WATERWATCH
Corangamite
Communities Caring For Catchments

CORANGAMITE WATERWATCH PROGRAM

WATER QUALITY REPORT - 2007

Southern Otway Landcare Network

Corangamite Waterwatch proudly supported by:

Barwon Water

CENTRAL HIGHLANDS WATER

CORANGAMITE CMA

action Salinity & Water AUSTRALIA

Introduction

Waterwatch is a national community water monitoring program with an environmental education and awareness focus. It brings together schools and community groups, Landcare groups, landowners, councils and water authorities to test the quality of their local stream or water body so that action can be taken to maintain or improve the water quality.

The Corangamite Region Waterwatch program is hosted by Corangamite Catchment Management Authority and is sponsored by Barwon Water and Central Highlands Water and the National Action Plan.

These notes have been compiled by the Corangamite Waterwatch team and offer some interpretation of the monitoring results. Freshwater systems are complex and the ideas presented here are designed to encourage discussion about the local waterways and the water quality issues that have been identified over the past 12 months. Waterwatch encourages groups to not only look at their own environment, but their whole waterway and catchment to find opportunities to improve their waterways.

It is important to realise that results can also vary with a number of factors including:

- the individual
- the expertise of the monitoring group
- time of day
- site of testing
- sampling method (eg. depth at which sample is taken)
- amount of recent rainfall
- seasonal variation
- accuracy of monitoring equipment

If you have any questions regarding the contents of this report, or would like further information about the Corangamite Waterwatch Program, please contact:

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Waterwatch Monitors of the Otway Coast

The Southern Otway Landcare Network coordinates Waterwatch activities amongst member groups Otway Barham, Wongarra, Apollo Bay and Hordenvale Glenaire Landcare Groups

These groups monitor waterways that are located in the Otway Coast basin. The rivers and creeks discharge from the Otway Ranges to the sea. The lower reaches of the waterways are used for recreational purposes by coastal visitors and residents. The Barham River estuary also forms a floodplain that is used for grazing and recreation.

The Barham River is one of the estuaries involved in the estuary restoration program conducted by the Corangamite CMA. In June 2005, it was 're-snagged' to provide habitat and streambed stabilisation. Landholders, the Southern Otway Landcare Network and Corangamite CMA have streamside rehabilitation projects in progress upstream of the estuary to improve water quality.

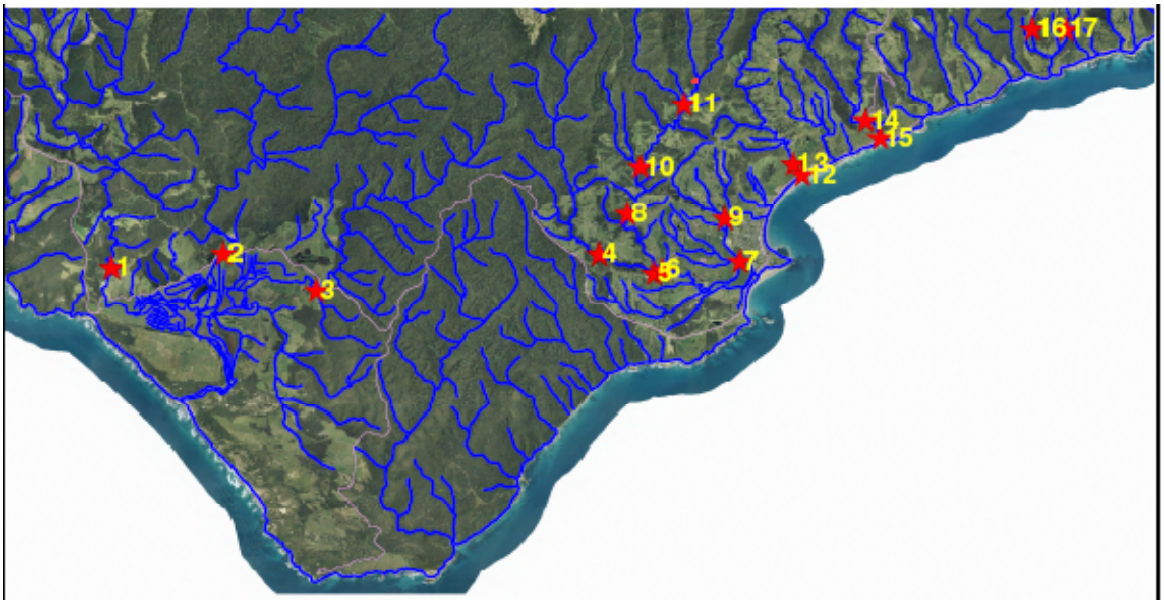
The declaration of the Barham River as a Special Water Supply Catchment was made to provide a reliable supply of potable water for the townships of Apollo Bay and Marengo. This has made protection of the region's rivers and creeks a priority through fencing and revegetation works. Waterwatch testing provides an important monitoring tool in these programs

Monitoring Sites

Information had been gathered at 17 sites in 2007 by volunteer monitors. This set of sites corresponds to the map of the Southern Otway Region below.

1. Ford River FOR009 monitored by Pam Dodsworth
2. Aire River AIR009 monitored by Kate Holmes and Leigh Dwan
3. Calder River CAL090 monitored by Marriners
4. West Barham River BHW005 monitored by Alan and Lesley Huggins
5. West Barham River above confluence BHW040 monitored by Simon and Susan Pockley
6. East Barham River above confluence BHE020 monitored by Simon and Susan Pockley
7. Barham River at Andersons Creek confluence BHR075 monitored by Simon and Susan Pockley
8. East Barham River at Paradise BHE010 monitored by Nicola Philp
9. Andersons Creek monitored by Jayne Martin (no recorded data in 2007)
10. Barham River East BHE015 monitored by Valerie Stahn
11. Barham River East BHE005 monitored by Sam and Glenda Falzon
12. Wild dog creek at estuary WLD100 monitored by Kristen Lees
13. Wild dog creek WLD090 monitored by Webley's
14. Skenes Creek Upper SKE090 monitored by Murray Champion and Fiona Nelson
15. Skenes Creek estuary SKE100 monitored by Murray Champion and Fiona Nelson
16. Whalebone Creek tributary WHA050 monitored by Bruce Ride
17. Whalebone Creek WHA040 monitored by Rob Wertheimer

Figure 1 Map of the Southern Otway Region monitored during 2007



In addition, some data was collected at Barham River at the Great Ocean Road bridge BHR095 at the beginning of 2007 and this has been included in this report.

Water Quality Tests

Dissolved Oxygen

Dissolved oxygen (DO) measures the amount of oxygen gas dissolved into the water. The level of DO is affected by water temperature and salinity; higher temperature or salt concentration results in lower amounts of dissolved oxygen. Data is represented as mg/L or % saturation

Major factors affecting dissolved oxygen concentration include altitude, presence/absence of air, plant and animal life (influencing photosynthesis and respiration rates), mixing rate, depth, salinity, temperature, organic and nutrient content.

Dissolved oxygen varies according to the temperature of the water along with other factors including surface area (eg. if we have a high surface area to volume ratio, DO levels will generally be high). Very low levels of DO in the water will reduce the numbers of sensitive species in the ecosystem.

pH

pH is a measure of the acidity or alkalinity of the water. pH levels above 7 are alkaline whilst pH levels below 7 are acidic. A pH of 7 is said to be neutral and in the middle of the pH range.

pH can be affected by factors such as the amount of algal or plant growth, time of day, photosynthesis and respiration, geology and soils, discharges of industrial wastes, agriculture, urban development or excavation disturbing acid sulphate soils, and seawater or salt content.

pH levels above or below normal levels for a waterway may affect sensitive species. Extremely high or low levels may limit even the hardiest of species

Temperature

Temperature (^{o}C) is an important parameter to measure as fluctuations in water temperature can affect other parameters such as dissolved oxygen.

Major factors affecting temperature include air temperature, exposure to sunlight, turbidity, ground water inflows, vegetation, industrial discharges, dam discharges, and depth and flow of waterbody.

Temperature has the same effect on aquatic ecosystems as pH. Too high or too low a temperature or severe temperature fluctuations may cause the death of even the most hardy of species. Temperature extremes may affect the way that larvae grow and result in species death over a longer period.

Electrical Conductivity

Conductivity is a measure of the amount of dissolved salts in water –salty water conducts electrical current far better than pure water. Data is represented as EC units (µs/cm) but can also be converted to salinity units (ppm or mg/L).

Conductivity is affected by geology and water movement through soils, irrigation and runoff, removal of vegetation, sewage and effluent discharges, industrial discharges, groundwater inflows, temperature, and evaporation and dilution.

As with temperature and pH, the salinity of water can affect the way species within the ecosystem survive. Sensitive species die and reproduction of species may be affected if the water conductivity rises beyond normal ranges

Turbidity

Turbidity is a measure of the clarity of water. The more suspended solids (fine particles) the higher the turbidity. These fine particles can be clay, silt, organic matter, algae or microorganisms. Data is represented as NTUs or FTUs.

Major factors affecting turbidity include rainfall and catchment runoff, soil erosion, stock access to waterways, waste discharge, stormwater, algal growth, lack of riparian vegetation, flow and salinity

The turbidity of water can have a large effect on an ecosystem because the more cloudy the water, the less sunlight penetrates it. This reduction in sunlight then reduces the ability of the aquatic plant to photosynthesise and therefore reduces the ability to make food for the plant and animals that feed on them. Reduction in photosynthesis also reduces the amount of oxygen produced by plants in daylight hours resulting in less oxygen being available for animals and plants.

Reactive Phosphorus

Phosphorus is a mineral nutrient that occurs naturally in trace amounts. Levels of reactive phosphate is readily available (ie in solution and not chemically bound to sediment) and indicates the nutrient status and organic enrichment of the water. A sudden increase in reactive phosphorus in inland waters can stimulate great increases in the growth of algae and other aquatic plants. Reactive phosphorus is tested in the field however total phosphorus (includes reactive phosphorus plus phosphorus chemically bound to sediments) must be tested in a laboratory. Reactive phosphorus is reported as mg P/L.

Phosphorus concentration in water is affected by rock type and geology, soil type, seasonal conditions, animal and human wastes, phosphate-containing fertilisers, disturbed land and urban runoff.

If phosphate levels rise significantly above natural levels, they can lead to algal blooms, which in turn increase turbidity, pH and produce toxins that make the water unsafe to use.

Interpreting Data: Corangamite Waterwatch Guidelines and State Environment Protection Policy Waters of Victoria

Corangamite Waterwatch Guidelines

All data reported in this report is compared with condition ratings based on Water Quality Guidelines for lowland rivers, ANZECC Guidelines, 1992. This method of assessment is widely used for snapshots of data eg when only limited data points are available for the sampling site.

Parameter	Measurement	Ratings & Values				
		Excellent (4)	Good (3)	Fair (2)	Poor (1)	Degraded (0)
Dissolved Oxygen (DO)	% Saturation	81 – 110	71 – 80 111 – 130	51 – 70 131 – 150	41 – 50 151 – 160	< 40 > 161
pH	Units	6.5 – 7.5	6.0 – 6.4 or 7.6 – 8.0	5.5 – 5.9 or 8.1 – 8.5	5.0 – 5.4 or 8.6 – 9.0	<5.0 or >9.1
Reactive Phosphorus	mg P/L	< 0.01	0.011 – 0.025	0.026 – 0.05	0.051 – 0.1	> 0.1
Conductivity (EC)	Electrical Conductivity (EC)	0 – 400	401 – 800	801 – 2,000	2,001 – 5,000	> 5,000
Turbidity (T)	NTU or FAU	< 10	10 – 20	20 – 30	30 – 50	> 50

The value of the rating can be added together to give a physico-chemical test water quality rating for the condition of the waterway. This rating is reported in the discussion section of the report. Similar condition scores can be performed on habitat and macro-invertebrate surveys (where the data is available) to give an overall waterway condition rating.

State Environment Protection Policy Waters of Victoria - SEPP (WoV)

Water quality can also be interpreted using the State Environment Protection Policy (Waters of Victoria) commonly referred to as SEPP (WoV)[1]. SEPP guidelines were developed by the EPA to provide a legal approach to environmental protection. Environment quality objectives ie the goal posts, are water quality or biological indicators set to protect the water environment. The SEPP describes the

(1) uses and values of the water environment (human consumption, irrigation etc) of the water environments and
(2) sets goal posts to know when they are protected and
(3) guidance on how to maintain them through an "attainment program".

The uses and values of the water environment are also called the beneficial uses ie those uses that depend on clean water eg human consumption or irrigation. The goal posts are

[1] Policy Impact Statement State Environment Protection Policy (Waters of Victoria) Our Water, Our Future!, EPA, 2003. Publication available on internet http://www.epa.vic.gov.au/water/epa/wov.asp

the environment quality objectives that protect the water environment eg water quality or biological indicators.
SEPP was developed in conjunction with the Victorian River Health Strategy and is reviewed every 10 years.
There are different types of water environment that SEPP defines as segments with different water quality objectives
1. Aquatic reserves of high conservation value with a water quality objective of "no variation from background condition"
2. Wetlands and Lakes (area that are wet on a regular or semi regular basis) that do not have a water quality objective yet
3. Rivers and Streams that range from forested areas and those that are cleared. The Corangamite region will have different water quality objectives for these different environments. The table on the following page has the description of rivers and streams and their associated water quality objectives used as the "goal posts" in the Corangamite Water Quality Reports.
4. Marine and estuarine water environments are diverse and environmental quality objectives are generally not set however Port Phillip Bay has specific protection and open coasts require a high level of ecosystem protection.

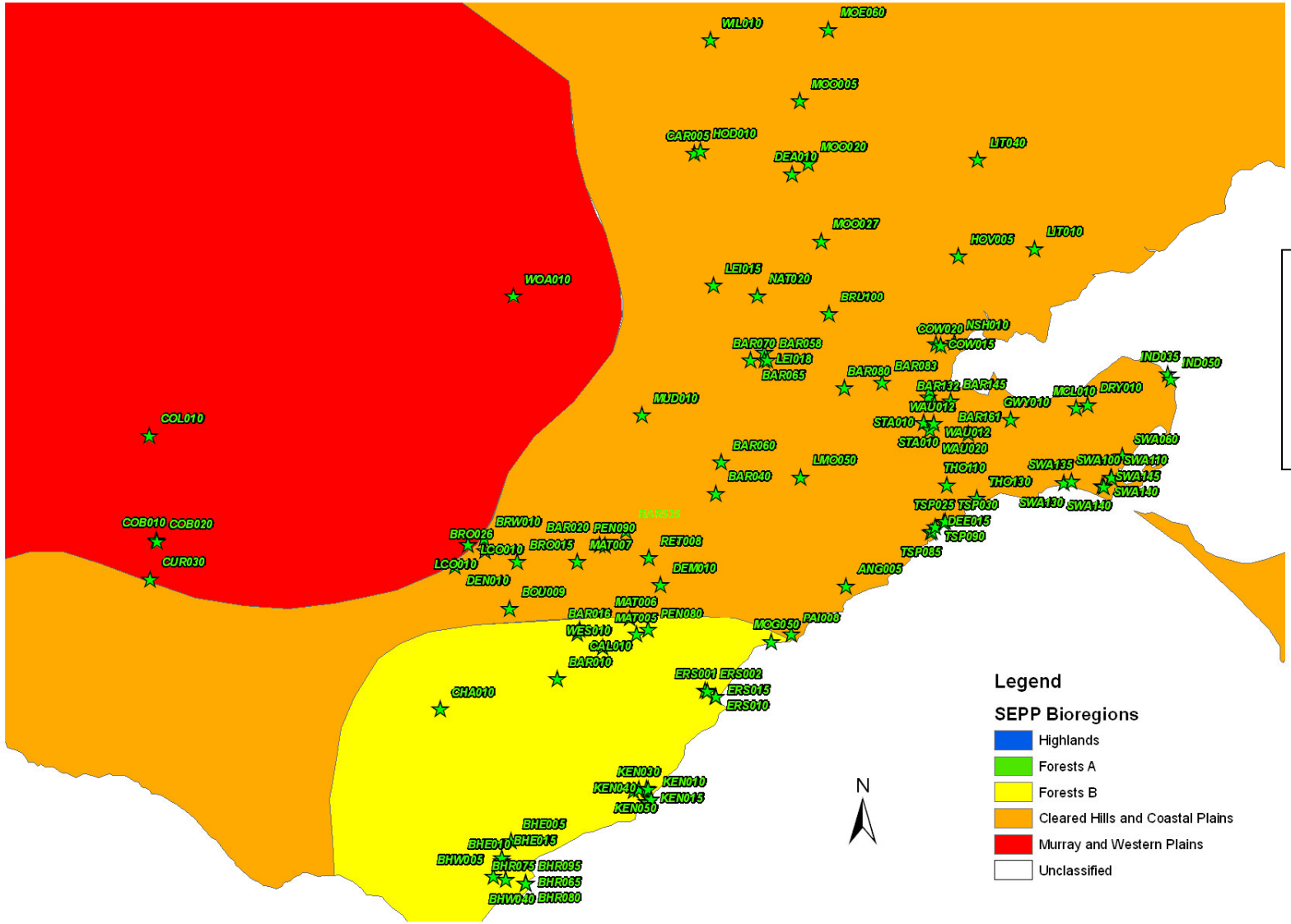
SEPP analysis can only be done where there are at least 11 data points for the year. SEPP analysis has been performed on all the river and stream data collected by Waterwatch monitors if there are enough data points collected. If insufficient data is able to be collected because of lack of water, this observation is noted in the results presentation. The indicators pH, electrical conductivity, dissolved oxygen and turbidity are analysed in this report. Total nitrogen and total phosphorus (rather than reactive phosphorus) are indicators in SEPP objectives but are not analysed in the Corangamite Waterwatch program.

The data is analysed statistically to calculate the 25^{th} and 75^{th} percentile ie the 75^{th} percentile is the value of the parameter (eg electrical conductivity) below which 75% of data points may be found. If the site data falls outside the required percentile, the water quality has not met the objective set to protect the uses and the values of the area. The result is that the objective is either met or not met.

SEPP Environmental Quality Objectives for the Corangamite region.

Segment	Indicator					
	Dissolved Oxygen (%sat)		Turbidity (NTU)	Electrical Conductivity (µS/cm)	pH units	
	25th percentile	maximum	75th percentile	75th percentile	25th percentile	75th percentile
Forested Areas – B						
Otway Ranges	90	110	5	500	6.4	7.7
All other areas	90	110	5	100	6.4	7.7
Cleared Hills and Coastal Plains						
Lowlands of the Barwon and Moorabool catchments	85	110	10	1500	6.5	8.3
Uplands of the Moorabool catchments	85	110	10	500	6.5	8.3
Murray and Western Plains						
Corangamite Basins	85	110	10	1500	6.5	8.3

The sites monitored in the Corangamite Waterwatch program fall into one of the segments Forests B, Cleared Hills and Coastal Plains, and Murray and Western Plains. Sites in the region have been mapped and are shown on the next page (map generated by Clare Marsh, Freshwater Services, EPA Victoria, 2007).



This map of the Corangamite region show the location of monitoring sites in relation to SEPP bioregions

Waterwatch Monitoring Plan for SOLN

Monitoring Purposes

- To connect people to their local waterway
- To establish and regularly record the stream condition of Otway coast streams and rivers
- Overall concern for water quality and land use issues
- Data collection to drive improvement in water quality and production of the estuary
- Opportunity for learning

Information Users

- Corangamite Waterwatch Program
- Corangamite Catchment Management Authority
- Friends of the Foreshore
- Colac Otway Shire
- Southern Otway Landcare Network
- Otway Barham, Apollo Bay, Hordenvale Glenaire, and Wongarra Landcare Groups
- Southern Otway community

Information Uses

- Public awareness
- Useful data that can be used when approaching shire or other group for funding
- Baseline knowledge of water conditions
- Determine how the estuary is impacted by changes in water quality

Parameters Monitored

- Habitat Survey (annual)
- Physical and Chemical parameters- pH, electrical conductivity, turbidity, dissolved oxygen, temperature, reactive phosphorus
- Macro-invertebrate Survey

Monitoring Times

- Monthly - around end of month

Group Involvement

- SOLN staff and volunteers, SOLN members

Data Management and Presentation

- Forwarded to Corangamite Waterwatch
- Waterwatch Database
- Annual Water Quality Report

Data Credibility

- Regular calibration of meters
- Participate in region QA/QC program
- Attend local Waterwatch training sessions.

Facilitator

- Brenda Skene (Corangamite Region Waterwatch Program) ph: 5232 9123

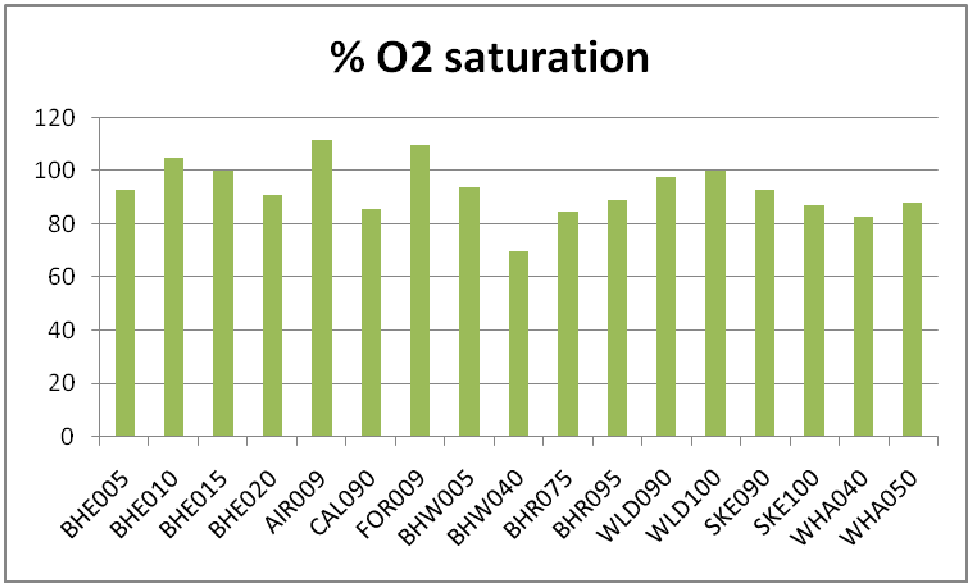
Results: Dissolved Oxygen

Dissolved oxygen levels have been measured at selected sites since 2004. Monitoring commenced for the majority of monitored sites in 2007 and these are shown in the table below

Site Code	Site Description	Dissolved Oxygen Median (% saturation)			
		2004	2005	2006	2007
BHR075	Barham R at Anderson C	87	79.5	85	85
BHR095	Barham R at Great Ocean Rd	79.5	84	95	89
BHE005	Barham R. East branch			75	93

Rating	Excellent	Good	Fair	Poor	Degraded

In 2007, dissolved oxygen was measured at 17 sites. The median value (the number in the middle of a set of numbers) for each site is shown in the chart below



The medians for each site were mostly excellent (81-110%) with the exception of BHW040 Barham River West Branch above confluence with the river's east branch.

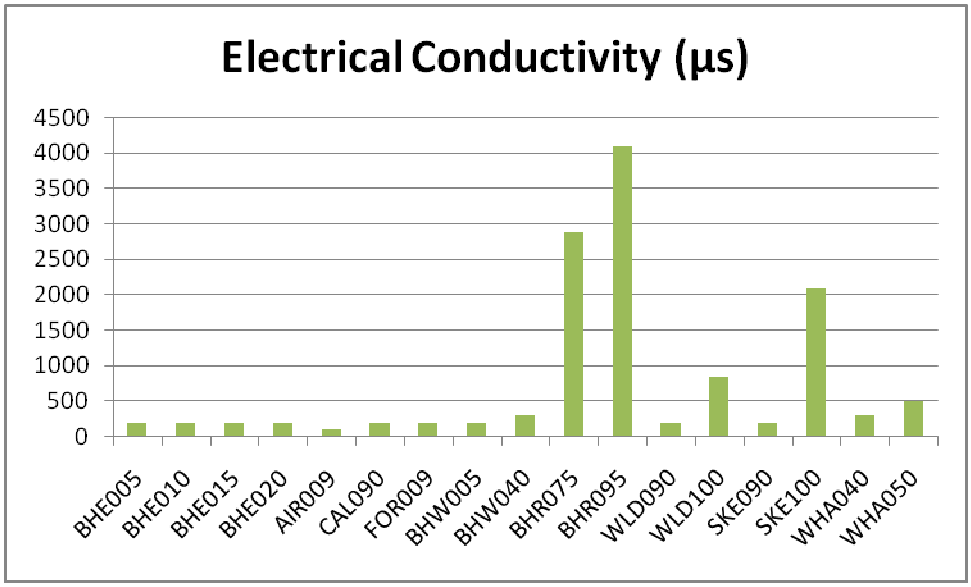
Results: Electrical Conductivity

Electrical conductivity levels have been measured at selected sites since 2004. Monitoring commenced for the majority of monitored sites in 2007 and these are shown in the table below

Site Code	Site Description	Electrical Conductivity (µs/cm)			
		2004	2005	2006	2007
BHR075	Barham R at Anderson C	350	1300	2250	2900
BHR095	Barham R at Great Ocean Rd	6300	5000	9550	4100
BHE005	Barham R. East branch			200	200

Rating	Excellent	Good	Fair	Poor	Degraded

In 2007, electrical conductivity was measured at 17 sites. The median value (the number in the middle of a set of numbers) for each site is shown in the chart below



The medians for each site were mostly excellent (<400 µs/cm) with the some exceptions. BHR095 the estuary of the Barham River sampled at the Great Ocean Road bridge, WLD100 the Wild Dog Creek estuary and SKE100 the Skenes Creek estuary. BHR075 the Barham River at the confluence with Anderson Creek is also influenced by the Barham River estuary and shows elevated salt levels. The rating "degraded" is based on high salt content in freshwater systems rather than estuaries. Estuaries require their own water quality rating system to reflect the health of that type of waterway.
WHA050 a tributary of Whalebone Creek has a median of 500µs/cm and is rated as good. All other sites are rated with excellent condition.

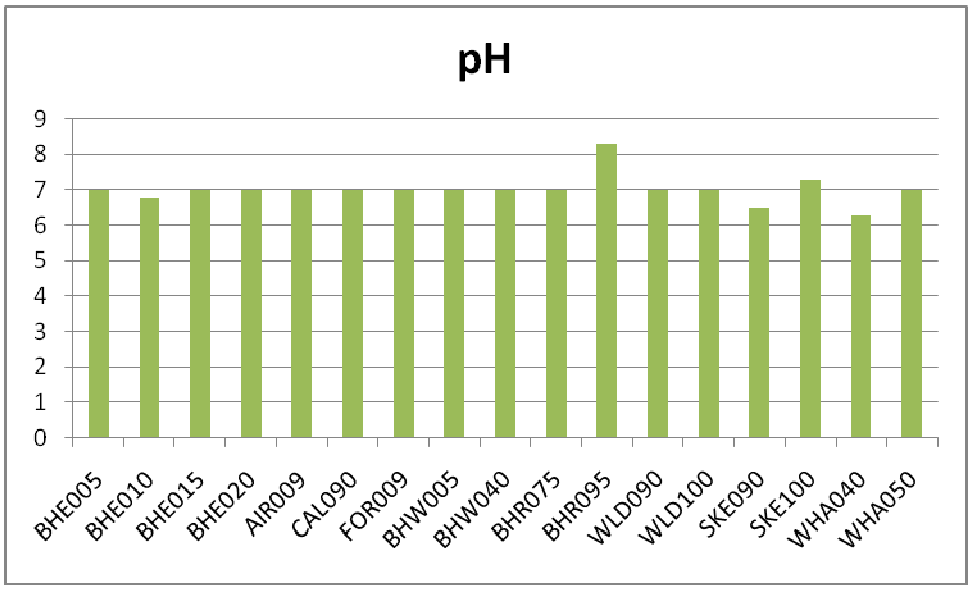
Results: pH

pH levels have been measured at selected sites since 2004. Monitoring commenced for the majority of monitored sites in 2007 and these are shown in the table below

Site Code	Site Description	pH			
		2004	2005	2006	2007
BHR075	Barham R at Anderson C	7.25	7.3	8	7
BHR095	Barham R at Great Ocean Rd	7.75	7.35	8	8.3
BHE005	Barham R. East branch			7	7

Rating	Excellent	Good	Fair	Poor	Degraded

In 2007, pH was measured at 17 sites. The median value (the number in the middle of a set of numbers) for each site is shown in the chart below



The medians for each site were mostly excellent (6.5-7.5) with the exception of BHR095 Barham River sampled at the Great Ocean Road bridge. The elevated pH has a fair value and may reflect the pH of seawater (7.5-8.4) present in the estuary.
WHA040 Whalebone Creek has a pH rated as good.

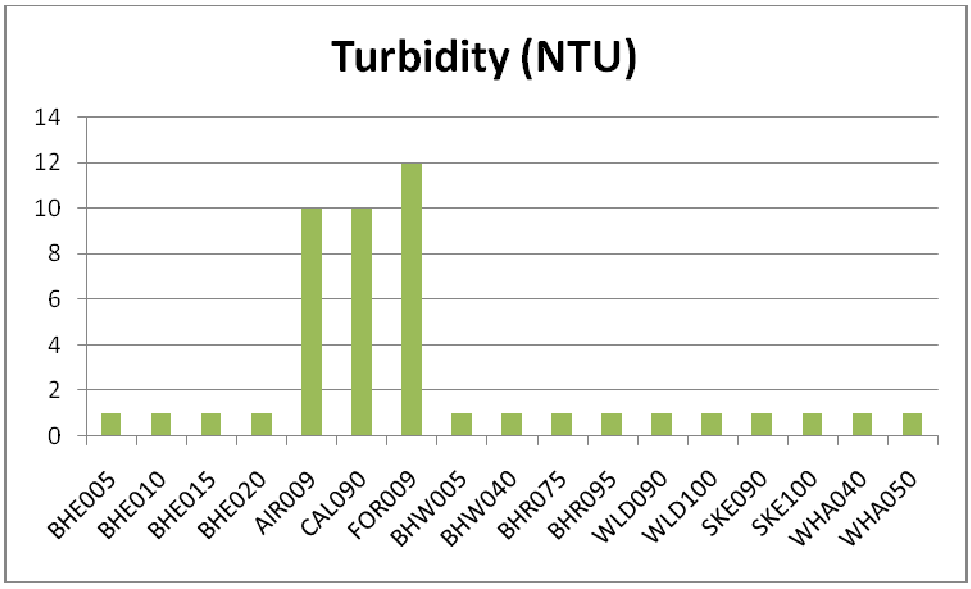
Results: Turbidity

Turbidity levels have been measured at selected sites since 2004. Monitoring commenced for the majority of monitored sites in 2007 and these are shown in the table below. The historical data includes both regular monthly monitoring and also event sampling. This event sampling involved monitoring turbidity during rainfall events as there is significant amounts of sediment transported during storms. This data was included in the calculation of the BHR075 median for 2004 and explains the high turbidity value of 60 NTU.

Site Code	Site Description	Turbidity (NTU)			
		2004	2005	2006	2007
BHR075	Barham R at Anderson C	60	15	15	<10
BHR095	Barham R at Great Ocean Rd	10	15	12.5	<10
BHE005	Barham R. East branch			<10	<10

Rating	Excellent	Good	Fair	Poor	Degraded

In 2007, turbidity was measured at 17 sites. The median value (the number in the middle of a set of numbers) for each site is shown in the chart below



The medians for each site were mostly excellent (<10) with the exception of AIR009 Aire River, CAL090 Calder River and FOR009 Ford River that rated good (10-20).

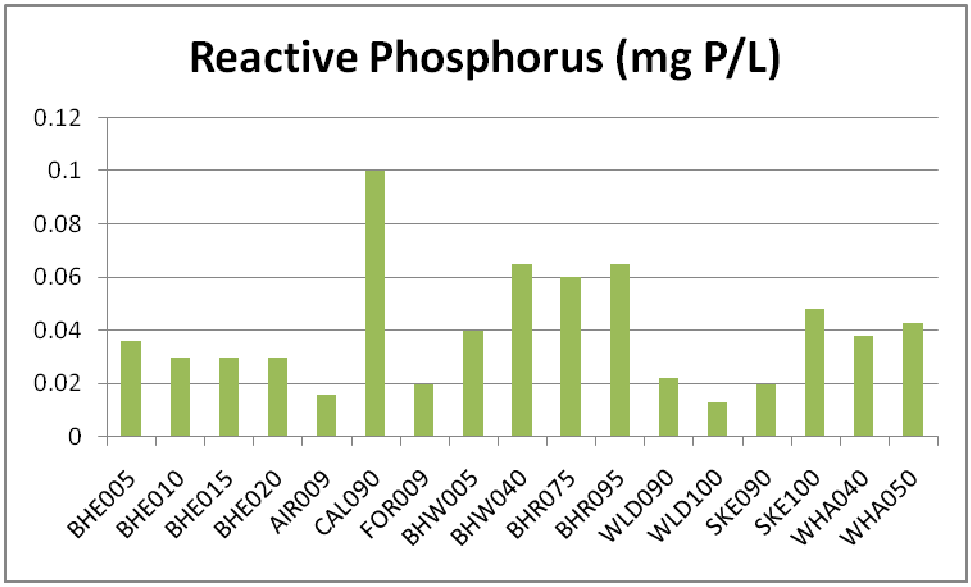
Results: Reactive Phosphorus

Reactive phosphorus levels have been measured at selected sites since 2004. Monitoring commenced for the majority of monitored sites in 2007 and these are shown in the table below

Site Code	Site Description	Reactive phosphorus (mg P/L)			
		2004	2005	2006	2007
BHR075	Barham R at Anderson C	0.045	0.08	0.085	0.06
BHR095	Barham R at Great Ocean Rd	0.03	0.045	0.08	0.065
BHE005	Barham R. East branch			0.045	0.036

Rating	Excellent	Good	Fair	Poor	Degraded

In 2007, reactive phosphorus was measured at 17 sites. The median value (the number in the middle of a set of numbers) for each site is shown in the chart below



The medians for each site were mostly good (0.011-0.025mg P/L) to fair (0.026-0.05mg P/L). The exception of BHW040 Barham River West Branch above confluence with the river's east branch, BHR075 Barham River at the confluence with Anderson Creek, BHR095 Barham River sampled at the Great Ocean Road bridge and CAL090 Calder River which all show poor ratings.

There has been a large amount of data generated and it has been included in Appendix A as raw data. The data has also been presented in tables and graphs and analysed statistically.

SEPP (WoV) Guidelines

Segment	Indicator					
	Dissolved Oxygen (%sat)		Turbidity (NTU)	Electrical Conductivity (µS/cm)	pH units	
	25th percentile	maximum	75th percentile	75th percentile	25th percentile	75th percentile
Forested Areas – B						
Otway Ranges	90	110	5	500	6.4	7.7

SEPP (WoV) can be used to provide an indication of the water quality when greater than 11 data points are available for the year.
The sites BHE005 Barham River East branch at Falzons and BHW005 Barham River West branch at Huggins have sufficient data points for this analysis and results are given below.

Sitecode	Indicator					
	Dissolved Oxygen (%sat)		Turbidity (NTU)	Electrical Conductivity (µS/cm)	pH units	
	25th percentile	maximum	75th percentile	75th percentile	25th percentile	75th percentile
Forested Areas – B Otway Ranges						
BHE005	91.8	105	<10	200	7	7
BHW005	84.3	105	<10	300	7	7

SEPP objectives for dissolved oxygen, electrical conductivity and pH were met at Barham River East Branch (BHE005).
SEPP objectives for electrical conductivity and pH were met at Barham River West branch (BHW005).

Data Confidence

Standard of Monitoring

The data generated by monitors is nominally rated as standard one two or three. People with little experience in Waterwatch testing will generate Standard 1 data eg a class of school children testing water at a creek. People who regularly test their site on a monthly basis, who have equipment maintained in good condition, who participate in quality assurance and quality control (QA/QC) activities and who have obtained training in Waterwatch techniques will generate Standard 3 data.

Training has been offered to Corangamite monitors throughout the year as formal Refresher Training sessions or as informal site visits. Monitors may choose to participate in up to 2 sessions per year.

For best performance, equipment should be serviced by Waterwatch staff 1-2 times per year.

Monitors are invited to participate in QA/QC activities up to two times per year. This can be done through site visits or by testing mystery samples. Mystery samples are not restricted to the physico-chemical tests (turbidity, reactive phosphorus, pH or electrical conductivity) but may also include the identification of macro-invertebrates to order level.

Routine Waterwatch testing is done on a monthly basis to maintain proficiency.

Data Confidence and SEPP (WoV) Objectives

The objective for turbidity is 5 NTU and the current equipment used by the Waterwatch monitors cannot resolve turbidity <10. Therefore we cannot confidently state that the SEPP (WoV) turbidity objective was met.

To improve the limits of detection from <10 for the turbidity tube, Waterwatch will investigate whether the LaMotte Smart2 Colorimeter can be used to measure turbidity to a lower limit.

Macro-invertebrate Surveys

Macro-invertebrate surveys identify the numbers of animals without backbones that live at least part of their life in water. One reason for studying macro-invertebrates is that they can be useful indicatiors of the ecological health of freshwater habitats. Some animals are more tolerant to pollution than others so their relative number reflect the health of the waterway.

In 2007 macro-invertebrate surveys were performed at many sites in the region and the data is given in the table below.

Aire River
Sitecode: AIR009 Date: 5/11/2007

Invertebrate Name	Bug Score	Result
Stonefly larvae	8	30
Mayfly larvae	7	30
Caddisfly larvae	7	30
Damselfly larvae	6	30
Freshwater Shrimp	5	200
Side swimmers	4	2
Beetle larvae	4	2
True bugs	4	2
Mosquitos	2	3
Total	**47**	**329**

Stream Condition Code **Very Good**

Wild Dog Creek

Sitecode: WIL090 Date: 25/5/2007

Invertebrate Name	Bug Score	Result
Mayfly larvae	7	500
Caddisfly larvae	7	70
Dobson fly/alder-fly	6	10
Freshwater shrimp	5	10
Freshwater slater	5	2
Beetle larvae	4	1
Total	**34**	**593**

Stream Condition Code Fair

Sitecode: WIL090 Date: 1/8/2007

Invertebrate Name	Bug Score	Result
Mayfly larvae	7	30
Freshwater shrimp	5	15
Beetle larvae	4	5
True Bugs	4	15
Mosquitos	2	12
Total	**22**	**77**

Stream Condition Code Poor

Sitecode: WIL090 Date: 25/10/2007

Invertebrate Name	Bug Score	Result
Stonefly larvae	8	150
Mayfly larvae	7	200
Caddisfly larvae	7	1
Freshwater slater	5	1
Snail	3	1
Flatworms	3	1
Total	**33**	**354**

Stream Condition Code Fair

Wild Dog Creek Estuary

Sitecode: WIL100 Date: 21/6/2007

Invertebrate Name	Bug Score	Result
Freshwater shrimp	5	300
Side swimmers	4	200
True Bugs	4	50
Total	**13**	**550**

Stream Condition Code Fair

Barham River East Branch (Falzon)
Sitecode: BHE005 Date: 23/5/2007

Invertebrate Name	Bug Score	Result
Mayfly larvae	7	20
Caddisfly larvae	7	15
Total	**14**	**35**

Stream Condition Code Poor

Sitecode: BHE005 Date: 12/11/2007

Invertebrate Name	Bug Score	Result
Stonefly larvae	8	4
Mayfly larvae	7	40
Caddisfly larvae	7	3
True Bugs	4	1
Leeches	3	2
Mosquitos	2	1
Total	**31**	**51**

Stream Condition Code Fair

Barham River East Branch (Paradise)
Sitecode: BHE010 Date: 21/10/2007

Invertebrate Name	Bug Score	Result
Stonefly larvae	8	40
Caddisfly larvae	7	1
Freshwater shrimp	5	1
Water mite	5	50
Snail	3	40
Mosquitos	2	20
Total	**30**	**152**

Stream Condition Code Fair

Barham River East Branch (Stahn)
Sitecode: BHE015 Date: 14/6/2007

Invertebrate Name	Bug Score	Result
Mayfly larvae	7	3
Freshwater shrimp	5	3
Water mites	5	10
True Bugs	4	20
Total	**21**	**36**

Stream Condition Code Poor

Sitecode: BHE015 Date: 13/11/2007

Invertebrate Name	Bug Score	Result
Stonefly larvae	8	10
Mayfly larvae	7	1
Caddisfly larvae	7	10
Water mite	5	6
Total	**27**	**27**

Stream Condition Code Poor

The Aire River at this site has very good stream condition as measured by stream fauna. This is consistent with the good phys-chem data that has been collected. Macro-invertebrate sampling should be continued spring and autumn to compliment the sampling program.

The stream condition for Wild Dog Creek as measured by the macro-invertebrate survey was poor to fair. Although the phys chem tests showed good water quality, there may have been factors such as reduction in habitat or flow that has influenced invertebrate numbers at this site.

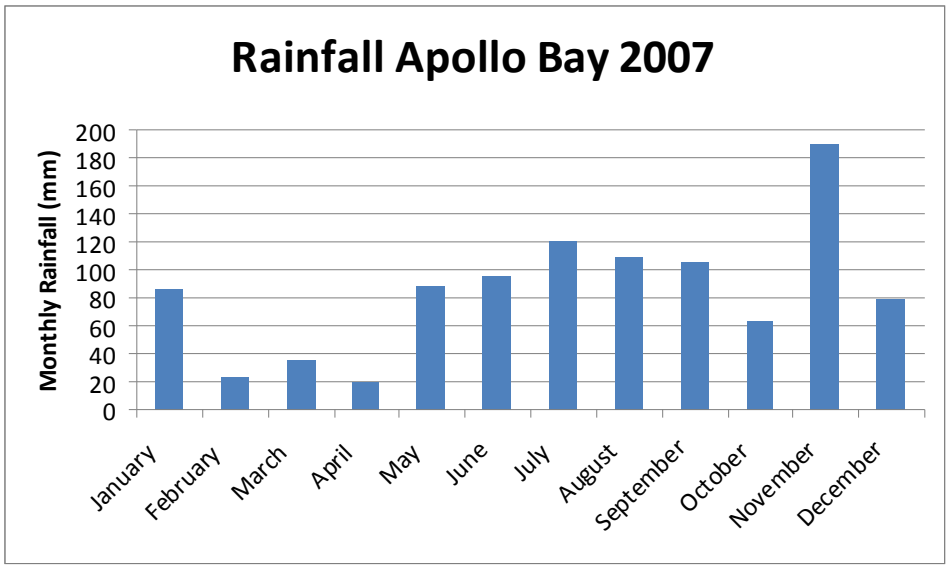
Wild Dog Creek estuary measured by the macro-invertebrate survey was fair. The diversity of macro-invertebrates present would be influenced by the changing salt water conditions of the estuary.

Three sites along the Bahram River East branch also measure poor to fair. This is inconsistent with the good phys-chem data obtained at these sites. Again further information regarding the habitat and flow conditons may explain this inconsistency.

It is impotant that correct procedures are followed in the macroinvertebrate sweep prodedure. For instance, sweeping for 10 minutes in a 10 meter section of the waterway should give the sampler opportunity to reach a diverse range of habitats eg in vegetation, on rock surfaces, snag surfaces, river bed and bank. This will give the greatest number and type of animal present. Sufficient time (30min) must be given for sorting and identifying the creatures found. Finally, it is easier to sort from a tray with little "clutter" – removing unnecesary vegetation or sediment makes it easier to spot well camouflaged or slow moving creatures.

Rainfall

The low rainfall averages for the year will contribute to reduced water quality.



Source: Geelong Weather Service (2007) http://users.pipeline.com.au/gws

Discussion

Monitoring in the Southern Otway region generally showed good to excellent water quality (Corangamite Waterwatch guidelines).

Factors that impact the water quality rating include higher electrical conductivity and reactive phosphorus levels. The elevated electrical conductivity (EC) values in lower Barham River, Skenes Creek and Wild Dog Creek are expected as they are located in estuarine regions. The reactive phosphorus showed great variability across the sites and when elevated eg in the Calder River resulted in a lowering of the Water Quality Condition Rating.

According to the Corangamite Waterwatch guidelines, the following waterways had

- Excellent water quality condition: BHE005, BHE010, BHE015, BHE020, FOR009, BHW005, WLD090, SKE090, WHA040
- Good water quality condition: AIR009, CAL090, BHW040, BHR075, WLD100, SKE100, WHA050
- Fair water quality condition: BHR095

The SEPP (WoV) water quality objective for dissolved oxygen was met at BHE005. Objectives for electrical conductivity and pH were met at both BHE005 and BHW005. The SEPP (WoV) analysis was only performed on sites with at least 11 data points. Many volunteers in this region commenced monitoring part way through 2007. We expect more sites will be analysed with respect to the SEPP objectives in 2008.

This record will be useful when comparing the dataset over time to establish if positive or negative changes to the water quality are occurring in the catchment.

Recommendations

- Improvements in the water quality will only be seen in conjunction with a programme to improve the surrounding environment. Maintenance of present vegetation and further revegetation, especially in the riparian zone may improve the quality of water entering the Barham River.

- Habitat Surveys of all sites should be carried out on an annual basis to assess decline or improvement in banks, in-stream cover, verge vegetation and any other factors that influence the water quality.

- Identify possible sources of nutrients at sites where there are consistently poor and degraded condition ratings indicated and develop action plans to address the identified sources.

- Continue monitoring of stormwater influences on water quality in the catchment. Identify sites where only rain event monitoring may be necessary.

- Continue macro-invertebrate surveys during autumn and spring at selected sites and support group members with refresher training sessions.

- Investigate equipment with improved detection limits for measuring turbidity

Appendix A – Recorded Data

Site code	Test Date	% O2 Sat	EC (µS/cm)	ReactP (mg/L P)	pH	Turb (NTU)	Temp (° C)	Air Temp (° C)
AIR009	3/07/2007	90	100	0.016	7	0	10	13.5
AIR009	8/08/2007	112	100	0	7	41	9.1	10
AIR009	9/09/2007	125	100	0.016	6.5	0	9.5	15
AIR009	9/10/2007	120	100	0.2	7	10	10.5	20
AIR009	5/11/2007	98	100	0.013	5	45	12.5	14.5
BHE005	18/01/2007	75	200	0.043	7	0	18	22
BHE005	13/02/2007	92	200	0.036	7	0	20	21.5
BHE005	15/03/2007	85	200	0.013	7	0	14	17.5
BHE005	16/04/2007	92	200	0.036	7	0	15	20
BHE005	18/05/2007	100	200	0.043	7	0	14.5	17
BHE005	14/06/2007	98	200	0.03	7	0	10	14
BHE005	16/07/2007	92	200	0.043	7	0	9	15
BHE005	13/08/2007	94	100	0.036	7	0	9.5	11.5
BHE005	11/09/2007	91	100	0.03	7.5	0	10.5	12.5
BHE005	15/10/2007	100	100	0.07	7	0	14	17
BHE005	12/11/2007	105	200	0.03	7	0	16	16
BHE005	13/12/2007	100	100	0.045	7	0	16.5	30
BHE010	21/10/2007	100	200	0.036	7	0	14	18
BHE010	18/12/2007	110	200	0.023	6.5	0	19	24
BHE015	17/01/2007	70	200	0.04	7	0	20	22
BHE015	13/02/2007	105	200	0.03	7	0	16	26
BHE015	15/04/2007	75	200	0.04	7	0	15	20
BHE015	14/06/2007	90	200	0.07	6	0	10	10
BHE015	27/06/2007	105	200	0.03	7.5	0	10	12
BHE015	18/08/2007	105	200	0.03	7		9	14
BHE015	10/09/2007	100	200	0.04	7	0	11	17
BHE015	17/10/2007	90	200	0.03	6.5	0	12	13
BHE015	13/11/2007	105	200	0.026	6.5	0	17	19
BHE020	17/01/2007	89	200	0.05	7	0	24	27
BHE020	16/02/2007	76	200	0.02	7	0	19	24
BHE020	16/03/2007	100	200	0.04	7	0	20	19
BHE020	16/04/2007	90	200	0.02	7	0	15	17
BHE020	27/06/2007	92.5	200	0.03	7	0	9.5	11
BHE020	27/09/2007	130	100	0.03	7	0	13	21

BHR075	17/01/2007	80	8600	0.07	8	0	25	32
BHR075	16/02/2007	68	1100	0.106	7	0	21	25
BHR075	16/03/2007	92	5800	0.04	7	0	21.5	19
BHR075	16/04/2007	72	4700	0.05	7	0	17	20
BHR075	27/06/2007	92	700	0.07	7	0	10	11.5
BHR075	27/09/2007	90	500	0.033	7.5	0	15	19
BHR095	17/01/2007	78	7400	0.07	9	0	25	35
BHR095	15/02/2007	100	800	0.06	7.5	0	25	25
BHW005	17/01/2007	74	300	0.015	7	0	19	18
BHW005	16/02/2007	82.5	200	0.053	7	0	19.5	28
BHW005	16/03/2007	55	300	0.04	7	0	16.5	19
BHW005	17/04/2007	88	300	0.047	7	0	13	21
BHW005	16/05/2007	86	300	0.043	7	0	13	21
BHW005	27/06/2007	94	200	0.03	7	0	9.5	12
BHW005	18/07/2007	100	200	0.02	7	0	8	10
BHW005	15/08/2007	105	180	0.04	7.7	0	9.5	13
BHW005	14/09/2007	95	200	0.03	7	0	11	18
BHW005	16/10/2007	99	200	0.023	7	0	13	15.5
BHW005	14/11/2007	95	100	0.04	6.5	0	15.2	20
BHW040	17/01/2007	55	300	0.09	7	0	21	28
BHW040	15/02/2007	80	300	0.045	7	0	21	23
BHW040	16/03/2007	55	300	0.1	7	0	18	24
BHW040	16/04/2007	60	300	0.07	7	0	15	18
BHW040	27/06/2007	95	200	0.02	7	0	9	10.5
BHW040	27/09/2007	90	200	0.06	7	0	12	20
CAL090	3/07/2007	82	2000	0.08	6.5	0	10	13
CAL090	7/08/2007	91	2000	0.106	7	10	11	14
CAL090	10/09/2007	120	3000	0.08	7.5	10	13	13.5
CAL090	15/10/2007	85	3000	0.1	7	10	16	18
CAL090	10/11/2007	80	200		6		15	20
CAL090	12/12/2007	87	300	0.14	7	0	18	16
FOR009	5/06/2007	115	200	0.026	6.5	10	9	11
FOR009	6/07/2007	97	200	0.006	7	28	10	11
FOR009	8/08/2007	105	100	0.02	7	18	10	12
FOR009	5/09/2007	130	200	0.02	7	0	8	15
FOR009	8/10/2007	110	200	0.01	7	12	11	10
FOR009	7/11/2007	110	200	0.026	6	13	14	14
FOR009	8/12/2007	84	200	0.06	6	0	16	27

SKE090	24/05/2007	87	200	0.053	7	0	15	23
SKE090	1/08/2007	110	200	0.0266	7	0	10	15
SKE090	29/08/2007	122	200	0.03	7	0	12	20

SKE090	1/10/2007	75	200	0.11	7	0	12	15
SKE090	29/10/2007	98	200	0.037	7	0	13	15.5
SKE090	29/11/2007	85	200	0.02	6.5	0	17	19
SKE100	24/05/2007	83	2100	0.056	7.5	0	14.5	20
SKE100	2/08/2007	83		0.053	8	0	11	12
SKE100	29/08/2007	118	300	0.043	7	10	13	21
SKE100	30/09/2007	90	2400	0.12	7.5	11	14	14
SKE100	29/10/2007	90	1700	0.0333	7	0	13.5	
SKE100	29/11/2007	72.5	6200	0.027	7	0	18	20
WHA040	6/05/2007	69	500	0.07	6	0	13	13
WHA040	20/06/2007	85	300	0.026	6.5	0	8	8
WHA040	20/07/2007	77	300	0.03	6.5	0	9	12
WHA040	20/08/2007	80	300	0.03	6	0	9	11
WHA040	22/09/2007	85	200	0.053	6	0	10	11.5
WHA040	24/10/2007	86	200	0.046	7	0	13	13.8
WHA050	11/05/2007	67	1700	0.033	7	0	13	15
WHA050	20/06/2007	85	500	0.043	6.5	20	8	7
WHA050	22/07/2007	90	300	0.036	7	0	7	10
WHA050	24/08/2007	92	400	0.043	7	0	10	16
WHA050	27/10/2007	83	600	0.06	7.5	0	13	15
WHA050	21/11/2007	120	500	0.09	7	0	13.5	14
WLD090	1/04/2007	85	200	0.023	6	0	15	18.5
WLD090	24/05/2007	90	200	0.0133	7	0	12	16
WLD090	1/08/2007	100	200	0.01	7	0	10	16
WLD090	24/09/2007	105	200	0.023	7	0	11	15
WLD090	25/10/2007	100	200	0.02	7	0	13	16
WLD090	29/11/2007	95	200	0.023	7	0	21	22.3
WLD100	23/05/2007	99	1400	0.015	7		14	15
WLD100	21/06/2007	85		0.002	6.5	20	10	10
WLD100	31/07/2007	100		0.013	7	0	10	11.5
WLD100	1/09/2007	115	300	0.013	7.5	0	11	15.5