DRAFT PROCEDURE FOR PROFICIENCY TESTING SCHEME – SASS, RAPID BIOASSESSMENT ANALYSIS

- **Announcement & Invitation**
- **Procedure**
- **Typical Report**

October 2000

COVERING LETTER & INVITATION

Dear SASS Practitioner

This letter serves to invite you to participate in the next SASS Proficiency Testing Scheme (PTS).

As most of you will no doubt be aware the River Health Programme (RHP) recently entered what was termed the "anchoring phase" of the programme. This was after the RHP National Co-ordinating Committee met in 1999 and identified a number of key processes that were necessary to assist in the operational implementation of the RHP.

One of the key processes identified was the implementation of procedures for quality control and assurance. With SASS arguably the most "advanced" of all of the tools available to the RHP, this has been chosen to spearhead this process. As part of this, the first PTS for this method was recently run with some success with 4 SASS practitioners in KZN. The plan is to now expand this to cover the rest of the country. This letter serves as an invitation to participate in the next SASS PTS scheduled for early December 2000.

The basic programme for such a PTS is as follows:

- a single SASS sample is collected, preserved and stained
- this sample is then sent around the country to individual SASS practitioners (analysts) sequentially (pass-the-parcel manner)
- every analyst spends a maximum of half an hour analysing the sample before passing this on to the next analyst in the sequence
- results are emailed (preferably, on a standard template), or posted, to Mark Graham at Umgeni Water
- all results are then compiled, analysed and a summary report sent to all analysts.

This information will all feed into the QC system for the RHP.

As part of a longer-term goal of "certification" of SASS practitioners, all practitioners wishing to contribute to the RHP will be required to successfully participate in these SASS PTSs.

All SASS practitioners in SA will have the opportunity to join this scheme. A provisional list of involvement is as follows:
Brian Fowles (Envirocare)
Cebo Mhlongo, Mark Graham (Umgeni Water)
Jan Baxter (Private SASS trainer)
Angus Burns (Umlaas Irrigation Board)
Maxi Holder and Jake Alletson (Alletson Ecologicals)
Christa Thirion, Mary-Jean Gabriel (DWAF - IWQS)
Colleen Todd, Petro Vos, Peter MacMillan (Environmentek - CSIR Pretoria)
Piet Muller, Hermien Roux (Gauteng - Dept. Agriculture, Conservation & Environment)
Justine Fowler, Helen Dallas (Southern Water, UCT)
Candice Haskins (Cape Metro Council)
Stuart Mangold (North West Province – Dept. Agriculture, Conservation & Environment)
Gerhard Diederichs, Felicity Weir
Mark Chutter, Rob Palmer (AFRIDEV – consultants)

I would be pleased to hear of any other folk practising this method and will gladly add them to the list of participants.

Details needed from all participants would be the following:

- willingness to participate and to analyse a sample within a week of receipt
- full contact (postal) details, including email address if available
- willingness to forward the PTS sample on to the next person in the list (at own cost)

Please would all those SASS practitioners willing to participate contact Mark Graham, at Hydrobiology, Umgeni Water (via email on mark.graham@umgeni.co.za (preferably) or on 033 – 3411140) before 15th November 2000.

Only those people interested in this scheme will be included in the next PTS scheduled for early December 2000. At this stage there will be no cost to participants other than the postage costs to get the sample on to the next person in the sequential list of analysts.

The procedure and criteria for assessment are as detailed in the accompanying appendix.

We look forward to your participation

Dr Chris Dickens
Principal Scientist, Hydrobiology
Umgeni Water

SASS PROFICIENCY TESTING PROCEDURE

Introduction
This procedure is based on that used for accreditation of the SASS method at Umgeni Water according to the requirements of Standard ISO/IEC 17025, as assessed by the South African National Accreditation System (SANAS). (ISO - International Standards Organisation, IEC - International Electrotechnical Committee).

Sample description and method of tests
A routine SASS sample will be collected and preserved with formalin in the field. This will be returned to the laboratory and stained with Rose Bengal (or similar stain, to preferentially stain aquatic invertebrates). Obvious large plant debris and stone material is removed from the sample. After preservation and staining the sample is then drained of excess fluid. The "damp sample" is then placed in a wide mouth container padded with damp cotton wool or foam, to prevent excessive movement of the sample, and sequentially circulated to participants. The origin of the sample for testing will be varied to increase the diversity of families seen by practitioners. This will eventually involve regional co-ordinators collecting and preparing a single sample for dispatch into the "analysis chain". Initially results and reports will be centrally analysed and co-ordinated (to begin with at Umgeni Water).

Each participant analyses the sample with the following brief:

- notify Umgeni Water when sample has arrived
- carefully re-suspend preserved sample in a tray of clean water
- notify Umgeni Water if there is extensive damage to the invertebrates in the sample
- analyse the sample as per routine bankside SASS analysis ***not spending more than half an hour identifying invertebrates***
- score all invertebrates found on a standard SASS field sheet and calculate SASS Score (Score), Number of Taxa and Average Score per Taxon (ASPT)
- fill-in electronic spreadsheet template with results and post to mark.graham@umgeni.co.za
- if no email facility is available, field sheets with scores to be returned to UW for analysis
- drain sample (till just damp) and return to sample container and post to the next person on the list of sequential analysts
- notify Umgeni Water when sample has been sent (either by email or phone call)

Results
Each analyst (practitioner) is given a code so that they can track their own performance. Individual practitioners results will be assessed by looking at both the summary SASS metrics (indices), as well as respective families identified. This is done as follows:

SASS metrics/indices
Outlier results are assessed according to the method advocated by the American Society for Testing and Materials (ASTM) (1979).

Z scores are used to assist evaluation of performance of the respective labs.

Briefly:
Z score is based on the distribution of results around the mean

$$\text{Z score, Z} = \frac{\text{individual analysts result-overall mean value}}{\text{standard deviation}}$$

The ideal Z score is zero (0) and values of Z scores $\leq \pm 2$ are satisfactory, Z scores between ± 2 and ± 3 are questionable and $Z \geq 3$ are unsatisfactory (Smith, 1998).

SASS families

The SASS metrics presented (Score, ASPT, Taxa) are simply summary indices for the method. Behind them lies a set of family data with records of their abundance. A "model" score sheet is derived by majority agreement – assessed from data returned by participants. As there is no "external/independent assessor" of the sample for this PTS, consensual agreement on what was seen will indicate where there may be problems according to the criteria below. For example if only 3 out of 4 analysts observe an aquatic invertebrate family that is abundant (i.e. >10 individuals), this would indicate the fourth analyst may be having problems with identification of this particular family.

To assess the performance of analysts at the level of aquatic invertebrate family identification (the true essence of this PTS) the procedures used are as follows:

Does the analyst's score sheet:

1. Have any families (with approximate abundance) missing compared to the "model" score sheet? **(PASS = NO families with >10 individuals missing)**
2. Have any families (with approximate abundance) erroneously included compared to "model" score sheet? **(PASS = NO families with >10 individuals erroneously added)**
3. Show a difference between analysts number of families & "model" score sheet number of families? **(PASS = <20% difference in number of families)**

NOTE: **Any FAIL constitutes an overall FAIL**
Any discrepancies in identification and abundance will be noted.

A future refinement to the presentation of the data will be to portray SASS results as an ordination diagram. The results are essentially multivariate data i.e. for a single sample (practitioner) there are a range of SASS families that may have been identified. Obviously in an ideal world all participating practitioners would have found the same families, and in similar abundances. However this is rarely likely to be the case. Using ordination diagrams (and underlying multivariate statistical analysis) the data may be represented as an ordination 'graph' where the central tendency for all samples is the origin of both axes. This point would represent a hypothetical "average" sample containing all SASS families seen in their average abundance. The further away samples are from this origin the further that sample is away from the "average sample". The aim of ordinations is to arrange samples such that points on the diagram that are close together correspond with samples that are similar in SASS family composition. Obviously samples that are further apart correspond with samples that are dissimilar in composition. An example can be seen in the attached sheet.

Conclusions and remarks

The greater the number of analysts participating in this scheme the more robust the calculated statistics and ordination diagrams.

It is likely that to maintain the integrity and confidence of data being used in and by the RHP, the time will come when only data from certified practitioners will be accepted by the programme. One of the key requirements of certification of practitioners will be participation in such a PTS.

NOTE:

There is an obvious relationship between time spent observing and identifying invertebrates and the probability of encountering them. It should therefore be emphasised that to maintain some standard, exceeding the recommended ***half an hour of analysis*** should be avoided at all costs. It is also possible that results from analysts exceeding the half hour could stand-out from the "average" condition as determined by the majority of analysts – particularly when analysed with the multivariate ordination techniques.

References

American Society for Testing and Materials (ASTM) 1979. Annual Book of ASTM Standards, Part 31 - Water. Philadelphia, Pennsylvania.
Smith R, 1998. Proficiency Testing Course. Part 1: Proficiency Testing - Basic Principles, Organisation and Evaluation. SANAS, Pretoria, June 1998.

For further information contact Mark Graham at Umgeni Water (mark.graham@umgeni.co.za)

TYPICAL REPORT LAYOUT

A typical report layout for this SASS Proficiency Testing Scheme will be based on the following template:

Introduction and scope of PTS
Results of the Proficiency Testing Schemes run between (in no particular order) DWAFs Institute for Water Quality Studies; Umhlatuze Water; Midvaal Water Company; Rand Water; Scientific Services East London; Umgeni Water; Botswana Water Utilities Corporation, Magalies Water (Vaalkop), Universities of the Orange Free State, and Port Elizabeth, during December 2000.

For confidentiality your results are referred to in all Tables and Figures as Analyst Code …..

Sample description and method of tests
A raw SASS sample collected from kwaZulu Natal, preserved and stained was dispatched via courier to the first on the attached list of SASS analysts. This sample was circulated to each of the analysts sequentially. Analysis was by re-suspension of the sample into clean water, half an hour of identification and recording of invertebrate families, with results centrally compiled and analysed by Umgeni Water.

Results
Results for respective analysts supplying data are reported in Table 1 and graphically in Figures 1 to ??. Outlier results were assessed according to the method advocated by the American Society for Testing and Materials (ASTM) (1979). Only Lab X was deemed to be an outlier according to this procedure (Z scores ≥2).

The Z scores (used to statistically evaluate performance of respective analysts) have been included in the summary of results (Table 1).

Table 1. Summary table of SASS metrics and basics comparative statistics (December 2000)

Analyst Code	***1***	***2***	***3***	***4***	***Mean***	***Std. Dev'n***
Total Score	76	79	72	78	76.25	3.10
Nr of Families	14	16	15	13	14.50	1.29
ASPT	5.4	4.9	4.8	6.0	5.28	0.55
Z Score SASS	-0.08	0.89	-1.37	0.57		
Z Score No.Families	-0.39	1.16	0.39	-1.16		
Z Score ASPT	0.23	-0.68	-0.86	1.32		

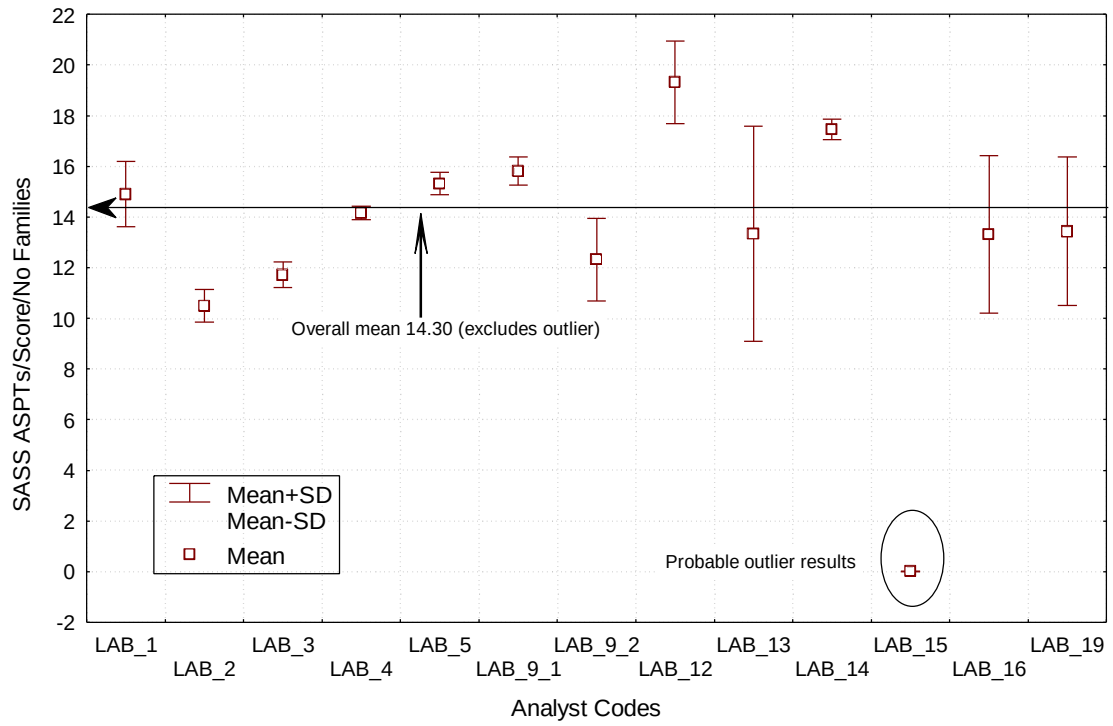

Figure 1: Graphical presentation of SASS PTS results (December 2000).

(Note there may be 3 of these figures to represent each of the SASS metrics).

In terms of these criteria all analysts in this PTS were deemed to be satisfactory for all metrics related to the SASS method i.e. SASS Score, Number of families, and ASPT.

An example of an ordination diagram reflecting these sorts of results is presented in Figure 2

Conclusion and Remarks
Analyst X and Y appear to be outliers in this PTS (distance from the central cluster of analysts in the ordination diagram).

As there is no "true value" for SASS metrics which can be assigned to the test sample it can only be assumed that the overall mean from all participants is approaching some central tendency for respective metrics in the test sample. There is a reasonable spread of means, from all participants, around the overall mean. This indicates no particular bias, either under or overestimating the "true" SASS metrics.

All analysts faired well in this PTS with good agreement obtained for all SASS metrics. Only one family (Planaria) appeared to be causing some confusion between analysts. This problem area should be addressed by individual practitioners.

These results show that …….

The next SASS PTS is planned for March 2000.

Thank you for your participation. We trust this exercise is proving useful to all concerned.

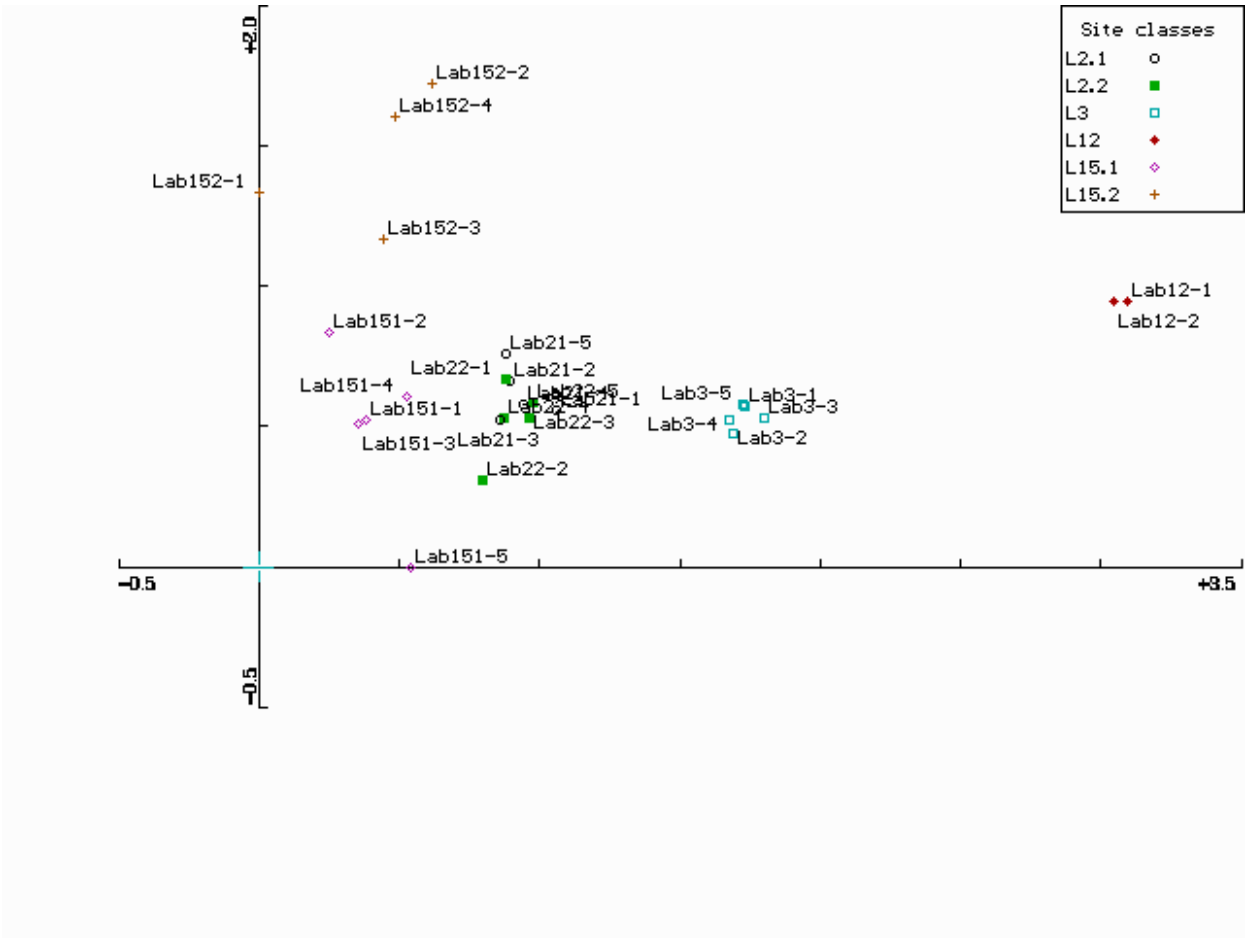

Figure 2. Ordination diagram of SASS family data from December 2000 SASS PTS.

Dr Chris Dickens
Principal Scientist, Hydrobiology
Umgeni Water