ACHERON RIVER COMMUNITY GROUP

WATER MONITORING REPORT 1998 - 2007

A monitoring program is important as:

- *An educational tool that introduces water quality issues to the general community;*
- *A means of gathering base datasets to allow useful discussion of issues and provide some direction for future works;*
- *A method of assessing the value of works completed.*

FRONT COVER: LITTLE RIVER AT TAGGERTY BEFORE CONFLUENCE WITH ACHERON RIVER (UPSTREAM).

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Introduction

Waterwatch is a community water quality monitoring program that assists the community in monitoring their local waterway. The Program aims to:

- Increase community awareness and understanding of water quality issues;
- Increase community involvement in water management decisions; and,
- Generate useful data for community and agency use which complements that collected by Agency monitoring networks.

Monitoring networks across the Goulburn Broken Catchment have been formed to study water quality in their local areas. The networks are able to test a local stream for a range of parameters using equipment supplied by the Waterwatch Program. The parameters selected for testing in each area depend upon the water quality issues identified by the monitoring network. Monitors also record the date, time and rainfall to assist in the interpretation of the data.

The Acheron River Community Group (ARCG) are concerned with the water quality in the Acheron River and its tributaries including the Steavenson River, Taggerty River and many other smaller waterways.

This report contains the following information:

1. The Monitoring Plan of the network
2. Information about water quality parameters
3. A tabular summary of data collected at sites monitored by the ARCG. This table also includes historical data collected by Waterwatch dating back as far as 1998
4. Graphical representation of each parameter along the length of the waterway
5. Comparisons of local water quality data with State Environment Protection Policy (SEPP) guidelines
6. Macro-invertebrate sampling conducted over the period of water monitoring.

There are many reasons why people are prepared to become involved in a water monitoring program. **In fact, there are as many different reasons as there are people participating in a program!**

The challenge for Waterwatch as a community monitoring program is to help monitoring networks gather the information that **they** want. In the process, the data collected can be extremely valuable to waterway management agencies that are committed to improving the condition of our rivers and streams.

Definitions	
Median	Middle number in a series
Mean	Average calculated by adding all data points and dividing by the number of data points

Acheron River Community Group – Monitoring Plan

(Based upon data collected as initial group meeting February 3rd 2000)

1. Why are you monitoring?
   - *To find out about water quality in the area.*
   - *As a fisherman, I am interested in the environment.*
   - *Concerned about the general health of the Acheron River, as it has become a poorer fishing river.*
   - *Concerned about turbidity and water levels in the Steavenson and Little Steavenson Rivers.*
   - *To determine the source of turbidity in the system.*
   - *Concerned about nutrient levels entering the system from fish farms.*
   - *I volunteered in response to an article in the local papers – general interest.*

2. Who might be interested in using your data?
   - *Acheron River Community Group members.*
   - *CMA, DSE, Local Shire, fish farmers.*
   - *Local community members.*
   - *General public – via WW websites.*
   - *Tertiary institutions.*

3. How will the data you have collected be used?
   - *To educate the general public about the Acheron River system.*
   - *To produce data in various formats for the CMA to assist them in their planning.*
   - *To determine if fish farms are meeting their EPA licences.*
   - *To promote hot spots directly to the relevant agencies to encourage change in current practices.*

4. What parameters will the group monitor and how often (times per year)?
   - *Turbidity – about once a fortnight and during rain events.*
   - *Orthophosphate – about once a fortnight for those near fish farms.*
   - *Total Phosphorous – for those near fish farms (collecting a water sample for lab analysis)*
   - *WW coordinator will do full set of tests (6 parameters – temperature, pH, dissolved oxygen, turbidity, electrical conductivity (salinity) and soluble phosphorus) during rounds – about every 6 weeks or so*.

5. What methods will you use?
   - *Standard Waterwatch procedures for the equipment provided.*

6. Where will you monitor (list of sites)?
   - *Sites have been determined by mutual consent between the WW coordinator and the individual monitor after discussion of which would be the most appropriate site.*
   - *Currently there are there are 38 sites across the entire Acheron River system.*

7. When and how often will you monitor?
   - *Either once a fortnight or once a month. Some more frequently.*
   - *During rain events the monitoring may be every 3-4 hours for the duration of the flush*.

8. Who in the group will be involved and what will they be doing?
   - *All members of the group have one or more sites, which they are responsible for.*
   - *All members will do their normal monitoring and collect samples during rain events.*
   - *Currently 25 monitors, not all necessarily active.*

9. How will the data be managed and presented?
   - *Forward to David Hodgkins or Glenda Woods to be entered on the GBWW database.*
   - *Copies of record sheets to be kept by group members (optional).*
   - *All monitors to receive a printout of their personal data either on request or on an annual basis.*
   - *Data and photos to be entered on Goulburn Broken Waterwatch web site.*
   - *Community Group booklets produced about once every two years.*
   - *Regular newsletters (twice a year) to provide updates for every group member plus special release newsletters, as demand requires.*
   - *Posters may be prepared for the group as the demand arises.*

10. How will the group ensure that the data is credible?
    - *Regular calibration of equipment.*
    - *Participate in WW training sessions when the group meets twice yearly.*
    - *Techniques checked with each visit from the WW Co-ordinator.*
    - *Participation in regional QA/QC programs with mystery solutions.*

Acheron River Community Group – Monitor Survey

(Based upon results collated April 2006 - 17 surveys sent representing 20 monitors, 14 returned)

What motivated you to join Waterwatch?

- Concern for the environment
- The need for hard data
- My workplace wanted to give something back to the environment
- To learn more about the river and its inhabitants
- Due to flooding in the area and need to find out relevant authority
- Trout farm practices and processes
- General interest in water quality
- To be actively involved in checking water quality
- To help provide information that will lead to improvement in the environment
- An interest in natural science and a love of the bush
- Good opportunity to exercise (I have to walk to the sites!)
- To monitor the effects of forestry and forest management on waterways
- To understand more about issues related to future health of our waterways, both regionally and statewide
- I value the cleanliness of the Acheron River and would like it to stay that way.
- I am a fly fisherman and have a special interest in water quality and bug sampling
- We have more free time and are interested in volunteer work that is close to home.
- Concerns about water problems from a nearby convention centre.

What parts of Waterwatch do you find rewarding?

- Being part of an environmental interest group
- Teaching students about the river and its health and how we can help the river
- Meeting others who are passionate about the environment
- The concept of reliable data collection
- The construction of a data base accessible for a range of uses
- Sharing information
- Getting to be near the river
- Finding that the health of the sites I am monitoring are not deteriorating
- Contributing to a community group that is seen as protecting our waterways
- All aspects. I enjoy the meetings
- The bug surveys results are most informative
- Monitoring the flow through the seasons and the aquatic animals I might see around the creek

What would you like your waterway to look like in 20 years time?

- Revegetated with indigenous plants and trees
- The creek flowing all year as it did almost 25 years ago except in severe drought
- Have the same water quality with increased vegetation and native animals
- The waterway as clear as clean as they are today with an educated community to monitor this
- More vegetation in a wider stretch along the river (wider riparian zones)
- To look the same except for less weeds (blackberry)
- Less siltation, less clear felling and improved weed control
- To be the same in 20 years
- To have as pure water as possible
- To have many residents involved in water sampling
- To be rehabilitated to the state it was in when I first fished it 30 years ago
- To have drinkable water again from Connelly's Creek

Turbidity

Turbidity is the cloudiness of water and is the result of suspended material in the water. The suspended material decreases the ability of light to pass through the water column and can limit plant growth. This, in turn, affects the fish and invertebrate communities which feed on and live in the plants. Turbidity may be caused by silt, micro-organisms, plant material and chemicals. However, the most frequent causes of turbidity in rivers and other water bodies are algae and inorganic material produced from soil weathering and erosion.

High levels of turbidity have a two-fold effect on water:

- It loses its ability to support a large variety and number of aquatic organisms. Where there is less light penetrating the water, there will be less photosynthesis which reduces the level of oxygen in the water.
- The water becomes warmer because any suspended material absorbs heat from the sun. This also decreases the amount of oxygen dissolved in water.

Turbidity can be controlled by the retention of vegetation along streams and good farming practices such as contouring, stubble retention and off-stream watering of stock.

Turbidity in Acheron Region

Waterwatch has monitored some sites along the Acheron River since 1998. The ARCG has collected samples since 2000. The network is now collecting samples as part of a more comprehensive testing regime. The tables and graphs below summarise the data collected by Waterwatch ***and*** the ARCG since 1998.

Site Code	Site Description	TURBIDITY MEDIANS (NTU)									
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
ACH001	**Acheron R at Acheron Gap**					2		3.5			-
ACH002	**Acheron R at Fieglin's Rd**				4	6	4	4	5		3
ACH003	**Acheron R off Old Coach Rd**				4		10.5		6.5		-
ACH004	**Acheron R at Granton & Marysville Rd**				6	6	7	6			-
FIS015	*Fishers Ck few km upstream Acheron*			4	4	10	5.5	11*			-
ACH005	**Acheron R at Buxton bridge**				8	6	6	7			-
ACH007	**Acheron R at Silver Ck Res Buxton**						9	8			-
WIL010	*Wilkes Ck at Fruit Salad footbridge*			0	4	5	5	5			-
STE003	*Steavenson R at Yellow Dog Rd*			3	2	3	7	3	4	*4**	*5**
STE005	*Steavenson R at Bartons bridge*			0	2	2	3	3	3	*3**	-
TAG010	*Taggerty R at Lady Talbot Drive*			0	2	2.5	4	11			3
TAG015	*Taggerty R at Buxton-Marysville Rd*							15	10	3	2
STE015	*Steavenson R at Retreat Rd bridge*			4	6	6.5	3.5	13	8	4	3
KPL005	*Keppel Ck at Cerberus Rd bridge*			7.5		3.5	10	*3**	*5**	*4**	2
KPL010	*Keppel Ck u/s Steavenson R confluence*			17		8	32	6	*6**	*9**	12
STE016	*Steavenson R upstream of Buxton Rd Turnoff*			17.5							-
STE018	*Steavenson R at Cameron Close*							3	3	3	3
STE019	*Steavenson R at Buxton*			13	16.6	18	22	15.5	*89**	19*	8
STE020	*Steavenson R in Buxton b/f Acheron R*			10.5	4	7	6	5	11	20	-
LST015	*Little Steavenson R above Buxton Fish Farm*				6	*8.5**	*5**	6	*6**	*5.5**	*5**
DRN710	*Outlet from Buxton Fish Farm*			9	7	6	*8**	8	*6**	*5.5**	*7**
LST019	*Little Steavenson R at Buxton*		*51**	10.5	6	8	8	10	15	19	-
ACH011	**Acheron R below Buxton**								9.5	8	9
ACH015	**Acheron R at Taggerty**	5	11.5	9	12	10.5	8		9	12.5	-

Rating:Turbidity for the Mountains –
<5 NTU Excellent, <7.5 NTU Good, <10 NTU Fair, <12.5 NTU Poor, >12.5 NTU Degraded

Rating:Turbidity for the Valleys –
<10 NTU Excellent, <12.5 NTU Good, <15 NTU Fair, <22.5 NTU Poor, >22.5 NTU Degraded

Note: results in italic with * indicate <5 data sets used for interpretation.

Table 1

Site Code	Site Description	TURBIDITY MEDIANS (NTU)									
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
BLA005	*Blackwood Ck in Cathedral Lane*					**22**	**45.5**	**28**	**40**	**28**	**28**
UBL010	*Upper Blackwood Ck at Cathedral Lane*							***40****	**27**	**18**	**-**
AND010	*Andrews Ck*								**8**	**8**	**-**
LIT005	*Little R at Cathedral Lane*			**7.5**	**2**		**2**	**4**	**4**	**2**	**2**
LIT025	*Little R at Taggery b/f Acheron confluence*	**2**	**5**	**6**	**3**	**4**	**12**	**12**	**22**	**3**	**8**
YEL020	*Yellow R at Taggery b/f Acheron confluence*		**28**	**30**	**21**	**18.5**	**30**	**30**	**34**	**17**	**27**
ACH020	**Acheron R d/s of Taggerty at Kerrs Rd**		**15**	**15**	**14.5**	**20.5**	**18**	**27**	**30**	**10**	**15**
SWA010	*Swamp Ck u/s Acheron R Taggerty*			***22.5****	***18****	***20****	***24****	**25**	***35****	***21****	**-**
CON025	*Connellys Ck at McColls Rd bridge*			**28**	**22**	**19.5**	**29**	**27.5**	**26**	**25**	**32**
ACH025	**Acheron R b/f Goulburn confluence**	**10**	**8**	**12**	**12.3**	**10**	**12**	**10**	**12**	**10.5**	**10**
RUB010	*Rubicon R at Kendalls Camp Ground*							*4**	*4*	*2**	*6*
RUB025	*Rubicon R before Goulburn Confluence*	*4*	*6*	*7*	*9*						-
EGL003	*Eglington Ck at Page's property*										*16*

Rating:Turbidity for the Mountains –
<5 NTU Excellent, <7.5 NTU Good, <10 NTU Fair, <12.5 NTU Poor, >12.5 NTU Degraded

Rating:Turbidity for the Valleys –
<10 NTU Excellent, <12.5 NTU Good, <15 NTU Fair, <22.5 NTU Poor, >22.5 NTU Degraded

Note: results in italic with * indicate <5 data sets used for interpretation.

Table 1 continued

Turbidity results in the Acheron River remain quite **steady** and **low** over the monitoring period although tributaries such as Yellow Creek, Swamp Creek, Blackwood Creek and Connelly's Creek show consistently elevated levels.

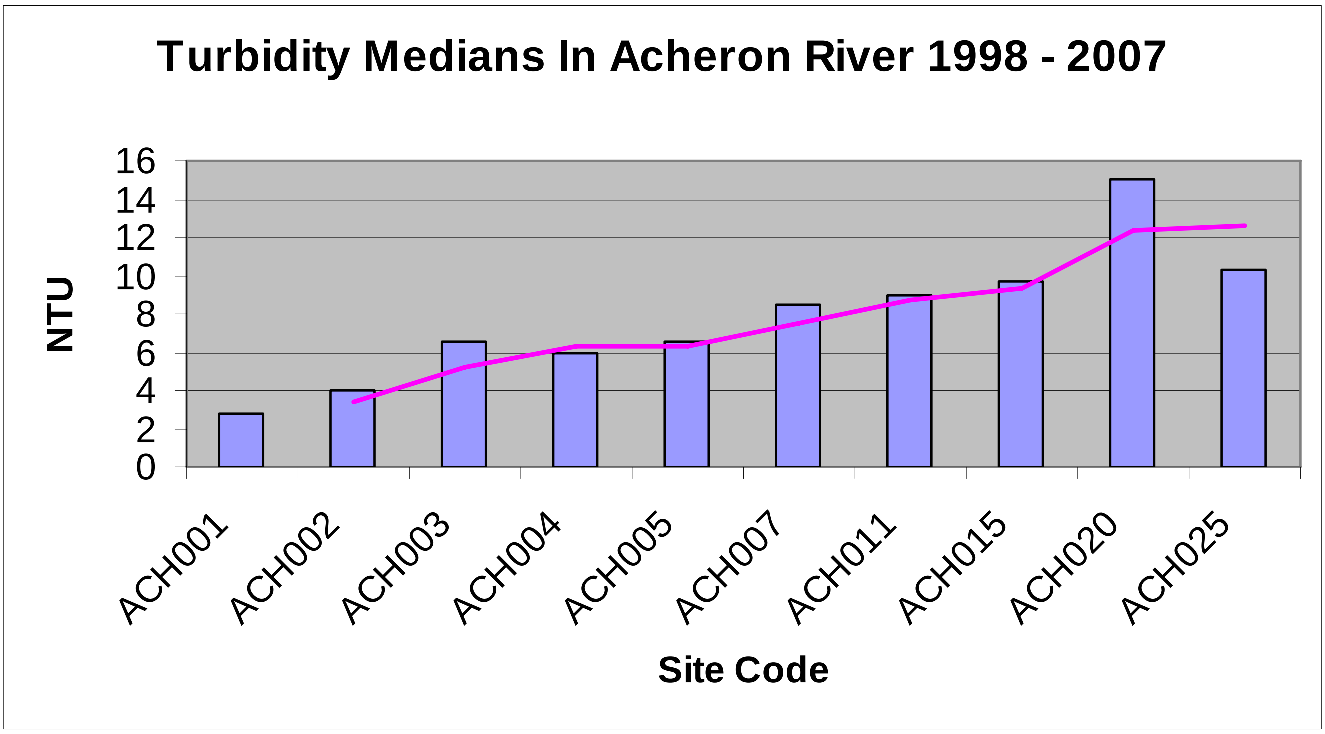

Fig 1

Figure 1 shows the median turbidity over the period of 1998 to 2007. These are low turbidities as would be expected in the Upper Goulburn Catchment. In general, turbidity levels can be expected to rise as a waterway moves down a catchment.

Figure 2 shows median turbidities in Steavenson River over the monitoring period. STE019 has had consistently "Poor" readings, resulting from the fact that this site is only monitored during rainfall events. Pleasingly it has been rated as "Excellent" for 2007.

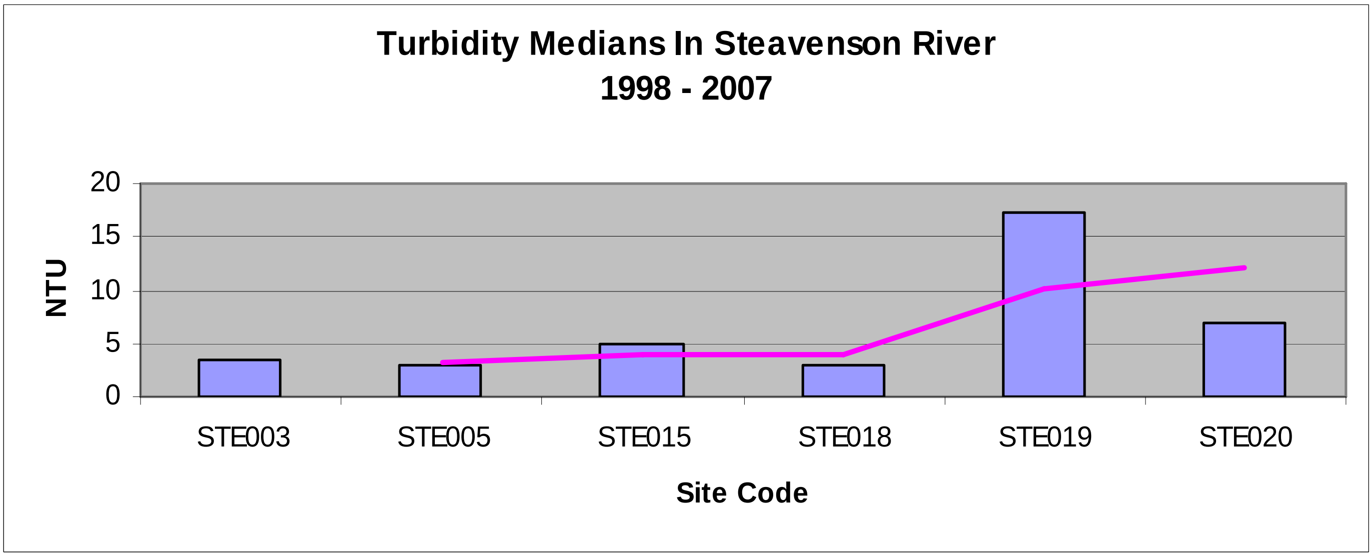

Fig 2

Salinity

Just as excess salt in our diets can be bad for our health, high salt levels in the environment negatively affect plants, animals and soils in and near waterways. Salinity is potentially the largest environmental problem facing Australia and is a major problem in Northern Victoria. The most concentrated problem areas are in the Shepparton Irrigation Region and areas around and to the west of Seymour. In the SIR, rising watertables have brought salinity closer to the surface, and at Seymour, dryland salting problems have occurred because deep rooted trees have been replaced by seasonal crops and grasses. Tree clearing can lead to dramatic rises in watertables. The solutions to salinity problems include revegetation of recharge areas and greater efficiency of irrigation in areas such as the SIR.

The information below explains the effect of salinity in agriculture.

0-800 EC

If you tested the water from your tap at home it would be within this range. This is good drinking water for people and suitable for all animals. When water of 300EC is used in overhead sprinklers by irrigation farmers, plants that are sensitive to salt may develop leaf scorch.

800-2500 EC

People can drink water within this range but it would start to taste very salty. This water is still suitable for all animals.

Peas, apricots and grapes can't be grown with water over 1,500 EC. If this water is used for irrigation farming, special care must be taken with drainage and choosing plants that are tolerant to salt. For example, lucerne can be irrigated with water of 2,000 EC and white clover with water of 1,000 EC, provided they are grown on sandy soil with good drainage.

2,500-10,000 EC

Water in this range is not suitable for people and should only be drunk in an emergency. When water over 4,000 EC is given to laying hens it causes their eggs to crack. Water over 6,000 EC is unsuitable for pigs and poultry. Highly saline water may also contain a high level of magnesium which can be harmful to stock. A water sample should be sent to a laboratory for analysis and specific advice obtained. This water is generally not used for irrigation farming except on some crops that have a very high tolerance to salt.

Pears, apples and tomatoes could not be grown with water in this range.

Over 10,000 EC

Don't drink this water! Water over 10,000 EC has an extremely high salinity. This water is unsuitable for people and for most animals. Only beef cattle and adult sheep can survive on water in this range. Irrigation farming is not possible with such highly saline water. In dryland areas only salt tolerant pastures will survive.

At 50,000 EC water has the same salinity as the sea. This water can be used for making concrete and flushing toilets as long as they are able to resist corrosion.

Salinity in Acheron Region

Waterwatch monitored salinity in the Acheron River region from 1998 and in 2000 the ARCG became involved.

Table 2 below shows electrical conductivity since 1998 at all sites monitored by the association.

Site Code	Site Description	Salinity MEDIANS (EC)									
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
ACH001	**Acheron R at Acheron Gap**					10		5			-
ACH002	**Acheron R at Fieglin's Rd**				30	10	20	20		30	*32**
ACH003	**Acheron R off Old Coach Rd**				30		-		-		-
ACH004	**Acheron R at Granton & Marysville Rd**				10	15	20	20		*30**	-
FIS015	*Fishers Ck few km upstream Acheron*				40	20	*25**	*30**	-	-	-
ACH005	**Acheron R at Buxton bridge**				15	20	20	25		*40**	-
ACH010	**Acheron R at Passing Lane**				*30**	*20**	*20**	*30**		*35**	-
WIL010	*Wilkes Ck at Fruit Salad footbridge*			*20**	*10**	*20**	20	30			-
STE003	*Steavenson R at Yellow Dog Rd*			*10**	*10**	*10**	10	10	*20**	*28**	*25**
STE005	*Steavenson R at Bartons bridge*			*10**	10	10	10	10	-	*30**	-
TAG010	*Taggerty R at Lady Talbot Drive*			*10**	*10**	*10*	*10*	*10*	-	*20**	26
TAG015	*Taggerty R at Buxton-Marysville Road*							*20**	-	*30**	30
STE015	*Steavenson R at Retreat Rd bridge*			*20**	10	*10**	*15**	*15**	*30**	*29**	30
KPL005	*Keppel Ck at Cerberus Rd bridge*			*10*		*23*	*15*	*20*	-	*30**	*34**
KPL010	*Keppel Ck u/s Steavenson R confluence*					*34*	*25*	*30*	-	*40**	*39**
STE019	*Steavenson R at Buxton*				*10**			*30**	-	*30**	-
STE020	*Steavenson R in Buxton b/f Acheron R*			20	30	10	20	*20**	*30**	*30**	-
LST015	*Little Steavenson above Buxton Fish Farm*				*10*	*10**	*20**	*20*	*36**	*30**	*37**
DRN710	*Outlet from Buxton Fish Farm*			*40**	50	57	*20**	30	*34**	*30**	*40**
LST019	*Little Steavenson R at Buxton*			20	20	20	20	*20**	*30**	*30**	-
ACH011	**Acheron R below Buxton**			*30**	*40**			*10**			-
ACH015	**Acheron R at Taggerty**	*30**		38	45	20	43	-	-	-	-

Rating: Conductivity for the Mountains –
<30 EC Excellent, <90 EC Good, <150 EC Fair, <225 EC Poor, >225 EC Degraded

Rating: Conductivity for the Valleys –
<80 EC Excellent, <240 EC Good, <400 EC Fair, <600 EC Poor, >600 EC Degraded

Note: results in italic with * indicate <5 data sets used for interpretation.

Table 2

Site Code	Site Description	Salinity MEDIANS (EC)									
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
BLA005	*Blackwood Ck in Cathedral Lane*					***130****	***145****	**120**	**-**	**-**	
UBL010	*Upper Blackwood Ck at Cathedral Lane*							***56****	**53**	**47**	**-**
AND010	*Andrews Ck*							***74****	**78**	**59**	**-**
LIT005	*Little R at Cathedral Lane*			***15****	***10****	**10**	**10**	**10**	***20****	***20****	**-**
LIT025	*Little R at Taggerty b/f Acheron confluence*	**30**	**30**	***20****	**10**	**10**	**10**	**20**	***30****	***25****	**29**
YEL020	*Yellow R at Taggerty b/f Acheron confluence*		***380***	***300***	***410***	***549***	***370***	***320***	***665****	***620****	***633****
ACH020	**Acheron R d/s of Taggerty at Kerrs Rd**		***20****	**-**	***40****	**-**	**-**	***39****	**-**	**-**	**-**
SWA010	*Swamp Ck u/s Acheron R Taggerty*			***60****	***150****	***120****	***120****	***120****	***150****	***120****	**-**
CON025	*Connellys Ck at McColls Rd bridge*			***80***	***70***	***50***	***60***	***80***	***60****	***80****	***127***
ACH025	**Acheron R b/f Goulburn confluence**	**30**	**20**	**30**	**20**	**20**	**30**	**30**	**39**	**40**	**39**
RUB010	*Rubicon R at Kendalls Camp Ground*							*30**	*35*	*30*	*35*
RUB025	*Rubicon R before Goulburn Confluence*	*20*	*10*	*10*	*10*						-
EGL003	*Eglington Ck at Page's property*										***172****

Rating: Conductivity for the Mountains* –
<30 EC Excellent, <90 EC Good, <150 EC Fair, <225 EC Poor, >225 EC Degraded

Rating: Conductivity for the Valleys* –

<80 EC Excellent, <240 EC Good, <400 EC Fair, <600 EC Poor, >600 EC Degraded

Note: results in italic with * indicate <5 data sets used for interpretation.

Table 2 continued

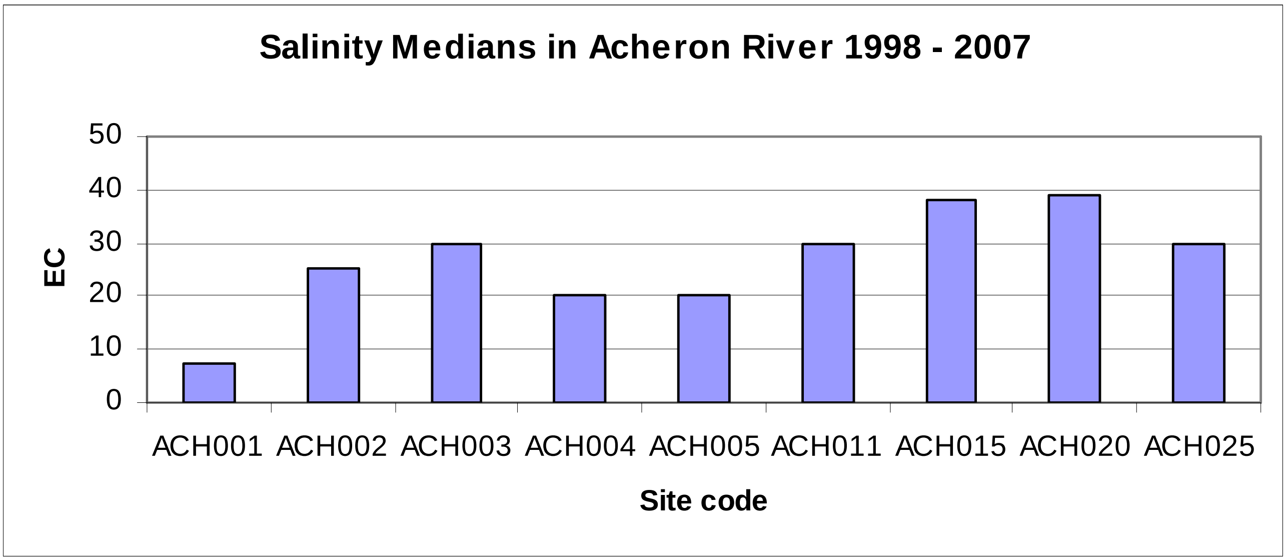

Fig 3

Salinity (Electrical Conductivity) at all Acheron River sites has consistently rated as "Excellent" since 1998 (see Table 2 and Fig 3). Some tributaries, notably Yellow River (not shown on this graph), do show very high salt levels (See Table 2), however these high readings have not affected the Acheron River readings over time. This can be seen in Fig 3, which shows the median conductivity at all Acheron River sites between 1998 and 2007. There is a slight upward trend as the river progresses through the catchment, however no major jump at ACH020 downstream of the confluence with Yellow Creek.

Figure 4 below shows median salinities in Steavenson River for the period 1998 to 2007. Again, all results are "Excellent".

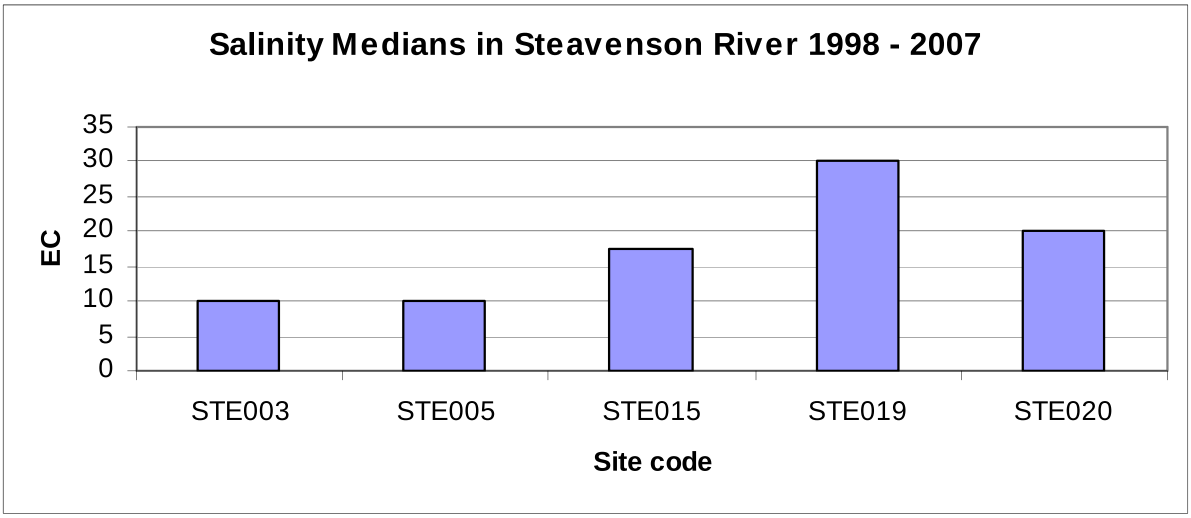

Fig 4

Phosphorus

Phosphorus is a nutrient that occurs naturally at low concentrations in water and it is essential for all forms of life. It comes from processes like the weathering of rocks and from the decomposition of organic matter such as plant litter. Other sources of phosphorus entering river systems include:

- ☐ sewage treatment works
- ☐ stormwater drains
- ☐ irrigation drains intensive agricultural industries
- ☐ runoff from agricultural land
- ☐ runoff from forests

An increase in phosphorus levels in streams may result from erosion, discharge of sewage, detergents, urban stormwater and rural runoff that contains fertilisers and animal and plant material. When the phosphorus concentration becomes too high, problems such as algal blooms, excessive growth of aquatic weeds and the loss of species diversity occurs.

Phosphorus in Acheron Region

The Acheron River and tributaries have been tested for phosphorus by Waterwatch since 1998. Since 2000, the ARCG has conducted an additional monitoring program. The tables and graphs below summarise the data collected to date by Waterwatch and the ARCG.

Site Code	Site Description	Total Phosphorus MEDIANS (mg/L)									
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
ACH001	**Acheron R at Acheron Gap**					0.03*					-
ACH002	**Acheron R at Fieglin's Rd**				0.04	0.02	0.02*	<0.02*	-	-	-
ACH003	**Acheron R off Old Coach Rd**				0.02		0.06*		-		-
ACH004	**Acheron R at Granton & Marysville Rd**				0.08*		0.02*	-		-	-
FIS015	*Fishers Ck few km upstream Acheron*				0.05	0.05	0.02				-
ACH005	**Acheron R at Buxton bridge**				0.09	0.04	0.08*				-
ACH010	**Acheron R at Passing Lane**	0.03		0.06	0.04	0.06	<0.02				-
WIL010	*Wilkes Ck at Fruit Salad footbridge*			0.04		0.06	0.01				-
STE003	*Steavenson R at Yellow Dog Rd*			0.05			0.01	0.02			-
STE005	*Steavenson R at Bartons bridge*			0.02			0.03				-
TAG010	*Taggerty R at Lady Talbot Drive*			0.04		0.02	0.02				-
STE015	*Steavenson R at Retreat Rd bridge*			0.03	0.04		0.03	0.03			-
KPL005	*Keppel Ck at Cerberus Rd bridge*				0.08	0.03					-
KPL010	*Keppel Ck u/s Steavenson R confluence*			0.04	0.06	0.05	0.09	0.02			-
STE016	*Steavenson R upstream of Buxton Rd Turnoff*			0.07		0.03	0.07				-
STE018	*Steavenson R at Cameron Close*					0.05	0.01				-
STE019	*Steavenson R at Buxton*			0.12	0.07	0.07	0.05	0.07	0.06	0.06	-
STE020	*Steavenson R in Buxton b/f Acheron R*				0.02*	0.04*	0.04*	0.04	0.05*	0.02*	-
DRN710	*Outlet from Buxton Fish Farm*			0.06	0.08	0.1	0.1	-	-	-	*0.04**
LST019	*Little Steavenson R at Buxton*						<0.02*				-
ACH011	**Acheron R Below Buxton**			0.03		0.04	0.02	-	-	-	-

Ratings: Total Phosphorus for the Mountains, Valleys and Plains–
<0.01 mg/L Excellent, <0.025mg/L Good, <0.05mg/L Fair, <0.1mg/L Poor, >0.1mg/L Degraded
Note: results in italic with * indicate <5 data sets used for interpretation.

Table 3

Site Code	Site Description	Total Phosphorus MEDIANS (mg/L)									
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
BLA005	*Blackwood Ck in Cathedral Lane*	<0.02		0.03	0.03	0.03	0.01	<0.02			-
LIT005	*Little River at Cathedral Lane*					0.07	0.04	0.03			-
LIT025	*Little R. at Taggerty b/f Acheron confluence*				0.03	0.04	0.01	0.04			-
YEL020	*Yellow R. at Taggerty b/f Acheron confluence*			0.01	0.15		0.02	0.03			-
ACH020	**Acheron R. d/s of Taggerty at Kerrs Rd**			0.08	0.03	0.05	0.03	0.02			-
SWA010	*Swamp Ck u/s Acheron R. Taggerty*	0.03	0.04	0.04	0.04	0.05	0.02	0.02	<0.02		-
CON025	*Connellys Ck at McColls Rd bridge*										-
ACH025	**Acheron river b/f Goulburn confluence**	0.05	0.04	0.04	0.05						0.02
RUB010	*Rubicon R. at Kendalls Camp Ground*					*0.03**					-
RUB025	*Rubicon R. before Goulburn Confluence*				*0.04*	*0.02*	*0.02**	*<0.02**	-	-	-

Ratings: Total Phosphorus for the Mountains, Valleys and Plains–
<0.01 mg/L Excellent, <0.025mg/L Good, <0.05mg/L Fair, <0.1mg/L Poor, >0.1mg/L Degraded
Note: results in italic with * indicate <5 data sets used for interpretation.

Table 3 continued

Due to insufficient resources, Total Phosphorus monitoring was amended in 2005 to include only the most downstream monitoring sites on some of the larger watercourses. Table 3 therefore shows only one result for total phosphorus in 2007.

SEPP Compliance

The State Environment Protection Policy (SEPP) Waters of Victoria (WoV) water quality objectives identify the 'ideal' result range for environmental data at a particular location in a waterway. If a site fails a SEPP objective for one parameter, it indicates a possible problem for the whole system, not just for the one parameter and not just for the one site). It is recommended that an ecological risk assessment (ERA) be undertaken to determine if there is a risk to the values (or "beneficial uses") associated with that stream.

Basically, any set of results that fails the objective is a red flag to look more closely at what's going on. This differs from aiming for a particular turbidity or total phosphorus result, as an ERA may determine that it is acceptable to exceed the SEPP objectives for some parameters depending on the use/value of the waterway.

SEPP (WoV) environmental quality objectives for rivers and streams – water quality

Colours highlight the SEPP (WoV) segments and objectives applicable within the Goulburn Broken CMA region for the tests of relevance to the ARCG.

SEGMENT	INDICATOR							
	Total phosphorus (ug/L)	Total nitrogen (ug/L)	Dissolved oxygen % saturation		Turbidity (NTU)	Electrical conductivity (uS/CM)	pH (pH units)	
	75th percentile	75th percentile	25th percentile	maximum	75th percentile	75th percentile	25th percentile	75th percentile
Forests – A								
• all other areas	≤25	≤500	≥90	110	≤5	≤100	≥6.4	≤7.7
Cleared Hills and Coastal Plains								
• mid-reaches of Ovens, Goulburn and Broken catchments	≤25	≤600	≥85	110	≤10	≤500	≥6.4	≤7.7

Table 4

Results in Acheron Region in 2007 compared to SEPP objectives above – water quality

SEGMENT	INDICATOR							
	Total phosphorus (ug/L)	Total nitrogen (ug/L)	Dissolved oxygen % saturation		Turbidity (NTU)	Electrical conductivity (uS/CM)	pH (pH units)	
	75th percentile	75th percentile	25th percentile	maximum	75th percentile	75th percentile	25th percentile	75th percentile
TAG015 *Taggerty R at Buxton-Marysville Rd*					3.3	30		
STE015 *Steavenson R at Retreat Rd bridge*					4	30	6.6	6.6
STE018 *Steavenson R at Cameron Close*					9			
LIT025 *Little River at Taggerty*					8	42		
YEL020 *Yellow Ck at Goulburn confluence*					32	838		
ACH020 *Acheron R d/s of Taggerty*					23	-		
CON025 *Connellys Ck at McColls Rd bridge*					41	153		
ACH025 **Acheron R b/f confluence with Goulburn R**	20		81	95	15	42	6.4	6.8

Table 5

Three quarters of the readings taken should fall below the 75th percentile. In the case of the ARCG testing area, with the exception of Yellow Creek, all salinity readings fall below the 75th percentile. The result for Yellow Creek was calculated using only four results, two of which were between 700 and 1200 EC. This shows that the more results that are obtained, the better the data set to calculate from. Phosphorus and pH results are within SEPP objectives, however turbidity readings do show some results above the SEPP objectives.

Why do a Macro-invertebrate Survey?
Macro-invertebrates are animals without backbones that live at least a part of their life in water.
One reason for studying macro-invertebrates (or waterbugs) is that they can be useful indicators of the ecological health of freshwater habitats. Some aquatic invertebrates are more tolerant to pollution than others.
If a stream is polluted, tolerant bugs will usually be found in larger numbers than the intolerant or sensitive ones. However, if a habitat is close to pristine, or in its natural state, tolerant types of bugs will be found alongside the more sensitive bugs which will be in equal or greater numbers than the tolerant.

Sites and habitats within the Acheron and Steavenson Catchments were assessed against the SEPP WoV biological objectives (State Environmental Protection Policy – Waters of Victoria), outlined in Tables below.

There are many ways of analysing and interpreting invertebrate data to assess ecological condition. Currently five biological indices are used in Victoria for assessing the condition of aquatic ecosystems. These fall into three categories:

- a measure of diversity – number of families.
- biotic indices – the SIGNAL and EPT indices
- measuring of community composition – numbers of key families.

The development of these indices for assessing ecosystem condition has included the establishment of environmental quality objectives to aid in their interpretation. In recognition of the fact that aquatic communities will vary naturally across the State, the State has been characterised into five biological regions. The biological indices and their respective environmental quality objectives have been developed specific to the invertebrate communities within each region (EPA Victoria, 2003a). These biological indices and their associated environmental quality objectives have been set down in the ***State Environmental Protection Policy (Waters of Victoria)*** SEPP (WoV) and its schedules.

USING THE BIOLOGICAL INDICES
Separate assessments are made for riffle and edge habitats. In order to make a complete and accurate assessment of a site, the biological samples must be collected in both autumn and spring, and the invertebrate data from both seasons combined in the calculation of the indices

1. Number of Families.

The number of invertebrate families found at a site can give a reasonable representation of the ecological health of a stream as healthy streams generally have more families. **The Number of Families** index is calculated by simply summing the total ‘families’ of invertebrates present at a site.

Throughout a biological region, the expected number of families will vary according to quality of habitat and stream size, with larger streams, in general, supporting more taxa. Mild nutrient enrichment can increase the number of families due to an increase in food supply. Reduction in the expected number of families present can be caused by poor quality habitat and by various pollutants.

2. The SIGNAL biotic index.

SIGNAL (Stream Invertebrate Grade Number- Average Level) is an index of water quality based on the tolerance of aquatic biota to pollution (Chessman 1995). Using data from various studies of pollutants in south-eastern Australian streams, most, but not all, families of aquatic invertebrates have been assigned sensitivity grades according to their tolerance or intolerance to various pollutants. The list of invertebrate families and SIGNAL scores currently in use is based largely on those in the original publication (Chessman 1995). Oligochaeta has been added and assigned a score of one**. See Appendix B, Sub-appendix 2**.

The SIGNAL index is calculated by summing together the sensitivity grades of each of the families found at a site that have been assigned a sensitivity grade, and then by dividing the number of graded families present. The output is a single number, between zero and ten, reflecting the degree of water pollution. Generally, high quality sites have high SIGNAL scores and, low quality sites have low SIGNAL scores.

Table 2: Generic key to SIGNAL scores

SIGNAL score	Water Quality
>7	Excellent
6-7	Clean water
5-6	Mild pollution
4-5	Moderate pollution
<4	Severe pollution

3. The EPT biotic index

The EPT index is the total number of families in the generally pollution sensitive insect orders of Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies). It is calculated by summing together the number of families in these three orders present at a site. Any loss of families in these groups usually indicates disturbance.

The EPT index cannot be used in all stream systems due to the natural variations in the biogeographical distribution of the relevant taxa. For example, due to their ecological preference for well oxygenated, cool water streams, stoneflies and some mayfly families are naturally uncommon in the warmer, slower flowing waters that are typical of lowland regions.

4. Key Invertebrate Families

This index focuses mainly on the loss of key taxa that are indicative of good habitat and water quality. It is based on a pre-determined list of invertebrate families that are expected to occur in each of the biological regions of the State as defined in the State Environmental protection Policy (*Waters of Victoria*). **See Appendix B, Sub-appendix 1**.

The families included in each list are those which:

- are typically found in non-degraded streams in that region;
- are representative of particular habitat types, such as riffles, woody debris, fringing vegetation, macrophytes or pools in that region;
- represent reasonable to good water quality and tend to disappear as conditions deteriorate, and
- are commonly collected when present, using the rapid bioassessment method.

Because the lists incorporate taxa from a range of habitat types, stream sizes and stream types, it is unlikely that a site would contain all families. Thus, the environmental quality objective for the Key Families index requires the presence of a proportion, not all, of the listed families.

Unlike the other indices, edge and riffle habitats are not distinguished with the key Families index. Both habitats must be sampled where present and the data from both samples and both seasons (autumn and spring) combined when making an assessment.

To calculate the Key Families index, simply compare the list of families present at a site with the appropriate list of key families as specified in the ***State Environmental Protection Policy (Waters of Victoria*)**. The key families score is the total number of these key families present at a site.

Goulburn Broken Waterwatch Macroinvertebrate survey results in the Acheron and Steavenson Rivers in 2007

Biological regions from the SEPP (WoV) are as follows:

1. **Forests A (B2) –** upland region with moderate to high altitudes and moderate to high rainfall in predominantly forested areas with some forestry and grazing. Cool, clear streams with good water quality and riparian vegetation, located on moderately steep slopes. Stream substrate relatively coarse.

1. Sampling, identification and data collation

Sampling was conducted in accordance with the Victorian Rapid Bio-assessment (VRBA) sampling protocol (Victorian EPA). This involved collecting water quality data and sampling aquatic invertebrates from available stream habitats. Sampling was undertaken in autumn 2007 and spring 2007. Samples were collected from ‘riffle’ habitat i.e. slow to fast areas where the water breaks over the substrate and ‘edge’ habitat i.e. slow to no flow areas which can include pool, undercut banks and backwaters. Riffle samples (also known as kick samples) were collected using a fine mesh net held downstream and kicking the substrate for a total of ten metres at each site. Edge samples (also known as sweep samples) were taken using a fine mesh net and sweeping the net through the water as well as in amongst the vegetation in the edge and pool sections of the stream for approximately ten metres. Both habitats were sampled where present. Each sample was emptied into a white sorting tray and aquatic invertebrates were picked from the sample for 30 minutes and placed in 70% ethanol for preservation and later identification in the laboratory.

Aquatic invertebrates were identified in the laboratory to Family level where possible with the exception of Acarina (mites), identified to Class level and Chironomidae (midges) identified to Sub Family.

The Waterwatch sites for 2007 are

1. Acheron River at Fieglin’s Road Bridge, Waterwatch code ACH002
2. Steavenson River at Retreat Road Bridge, Waterwatch code STE015

2. Results

Table 6 has been reproduced from the SEPP WoV (Victorian Environment Protection Authority 2003). To meet objectives, sites assessed must return values equal to or greater than the values given in Table 6. If one or two habitats at a site fail, an overall failure is given to the site. Three of four biological objectives should be met in region B2 for SEPP compliance.

Table 6

Objectives for biological indicators of environmental quality as listed in the SEPP WoV (Victorian Environmental Protection Authority 2003)

Indicators Region & Habitat	No of Families	SIGNAL index score	EPT index score	Key families combined habitat
B2 riffle	21	6.0	9	22
B2 edge	22	5.7	7	22

Table 7

Biotic indices **results** for two sites in the Goulburn Broken Waterwatch Program 2007 assessed against SEPP WoV objectives for biological indicators of environmental quality.

Site code/ year	Site location	Biological Region	Habitat	Number of families score	SIGNAL index score	EPT	Key families Combined Habitat score	Site Pass Fail
ACH002 2007	Acheron River at Fieglins Rd Bridge	B2	Riffle	30	7.0	15	31	Pass
ACH002 2007	Acheron River at Fieglins'Rd Bridge	B2	Edge	18	7.1	8	31	Pass
STE015 2007	Steavenson River at Retreat Rd Bridge	B2	Riffle	30	6.7	16	34	Pass
STE015 2007	Steavenson River at Retreat Rd Bridge	B2	Edge	21	6.7	10	34	Pass

Marginal value
Fail

3. Discussion

The data provided for the Acheron River at Fieglin's Bridge shows that the Acheron River is clearly meeting the SEPP biological objectives for the riffle and just meeting SEPP biological objectives for the edge samples in 2007. The number of families for the edge sample is 18 (SEPP guidelines recommend 22) so there is concern that diversity is lower than expected. There is a marginal value at the edge habitat for the EPT taxa (8) whereas SEPP guidelines say a minimum of 7.

The data provided for the Steavenson River at Retreat Rd Bridge on the Buxton – Marysville Road, shows that the Steavenson River is meeting the SEPP biological objectives for the riffle in every aspect.

The edge habitat is SEPP compliant in all but one category and that is the number of families present (21 whereas SEPP minimum is 22). The autumn sample was taken when the river was extremely low after a prolonged period of dry and this may have had an impact. The site was also chosen for its riffle habitat and does not necessarily provide the best habitat for an edge sample.

Further sampling of both sites in 2008 will see if diversity improves for the edge samples or if current trends continue.

Table 8

Families present on combined autumn and spring surveys for
ACH002- Acheron River Fieglins Rd Bridge Biological region B2 - Riffle
Shaded boxes represent Key Families for Key families Combined Habitat score.

Order	Family	SIGNAL GRADE SEPP	Common name
Plecoptera	Eustheniidae	10	Large green stonefly with paired gills
Coleoptera	Ptilodactylidae	10	Beetle larva
Trichoptera	Philopotamidae	10	Free swimming caddis, white mouth no gills
Ephemeroptera	Leptophlebiidae	10	Feathery split gills mayfly
Ephemeroptera	Coloburiscidae	10	Spiny horse mayfly
Trichoptera	Helicopsychidae	10	Snail sand caddis
Trichoptera	Calocidae	8	Sand case caddis black head
Trichoptera	Glossosomatidae	8	Sand caddis on rocks
Trichoptera	Philorheithridae	8	Sand caddis, mid leg fused
Neuroptera	Neurorthidae	8	Lacewing
Trichoptera	Conoesucidae	8	Hooped case caddis
Trichoptera	Calamoceratidae	8	Sleeping bag caddis
Coleoptera	Scirtidae	8	Marsh beetle larva
Plecoptera	Gripopterygidae	7	Mudeye
Trichoptera	Hydrobiosidae	7	Free swimming caddis large front leg
Coleoptera	Elmidae	7	Riffle beetle
Trichoptera	Leptoceridae	7	Plant case caddis
Odonata S.O. Epiproctophora	Telephlebiidae	6	Stonefly tufted abdomen
Diptera	S.F. Podonominae	6	Non biting midge larva
O. Acarina		NA	Water mites
Diptera	S.F. Chironominae	6	Non biting midge larva
Coleoptera	Psephenidae	5	Water penny
Trichoptera	Hydropsychidae	5	Free caddis with gills
Ephemeroptera	Baetidae	*5*	Mayfly plate gills
Diptera	Simuliidae	5	Blackfly larva
Diptera	Tipulidae	5	Fly larva
Diptera	S.F. Orthocladiinae	5	Non biting midge larva

Amphipoda	**Ceinidae**	**5**	**Scuds orange**
Megaloptera	**Corydalidae**	**4**	**Toebiter**
Oligochaeta		**1**	**Worms**
	No of Families 30 (29 for SIGNAL index score)	**Total 202**	
		SIGNAL index score 7.0	

Table 9

Families present on combined autumn and spring surveys for
ACH002- Acheron River Fieglins Road, Biological Region B2 - Edge
Shaded boxes represent Key Families for Key families Combined Habitat score.

Order	Family	SIGNAL GRADE SEPP	Common name
Ephemeroptera	Leptophlebiidae	10	Mayfly nymph
Trichoptera	Helicopsychidae	10	Snail case caddis larva
Trichoptera	Calocidae	8	Sand case caddis larva
Diptera	Dixidae	8	Black U bend larva
Neuroptera	Osmylidae	8	Lacewing larva
Coleoptera	Scirtidae	8	Marsh beetle larva
Trichoptera	Hydrobiosidae	7	Free swimming caddis larva
Plecoptera	Gripopterygidae	7	Stonefly nymph
Trichoptera	Leptoceridae	7	Stick caddis larva
Coleoptera	Elmidae	7	Riffle beetle adult
Acarina		NA	Water mite
Diptera	S.F. Orthocladiinae	5	Non biting midge larva
Hemiptera	Hydrometridae	5	Water measurer
Diptera	Simuliidae	5	Blackfly larva
Ephemeroptera	Baetidae	5	Mayfly nymph
Amphipoda	Ceinidae	5	Scud
Hemiptera	Corixidae	5	Water boatman
Hemiptera	Veliidae	4	Small water strider
	No of families 18 (17 for SIGNAL index score	Total 121	
		SIGNAL index score 7.1	

Table 10

Families present in combined autumn and spring surveys for
STE015 Steavenson River at Retreat Rd Bridge Biological Region B2 Riffle
Shaded boxes represent Key Families for Key Families Combined Habitat score.

Order	Family	SIGNAL GRADE SEPP	Common name
Plecoptera	Eustheniidae	10	Stonefly nymph
Plecoptera	Austroperlidae	10	Stonefly nymph
Trichoptera	Helichopsychidae	10	Snail case caddis larva
Ephemeroptera	Leptophlebiidae	10	Mayfly nymph
Ephemeroptera	Coloburiscidae	10	Mayfly nymph
Trichoptera	Calocidae	8	Sand case caddis larva
Trichoptera	Philorheithridae	8	Sand case caddis larva
Trichoptera	Calamoceratidae	8	Sleeping bag caddis larva
Trichoptera	Conoesucidae	8	Hooped case caddis larva
Plecoptera	Notonemouridae	8	Stonefly nymph
Coleoptera	Scirtidae	8	Marsh beetle larva
Ephemeroptera	Caenidae	7	Mayfly nymph
Coleoptera	Elmidae	7	Riffle beetle
Plecoptera	Gripopterygidae	7	Stonefly nymph
Trichoptera	Leptoceridae	7	Stick caddis larva
Trichoptera	Hydrobiosidae	7	Free swimming caddis larva
Diptera	S.F. Tanypodinae	6	Non biting midge larva
Diptera	S.F Diamesinae	6	Non biting midge larva
O. Odonata S.O Epiproctophora	Telephlebiidae (Aeshnidae)	6	Dragonfly nymph
Acarina		NA	Water mite
Diptera	Ceratopogonidae	6	Pog larva
Diptera	S.F. Chironominae	6	Non biting midge larva
Diptera	S.F. Orthocladiinae	5	Non biting midge larva
Trichoptera	Hydropsychidae	5	Free caddis larva
Coleoptera	Psephenidae	5	Water penny larva
Ephemeroptera	Baetidae	5	Mayfly nymph
Diptera	Simuliidae	5	Blackfly larva
Megaloptera	Corydalidae	4	Dobsonfly larva
Diptera	Stratiomyidae	2	Soldier fly larva
Oligochaeta		1	Worms
	No of Families 30 (29 for SIGNAL score index)	Total 195	
		SIGNAL Index score 6.7	

Table 11

Families present in autumn and spring survey for
STE015 – Steavenson River at Retreat Rd Bridge Biological Region B2 - Edge
Shaded boxes represent Key Families for Key Families Combined Habitat score.

Order	Family	SIGNAL GRADE SEPP	Common name
Plecoptera	Austroperlidae	10	Stonefly nymph
Ephemeroptera	Oniscigastridae	10	Mayfly nymph
Trichoptera	Atriplectididae	10	Vulture caddis larva
Ephemeroptera	Leptophlebiidae	10	Mayfly nymph
Trichoptera	Conoesucidae	8	Hooped case caddis larva
Coleoptera	Scirtidae	8	Marsh beetle larva
Plecoptera	Notonemouridae	8	Stonefly nymph
Plecoptera	Gripopterygidae	7	Stonefly nymph
Trichoptera	Leptoceridae	7	Stick caddis larva
Ephemeroptera	Caenidae	7	Mayfly nymph
O. Odonata S.O Epiproctophora	Synthemistidae (Corduliidae)	7	Dragonfly nymph
Diptera	S.F. Tanypodinae	6	Non biting midge larva
O. Odonata S.O Epiproctophora	Telephlebiidae (Aeshnidae)	6	Dragonfly nymph
Diptera	S.F Chironominae	6	Non biting midge larva
Ephemeroptera	Baetidae	5	Mayfly larva
Hemiptera	Corixidae	5	Water boatman
Diptera	S.F. Orthocladiinae	5	Non biting midge larva
Diptera	Tipulidae	5	
Diptera	Simuliidae	5	Blackfly larva
Hemiptera	Veliidae	4	Small water strider
C. Oligochaeta		1	Aquatic worm
	No of families 21	Total 140	
		SIGNAL SCORE 6.7	

Acheron Region General Comments

With all sites in the upper catchment it could be expected that results would generally be very good. In 2007 we found:

a) Turbidity was generally low (in comparison with results commonly found in the Goulburn Broken Catchment) with the same tributaries having the higher results as in previous years.

b) Salinity was low

c) Phosphorus was low

d) Macroinvertebrates passed at all sites when assessed against SEPP WoV objectives for biological indicators of environmental quality

e) Overall an excellent result; the Acheron River region is in very good health

It is recommended that testing continue as these results provide excellent base line data for use by numerous authorities in the industry. These results have so far been distributed to

- Goulburn Broken Catchment Management Authority
- Waterwatch State Office
- Goulburn-Murray Water

Appendix A

Chemical Test Ratings

The figures below are a guide for each of the water quality tests to help you interpret your results in terms of water quality.

Index of Stream Conditions (ISC) Ratings for each of the parameters.

Parameter	Excellent	Good	Fair	Poor	Degraded
Conductivity (uS/cmEC) mountain	<30	<90	<150	<225	>225
Conductivity (uS/cmEC) valley	<80	<240	<400	<600	>600
Conductivity (uS/cmEC) plain	<100	<250	<500	<750	>750
Turbidity (NTU) mountain	<5.0	<7.5	<10	<12.5	>12.5
Turbidity (NTU) valley	<10	<12.5	<15	<22.5	>22.5
Turbidity (NTU) plain	<15	<17.5	<20	<30	>30
pH	6.0 - 7.5	5.5 - 6 or <8.0	8.0 - 8.5	5.0 - 5.5 or 8.5 9.0	< 5.0 or > 9.0
Reactive Phosphorus (mg/L)	< 0.008	< 0.02	< 0.04	< 0.08	> 0.08
Total Phosphorus (mg/L)	< 0.01	< 0.025	< 0.05	< 0.10	> 0.10
Nitrates (mg/L)	< 0.05	< 0.1	< 0.2	< 0.4	> 0.4

Appendix B

ASSESSING THE CONDITION OF AQUATIC ECOSYSTEMS

There are many ways of analysing and interpreting invertebrate data to assess ecological condition. Currently five biological indices are used in Victoria for assessing the condition of aquatic ecosystems. These fall into three categories:

- a measure of diversity – number of families.
- biotic indices – the SIGNAL and EPT indices
- measuring of community composition – numbers of key families.

The development of these indices for assessing ecosystem condition has included the establishment of environmental quality objectives to aid in their interpretation. In recognition of the fact that aquatic communities will vary naturally across the State, the State has been characterised into five biological regions. The biological indices and their respective environmental quality objectives have been developed specific to the invertebrate communities within each region (EPA Victoria, 2003a) These biological indices and their associated environmental quality objectives have been set down in the ***State Environmental Protection Policy (Waters of Victoria)*** SEPP (WoV) and its schedules.

USING THE BIOLOGICAL INDICES

Separate assessments are made for riffle and edge habitats. In order to make a complete and accurate assessment of a site, the biological samples must be collected in both autumn and spring, and the invertebrate data from both seasons combined in the calculation of the indices

1. Number of Families.

The number of invertebrate families found at a site can give a reasonable representation of the ecological health of a stream as healthy streams generally have more families. **The Number of Families** index is calculated by simply summing the total 'families' of invertebrates present at a site.

Throughout a biological region, the expected number of families will vary according to quality of habitat and stream size, with larger streams, in general, supporting more taxa. Mild nutrient enrichment can increase the number of families due to an increase in food supply. Reduction in the expected number of families present can be caused by poor quality habitat and by various pollutants.

2. The SIGNAL biotic index.

SIGNAL (Stream Invertebrate Grade Number- Average Level) is an index of water quality based on the tolerance of aquatic biota to pollution (Chessman 1995). Using data from various studies of pollutants in south-eastern Australian streams, most, but not all, families of aquatic invertebrates have been assigned sensitivity grades according to their tolerance or intolerance to various pollutants. The list of invertebrate families and SIGNAL scores currently in use is based largely on those in the original publication (Chessman 1995). Oligochaeta has been added and assigned a score of one**. See Appendix 2**.

The SIGNAL index is calculated by summing together the sensitivity grades of each of the families found at a site that have been assigned a sensitivity grade, and then by dividing the number of graded families present. The output is a single number, between zero and ten, reflecting the degree of water pollution. Generally, high quality sites have high SIGNAL scores and, low quality sites have low SIGNAL scores.

Table 2: Generic key to SIGNAL scores

SIGNAL score	Water Quality
>7	Excellent
6-7	Clean water
5-6	Mild pollution
4-5	Moderate pollution
<4	Severe pollution

3. The EPT biotic index

The EPT index is the total number of families in the generally pollution sensitive insect orders of Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies). It is calculated by summing together the number of families in these three orders present at a site. Any loss of families in these groups usually indicates disturbance.

The EPT index cannot be used in all stream systems due to the natural variations in the biogeographical distribution of the relevant taxa. For example, due to their ecological preference for well oxygenated, cool water streams, stoneflies and some mayfly families are naturally uncommon in the warmer, slower flowing waters that are typical of lowland regions.

4. Key Invertebrate Families

This index focuses mainly on the loss of key taxa that are indicative of good habitat and water quality. It is based on a pre-determined list of invertebrate families that are expected to occur in each of the biological regions of the State as defined in the State Environmental protection Policy (*Waters of Victoria*). See Appendix 1.

The families included in each list are those which:

- are typically found in non-degraded streams in that region;
- are representative of particular habitat types, such as riffles, woody debris, fringing vegetation, macrophytes or pools in that region;
- represent reasonable to good water quality and tend to disappear as conditions deteriorate, and
- are commonly collected when present, using the rapid bioassessment method.

Because the lists incorporate taxa from a range of habitat types, stream sizes and stream types, it is unlikely that a site would contain all families. Thus, the environmental quality objective for the Key Families index requires the presence of a proportion, not all, of the listed families.

Unlike the other indices, edge and riffle habitats are not distinguished with the key Families index. Both habitats must be sampled where present and the data from both samples and both seasons (autumn and spring) combined when making an assessment.

To calculate the Key Families index, simply compare the list of families present at a site with the appropriate list of key families as specified in the ***State Environmental Protection Policy (Waters of Victoria*)**. The key families score is the total number of these key families present at a site.

APPENDIX 1. KEY FAMILIES USED TO CALCULATE SEPP (WATERS OF VICTORIA) OBJECTIVES

SEPP (WoV) SEGMENT				
Highlands	**Forests A**	**Forests B**	**Cleared Hills and Coastal Plains**	**Murray and Western Plains**
Aeschnidae	Aeschnidae	Aeschnidae	Aeschnidae	Aeschnidae
Acarina	Acarina	Acarina	Acarina	Acarina
Aphroteniinae	Ameletopsidae	Ameletopsidae	Ancylidae	Ancylidae
Austroperlidae	Ancylidae	Ancylidae	Atyidae	Atyidae
Baetidae	Athericidae	Athericidae	Baetidae	Baetidae
Blepharoceridae	Austroperlidae	Atriplectidae	Caenidae	Caenidae
Calocidae	Baetidae	Atyidae	Calamoceratidae	Calamoceratidae
Ceratopogonidae	Blepharoceridae	Austroperlidae	Ceinidae	Ceinidae
Chironominae	Caenidae	Baetidae	Ceratopogonidae	Ceratopogonidae
Coloburiscidae	Calocidae	Caenidae	Chironominae	Chironominae
Conoesucidae	Ceratopogonidae	Calamoceratidae	Coenagrionidae	Coenagrionidae
Dixidae	Chironominae	Calocidae	Conoesucidae	Corbiculidae
Dugesiidae	Coloburiscidae	Ceinidae	Corixidae	Cordylophora
Elmidae	Conoesucidae	Ceratopogonidae	Dixidae	Corixidae
Eusiridae	Corduliidae	Chironominae	Dugesiidae	Culicidae
Eustheniidae	Corixidae	Coenagrionidae	Dytiscidae	Dytiscidae
Gripopterygidae	Corydalidae	Coloburiscidae	Ecnomidae	Ecnomidae
Helicophidae	Dixidae	Conoesucidae	Elmidae	Gerridae
Hydrobiosidae	Dugesiidae	Corduliidae	Gomphidae	Gomphidae
Hydropsychidae	Dytiscidae	Corixidae	Gripopterygidae	Gripopterygidae
Hydroptilidae	Ecnomidae	Corydalidae	Gyrinidae	Gyrinidae
Leptoceridae	Elmidae	Dixidae	Hydrobiidae	Hydrobiidae
Leptophlebiidae	Empididae	Dolichopodidae	Hydrobiosidae	Hydrometridae
Limnephilidae	Eusiridae	Dugesiidae	Hydrometridae	Hydrophilidae
Nannochoristidae	Eustheniidae	Dytiscidae	Hydrophilidae	Hydroptilidae
Neoniphargidae	Glossosomatidae	Ecnomidae	Hydropsychidae	Hyriidae
Notonemouridae	Gomphidae	Elmidae	Hydroptilidae	Janiridae
Oligochaeta	Gripopterygidae	Empididae	Leptoceridae	Leptoceridae
Orthocladiinae	Gyrinidae	Gerridae	Leptophlebiidae	Leptophlebiidae
Philopotamidae	Helicophidae	Glossosomatidae	Mesoveliidae	Mesoveliidae
Philorheithridae	Helicopsychidae	Gomphidae	Nepidae	Naucoridae
Psephenidae	Hydrobiosidae	Gripopterygidae	Notonectidae	Nepidae

SEPP (WoV) SEGMENT				
Highlands	**Forests A**	**Forests B**	**Cleared Hills and Coastal Plains**	**Murray and Western Plains**
Scirtidae	Hydrophilidae	Gyrinidae	Oligochaeta	Notonectidae
Simuliidae	Hydropsychidae	Helicophidae	Orthocladiinae	Oligochaeta
Siphlonuridae	Leptoceridae	Helicopsychidae	Parastacidae	Orthocladiinae
Tanypodinae	Leptophlebiidae	Hydrobiidae	Physidae	Parastacidae
Tipulidae	Limnephilidae	Hydrobiosidae	Psephenidae	Physidae
	Notonemouridae	Hydrophilidae	Pyralidae	Planorbidae
	Oligochaeta	Hydropsychidae	Scirtidae	Pleidae
	Oniscigastridae	Hydroptilidae	Simuliidae	Pyralidae
	Orthocladiinae	Leptoceridae	Stratiomyidae	Simuliidae
	Philopotamidae	Leptophlebiidae	Tanypodinae	Stratiomyidae
	Philorheithridae	Mesoveliidae	Tipulidae	Tanypodinae
	Polycentropodidae	Notonectidae	Veliidae	Veliidae
	Psephenidae	Odontoceridae		
	Ptilodactylidae	Oligochaeta		
	Scirtidae	Oniscigastridae		
	Simuliidae	Orthocladiinae		
	Tanypodinae	Parastacidae		
	Tipulidae	Philopotamidae		
	Veliidae	Philorheithridae		
		Physidae		
		Planorbidae		
		Polycentropodidae		
		Psephenidae		
		Ptilodactylidae		
		Scirtidae		
		Simuliidae		
		Stratiomyidae		
		Synlestidae		
		Tanypodinae		
		Temnocephalidea		
		Tipulidae		
		Veliidae		

APPENDIX 2. SIGNAL BIOTIC INDEX GRADES USED TO CALCULATE SEPP (WATERS OF VICTORIA) OBJECTIVES

Family	Grade	Family	Grade	Family	Grade
Aeshnidae	6	Gerridae	4	Oligochaeta	1
Ameletopsidae	10	Glossiphoniidae	3	Oniscigastridae	10
Amphipterygidae	8	Glossosomatidae	8	Orthocladiinae	5
Ancylidae	6	Gomphidae	7	Osmylidae	8
Aphroteniinae	8	Gordiidae	7	Palaemonidae	5
Athericidae	7	Gripopterygidae	7	Paracalliopidae	7
Atriplectididae	10	Gyrinidae	5	Paramelitidae	5
Atyidae	6	Haliplidae	5	Parastacidae	7
Austroperlidae	10	Hebridae	6	Perthiidae	6
Baetidae	5	Helicophidae	10	Philopotamidae	10
Belostomatidae	5	Helicopsychidae	10	Philorheithridae	8
Blepharoceridae	10	Hydraenidae	7	Physidae	3
Caenidae	7	Hydridae	4	Planorbidae	3
Calamoceratidae	8	Hydrobiidae	5	Pleidae	5
Calocidae	8	Hydrobiosidae	7	Podonominae	6
Ceinidae	5	Hydrometridae	5	Polycentropodidae	8
Ceratopogonidae	6	Hydrophilidae	5	Protoneuridae	7
Chironominae	6	Hydropsychidae	5	Psephenidae	5
Clavidae	5	Hydroptilidae	6	Psychodidae	2
Coenagrionidae	7	Hygrobiidae	5	Ptilodactylidae	10
Coloburiscidae	10	Hymenosomatidae	4	Pyralidae	6
Conoesucidae	8	Isostictidae	7	Scirtidae	8
Corbiculidae	6	Janiridae	5	Sialidae	4
Corduliidae	7	Leptoceridae	7	Simuliidae	5
Corixidae	5	Leptophlebiidae	10	Sphaeriidae	6
Corydalidae	4	Lestidae	7	Sphaeromatidae	5
Culicidae	2	Libellulidae	8	Spionidae	5
Curculionidae	7	Limnephilidae	8	Spongillidae	5
Diamesinae	6	Lymnaeidae	3	Staphylinidae	5
Dixidae	8	Megapodagrionidae	7	Stratiomyidae	2
Dolichopodidae	6	Mesoveliidae	4	Synlestidae	7
Dugesiidae	3	Muscidae	3	Tabanidae	5
Dytiscidae	5	Nannochoristidae	10	Talitridae	5
Ecnomidae	4	Naucoridae	5	Tanypodinae	6
Elmidae	7	Nepidae	5	Tasimiidae	7
Empididae	4	Neurorthidae	8	Temnocephalidea	6
Ephydridae	2	Noteridae	9	Tetrastemmatidae	5
Erpobdellidae	3	Notonectidae	4	Thaumaleidae	7
Eusiridae	8	Notonemouridae	8	Tipulidae	5
Eustheniidae	10	Ochteridae	5	Veliidae	4
Gelastocoridae	6	Odontoceridae	8		

Appendix C

Acheron River Raw Data

For Samples from 01 Jan 2007 to 31 Dec 2007

SiteNo: ACH002 Acheron River at Fieglin's Road (Lowering Gear Track)

Parameters:

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
19-Apr-07	9:40 AM	Grab		6.3	10.9	0			3			30
20-Aug-07	12:10 PM	Grab	11.4		6.8	0			4			33
08-Oct-07	9:45 AM	Grab		6.4	7.4	0			3			32
31-Oct-07	1:00 PM	Grab				0			2			
14-Dec-07	12:00 PM	Grab				0			2			

SiteNo: ACH003 Acheron River off Old Coach Road

Parameters:

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
31-Oct-07	12:45 PM	Grab				0			2			
14-Dec-07	12:00 PM	Grab				0			2			

SiteNo: ACH004 Acheron River at Granton and Marysville Road

Parameters:

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
19-Apr-07	12:00 PM	Grab		6.3	12.4	0			6			30
20-Aug-07	12:30 PM	Grab	11.2		6.9	0			6			35

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SiteNo: ACH005 Acheron River on Maroondah Hwy south of Buxton

Parameters:

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
19-Apr-07	**9:10 AM**	Grab		6.0	11.6	0			6			30
20-Aug-07	**11:55 AM**	Grab	11.5		7.6	0			5			37

SiteNo: ACH010 Acheron River at Passing Lane at Buxton

Parameters:

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
20-Aug-07	**11:40 AM**	Grab	11.1		7.7	0			7			41

SiteNo: ACH011 Acheron River below Buxton

Parameters:

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
04-Jan-07	**4:00 PM**	Grab				0			10			
20-Jan-07	**4:00 PM**	Grab				7.5			7			
21-Jan-07	**10:00 AM**	Grab				16			15			
14-Feb-07	**9:00 AM**	Grab				0			7			
20-Mar-07	**6:00 PM**	Grab				37.5			11			
26-Apr-07	**2:00 PM**	Grab				0			8			
06-May-07	**4:00 PM**	Grab				24			8.5			
02-Jun-07	**12:00 PM**	Grab				21			11			

SiteNo: ACH020 Acheron River downstream of Taggerty at Kerrs Road

Parameters:

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
07-Mar-07	**9:10 AM**	Grab				1			12			
04-Apr-07	**9:00 AM**	Grab				0			8			
01-May-07	**9:10 AM**	Grab				0			8			
19-May-07	**9:10 AM**	Grab				52			28			
19-Jul-07	**9:20 AM**	Grab				5			12			
18-Aug-07	**9:20 AM**	Grab				17			0			
12-Sep-07	**9:00 AM**	Grab				25			18			
05-Nov-07	**9:00 AM**	Grab				23.5			25			
22-Dec-07	**9:00 AM**	Grab				69			70			
26-Dec-07	**9:20 AM**	Grab				0			18			

SiteNo: ACH025 Acheron River before confluence with the Goulburn River

Parameters:

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
17-Jan-07	**2:30 PM**	Grab	5.5	6.3	25.2	0			8.8		0.02	46
03-Feb-07	**10:00 AM**	Grab				0			7			
21-Feb-07	**2:30 PM**	Grab	6.0	6.3	28.2	0			6		0.02	42
27-Feb-07	**2:00 PM**	Grab				0			5			
21-Mar-07	**1:30 PM**	Grab	7.1	6.5	19.9	25			11		0.04	42
23-Mar-07	**10:00 AM**	Grab				28			5			
31-Mar-07	**10:00 AM**	Grab				16.5			15			
18-Apr-07	**3:05 PM**	Grab	8.1	6.8	16.4	0			3.4		<0.02	38
24-Apr-07	**9:30 AM**	Grab				8.5			4			
19-May-07	**9:30 AM**	Grab				61.5			55			

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
19-Jun-07	**2:10 PM**	Grab	10.6	6.7	7.0	0			4.7		<0.02	39
09-Jul-07	**10:15 AM**	Grab				23.25			20			
18-Jul-07	**2:30 PM**	Grab	10.0	6.3	6.6	7			26		0.02	66
31-Jul-07	**10:30 AM**	Grab				0			15			
14-Aug-07	**2:45 PM**	Grab		6.4	7.8	0			10		<0.02	42
16-Aug-07	**10:00 AM**	Grab				0			25			
19-Sep-07	**2:50 PM**	Grab	10	6.6	10.2	0			12		<0.02	38
24-Sep-07	**11:30 AM**	Grab				0			10			
16-Oct-07	**3:00 PM**	Grab	8.3	7.1	14.3	0			7.3		<0.02	35
03-Dec-07	**2:30 PM**	Grab		6.8	21.6	15			9			32
18-Dec-07	**2:05 PM**	Grab	7.8	7.0	20.9	0			5.1		<0.02	37

SiteNo: AND010 Andrews ck just upstream of confluence with Little River

Parameters:

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
15-Jan-07	**12:00 PM**	Grab				0				0		
31-Jan-07	**10:30 AM**	Grab				0				0		
15-Feb-07	**12:00 PM**	Grab				0				0		
23-Feb-07	**5:15 PM**	Grab				4.5				0		
15-Mar-07	**12:00 PM**	Grab				0				0		
31-Mar-07	**2:30 PM**	Grab			21	32			9	0		218

SiteNo: BIG002 Big River at Stockman's Rewards camp site

Parameters:

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
31-Oct-07	**11:30 AM**	Grab				2.5			2			
12-Dec-07	**1:18 PM**	Grab				0			2			

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SiteNo: BIG005 Big River at Vennells camp site

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
31-Oct-07	**12:00 PM**	Grab				2.5			2			
12-Dec-07	**2:00 PM**	Grab				0			2			

SiteNo: BLA005 Blackwood Creek in Cathedral Lane at Taggerty

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
12-Aug-07	**12:00 PM**	Grab				9			35			
18-Aug-07	**12:00 PM**	Grab				6.5			40			
03-Sep-07	**11:30 AM**	Grab				0			17			
12-Sep-07	**8:30 AM**	Grab				25.5			70			
23-Sep-07	**9:30 AM**	Grab				0			20			
07-Oct-07	**3:00 PM**	Grab				3			4			
28-Oct-07	**4:30 PM**	Grab				0						
12-Nov-07	**9:30 AM**	Grab				0						
19-Nov-07	**12:00 PM**	Grab				3				dry		
20-Dec-07	**11:45 AM**	Grab				20				dry		

SiteNo: CON025 Connelly Creek at McColl's Road Bridge

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
03-Feb-07	**10:00 AM**	Grab								0		
27-Feb-07	**2:00 PM**	Grab								0		

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
23-Mar-07	**10:00 AM**	Grab				28			43			
31-Mar-07	**10:00 AM**	Grab				16.5			60			
19-Apr-07	**2:30 PM**	Grab		7.3	13.7	0			32			120
24-Apr-07	**9:30 AM**	Grab				8.5			30			
19-May-07	**9:30 AM**	Grab				61.5			80			
24-May-07	**10:25 AM**	Grab		6.1	12.1	10			24			210
09-Jul-07	**10:00 AM**	Grab				23.5			40			
31-Jul-07	**10:30 AM**	Grab				0			30			
16-Aug-07	**10:30 AM**	Grab				0			25			
20-Aug-07	**9:50 AM**	Grab	10.0	6.6	7.7	0			18			134
24-Sep-07	**11:30 AM**	Grab				0			15			
03-Dec-07	**2:35 PM**	Grab		7.0	18.8	15			29			96

SiteNo: DRN710 Outfall from Buxton Fish Farm into Little Steavenson River

Parameters:

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
24-May-07	**4:35 PM**	Grab		5.6	11.7	10			7		0.06	80
20-Aug-07	**2:55 PM**	Grab	9.7		8.4	0			4		<0.02	32
03-Dec-07	**4:40 PM**	Grab		6.8	18.7	20			19			40

SiteNo: EGL003 Eglington Creek at Page's property

Parameters:

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
15-Feb-07	**4:00 PM**	Grab				44			18			
02-Mar-07	**10:30 AM**	Grab				0			18			339
21-May-07	**4:00 PM**	Grab				44			18			
01-Jun-07	**2:00 PM**	Grab				0			6			

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
22-Jun-07	**9:00 AM**	Grab				2.4			3			170
06-Jul-07	**4:00 PM**	Grab				30			13			172
10-Oct-07	**4:00 PM**	Grab				0			4			

SiteNo: KPL005 Keppel Creek at Cerberus Road bridge.

Parameters:

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
19-Apr-07	**1:35 PM**	Grab		6.8	12.2	0			2			30
20-Aug-07	**2:40 PM**	Grab	11.5		7.0	0			3			34
31-Oct-07	**1:25 PM**	Grab				0			2			
03-Dec-07	**3:25 PM**	Grab		7.0	15.0	20			10			36
12-Dec-07	**3:30 PM**	Grab				0			2			

SiteNo: KPL010 Keppel Creek upstream of confluence with Steavenson River

Parameters:

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
19-Apr-07	**1:45 PM**	Grab		6.4	15.2	0			6			30
20-Aug-07	**2:45 PM**	Grab	11.0		9.1	0			4			39
31-Oct-07	**1:35 PM**	Grab				0			12			
03-Dec-07	**3:15 PM**	Grab		6.8	19	20			26			44
12-Dec-07	**3:40 PM**	Grab				0			40			

SiteNo: LIT005 Little River at Cathedral Lane in Cathedral Ranges N. P.

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Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
12-Aug-07	**12:00 PM**	Grab				9			4			
18-Aug-07	**12:00 PM**	Grab				6.5			2			
20-Aug-07	**10:30 AM**	Grab	11.9		5.7	0			2			30
03-Sep-07	**9:00 AM**	Grab				0			2			
12-Sep-07	**8:45 AM**	Grab				25.5			2			
23-Sep-07	**9:00 AM**	Grab				0			2			
07-Oct-07	**2:30 PM**	Grab				3			2			
28-Oct-07	**4:00 PM**	Grab				0			2			
12-Nov-07	**9:00 AM**	Grab				0			2			
19-Nov-07	**12:00 PM**	Grab				3			2			
20-Dec-07	**11:30 AM**	Grab				20			2			

SiteNo: LIT025 Little River at Taggerty before confluence with Acheron R.

Parameters:

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
07-Mar-07	**9:00 AM**	Grab				1			8			
04-Apr-07	**8:50 AM**	Grab				0			3			
19-Apr-07	**2:10 PM**	Grab		6.4	13.2	0			3			20
01-May-07	**8:50 AM**	Grab				0			3			
19-May-07	**8:50 AM**	Grab				52			20			
24-May-07	**10:40 AM**	Grab		6.5	11.2	10			5			70
19-Jul-07	**9:00 AM**	Grab				5			8			
18-Aug-07	**9:00 AM**	Grab				17			8			
20-Aug-07	**10:15 AM**	Grab	12.1		5.6	0			2			32
12-Sep-07	**9:10 AM**	Grab				25			12			
05-Nov-07	**9:10 AM**	Grab				23.5			8			
03-Dec-07	**2:55 PM**	Grab		6.9	18.3	20			5			26
22-Dec-07	**9:10 AM**	Grab				69			80			
26-Dec-07	**9:00 AM**	Grab				0			8			

SiteNo: LST015 Little Steavenson River above Buxton Fish Farm

Parameters:

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
24-May-07	**4:30 PM**	Grab		5.5	11.7	10			5		<0.02	70
20-Aug-07	**3:00 PM**	Grab	11.5		8.9	0			3		0.02	29
03-Dec-07	**4:30 PM**	Grab		6.7	18.4	20			11			37

SiteNo: MID010 Middle Creek at John Walsh's farm

Parameters:

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
13-Jan-07	**5:30 PM**	Grab			25.0	0		0.16	14			2630
03-Mar-07	**4:45 PM**	Grab			26.8	0		0.16	5			3660
10-Apr-07	**5:30 PM**	Grab			19.4	0		0	12			3480
13-May-07	**2:50 PM**	Grab			15.5	0		0.16	8			3310
12-Jun-07	**2:40 PM**	Grab			10.0	1.5		0	5			260

SiteNo: RUB010 Rubicon River at Kendalls Camp Ground

Parameters:

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
14-Feb-07	**12:00 PM**	Grab				0			1.5			25
26-Feb-07	**4:10 PM**	Grab				0			6			28
21-Mar-07	**4:00 PM**	Grab				33			13			35
03-May-07	**4:20 PM**	Grab				8			5			40
16-May-07	**3:30 PM**	Grab			12.7	13			10			49

Waterwatch Victoria Application (WVA) - Site Report

SiteNo: STE003 Steavenson River upstream of Marysville on Yellow Dog Rd.

Parameters:

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
19-Apr-07	**12:30 PM**	Grab		6.6	11.3	0			2			20
24-May-07	**3:45 PM**	Grab		5.6	10	10			6			50
20-Aug-07	**12:50 PM**	Grab	11.6		6.4	0			3			25
03-Dec-07	**4:04 PM**	Grab		6.7	15.0	20			10			25

SiteNo: STE005 Steavenson River at Barton's Bridge in Marysville

Parameters:

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
19-Apr-07	**1:00 PM**	Grab		6.5	13.4	0			2			30
20-Aug-07	**1:20 PM**	Grab	11.6		6.4	0			3			28

SiteNo: STE015 Steavenson River at Retreat Rd Bridge

Parameters:

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
19-Feb-07	**6:05 PM**	Grab			23.2	4.25			4			30
19-Mar-07	**2:50 PM**	Grab			16.2	0			4			30
19-Mar-07	**3:30 PM**	Grab		6.6	16.8				3			20
19-Apr-07	**7:35 AM**	Grab			10.5	0			2			30
19-Apr-07	**1:25 PM**	Grab		6.5	12.3	0			3			30
08-May-07	**8:00 AM**	Grab				0			2			
21-May-07	**1:25 PM**	Grab			9.8	8.2			6			30
24-May-07	**11:00 AM**	Grab		6.6	10.8	10			6			70

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
22-Jun-07	**7:52 AM**	Grab			4.5	24			3			30
05-Jul-07	**8:10 AM**	Grab				5			3			
05-Jul-07	**7:43 AM**	Grab				23			12			
25-Jul-07	**10:15 AM**	Grab			4.8	0			2			30
08-Aug-07	**8:08 AM**	Grab				7			3			
20-Aug-07	**2:25 PM**	Grab	11.8		7.0	0			3			28
23-Aug-07	**7:45 AM**	Grab			6.1	0			3			30
25-Sep-07	**7:50 AM**	Grab			6.2	0			2			20
08-Oct-07	**7:37 AM**	Grab				0			2			
08-Oct-07	**1:00 PM**	Grab		6.6	8.6	0			5			27
24-Oct-07	**7:42 AM**	Grab			10.5	0			3			30
20-Nov-07	**5:45 PM**	Grab			19.8	0			4			30
03-Dec-07	**3:30 PM**	Grab		6.8	16.8	20			8			34
07-Dec-07	**7:50 AM**	Grab				0			3			
18-Dec-07	**8:00 AM**	Grab			13.1	0			2			30

SiteNo: STE018 Steavenson River at Cameron Close

Parameters:

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
20-Jan-07	**5:00 PM**	Grab				7			3			
15-Feb-07	**1:00 PM**	Grab				0			12			
25-Feb-07	**6:00 PM**	Grab				4			2			
19-Mar-07	**9:00 AM**	Grab				0			2			
10-Apr-07	**12:00 PM**	Grab				0			2			
09-May-07	**2:00 PM**	Grab				0			2			
23-May-07	**11:00 AM**	Grab				17			2			
13-Sep-07	**10:00 AM**	Grab				37			10			
20-Sep-07	**10:00 AM**	Grab				0			1			
16-Oct-07	**8:00 AM**	Grab				0			1			
20-Nov-07	**10:00 AM**	Grab				0			3			

Waterwatch Victoria Application (WVA) - Site Report

SiteNo: STE020 Steavenson River in Buxton before Acheron River

Parameters:

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
20-Aug-07	11:20 AM	Grab	11.8		6.1	0			2			31

SiteNo: SWA010 Swamp Creek before Acheron River at Taggerty

Parameters:

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
15-Jan-07	12:00 PM	Grab				0				Dry		
15-Feb-07	12:00 PM	Grab				0				Dry		
15-Mar-07	12:00 PM	Grab				0				Dry		

SiteNo: TAG010 Taggerty River at Lady Talbot Drive.

Parameters:

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
19-Apr-07	12:55 PM	Grab		6.5	11.3	0			2			20
24-May-07	4:05 PM	Grab		5.5	10.3	10			4			70
20-Aug-07	1:10 PM	Grab	12.1		5.2	0			2			22
03-Dec-07	3:50 PM	Grab		6.9	14.9	20			11			26
07-Dec-07	7:36 AM	Grab				0			3			
18-Dec-07	7:47 AM	Grab			14.2	0			3			30

Waterwatch Victoria Application (WVA) - Site Report

SiteNo: TAG015 Taggery River at the Buxton-Marysville Road

Parameters:

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
19-Feb-07	**5:50 PM**	Grab			20.2	4.25			2			30
19-Mar-07	**5:40 PM**	Grab			14.8	0			2			30
19-Apr-07	**7:20 AM**	Grab			10.1	0			2			30
08-May-07	**8:07 AM**	Grab				0			2			
21-May-07	**1:35 PM**	Grab			9.3	8.2			5			30
05-Jun-07	**8:25 AM**	Grab				5			2			
22-Jun-07	**7:41 AM**	Grab			5.2	24			4			40
05-Jul-07	**7:58 AM**	Grab				23			6			
08-Aug-07	**8:16 AM**	Grab				7			2			
20-Aug-07	**2:15 PM**	Grab	12.2		6.0	0			3			23
23-Aug-07	**7:34 AM**	Grab			5.8	0			2			20
25-Sep-07	**7:39 AM**	Grab			7.7	0			3			30
08-Oct-07	**7:43 AM**	Grab				0			2			
24-Oct-07	**7:55 AM**	Grab			9.8	0			3			20
20-Nov-07	**5:55 PM**	Grab			17.6	0			2			30
03-Dec-07	**3:40 PM**	Grab		6.9	15.6	20			7			27

SiteNo: UBL010 Upper Blackwood Ck at Cathedral Lane, Taggerty

Parameters:

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
15-Jan-07	**12:00 PM**	Grab				0				0		
31-Jan-07	**4:10 PM**	Grab								0		
15-Feb-07	**12:00 PM**	Grab				0				0		
23-Feb-07	**6:00 PM**	Grab				4.5				0		

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
15-Mar-07	**12:00 PM**	Grab				0				0		
31-Mar-07	**6:15 PM**	Grab				32				0		

SiteNo: YEL020 Yellow River at Taggerty before confluence with Acheron R.

Parameters:

Date:	Time:	Sample Type:	DO mg/L	pH pH Units	Temp ° C	Rainfall mm	Ecoli orgs/100 mL	ReactP mg/L P	Turb NTU	Flow ML/day	TPhos mg/L P	EC µS/cm
07-Mar-07	**8:50 AM**	Grab				1				dry		
04-Apr-07	**9:10 AM**	Grab				0				dry		
19-Apr-07	**2:20 PM**	Grab		7.0	14.3	0			24	0		740
01-May-07	**9:00 AM**	Grab				0				dry		
19-May-07	**9:00 AM**	Grab				52			21			
24-May-07	**10:35 AM**	Grab		5.9	12.5	10			37	0		1130
19-Jul-07	**9:10 AM**	Grab				5			20			
18-Aug-07	**9:10 AM**	Grab				17			24			
20-Aug-07	**10:00 AM**	Grab	8.9	6.7	7.9	0			13			220
12-Sep-07	**9:20 AM**	Grab				25			28			
05-Nov-07	**9:15 AM**	Grab				23.5			28			
03-Dec-07	**2:45 PM**	Grab		7.3	19.3	20			27			526
22-Dec-07	**9:15 AM**	Grab				69			150			
26-Dec-07	**9:10 AM**	Grab				0			35			