

**WATERWATCH VICTORIA  
QA/QC WEEK 2009**

**REPORT ON STATE-WIDE RESULTS FOR  
PHYSICOCHEMICAL PARAMETERS AND  
MACROINVERTEBRATES**

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## **1.0 Background**

Waterwatch Victoria is a state-wide community based water quality monitoring organisation that aims to increase local community understanding and ownership of waterway and catchment issues. Community volunteers and Waterwatch co-ordinators are involved in the monitoring of waterway health including water quality and macroinvertebrate indicators.

Waterwatch Victoria's QA/QC Week program is an annual event co-ordinated at a state-wide level. It involves the testing of laboratory prepared standard samples by monitors and co-ordinators to ensure that their equipment and monitoring techniques are accurate. For more information on Waterwatch Victoria's Data Confidence Framework, guidelines and data confidence plans, visit [www.vic.waterwatch.org.au](http://www.vic.waterwatch.org.au)

This report provides a simple summary of the state-wide data provided by both co-ordinators and monitors during QA/QC Week 2009. It follows on from similar programs that have been conducted annually since 1998. Further detail can be found within the ten regional reports that have been distributed to the Waterwatch Co-ordinators.

## **2.0 Methods**

### **2.1 Physicochemical Parameters**

Stable 'Mystery' reference water samples were prepared for pH, electrical conductivity (EC), turbidity and orthophosphate by Australian Chemical Reagents (Roach Analysts), QLD. Each parameter was further divided into a low range sample (A) and a high range sample (B) giving a total of 8 unique samples. A subset of all of these samples (approximately 10%) were tested by the NATA accredited Ecwise Analytical laboratories to check for sample homogeneity and stability.

Physicochemical 'mystery' solutions were prepared to specifications recommended by the state Waterwatch Victoria office. Values listed in Table 1 are the averaged solution concentrations of the subset measured during QA/QC Week by Ecwise. Individual parameter solutions were provided to all regions in separate bottles with labelled instructions for sample preservation and use. Acceptable upper and lower quality control limits for each parameter were set according to the standards outlined in the Waterwatch Victoria Data Confidence Framework. These quality control limits are sensitive to the wide array of equipment used by Waterwatch coordinators and monitors.

This year several co-ordinators and monitors highlighted an issue relating to the measurement of orthophosphate samples using the colour comparators. It appears that after the reagents have been added there is a colour discrepancy between the sample and the wheel, with the sample containing shades of blue/green instead of the blue/purple that is found on the wheel. This issue made assessment of the actual orthophosphate levels much more difficult. In light of the

problem, the acceptable range for the orthophosphate low range (A) samples has been substantially increased. The acceptable range for the high range (B) samples remains unchanged as colour discrepancy within these samples was much less obvious.

The supplier of the samples is currently working with the colour comparator manufacturers to determine the cause of the colour variation and devise an appropriate solution for the problem.

Please note that comparisons of low range orthophosphate samples with previous years results should therefore be avoided, as the acceptable range is significantly different.

**Table 1. True values and acceptable limits for phys-chem parameters.**

Parameter	Sample	Acceptable Range	True Value	Lower Limit	Upper Limit
pH (pH units)	A	± 0.3	6.6	6.3	6.9
	B	± 0.3	9.1	8.8	9.4
EC (µS/cm)	A	± 10%	540	486	594
	B	± 10%	5700	5130	6570
Turbidity Meter (NTU)	A	± 20%	12	9.6	14.4
	B	± 20%	120	96	144
Turbidity Tube (NTU)	A	± 25%	12	9	15
	B	± 25%	120	90	150
Orthophosphate mg/L	A	± 40%	.094	0.056	0.13
	B	± 20%	.50	0.40	0.60

A total of 1650 phys-chem samples were sent out across the state for QA/QC Week 2009. Three hundred and sixty seven participants took part in QA/QC Week 2008 including 36 co-ordinators and 331 monitors. Please note that not every participant attempted all eight samples as regional co-ordinators decided which samples they, and their monitors, would assess prior to QA/QC Week 2009. The minimum number of samples assessed by any one participant was two with the majority assessing between four and seven. All participants were provided with QA/QC Codes to allow their results to be included in the state-wide analysis anonymously.

The Victorian Waterwatch Data Confidence Framework sets out minimum requirements for equipment to be used by monitors and co-ordinators to conduct water quality analysis. A summary of the requirements for monitoring standards three and four is provided in Table 2 below.

**Table 2. Minimum requirements outlined in the Data Confidence Framework.**

Parameter	Standard 3	Standard 4
EC	Low range = minimum resolution of 0.10 mS/cm	Low range = min resolution of 0.10 mS/cm
	High Range = minimum resolution of 10 mS/cm	High Range = minimum resolution of 10 mS/cm
pH	pH meters (not strips)	pH meters (not strips)
Turbidity	Turbidity tubes	Turbidity meter
P04	Comparator	Colorimeter

## 2.2 Macroinvertebrates

A total of 81 'Mystery' macroinvertebrate samples of known taxonomic composition were prepared by Instream Solutions (Victoria). These samples were provided to test the co-ordinator's and monitor's identification skills at variable taxonomic resolutions. The 'mystery' samples consisted of six macroinvertebrates that are naturally found in the majority of Victorian bioregions so not to disadvantage participants (Table 3). Coordinators and monitors were asked to identify the macroinvertebrates at the Order, Family and common name level.

Analysis of results was carried out at the Family level, as this is the level required for the biological indices (e.g. AUSRIVAS and SIGNAL) used in the State Environment Protection Policy Waters of Victoria (SEPP WOV). A non attempt at identification was marked as a blank space in the results sheet and was ignored in the final statistical analysis.

**Table 3. Macroinvertebrate "Mystery Sample" taxa list.**

Order	Family	Common Name	Found in Victorian Bioregions
Hemiptera	Corixidae	Water Boatmen	Highlands, Forest A, Forest B, Cleared Hills and Coastal plains
Decapoda	Atyidae	Freshwater Shrimp	Highlands, Forest A, Forest B, Cleared Hills and Coastal plains
Trichoptera	Hydropsychidae	Caddisfly, Caseless Caddis	Highlands, Forest A, Forest B, Cleared Hills and Coastal plains
Diptera	Chironomidae	Bloodworm, non biting midge	Highlands, Forest A, Forest B, Cleared Hills and Coastal plains
Hygrophila	Physidae	Freshwater Snail (introduced)	Highlands, Forest A, Forest B, Cleared Hills and Coastal plains
Ephemeroptera	Baetidae	Mayfly	Highlands, Forest A, Forest B, Cleared Hills and Coastal plains

### 3.0 Results

#### 3.1 physicochemical

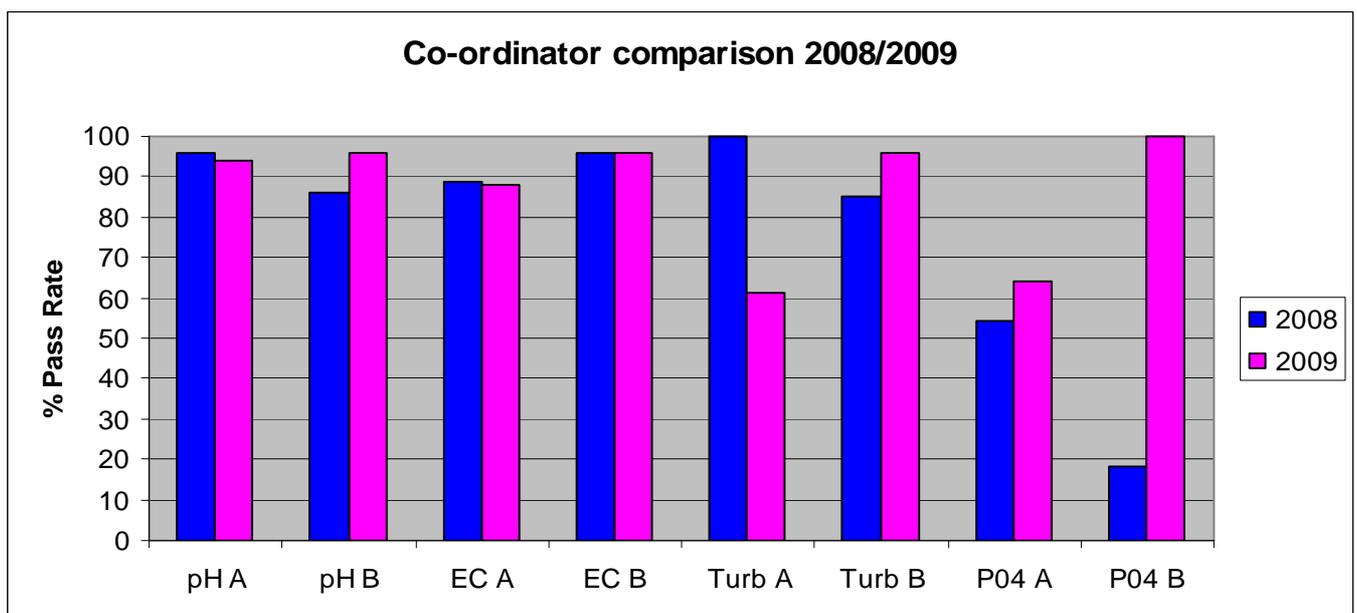
The following table summarises the co-ordinators results across all of the ten regions. Pass rates for the majority of samples were very high with the exceptions been the low range (A) turbidity and orthophosphate samples.

**Table 4. Co-ordinator pass rates for physicochemical parameters.**

Parameter	Sample	Number of results (n)	Pass Rate %	2008 Pass Rate %
pH (pH units)	A	32	94	96
	B	25	96	86
EC ( $\mu\text{S}/\text{cm}$ )	A	33	88	89
	B	25	96	96
Turbidity (NTU)	A	33	61	100
	B	24	96	85
Orthophosphate mg/L	A	25	64	54
	B	10	100	18

As can be seen in Figure 1 the majority of co-ordinator results in 2009 were similar to those observed in 2008. The two key differences were a significant decrease in the low range turbidity pass rate and a significant increase in the high range orthophosphate pass rate.

**Figure 1. Comparison of Co-ordinator pass rates between 2007 and 2008.**



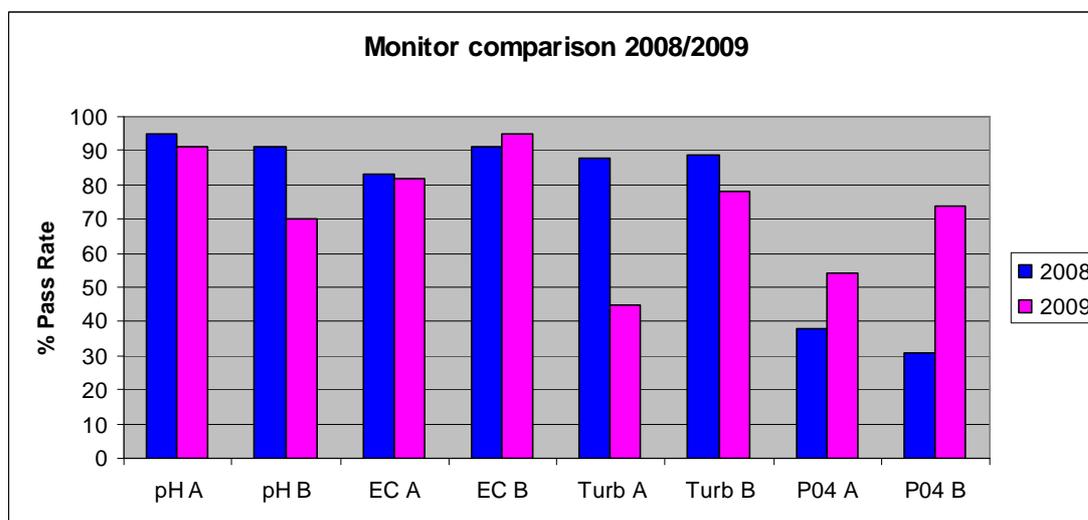
State-wide results for the monitors are summarised in Table 5 below. Again, pass rates were generally quite high with the exceptions being the pH (high range) and turbidity (low range) samples.

**Table 5. Monitor pass rates for physicochemical parameters.**

Parameter	Sample	Number of results (n)	Pass Rate %	2008 Pass Rate %
pH (pH units)	A	234	91	95
	B	196	70	91
EC ( $\mu\text{S}/\text{cm}$ )	A	277	82	83
	B	167	95	91
Turbidity (NTU)	A	272	45	88
	B	168	78	89
Orthophosphate mg/L	A	228	54	38
	B	43	74	31

A comparison between pass rates in 2008 and 2009 suggests that monitors accuracy increased for the orthophosphate high range (B) samples. A decrease in pass rates was observed for the high range pH sample and both of the turbidity samples.

**Figure 2. Comparison of monitor pass rates between 2007 and 2008.**



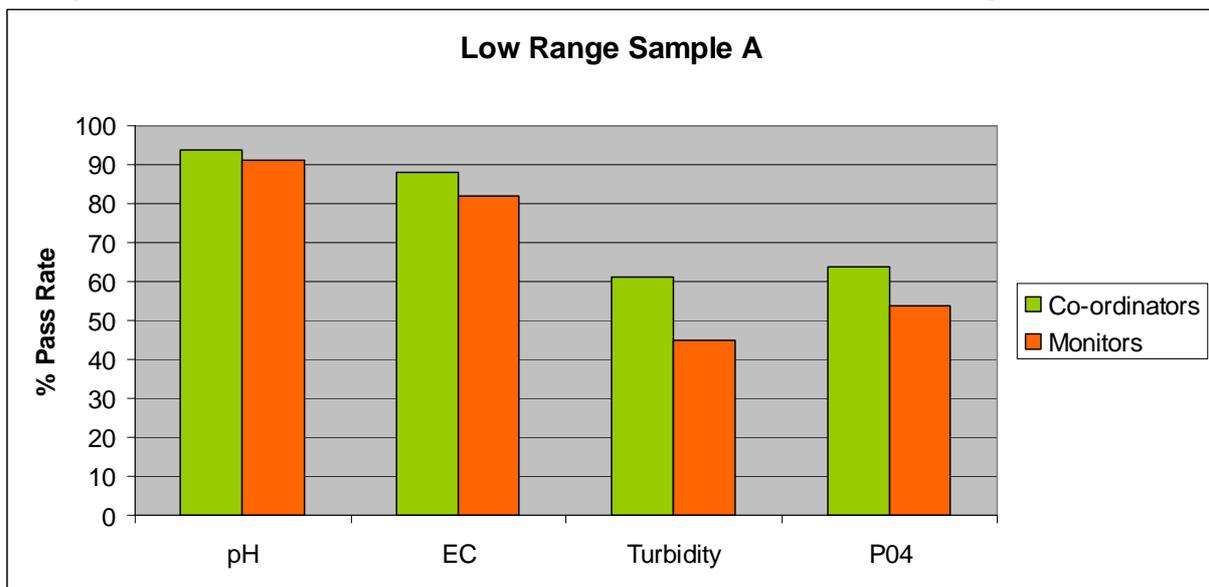
The reduced turbidity A pass rate that was observed for both monitors and coordinators appears to be related to the comparatively low (12.5 versus 32 NTU from 2008) value that was used this year. Many participants overestimated the value of the low range sample when using the tubes obtaining values between 16-20 NTU.

The use of tubes to measure turbidity is fairly subjective and can be affected by a range of factors such as ambient light levels and the operator's visual ability. These results suggest that obtaining accurate measurements, using turbidity tubes, is much harder at levels below 15 NTU.

Ecologically speaking, the difference between a spot turbidity measurement of 12.5 and 20 NTU is relatively insignificant. As such, the decrease in accuracy observed at the lower turbidity levels should be considered as a minor issue for the Waterwatch participants. However, if regions wish to improve their accuracy then it suggested that monitors upgrade from tubes to turbidity meters.

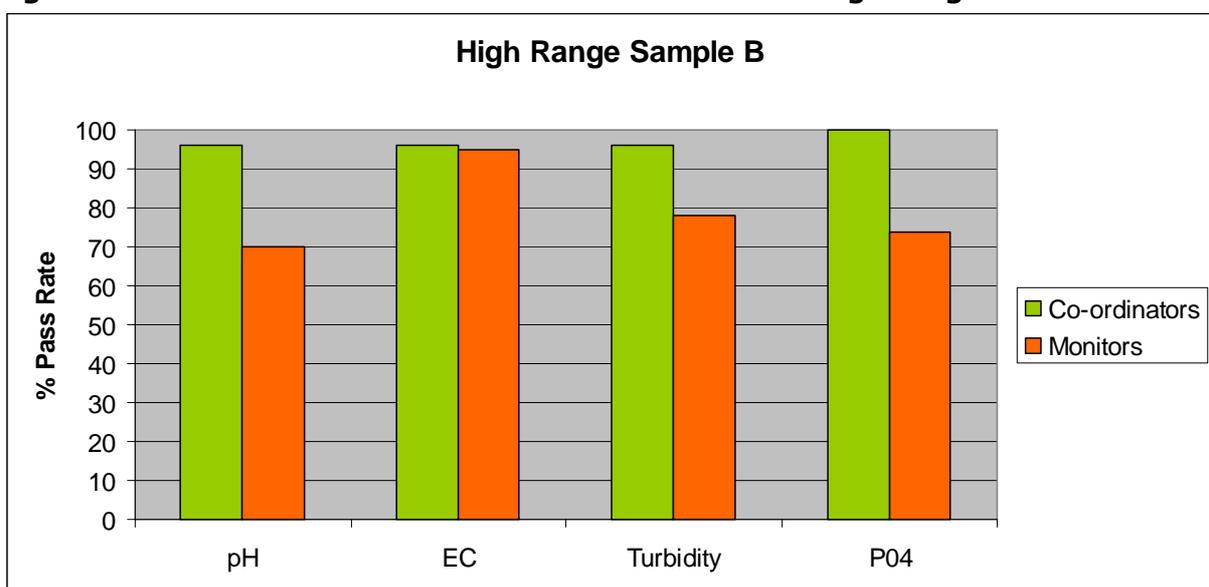
A comparison between the performance of the co-ordinators and that of the monitors, in 2009, is provided in figures 3 and 4. As would be expected co-ordinators achieved higher pass rates than the monitors across all of the low range (A) parameters.

**Figure 3. Pass rates for co-ordinators and monitors – Low range**



Results for the high range parameters mirrored those above with co-ordinators consistently achieving higher pass rates when compared to the monitors.

**Figure 4. Pass rates for co-ordinators and monitors – High range**



### 3.2 Macroinvertebrates

27 co-ordinators and 52 monitors attempted to identify the macroinvertebrate 'Mystery samples'. Bugs were identified by eye, hand lens or microscope, using a variety of macroinvertebrate keys and picture books. All of the co-ordinators and approximately half of the monitors attempted to identify the bugs at family level. Pass rates were generally quite good, with the co-ordinators having a higher overall pass rate than the monitors.

**Table 6. Family level pass rates for macroinvertebrates**

Position	Atyidae	Chironomidae	Baetidae	Corixidae	Hydropsychidae	Physidae
Co-ordinators	100	100	96	96	88	75
Monitors	94	86	70	91	75	63

These results are very encouraging considering that this years set of macroinvertebrates contained two families which are quite hard to identify. Chironomidae (non biting midges) are generally very small and hence are hard to identify without a microscope, while snails of the family Physidae can look similar to both Planorbid's and Lymnaeid's.

A list of common misidentifications made by participants in QA/QC week 2009 are outlined in the table below.

**Table 7. Common misidentifications at family level**

Macroinvertebrate	Common Mistakes
Atyidae	Palaemonidae
Chironomidae	Tipulidae, Ceratopogoninae
Baetidae	Leptophlebiae, Odonata
Corixidae	Notonectidae
Hydropsychidae	Beetle larvae
Physidae	Lymnaeidae, Planorbidae

Identification of macroinvertebrates at family level can be difficult. There are a number of ways individual regions can improve their identification accuracy if they wish to, including; purchasing stereo microscopes, obtaining appropriate family level keys and participating in macroinvertebrate training seminars.

## **5.0 Conclusion**

The annual QA/QC Week, which is conducted across the state, is just one quality control check provided by Waterwatch Victoria to support volunteer monitors and co-ordinators. This year over 360 data sheets for phys-chem and 80 data sheets for macroinvertebrates were received for analysis. Pass rates for samples were generally high with the exception being the low range turbidity samples. It is suggested that participants outside of the acceptable range either undergo further training in the use of the turbidity tubes or upgrade to turbidity meters, to ensure that the stream data they collect remains accurate.

A comparison between the 2008 and 2009 results revealed that overall the pass rates are approximately the same for the two years with an increase in the high range orthophosphate pass rate and a decrease in the low range turbidity pass rate.

As was the case last year, several issues relating to the use of equipment were discovered when processing the data from QA/QC Week 2009. Many level 3 and 4 participants are still using pH strips instead of pH meters to determine this parameter when they are required to use pH meters. Many level 4 co-ordinators and monitors are still using turbidity tubes and colour comparators when according to the Data Framework they should be using turbidity meters and colorimeters. It is suggested that if these participants were to use the appropriate equipment (which is more accurate when used correctly) many of their pass rates would improve.

### **Appendix 1: Data**

Raw data from QA/QC Week 2009 can be accessed in excel spreadsheet format upon request from Waterwatch Victoria.