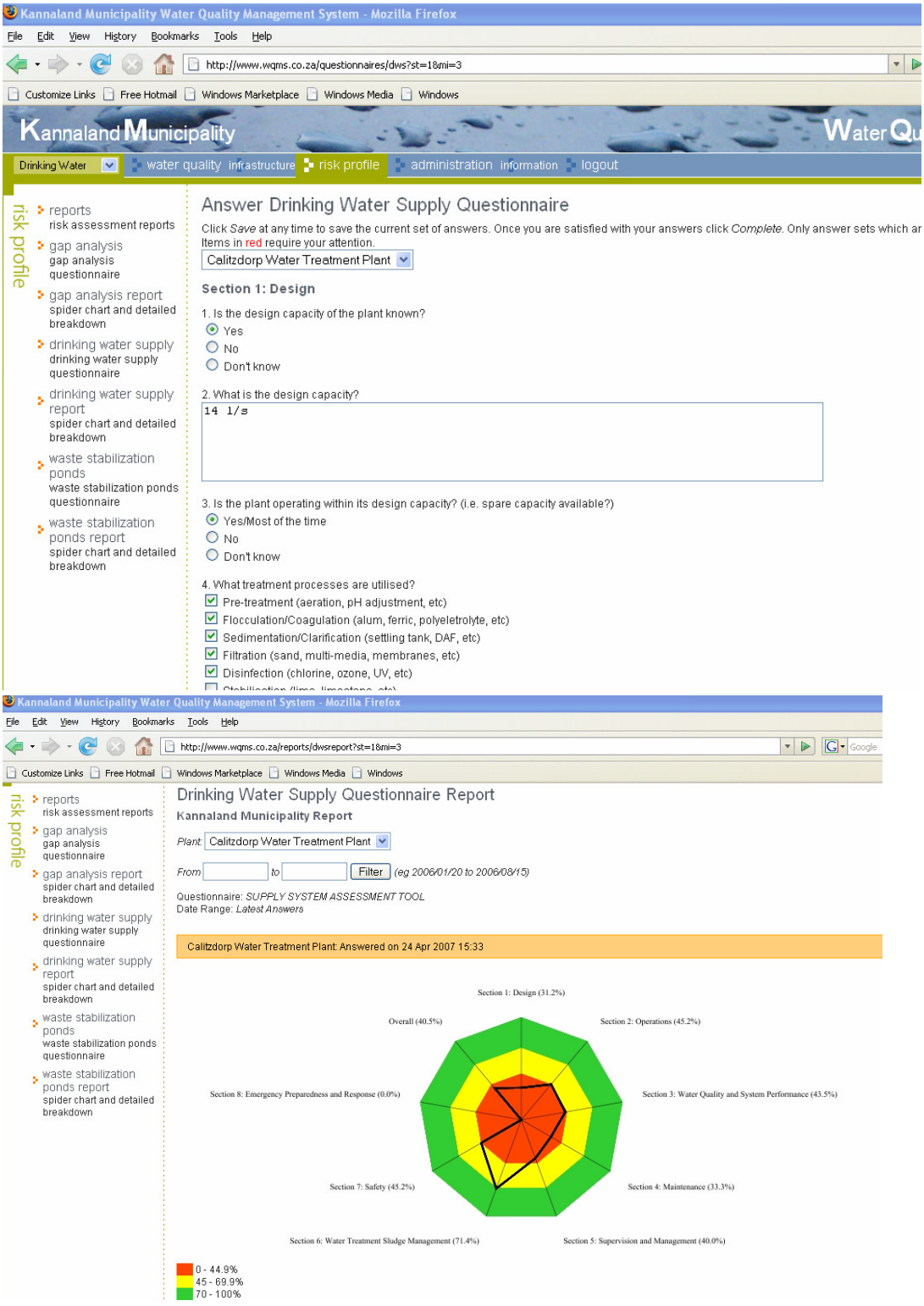


Figure A25: *Water supply system questionnaire and spider diagram output (Kannaland Municipality, Western Cape)*

- **Administration**

  Current WSA functionality includes the ability to manage sample points (add new/edit existing), manage recipients/distribution lists for automated communications, manage required automatic notifications (e-mail, summary report), data entry (water quality, infrastructure, etc) and ability to add comments related to drinking-water failures and actions taken to address issues of concern (i.e. comments serve as an action record taken to address issues of concern).

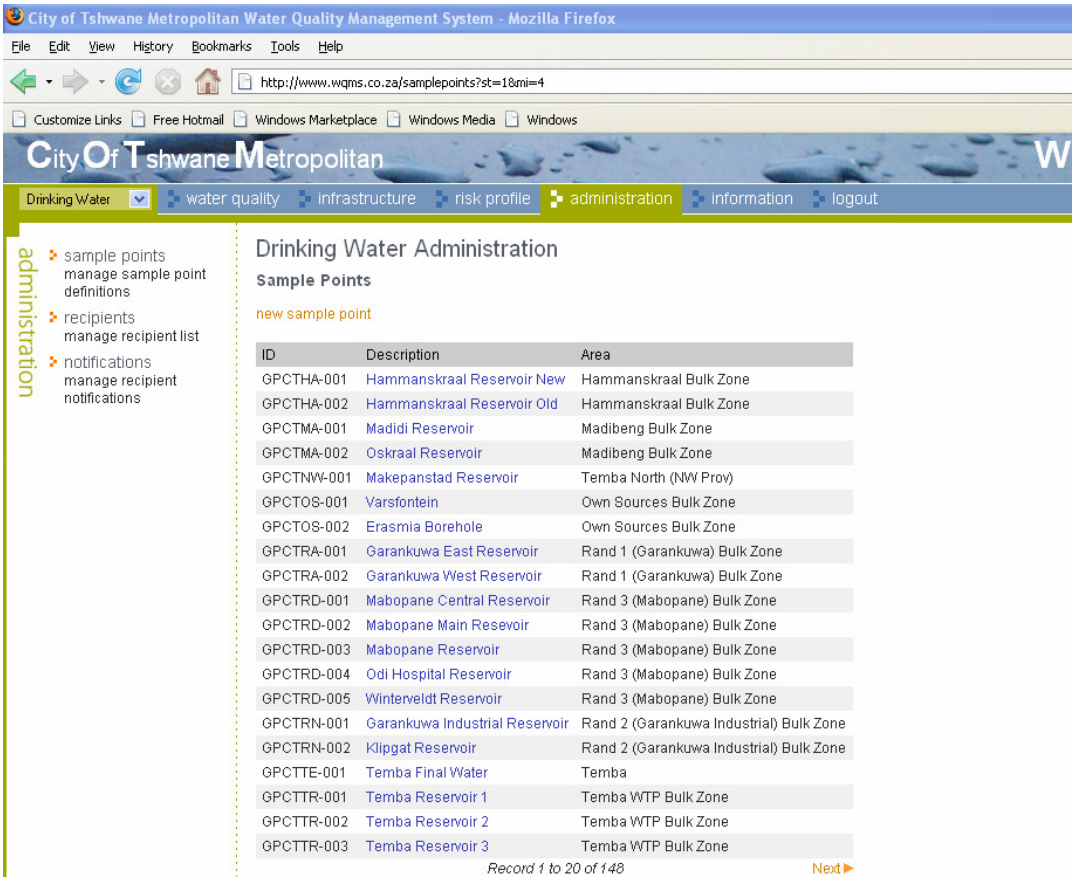
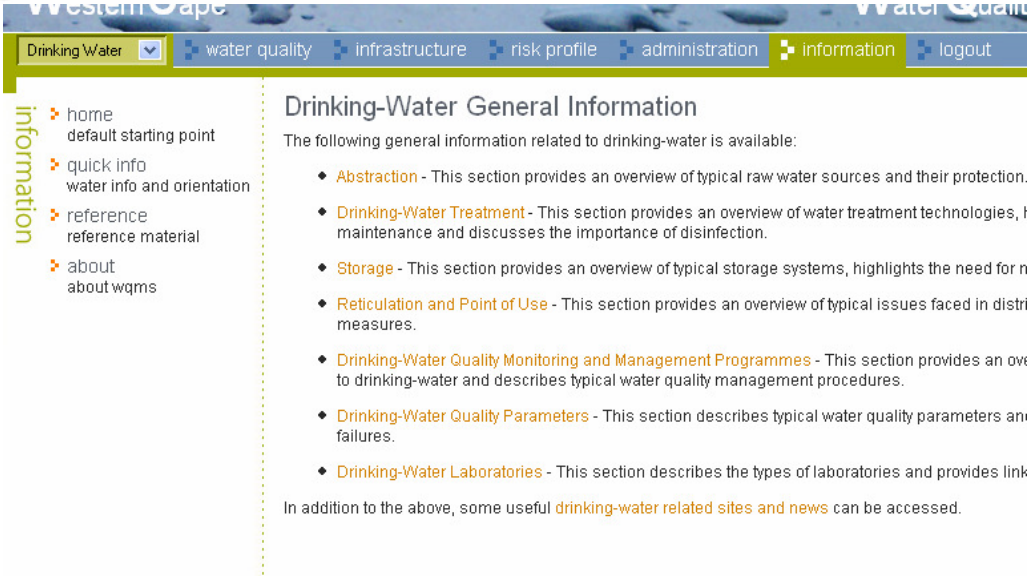


Figure A26: *Sample point administration (City of Tshwane, Gauteng)*

- **Guiding Information**

  Current functionality includes a convenient repository of drinking-water related information including: abstraction, treatment, storage, reticulation and point of use, Water Quality Monitoring and Management Programmes, water quality parameters, their effects and how to rectify issues, laboratories, water related sites and news and References including National Water Act, Water Services Act, Compulsory National Standards for DWQ, National DWQM Framework, etc.



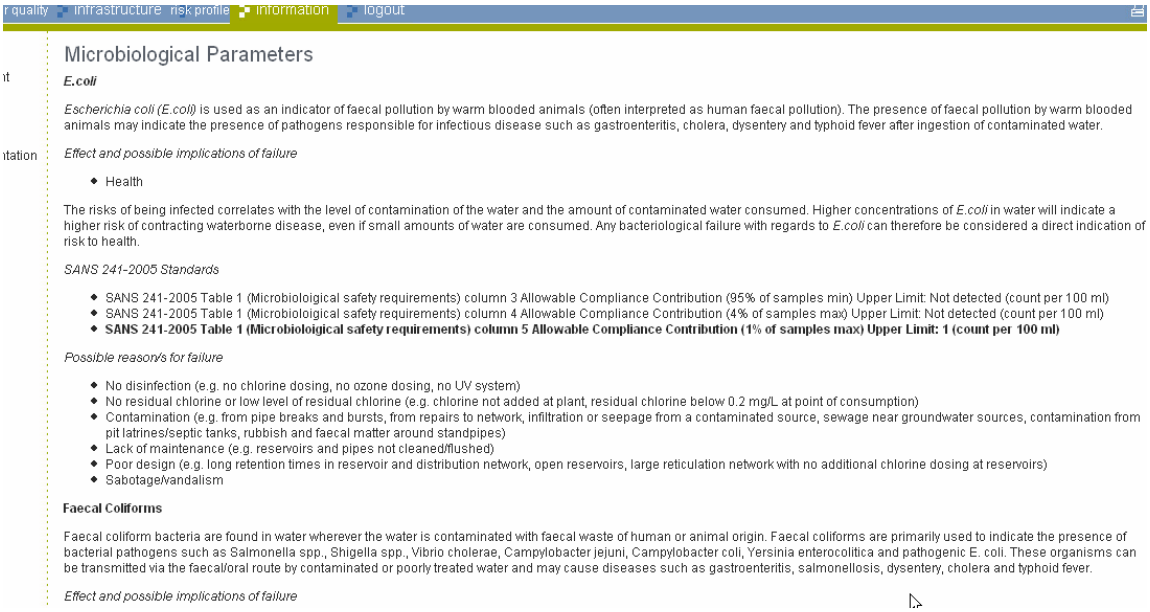


Figure A27: *Information examples*

4. User Requested Enhancements to the eWQMS System

As noted in Section 2, through the national roll-out process and IMESA led workshops, a number of enhancements to eWQMS functionality have been requested by system users. This has lead to the prioritisation of system user requirements and necessary incremental IT development of the eWQMS to meet the specified system user requirements. The development to the eWQMS includes enhancements to numerous components of the eWQMS including the Management Dashboard, Overview, Analysis (tables and graphs), Automatic Monthly Report and Communications. The methodology to be followed included development of the specified enhancement, testing and refinement of the specified enhancement and subsequent deployment

of the specified enhancement to eWQMS users. These enhanced components were made available to users in September 2007.

Furthermore, it must be noted that during the abovementioned enhancement phase, eWQMS users have noted the need for further developments and enhancements. Although some of these have already been implemented, other requests have only been noted and prioritised. The above highlights both the fact that WSAs find the eWQMS useful and contributes positively to improved water quality management, and the need to continuously develop the eWQMS to meet on-going user requirements for effective water quality management. In particular, eWQMS users have noted the need to further enhance wastewater components.