APPENDIX

to

Save the Barwon River

LAWROC

&

Otway Water

BOOK 32

Barwon River May 2016 at Conns Lane.

Appendix.

Appendix One EPA Report Number 8100017391, Inspection report No. 80011868.

From: **southwest.region@epa.vic.gov.au** SouthWest.Region@epa.vic.gov.au
Subject: Request for report - M Gardiner FW: Fish kill
Date: Today at 16:37
To: Malcolm Gardiner otwaywater@yahoo.com.au

Dear Malcolm,

Please find attached copy of my inspection report from 20 June 2016.

As this episode is not attributed to a pollution, EPA is not proposing to take further actions in relation to this episode. If you have any further questions, please direct these to Corangamite Catchment Management Authority.

Kind regards,

Ben Poole
Environment Protection Officer
South West Region

EPA VICTORIA | Environment Protection Authority Victoria

VICTORIA State Government

Environment Protection Authority Victoria
Government Offices, Corner Little Malop and Fenwick Streets, Geelong VIC 3220 | GPO Box 4395 Melbourne Vic 3001 | DX 216073
(1300 372 842 (1300 EPA VIC) | **E** southwest.region@epa.vic.gov.au | www.epa.vic.gov.au

A healthy environment that supports a liveable and prosperous Victoria.

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EPA VICTORIA

State Government Victoria

Inspection Report No:	80011868

INSPECTION REPORT

Who we are: The Environment Protection Authority (EPA) Victoria is an independent statutory authority established under the *Environment Protection Act 1970* (the EP Act). Our purpose is to protect and improve our environment by preventing harm to the environment and human health.

Why you, the duty-holder are receiving this inspection report: This report is a record of EPA's observations and any actions carried out during our recent inspection of the premises or site specified below. It also indentifies any other matters that may need to be followed up by EPA. Please retain this report for your reference.

1 SUMMARY INFORMATION

Date of inspection: 20/06/2016 Start time: 10:30 HRS End time: 15:30 HRS

Licence Number: Incident(s): 8100017391 Notice(s):

Lead EPA officer in attendance

Name: Phone: 1300 EPA VIC

Other EPA officers in attendance

Name:

Others (not EPA) in attendance

Name: Unknown Alleged Source Contact

Site representative

Name: Unknown Alleged Source Contact Position:

Site representative contact details

Email:

Phone: Fax:

Company name/Person: NATURAL OCCURRANCE

ACN: 0 0 0 0 0 0 0 0 0

Australian Company Number

Trading name: eg algal bloom,

Registered/principal office address: VIC

Premises address or site location:

Reason for inspection:

☑ Pollution report

Inspection location:

☑ Unlicensed premises

2 OBSERVATIONS

2.1 In response to a report regarding dead fish, an EPA officer attended the Barwon River at Colac-Lorne Road, MURROON at 1030 hours on Monday 20 June 2016. The officer:

2.2 Observed very clear water flowing in the river.

2.3 Observed five dead eels along a stretch of river approximately 100m long on the north side of Colac-Lorne Road.

2.4 Took a pH measurement using indicator paper, which gave a result approximately pH 6.

2.5 Met with a representative from Corrangamite Catchment Management Authority (CCMA).

2.6 Was informed by the CCMA representative that approximately 5km upstream of this location, Boundary Creek enters the Barwon River. Boundary Creek drains an area of peat bog that was known to contain Acid-Sulphate Soils and to have caused acidic runoff in the past.

2.7 Calibrated water meter.

2.8 Took in-situ measurements with the water meter in the Barwon River on the north side of Colac-Lorne Road. Results were Temperature 9.3 Degrees C, Dissolved Oxygen (DO) 92%, 10.3 mg/l, Conductivity 868 µS/cm, pH 4.0.

2.9 Drove to Boundary Creek at Colac-Forrest Road, YEODENE.

2.10 Observed clear water flowing in the creek.

2.11 Observed that there was a permanent water monitoring station at this location (Site ID 233228A).

2.12 Took a pH measurement using indicator paper, which gave a result approximately pH 5.

2.13 Took in-situ measurements with the water meter in Boundary Creek on the east side of Colac-Forrest Road. Results were Temperature 10.9 Degrees C ,DO 39.2%, 4.2 mg/l, Conductivity 1812 µS/cm , pH 2.9.

2.14 Drove to the Barwon River at Seven Bridges Road, GERANGAMETE. This location is upstream of the confluence of Boundary Creek with the Barwon River.

2.15 Observed clear water flowing in the river.

2.16 Took in-situ measurements with the water meter in the Barwon River on the north side of Seven Bridges Road. Results were Temperature 8.8 Degrees C, DO 82.5%, 9.36 mg/l, Conductivity 385 µS/cm, pH 5.3.

2.17 Met again with the CCMA representative.

2.18 Was informed by the CCMA representative that he had observed a number of dead fish in the Barwon River at Birregurra.

2.19 Drove to the Barwon River at Birregurra-Deans Marsh Road, BIRREGURRA

2.20 Observed clear water flowing in the river.

2.21 Observed six dead fish and one dead eel under the bridge.

2.22 Took in-situ measurements with the water meter in the Barwon River on the north side of Birregurra-Deans Marsh Road. Results were Temperature 9.2 Degrees C, DO 97.4%, 10.92 mg/l, 1273 µS/cm, pH 4.4.

2.23 Received a phone call from a representative of Colac Otway Shire (COS).

2.24 Was informed by the COS representative that COS had information relating to acidic drainage from a swamp upstream Boundary Creek. Studies have been done to investigate the cause, scale of the issue and possible solutions. This indicated that that the swamp had significant quantities of material that could generate acidic drainage. All remedial options previously considered were determined to be cost prohibitive.

2.25 Called a representative from DELWP and provided an update on EPA's investigation.

2.26 Drove to the Barwon River at Winchelsea-Deans Marsh Road, WINCHELSEA.

2.27 Observed greenish, cloudy (normal looking) water flowing in the river.

2.28 Observed no dead fish at this location.

2.29 Took in-situ measurements with the water meter in the Barwon River on the east side of Winchelsea-Deans Marsh Road. Results were Temperature 9.7 Degrees C, DO 100.9%, 11.2 mg/l, 1558 µS/cm, pH 5.6.

2.30 Drove to the Barwon River on the North West side of the Princess Highway, WINCHELSEA.

2.31 Observed greenish, cloudy (normal looking) water flowing in the river.

2.32 Observed no dead fish at this location.

2.33 Took in-situ measurements with the water meter in the Barwon River approximately 300m North West of the Princess Highway. Results were: Temperature 9.5 Degrees C, DO 101.8%, 11.37 mg/l, Conductivity 1646 µS/cm, pH 6.1.

2.34 Left the Barwon River at about 1530 hours.

3 ACTIONS TAKEN

3.1 Remedial action taken by duty-holder during inspection ('voluntary compliance')

3.1.1 Not applicable.

3.2 Confirmation of compliance advice given by EPA

3.2.1 Not applicable.

3.3 s62B directions given by EPA where imminent danger arises[1]

No matters gave rise to the need to give a direction during the inspection.

[1] Section 62B of the EP Act allows authorised officers to direct a person to conduct work where the officer is of the opinion that there is, or likely to be imminent danger to life or limb or the environment.

4 MATTERS TO BE FOLLOWED UP BY EPA

Applicable?	Follow-up required	Further details
☐	On the basis of my observations from this inspection EPA requires no further action	
☐	EPA will serve a notice under s55(3) of the EP Act to require further information	
☐	The duty-holder has agreed to voluntarily provide to EPA:	
☐	EPA will provide information to the duty-holder:	
☐	Follow-up assessment and/or inspection	
☐	**Remedy:** EPA intends to serve one or more remedial notices[1, 2]	
☐	**Sanction:** Further consideration will be given in applying a sanction under the *Compliance and Enforcement Policy* (EPA publication 1388)[1]	
☑	Other	Fish death likely due to natural event. EPA to coordinate media messages with CCMA and other agencies as required.

[1] Please note that any future remedial or sanctioning actions will be issued in accordance with EPA's *Compliance and Enforcement Policy* (EPA publication 1388). To obtain a copy, please visit EPA's website at http://www.epa.vic.gov.au/compliance-enforcement.

[2] Please refer to EPA's *Remedial Notices Policy* (EPA publication 1418) for further information. To obtain a copy, please visit EPA's website at http://www.epa.vic.gov.au/compliance-enforcement.

5 AUTHORISED OFFICER'S SIGNATURE

Name of EPA authorised officer:

Date:

Signature:

6 FURTHER INFORMATION

For further information, please visit EPA's website at www.epa.vic.gov.au, call EPA on **1300 EPA VIC (1300 372 842)** or email EPA at contact@epa.vic.gov.au.

EPA authorised officers are given powers under the EP Act to do their job. EPA expects its officers to exercise these powers with a high standard of professionalism and impartiality.

If you wish to make a formal complaint about an authorised officer's conduct, submit this in writing using the authorised officer complaint form online at www.epa.vic.gov.au

For more information see the EPA Authorised Officer Complaints Management Policy (EPA publication 1454).

From: **Malcolm Gardiner** otwaywater@yahoo.com.au
Subject: Re: Request for report - M Gardiner FW: Fish kill
Date: Today at 09:31
To: southwest.region@epa.vic.gov.au SouthWest.Region@epa.vic.gov.au

Dear Ben,
Thank you for getting back to me with your report so promptly.
I would like to draw it to your attention that our Landcare Group believes there is sufficient data available to support the notion that this fish kill is a direct result of unsustainable groundwater extraction at the Barwon Downs Borefield and is therefore not a natural event.

In such a situation our Group also believes that the EPA has a responsibility to check this out.

Kind regards,
Malcolm.

Malcolm Gardiner
Email otwaywater@yahoo.com.au
www.otwaywater.com.au
Phone +61 3 52358325

> On 27 Jun 2016, at 16:37, SouthWest Region <SouthWest.Region@epa.vic.gov.au> wrote:
>
> Dear Malcolm,
>
> Please find attached copy of my inspection report from 20 June 2016.
>
> As this episode is not attributed to a pollution, EPA is not proposing to take further actions in relation to this episode. If you have any further questions, please direct these to Corangamite Catchment Management Authority.
>
> Kind regards,
>
> **Ben Poole**
> Environment Protection Officer
> South West Region
> <image001.jpg> <image002.jpg>
> **Environment Protection Authority Victoria**
> Government Offices, Corner Little Malop and Fenwick Streets, Geelong VIC 3220 | GPO Box 4395
>
> Melbourne Vic 3001 | DX 216073

Appendix Two. Vic Government Media release DATED 22 March 2016.

VICTORIA State Government | Environment, Land, Water and Planning

Media Statement

22 March 2016 | Media contact: Nicolas McGay 0439 790 766

Authorities respond to Barwon River fish death event

Authorities are responding to a fish death event in the upper Barwon River and Boundary Creek, upstream of Winchelsea. This event is the result of a naturally-occurring increase in acidic water levels in these waterways.

People are advised not to handle or eat dead or dying fish or fish that are swimming erratically and to avoid contact with the river water as this may cause eye or skin irritation.

Ruminants – cattle, sheep and goats – are likely to refuse to drink acidic water below pH 4.0, and livestock managers are advised to source an alternative supply such as dam water filled from pasture run-off if animals are reluctant to water from these waterways. Domestic pets have a lower tolerance and should be kept away from affected waterways.

Corangamite Catchment Management Authority (CCMA), Colac Otway Shire, Department of Environment, Land, Water and Planning (DELWP), Department of Health and Human Services (DHHS) and Agriculture Victoria are working together to respond to the incident.

The fish death event was caused by acidic water from Boundary Creek flowing into Barwon River.

Boundary Creek occasionally experiences acidic water quality events due to natural sources of acid in the catchment. In the past once the water from Boundary Creek reached the Barwon River, the acidic water has quickly diluted and there has been no significant environmental impact downstream.

In this situation the acidic water from Boundary Creek has also caused an acid event in the Barwon River. This is a result we have not seen in the past, and is likely the result of dry conditions across the catchment that have reduced flows in the Barwon River.

We have increased water quality monitoring to track the impact on the river. However, we know that waterways recover naturally from acidic water events. If landowners impacted by the event would like their water tested they can bring samples into the Corangamite CMA office in Colac to have its pH tested.

Investigations into previous similar events show that an increase in acidic water levels occurs when acid sulphate soils, previously inundated by water, are exposed to the air when waterways become dry. The acidic water levels increase when rain in the catchment collects and transports the acid from the acid sulphate soils.

Colac Otway Shire Council has placed signs advising of the hazards of swimming or consuming fish out of affected stretches of the river at the locations where recreational use of the river is prominent. In addition, the council will ensure this same advice is available in nearby community centres such as the Birregurra General Store and golf club.

DELWP Weekend Media Contact Number is 03 9637 8243

www.delwp.vic.gov.au | Follow us on Twitter: @DELWP_Vic |

Appendix Three. Barwon Water Media Release 23 June 2016

Good afternoon,

Please find below a media release issued by Barwon Water regarding recent fish deaths in the Barwon River.

Barwon River fish kill

Barwon Water has been made aware of a fish kill in the Barwon River upstream of Winchelsea.

Investigating agency EPA Victoria has stated it had measured low pH (acidic) water in the river and it was likely the water quality was due to natural causes – in this case runoff off from acid-containing soils in the area.

Barwon Water General Manager Strategy and Planning Carl Bicknell said nearby Big Swamp was a known acid sulphate soil site and had been the subject of extensive studies over the past decade.

"Acid sulphate soils are naturally occurring and questions remain about whether the issues at Big Swamp were caused by record drought, fire, man-made drainage or groundwater pumping," Mr Bicknell said.

"Although Barwon Water is not the agency responsible for managing acid sulphate soils, it has taken a proactive approach and is expanding its monitoring program to include new sites of interest, including those suspected of containing acid sulphate soils," he said.
Barwon Water began pumping water from the Barwon Downs borefield in April for the first time since December, 2010.

The borefield has only been used five times since the early 1980s to supplement Geelong's supplies during prolonged dry conditions.

Unlike the 2006-2010 drought, during which the borefield provided up to 70 per cent of Geelong's drinking water, the operation of the Melbourne to Geelong pipeline as a supply source means less reliance on Barwon Downs.

Appendix Four. **Department of Environment, Water and Planning Media Release.**

VICTORIA State Government | Environment, Land, Water and Planning

Media Statement

23 June 2016 | Media contact: Nicolas McGay 0439 790 766

Authorities respond to Barwon River fish death event

Authorities are responding to a fish death event in the upper Barwon River and Boundary Creek, upstream of Winchelsea. This event is the result of a naturally-occurring increase in acidic water levels in these waterways.

People are advised not to handle or eat dead or dying fish or fish that are swimming erratically and to avoid contact with the river water as this may cause eye or skin irritation.

Ruminants – cattle, sheep and goats – are likely to refuse to drink acidic water below pH 4.0, and livestock managers are advised to source an alternative supply such as dam water filled from pasture run-off if animals are reluctant to water from these waterways. Domestic pets have a lower tolerance and should be kept away from affected waterways.

Corangamite Catchment Management Authority (CCMA), Colac Otway Shire, Department of Environment, Land, Water and Planning (DELWP), Department of Health and Human Services (DHHS) and Agriculture Victoria are working together to respond to the incident.

The fish death event was caused by acidic water from Boundary Creek flowing into Barwon River.

Boundary Creek occasionally experiences acidic water quality events due to natural sources of acid in the catchment. In the past once the water from Boundary Creek reached the Barwon River, the acidic water has quickly diluted and there has been no significant environmental impact downstream.

In this situation the acidic water from Boundary Creek has also caused an acid event in the Barwon River. This is a result we have not seen in the past, and is likely the result of dry conditions across the catchment that have reduced flows in the Barwon River.

We have increased water quality monitoring to track the impact on the river. However, we know that waterways recover naturally from acidic water events. If landowners impacted by the event would like their water tested they can bring samples into the Corangamite CMA office in Colac to have its pH tested.

Investigations into previous similar events show that an increase in acidic water levels occurs when acid sulphate soils, previously inundated by water, are exposed to the air when waterways become dry. The acidic water levels increase when rain in the catchment collects and transports the acid from the acid sulphate soils.

Colac Otway Shire Council has placed signs advising of the hazards of swimming or consuming fish out of affected stretches of the river at the locations where recreational use of the river is prominent. In addition, the council will ensure this same advice is available in nearby community centres such as the Birregurra General Store and golf club.

DELWP Weekend Media Contact Number is 03 9637 8243

www.delwp.vic.gov.au | **Follow us on Twitter: @DELWP_Vic** |

Appendix Five. Issued by Corangamite Catchment Management Authority, June 2016.

Upper Barwon Low pH Event- Communications Plan

Agreed key messages:

- The upper Barwon River and Boundary Creek are unique natural assets valued by local community and have been identified as a priority waterways under the Corangamite Waterway Strategy 2014-2022.
- Boundary Creek experiences acidic or low pH water quality events due to natural sources of acid in the catchment.
- Rainfall intensity and timing is the key determinant of whether or not an acid flush occurs. Rain in the catchment activates, collects and transports the acid from naturally occurring Acid Sulphate Soils in the catchment. Acid is more readily mobilised after prolonged periods of low rainfall followed by soaking rain.
- In the past once the water from Boundary Creek reached the Barwon River, the acid has quickly diluted and there has been no significant environmental impact downstream.
- In this situation the acidic water from Boundary Creek has also caused an acid event in the Barwon River. This is a result we have not seen in the past, and is likely the result of dry conditions across the catchment that have reduced Barwon River flow.
- We have not experienced an event like this before, so increased monitoring will be undertaken to track the impact on the river. However, we know that waterways recover naturally from acid events as the catchment upstream dries out and the pH returns to neutral. If landowners impacted by the event would like their water tested they can bring samples into the Corangamite CMA office in Colac to have its PH tested.

*

*

- There have been extensive investigations into acid events in the region that highlight the importance of keeping potential acid sulphate soils inundated. Once acid sulphate soils are exposed to the air, as is the case at the peat swamp at Yeodene, the reaction that causes acid to be released cannot be reversed. Given the complexity of groundwater dynamics it is not possible to conclusively determine what caused water levels to decline resulting in acid sulphate soils being exposed to the air. However we do know that the millennium drought caused groundwater levels to decline across the region. Further investigations are unlikely to clarify the cause of these events.
- To protect public health when river water becomes acidic, Council, Department of Health and Human Services advise the public that fish that are dead, dying or swimming erratically should not be handled or eaten and to avoid contact with the water as this may cause eye or skin irritation. Council will place signs advising of the hazards of swimming or consuming fish out of affected stretches of the river at the locations where recreational use of the river is prominent. In addition, Council will ensure this same advice is available in nearby community centres such as the Birregurra General Store and golf club.
- Ruminants (i.e. cattle, sheep and goats) can tolerate drinking water that is more acidic than other animals such as pigs, poultry and dogs.
  - Animals are likely to refuse to drink water below pH4.0. Livestock managers should watch their stock for refusal.
  - Where animals are reluctant to drink the available stream water an alternative supply should be found such as farm dam water filled from pasture run off.

Appendix Six. Barwon Water Update 27-06-2016.

Received 27/06/2016

Good afternoon,

Please find below an update regarding the Barwon River low pH event.

The Department of Land, Water and Planning (DELWP) has provided an update in response to the Barwon River low pH event in the attached Media Release. This provides background information that may assist you with conversations you may be having in the community.

In summary, DELWP's advice is that the fish kills have occurred because consistent rainfall in recent weeks flushed out naturally occurring sources of acid in Boundary Creek. In the past, this acid release was diluted once it reached the Barwon River preventing any impact on fish populations. Exceptional dry conditions this year has resulted in lower than normal inflows in the Barwon River. The low inflows meant there was not sufficient water to dilute the acid to safe levels, which is what normally happens.

DELWP and Southern Rural Water are working to contact adjacent landholders along the Barwon River between Boundary Creek and Birregurra.

Barwon Water has offered assistance where needed to agencies managing this event.

Please see DELWP's media release for further information.

Kind regards,
Casey

Casey Tomkins
Communications Officer | Barwon Water
155 Mercer Street (PO Box 659) Geelong VIC 3220
T (03) 5226 2301 | M 0419 266 474 | W www.barwonwater.vic.gov.au

To:
MJG
27/06/2016.

VICTORIA
State Government

Environment, Land, Water and Planning

Appendix Seven. CFA Fire Ready web site

Community Update
Blue Green Algae
Gerangamete, Birregurra, Whoorel, Winchelsea, Yeodene, Ricketts Marsh.
Effective June 28, 10:21 AM.
Incident Information:This update is being issued by Department of Environment, Land, Water and Planning for water quality in the Upper Barwon River and Boundary Creek between Winchelsea and Gerangamete. Incident Information:As a result of a naturally occurring increase in acidic water levels a large number of fish deaths have been reported. This event was caused by acidic water from Boundary Creek flowing into Barwon River. Boundary Creek occasionally experiences acidic water quality events due to natural sources of acid in the catchment. Corangamite Catchment Management Authority, Colac Otway Shire, Department of Environment, Land Water and Planning, Department of Health and Human Services and Agriculture Victoria are working together to respond to this incident. Response to this incident includes increased water quality monitoring. Towns impacted include Yeodene, Gerangamete, Birregurra, Whoorel, Ricketts Marsh, Winchelsea.Health & Wellbeing Information:It is advised you avoid contact with the river water as it may cause eye or skin irritation. People are advised not to handle or eat dead or dying fish or fish swimming erratically. Colac Otway Shire has placed signs advising of the hazards of swimming or consuming fish out of affected stretches of the river at the locations where recreational use of the river is prominent. Anyone with concerns about their health should seek medical advice or call NURSE-ON-CALL on 1300 60 60 24.Livestock and pets: Cattle, sheep and goats can tolerate drinking water that is more acidic. Farmers and livestock owners should watch for their stock refusing to drink water. If animals are reluctant to drink the available stream water an alternative supply should be found.Pigs, poultry and dogs are more sensitive to acidic water and an alternative water supply should be found for them. Domestic pets should be kept away from affected waterways. Landowners:If landowners impacted by this event want their water tested they can bring samples into the Corangamite CMA office in Colac for a pH test. Useful Information:Via www.emergency.vic.gov.au/ca Corangamite CMA during business hours on (03) 5232 9100Stay Informed:Colac Otway Shire Council has posted advice in nearby community centres such as the Birregurra General Store and Golf Club. More information can be found on www.ccma.vic.gov.au

Appendix Eight. ANSA & VRfish Victoria Happy with Media release stance.

From: **ANSA Victoria** ansavic@bigpond.com
Subject: RE: Barwon River Fish Kill
Date: 5 July 2016 at 17:44
To: Malcolm Gardiner otwaywater@yahoo.com.au
Cc:

Hi Malcolm,

My interest in the fish kill in the Barwon River comes from an email you sent to Jim O'Dowd which he forwarded to me as a concerned member of an ANSA
Club. As secretary of ANSA Victoria I sent an enquiry to VRFish requesting information. And also spoke to a friend who works for Barwon Water. From the responses I received I am comfortable with the theory that the recent fish kill is due to a natural occurance.

See attached information that I received. (Same as DELW7 Release 23 June 2016.)

Regards

ANSA Victoria
Phone: 03 52435703
Mobile: 0408108451

"SPORT, COSERVATION, INTEGRITY"

Appendix Nine. Newspaper Cuttings.

www.colacherald.com.au 22 June 2016

District's fish deaths prompt investigation

by Devon McGillicuddy

The Environment Protection Authority has investigated a fish kill in two spots of the Barwon River upstream from Winchelsea.

EPA acting southwest regional manager Carolyn Francis confirmed acidic water killed eels and carp along the river.

"An EPA officer investigated the site yesterday and confirmed about 10 to 15 dead eels and carp along the two stretches of the river," Ms Francis said.

"The officer measured low pH, acidic, water in the Barwon River and Boundary Creek; no direct discharged point was determined," she said.

"It is likely that water quality is due to natural causes; in this case runoff from acid-containing soils in the area."

Kawarren resident and water campaigner Malcolm Gardiner said there were "massive amounts" of blackfish, carp and eels that had died along the stretch of river from Boundary Creek to at least Conns Road Bridge.

Mr Gardiner said he believed the cause of the fish kill was from the Big Swamp on Boundary Creek at Yeodene.

"Extensive groundwater extraction at Barwon Downs is the major contributing factor causing the Big Swamp to dry out, creating enormous amounts of acid and heavy metal toxins," he said.

"This type of event has been on the cards for some considerable time and present day predictions forecast that this type of episode will happen on a regular basis until a natural balance in the depleted aquifer has been restored."

Mr Gardiner said the State Government's decision to move Geelong onto Melbourne's water system would help avert future fish kills in the river.

But Mr Gardiner has called for action to prevent further fish kills.

DEAD FISH: Andrew McLennan inspects the Barwon River where acidic water has killed fish.

Water unhealthy for stock, people

Colac Herald 27 June 2016.

Authorities are warning people to avoid handling or eating dead fish from the Barwon River and Boundary Creek after a spate of fish deaths.

The Corangamite Catchment Management Authority said a naturally occurring increase in acidic water levels killed fish in the Barwon River upstream from Winchelsea and the creek.

People should avoid touching or eating fish swimming erratically and avoid contact with the river water because it could cause eye or skin irritation.

CCMA chief Gareth Smith said cattle, sheep and goats were likely to refuse to drink the water and farmers should source alternative water.

Mr Smith said pets had a lower tolerance to acidic water and pet owners should keep pets away from the waterways.

The CCMA is working with Colac Otway Shire Council, the Department of Environment, Land, Water and Planning, the Department of Health and Human Services and Agriculture Victoria to respond to the incident.

"Boundary Creek occasionally experiences acidic water quality events due to natural sources of acid in the catchment," Mr Smith said.

"In the past once the water from Boundary Creek reached the Barwon River, the acidic water has quickly diluted and there has been no significant environmental impact downstream," he said.

"In this situation the acidic water from Boundary Creek has also caused an acid event in the Barwon River.

"This is a result we have not seen in the past, and is likely the result of dry conditions across the catchment that have reduced flows in the Barwon River.

"We have increased water quality monitoring to track the impact on the river."

Mr Smith said landowners concerned about water at their properties could have CCMA test their water by taking a water sample to the authority's Colac office at the corner of Hesse and Dennis streets.

"Colac Otway Shire Council has placed signs advising of the hazards of swimming or consuming fish out of affected stretches of the river at the locations where recreational use of the river is prominent," he said.

"In addition, the council will ensure this same advice is available in nearby community centres such as the Birregurra General Store and golf club."

Rivers remain unsafe

Colac Herald 4 July 2016

Authorities are reminding people to avoid contact with water in Boundary Creek and the Upper Barwon River after fish deaths last month.

The Department of Environment, Land, Water and Planning said an increase in naturally occurring acidic water levels in the waterways meant contact with the river water could cause eye or skin irritation in humans.

People should continue to avoid touching or eating dead or dying fish from these waters.

DEWLP warned landowners to keep animals away from the affected waterways at Birregurra, Yeodene, Whoorel, Ricketts Marsh, Winchelsea and Gerangamete.

Landowners concerned about their water quality can take samples from their properties to the Corangamite Catchment Management Authority office at the corner of Dennis and Hesse streets, Colac, for testing.

Anyone with concerns about their health should seek medical advice or call NURSE-ON-CALL on 1300 606 024.

No surprise in deaths

It came as no surprise to hear of a significant fish kill below the confluence of Boundary Creek and the Barwon River. It was not a matter of if, but more a matter of when.

Some time after the fish kill, I visited the Big Swamp area of Boundary Creek and did some pH water testing. Water entering the swamp margins registered between 6pH and 7pH, very close to neutral.

Below the Big Swamp at the Colac to Forrest Road Bridge, the Boundary Creek water tested between 4pH and 5pH, 100 times more acidic.

More alarming than that, are the 2pH to 3pH readings I was able to take throughout the swamp.

These readings were one metre below the surface in a rising water table indicating a massive ability for the peat to continue producing huge volumes of acid.

The Big Swamp is blooming and brewing up a cocktail of many more surprises, and will show the 2015 vegetation study completed by Barwon Water to be uninformed and inaccurate when it states the Big Swamp is in recovery mode from fire and potentially low soil pH.

Malcolm Gardiner,
Kawarren

Pumping kills fish

Recent fish kills in the Barwon River were entirely predictable given Barwon Water over-pumping of Colac district water tables.

Families living for generations in the Boundary Creek area can attest that peat swamps never dried up prior to Barwon Water's commencement of pumping from the Barwon Downs borefield in the 1980s.

Potential acid sulphate soils, PASS, occur naturally in coastal swamps, estuaries and some inland peat swamps like Boundary Creek and can be safe as long as they remain submerged under water.

When dried out and allowed to oxidise, they become dangerous actual acid sulphate soils, AASS, producing enough sulphuric acid to dissolve toxic heavy metals that are otherwise chemically bound up in the soil.

After substantial rain following the recent long dry period, the acid has mixed with water and is now flowing into district watercourses, killing most things living in the streams.

The EPA has strict rules in place to control and dispose of AASS in coastal and industrial settings because of the well-recognised threat the soils pose to human and environmental health.

Sadly, the EPA failed to protect either fish or environment but instead protected its Barwon Water mates when it investigated the cause of dying fish and eels downstream of the Boundary Creek AASS. The simple truth is that Barwon Water negligence has directly created the conditions for PASS to become AASS.

Both Barwon Water and the EPA are now covering up AASS. If Sarah Henderson can fix the CFA dispute, she should fix this as well.

Neil Longmore,
Gellibrand River

DANGER ZONE: Acid leaching from acid sulphate soils has killed fish in Boundary Creek and the Barwon River.

6 | Colac Herald, Wednesday, June 29, 2016

Colac Herald, Wednesday, July 13, 2016 | 3

Fish kill claims were incorrect

A letter to the editor on Wednesday, June 29, is inaccurate.

Mr Neil Longmore makes an unfounded and highly offensive allegation that Barwon Water is involved in a cover up of acid sulphate soils.

Further, he alleged the corporation was negligent by over-pumping of water tables creating acid sulphate soils that were responsible for the kills.

Investigations, in fact, found the water quality in the river was likely due to natural causes – in this case, run-off from acid containing soils in the area, namely Big Swamp.

Mr Longmore fails to acknowledge a range of factors may have created these soils, including drought, fire, man-made draining, farming practices, groundwater pumping and, possibly, others. Investigations are ongoing.

What is clear is that parts of the Otways experienced the driest spring-summer on record during 2015-16.

Also, Barwon Water has expanded its monitoring program around the Barwon Downs borefield, particularly new sites of interest, including those suspected of containing acid sulphate soils.

The corporation also has been working with a local community reference group on the scope of its monitoring program.

Joe Adamski,
managing director,
Barwon Water

4 | Colac Herald, Friday, July 15, 2016

OPINION

Pumping pressure

It is gratifying to read in Wednesday's *Colac Herald* Joe Adamski, managing director of Barwon Water, has accepted that the Big Swamp at Yeodene is a site of contamination.

But for him to be surprised and offended that Barwon Water and the EPA have been accused of a cover up regarding the cause of this fish kill, should come as no surprise.

Whatever the story it is blatantly obvious strenuous efforts are being made to blame the recent fish kills down the Barwon River as natural

Dry out the Big Swamp and a natural reaction will take place. However, what all of the Government authorities are not prepared to even vaguely look at, is the unnatural human activity events triggering this so called natural occurrence.

Barwon Water's own data and that collected by the LAWROC Landcare Group, strongly indicate the major contributing cause of the Big Swamp's present demise is groundwater extraction for urban use by Barwon Water.

What Mr Adamski fails to state is that the ongoing investigations he talks about have been ongoing since the 1970s.

The best that Barwon Water officers can do is sweep several of these studies under the carpet and make a fresh start from 2013.

How many more decades will it be before the benefactor of groundwater extraction will come to the conclusion that is staring them in the face?

Mr Adamski's letter also mentions Barwon Water is working with a local community reference group. This reads well. However, this group has not met for over six months and with a multitude of community concerns outstanding, it is probably time to meet again.

Malcolm Gardiner,
Kawarren

River's water quality improving

Corangamite Catchment Management Authority says the acidic water in the Barwon River has "largely dissipated".

CCMA chief executive officer Gareth Smith said the increased rainfall and river flow has caused the pH levels in a majority of the affected stretch of river to return to normal.

The acidic water environment caused multiple fish deaths in the upper Barwon River and Boundary Creek, upstream of Winchelsea in late June.

Mr Smith said the pH levels in the upper Barwon River, from Birregurra to Winchelsea, had returned to normal but Boundary Creek still had acidic water levels.

"pH levels in Boundary Creek, which has history of acidic water quality events due to natural sources of acid in the catchment, remains low and continues to affect the upper Barwon River for a short stretch downstream from the Boundary Creek confluence," he said.

Mr Smith said people could identify stretches of the river still affected by acidity by unusually clear water.

"Where river water is still displaying low pH it is advised to avoid contact with the water and source alternative supplies of drinking water for stock and pets," he said.

Landowners who are concerned about the acidity in the river can take samples of water into the Corangamite CCMA office in Colac for testing.

Misleading claim

Isn't it interesting how easily it can be stated pH levels in Boundary Creek have been historically acidic when not bothering to carry out a background check, *Colac Herald* July 18.

If history were to have started a few years ago this statement would be accurate.

However, going back to 1912 and checking the facts tells that acidic water flowing down Boundary Creek is a most recent happening.

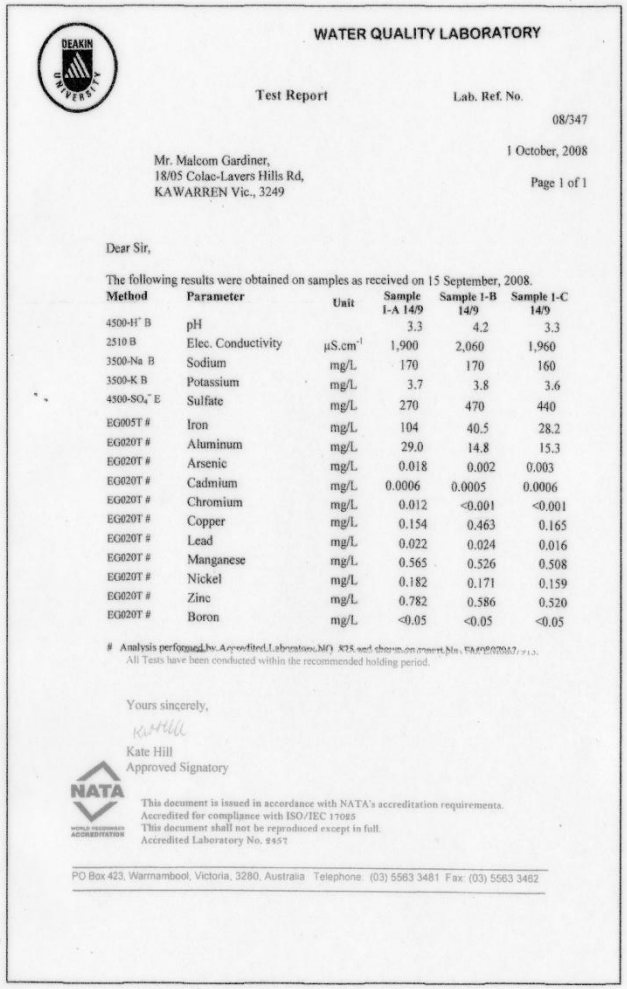
Also, continuing to claim that the sole reason for the recent fish kill down the Barwon River is due to natural causes is a typical example of a factoid.

Just because a statement appears in print does not automatically mean it is correct.

Factoids have no existence before appearing in a newspaper or media release and are not so much lies as products attempting to manipulate the "Silent Majority".

Until scientifically rigorous research supports the above statements the "Silent Majority" will not be fooled.

Malcolm Gardiner,
Kawarren



WATER QUALITY LABORATORY

Test Report

Lab. Ref. No. 08/347

1 October, 2008

Page 1 of 1

Mr. Malcom Gardiner,
18/05 Colac-Lavers Hills Rd,
KAWARREN Vic., 3249

Dear Sir,

The following results were obtained on samples as received on 15 September, 2008.

Method	Parameter	Unit	Sample 1-A 14/9	Sample 1-B 14/9	Sample 1-C 14/9
4500-H+ B	pH		3.3	4.2	3.3
2510 B	Elec. Conductivity	µS.cm-1	1,900	2,060	1,960
3500-Na B	Sodium	mg/L	170	170	160
3500-K B	Potassium	mg/L	3.7	3.8	3.6
4500-SO4 E	Sulfate	mg/L	270	470	440
EG005T #	Iron	mg/L	104	40.5	28.2
EG020T #	Aluminum	mg/L	29.0	14.8	15.3
EG020T #	Arsenic	mg/L	0.018	0.002	0.003
EG020T #	Cadmium	mg/L	0.0006	0.0005	0.0006
EG020T #	Chromium	mg/L	0.012	<0.001	<0.001
EG020T #	Copper	mg/L	0.154	0.463	0.165
EG020T #	Lead	mg/L	0.022	0.024	0.016
EG020T #	Manganese	mg/L	0.565	0.526	0.508
EG020T #	Nickel	mg/L	0.182	0.171	0.159
EG020T #	Zinc	mg/L	0.782	0.586	0.520
EG020T #	Boron	mg/L	<0.05	<0.05	<0.05

Analysis performed by Accredited Laboratory NO. 825 and shown on report No. EM0809047/713.
All Tests have been conducted within the recommended holding period.

Yours sincerely,

Kate Hill
Approved Signatory

NATA
WORLD RECOGNISED ACCREDITATION

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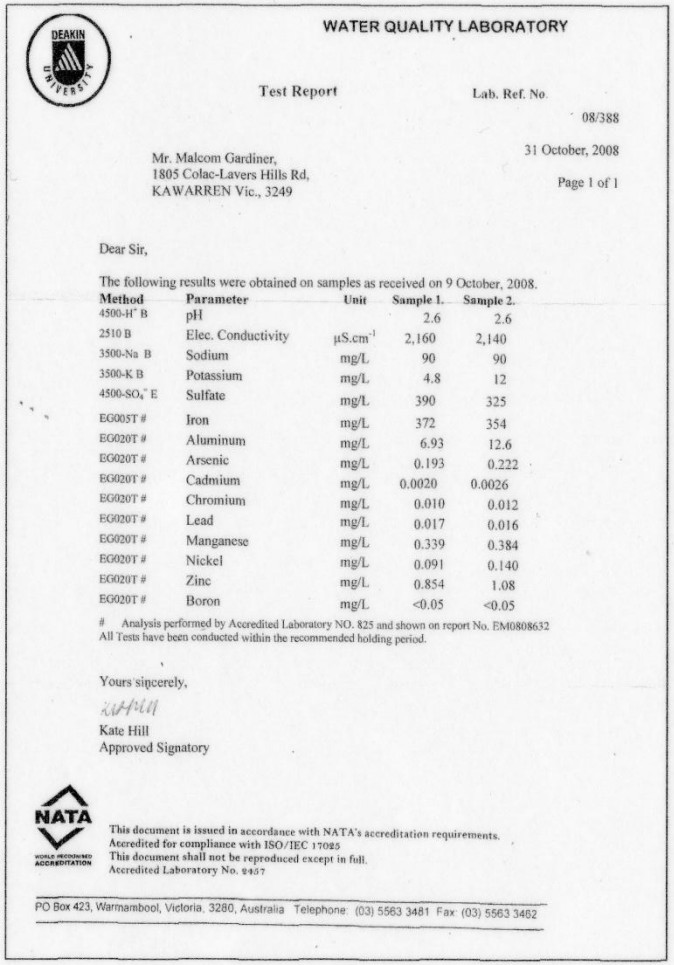
Accredited Laboratory No. 9457

PO Box 423, Warrnambool, Victoria, 3280, Australia Telephone: (03) 5563 3481 Fax: (03) 5563 3462



WATER QUALITY LABORATORY

Test Report

Lab. Ref. No. 08/388

31 October, 2008

Page 1 of 1

Mr. Malcom Gardiner,
1805 Colac-Lavers Hills Rd,
KAWARREN Vic., 3249

Dear Sir,

The following results were obtained on samples as received on 9 October, 2008.

Method	Parameter	Unit	Sample 1.	Sample 2.
4500-H+ B	pH		2.6	2.6
2510 B	Elec. Conductivity	µS.cm-1	2,160	2,140
3500-Na B	Sodium	mg/L	90	90
3500-K B	Potassium	mg/L	4.8	12
4500-SO4 E	Sulfate	mg/L	390	325
EG005T #	Iron	mg/L	372	354
EG020T #	Aluminum	mg/L	6.93	12.6
EG020T #	Arsenic	mg/L	0.193	0.222
EG020T #	Cadmium	mg/L	0.0020	0.0026
EG020T #	Chromium	mg/L	0.010	0.012
EG020T #	Lead	mg/L	0.017	0.016
EG020T #	Manganese	mg/L	0.339	0.384
EG020T #	Nickel	mg/L	0.091	0.140
EG020T #	Zinc	mg/L	0.854	1.08
EG020T #	Boron	mg/L	<0.05	<0.05

Analysis performed by Accredited Laboratory NO. 825 and shown on report No. EM0808632
All Tests have been conducted within the recommended holding period.

Yours sincerely,

Kate Hill
Approved Signatory

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Appendix Eleven. 2016 Water Test Analysis.

RESULTS OF WATER ANALYSIS (Page 1 of 1)

14 samples supplied by Land & Water Resource Otway Range on the 27th June, 2016 - Lab. Job No. F1340

Analysis requested by Malcolm Gardiner - **Your Project: Creek Water- Fish kills**

(1805 Colac-Lavers Hill Road KAWARREN VIC 3249)

PARAMETER	METHODS REFERENCE	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8	Sample 9	Sample 10	Sample 11	Sample 12	Sample 13	Sample 14
		Sample 1	Sample 2	Sample 3	Sample 4	Sample 6	Sample 7	Sample 8	Sample 9	Sample 10	Sample 11	Sample 12	Sample 13	Sample 14	Sample 15
	Job No.	F1340/1	F1340/2	F1340/3	F1340/4	F1340/5	F1340/6	F1340/7	F1340/8	F1340/9	F1340/10	F1340/11	F1340/12	F1340/13	F1340/14
pH	APHA 4500-H+	4.60	4.55	4.54	4.42	3.56	3.88	2.97	2.76	6.51	6.69	6.67	5.52	6.45	7.64
CONDUCTIVITY (EC) (dS/m)	APHA 2510-B	0.92	0.91	0.92	1.06	2.21	1.87	2.01	3.06	0.46	0.43	1.38	1.35	0.71	1.32
TOTAL DISSOLVED SALTS (mg/L)	calculation using EC x 680	628	619	626	719	1,501	1,274	1,370	2,081	313	293	935	917	482	894
ACIDITY (to pH 5.5) (mg/L $CaCO_3$ equivalent)	** Total Acidity - APHA 2310B	36	34	42	72	469	699	802	1459	0	0	0	0	0	0
ACIDITY (to pH 7.0) (mg/L $CaCO_3$ equivalent)	** Total Acidity - APHA 2310B	45	45	59	96	578	866	968	1937	1	3	3	4	2	0
ACIDITY (to pH 8.3) (mg/L $CaCO_3$ equivalent)	** Total Acidity - APHA 2310B	51	51	67	106	606	895	987	1992	5	6	5	5	3	3
CHLORIDE (mg/L)	APHA 4500-Cl^-	180	170	170	180	230	120	110	95	110	93	260	270	180	300
SULPHATE (mg/L SO_4^{2-})	APHA 3125 ICPMS *note 1&2	141	144	144	210	900	1,050	990	1,890	<9	17	174	171	22	12
CHLORIDE/ SULPHATE RATIO	Calculation	1.3	1.2	1.2	0.9	0.3	0.1	0.1	0.1	n/a	5.6	1.5	1.6	8.3	24.4
DISSOLVED IRON (mg/L)	APHA 3125 ICPMS *note 1&2	0.092	0.086	0.100	0.110	1.10	0.870	52.0	366	0.171	0.075	0.010	0.051	0.450	0.490
DISSOLVED ALUMINIUM (mg/L)	APHA 3125 ICPMS *note 1&2	6.50	6.70	8.40	15.0	98.0	160	140	201	0.089	0.010	0.008	0.290	0.087	0.070
SILVER (mg/L)	Dissolved - APHA 3125 ICPMS *note 1&2	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
ARSENIC (mg/L)	Dissolved - APHA 3125 ICPMS *note 1&2	0.001	0.001	0.002	0.002	0.010	0.015	0.029	0.071	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CADMIUM (mg/L)	Dissolved - APHA 3125 ICPMS *note 1&2	<0.001	<0.001	<0.001	<0.001	0.001	0.002	0.004	0.012	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
CHROMIUM (mg/L)	Dissolved - APHA 3125 ICPMS *note 1&2	<0.001	<0.001	<0.001	<0.001	0.003	0.003	0.009	0.045	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
COPPER (mg/L)	Dissolved - APHA 3125 ICPMS *note 1&2	0.011	0.001	0.001	<0.001	0.002	0.002	0.002	0.043	<0.001	0.001	<0.001	0.003	<0.001	<0.001
MANGANESE (mg/L)	Dissolved - APHA 3125 ICPMS *note 1&2	0.600	0.710	0.270	0.170	0.380	0.230	0.130	0.220	0.002	0.013	0.290	1.10	0.013	0.021
NICKEL (mg/L)	Dissolved - APHA 3125 ICPMS *note 1&2	0.040	0.041	0.039	0.061	0.320	0.490	0.490	2.161	0.001	<0.001	0.010	0.037	0.002	0.002
LEAD (mg/L)	Dissolved - APHA 3125 ICPMS *note 1&2	<0.001	<0.001	<0.001	<0.001	0.002	0.002	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
SELENIUM (mg/L)	Dissolved - APHA 3125 ICPMS *note 1&2	<0.005	<0.005	<0.005	<0.005	0.010	0.013	0.021	0.042	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
ZINC (mg/L)	Dissolved - APHA 3125 ICPMS *note 1&2	0.230	0.250	0.220	0.410	2.000	3.400	3.500	17.200	0.016	<0.005	0.056	0.240	<0.005	<0.005
MERCURY (mg/L)	Dissolved - APHA 3125 ICPMS *note 1&2	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

Notes:

1. Dissolved metals - samples filtered through 0.45µm cellulose acetate and then acidified with nitric acid prior to analysis
2. Metals analysed be ICP-MS (Inductively Coupled Plasma - Mass Spectrometry) or ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry)
3. 1 mg/L (milligram per litre) = 1 ppm (part per million) = 1000 µg/L (micrograms per litre)= 1000 ppb (part per billion)
4. For conductivity - 1 dS/m = 1 mS/cm = 1000 µS/cm
5. Analysis performed according to APHA, 2012, "Standard Methods for the Examination of Water & Wastewater", 22nd Edition, except where stated otherwise.

Environmental Analysis Laboratory, Southern Cross University,
Tel. 02 6620 3678, website: scu.edu.au/eal

checked: ....
Graham Lancaster
Laboratory Manager

Appendix Twelve. Drinking Water Standards

WATER ANALYSIS - CHEMICAL AND MICROBIOLOGICAL

GUIDELINES FOR DRINKING, DOMESTIC USE, IRRIGATION AND LIVESTOCK

Parameter	Method Reference	#Guideline Drinking	#Guideline Irrigation (Long term 100yrs)	#Guideline Livestock
pH	APHA 4500-H+	*6.5 - 8.5	6-9.0	--
Conductivity (dS/m)	APHA 2510	<0.8	<0.8	<4.8
Total Dissolved Solids (mg/L)	By Calculation	*<600	<500	<3000
Turbidity (NTU)	APHA 2130	*<5	--	--
Hardness (mg/L) (total as CaCO3)	APHA 2340	*<200	--	--
Alkalinity (mg/L) (total as CaCO3)	APHA 2320	--	--	--
Cadmium (mg/L)	APHA 3120 ICPMS	<0.002	<0.01	<0.01
Copper (mg/L)	APHA 3120 ICPMS	<2.0	<0.2	<0.4
Iron (mg/L)	APHA 3120 ICPMS	*<0.3	<0.2	--
Lead (mg/L)	APHA 3120 ICPMS	<0.01	<2	<0.1
Manganese (mg/L)	APHA 3120 ICPMS	*<0.1	<0.2	--
Zinc (mg/L)	APHA 3120 ICPMS	*<3	<2	<20
Arsenic (mg/L)	APHA 3120 ICPMS	<0.01	<0.1	<0.5
Nickel (mg/L)	APHA 3120 ICPMS	<0.1	<0.2	<1
Aluminium (mg/L)	APHA 3120 ICPMS	*<0.2	<5	<5
Boron (mg/L)	APHA 3120 ICPOES	<4	<0.5	--
Nitrate (mg/L N)	APHA 4500 NO3-F	<10	--	<400
Nitrite (mg/L N)	APHA 4500 NO2-C	<1	--	<30
Ammonia (mg/L N)	APHA 4500 NH3-H	*<0.5	--	--
Phosphate (mg/L P)	APHA 4500 P-G	--	<0.05	--
Sodium (mg/L)	APHA 3120 ICPOES	<180	<350-750	--
Potassium (mg/L)	APHA 3120 ICPOES	--	--	--
Calcium (mg/L)	APHA 3120 ICPOES	--	--	<1000
Magnesium (mg/L)	APHA 3120 ICPOES	--	--	<2000
Sodium Adsorption Ratio	By Calculation	--	<5.0	--
Chloride (mg/L)	APHA 4500 Cl-	*<250	<30-700	--
Sulphate (mg/L)	APHA 3120 ICPOES	<500	250	<1000
Total Coliforms (cfu per 100ml)	APHA 9222-C	Site Specific	--	--
Faecal Coliforms (cfu per 100ml)	APHA 9222-E	0 (<1)	<100	<100

1 mg/L (milligram per litre) = 1 ppm (part per million); 1 dS/m = 1 mS/cm = 1000 µS/cm; cfu = colony forming units

* Recommended level not directly health related but relates to the aesthetic quality of the water.

ANZECC Guidelines for Fresh and Marine Water Quality-Vol 1 – The Guidelines, October 2000. NHMRC, Australian Drinking Water Guidelines 6, 2012

Environmental Analysis Laboratory, Southern Cross University, Lismore, NSW.

*

Appendix Thirtenn. Forrest Rainfall

Australian Government
Bureau of Meteorology

RAINFALL OBSERVATIONS

F71 / Mat. No. 5021(
December 201

AT FORREST YEAR 201(

ALL ENTRIES IN MILLIMETRES TO ONE DECIMAL PLACE

Day of the week shown in the left hand column for each mon

DATE	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DATE
1	F	M 17.0	Tu	F	S	W	F 11.8	M 6.4	Th 2.6	Sat	Tu	Th	1
2	Sat	Tu	W	Sat	M 52.2	Th	Sat	Tu 8.0	F 3.8	S	W	F	2
3	S	W 8.0	Th	S	Tu	F 0.8	S	W 1.8	Sat	M	Th	Sat	3
4	M 0.6	Th	F	M	W 14.8	Sat	M 8.0	Th 0.8	S	Tu	F	S	4
5	Tu	F	Sat	Tu	Th	S	Tu 3.4	F 0.4	M	W	Sat	M	5
6	W	Sat	S	W 12.1	F	M 7.2	W 15.0	Sat	Tu	Th	S	Tu	6
7	Th 4.4	S	M 1.4	Th 3.8	Sat	Tu 2.4	Th 0.4	S	W 1.4	F	M	W	7
8	F	M	Tu	F	S	W 8.2	F 5.4	M 0.2	Th	Sat	Tu	Th	8
9	Sat	Tu	W	Sat	M 5.8	Th	Sat	Tu 0.2	F 35.4	S	W	F	9
10	S	W	Th	S	Tu 28.0	F 13.8	S	W 6.0	Sat	M	Th	Sat	10
11	M	Th	F	M	W 13.4	Sat	M 7.2	Th 16.0	S	Tu	F	S	11
12	Tu	F	Sat	Tu 4.4	Th 21.6	S	Tu 6.0	F 0.8	M 14.2	W	Sat	M	12
13	W	Sat	S	W 0.8	F 4.4	M	W 22.2	Sat	Tu 7.2	Th	S	Tu	13
14	Th	S	M	Th	Sat	Tu	Th 12.2	S	W 37.2	F	M	W	14
15	F	M 1.0	Tu 12.2	F	S	W	F 1.8	M 10.0	Th 9.0	Sat	Tu	Th	15
16	Sat	Tu 2.6	W	Sat	M 1.0	Th	Sat	Tu 0.2	F 4.4	S	W	F	16
17	S	W	Th 0.6	S	Tu 10.6	F 21.0	S	W 3.2	Sat	M	Th	Sat	17
18	M	Th	F 20.2	M 0.3	W 0.4	Sat	M 1.4	Th	S	Tu	F	S	18
19	Tu	F 0.4	Sat	Tu	Th 0.8	S	Tu 0.4	F 12.0	M	W	Sat	M	19
20	W 1.6	Sat	S	W	F 8.0	M 0.2	W	Sat	Tu	Th	S	Tu	20
21	Th 6.6	S	M 7.2	Th 1.0	Sat	Tu 4.8	Th 2.0	S	W	F	M	W	21
22	F 2.6	M	Tu	F 2.4	S	W 11.0	F 25.0	M 36.8	Th	Sat	Tu	Th	22
23	Sat	Tu	W	Sat	M 11.4	Th 2.0	Sat	Tu 1.8	F	S	W	F	23
24	S	W 2.2	Th	S	Tu 7.6	F 10.0	S	W	Sat	M	Th	Sat	24
25	M 3.2	Th 17.4	F	M	W 0.2	Sat	M	Th 2.4	S	Tu	F	S	25
26	Tu	F 0.4	Sat	Tu	Th 18.6	S	Tu 43.0	F 1.6	M	W	Sat	M	26
27	W	Sat	S	W	F 4.8	M 14.4	W 4.8	Sat	Tu	Th	S	Tu	27
28	Th 6.6	S	M	Th	Sat	Tu 0.8	Th 11.2	S	W	F	M	W	28
29	F	M 0.2	Tu 2.0	F 1.8	S	W 1.4	F 3.0	M 0.8	Th	Sat	Tu	Th	29
30	Sat	W	Sat	M 3.4	Th 5.2	Sat	Tu	F	S	W	F	30
31	S	Th		Tu		S	W 4.2		M		Sat	31
Totals	19.6	49.2	43.6	26.6	201.0	103.2	184.2	113.6					
Number of Days	7	9	6.	8.	18.	15.	19.	20					

	Since 1st Jan.	2 months	3 months	4 months	5 months	6 months	7 months	8 months	9 months	10 months	11 months	Year
Totals	19.6	68.8	112.4	139.0	346.0	449.2	633.4	747.0				
Average All Years	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
	Since 1st Jan.	2 months	3 months	4 months	5 months	6 months	7 months	8 months	9 months	10 months	11 months	Year
Total Number of Days	7.	16.	22.	30.	48.	63.	82.	102.				

stmasters and Observers with display facilities are requested to exhibit this sheet in a conspicuous position.
end of year retain this sheet with rain register. The rain should be entered on the day it is measured.

Appendix Fourteen. Sample Site Data Sheets

Barwon River Fish Kill June 2016.

Water Sample Site Number 01.

Water Sample Number 01.

GPS Co-ordinates E S 38° 30 370.

N E 143° 32 937. = E 0722261
N 5734943.

Time 11.00. Date 21 / 6 /2016.

Site Description...

PHILIPS WINDMILL.

Visual Appearance of this Section of Water...

RIVER WATER - CRYSTAL CLEAR.
VISABILITY TO 6 METRES THROUGH THE
PROFILE MANY DEAD EELS CAN BE SEEN SITTING ON BASE OF STREAM.

Samples Taken by...

ANDREW McLENNAN.
DENNIS PHILIPS.

General Comments...

SAMPLE 01 & 01A WAS COLLECTED
@ 1.5 m FROM SURFACE.

DIMENSIONS OF STREAM 5 m WIDE.
~~BY 3~~ BY 3 m DEEP.

One Carp, 3 eels (still alive) - located top portion 0-0.5 m profile of water,

Barwon River Fish Kill June 2016.

Water Sample Site Number 02. 2

Water Sample Number 02.

GPS Co-ordinates E S 33° 23' 340.
N E 143° 46' 168. = E 0741884
N 5747391.

Time 12:30 . Bate 21 / 6 /2016.

Site Description...

COLAC - BINGEWURRA ROAD BRIDGE
DOWN FROM PHILIPS WINDMILL APPROX 350 M

Visual Appearance of this Section of Water...

CRYSTAL CLEAR BOTTOM OF
STREAM SECTION VISABLE APPROX 2 M TO
BASE OF STREAM.

Samples Taken by...

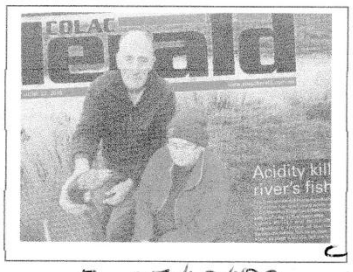
ANDREW MCGUINNESS.

General Comments...

SAMPLE 2 & 2A WAS COLLECTED
1 METER BELOW THE SURFACE.

1 DEAD EEL COULD BE
SEEN APPROXIMATELY 1 M DEEP
IN THE PROFILE LOOKED AGAINST A
TREE

Barwon River Fish Kill June 2016.



Water Sample Site Number 03. 3

Water Sample Number 3.

GPS Co-ordinates E S 38° 24' 550"

N 143 45' 196"

= E 0740402
N 5745195

Time 14:10. Bate 21 / 6 /2016.

Site Description...

A K D PLANTATION AT BARWON RIVER.
APPROX 1 KM UPSTREAM FROM DEN PHILIP.
(SITE 1)

Visual Appearance of this Section of Water... EXCELLENT. VISABILITY

PINE TREE STUMPS EVIDENT, CRYSTAL CLEAR, TO 6 M.
30-50 EUROPEAN CARP UP TO 6 KG.
FLOATING FLOATING & CALCAIT IN THE FRACTMITES.

Samples Taken by...

ANDREW MCKENNON.

General Comments...

ABOUT 10 M WIDE X 4 M DEEP.
NO VISABLE LIFE ROUND BE SEEN IN OR NEXT TO THE RIVER

*

Barwon River Fish Kill June 2016.

Water Sample Site Number 04 . 4

Water Sample Number 04 .

GPS Co-ordinates E S 38° 25' 038" .

N E 143° 44' 439" . = E 0739273
N 5744325

Time 15-38 . Bate ___/___/2016.

Site Description...

JUNCTION OF BARWON RIVER & BOUNDARY CREEK. BARWON RIVER CRYSTAL CLEAR 6 m VISABILITY BOUNDARY CREEK HAS SOME SEDIMENT COLLOIDAL PARTICLES PRESENT IN PROFILE .

Visual Appearance of this Section of Water...

A PLUME OF WATER FROM BOUNDARY CREEK WAS ENTERING BARWON RIVER APPROXIMATELY 0·3m x 0·3 m Mod flow.

Samples Taken by...

ANDREW McGOWAN .

ALLAN SHALLEY .

General Comments...

NO FISH OR ANY OTHER. LIFE FORMS WERE PRESENT AT THIS LOCATION .

Barwon River Fish Kill June 2016.

Water Sample Site Number 4B. 4B

Water Sample Number _____.

GPS Co-ordinates E S 38° 25' 011".

N E 143° 44' 538". = E 0739419
N 5744371

Time 15-58. Bate 21/6/2016.

Site Description...

BOUNDARY OF AKD PINES ABOUT 200 m BELOW ~~SOUTH~~ ~~LINE~~ ~~OF~~ OF W.S.S.N. 04.

Visual Appearance of this Section of Water...

CRYSTAL CLEAR, LARGE DEPOSITS OF ~~OF~~ WHITE PARTICULATE MATER ~~SETTLED~~ ACCUMULATED AGAINST THE FILAMENTS

Samples Taken by...

ANDREW McGENNAN. _____.

ALLAN SHALLEY. _____.

General Comments...

SAMPLE 4B ATTEMPTED TO COLLECT WHITE PARTICULATE MATTER. IN SAMPLE.

Barwon River Fish Kill June 2016.

F

Water Sample Site Number 05. 5

Water Sample Number 05.

GPS Co-ordinates E S 38° 25' 127".

N E 143° 44' 283". = E 0739041
N 5744168

Time 16.00. Bate 21 / 6 /2016.

Site Description...

SAMPLE COLLECTED APPROX 250-300 M UPSTREAM FROM BOUNDARY CREEK / BARWON RIVER JUNCTION. STREAM DIMENSIONS ABOUT 0.3 M x 0.3 M DEEP

Visual Appearance of this Section of Water...

COLLOIDAL PARTICULATE MATTER IS PRESENT IN THE PROFILE.

Samples Taken by...

ANDREW MCGINN.

ALLAN SHANLEY.

General Comments...

NO LIFE FORM COULD BE SEEN IN THIS SECTION CREEK.

Barwon River Fish Kill June 2016.

Water Sample Site Number 6 . 6

Water Sample Number _____ .

GPS Co-ordinates E S 38° 25' 270" .

N E 143° 43' 833" . = E 0738379
N 5743922.

Time 16-28 . Bate 21 / 6 /2016.

Site Description...

NAMES SHALLEYS BRIDGE ,
SAMPLE TAKEN DIRECTLY BELOW
THE BRIDGE .

Visual Appearance of this Section of Water...

CRYSTAL CLEAR.

Samples Taken by...

ANDREW McLENNAN . _____ .
ALLAN SHALLEY. . _____ .

General Comments...

NO LIFE FORMS PRESENT IN THIS
SECTION OF CREEK. .
~~FLOW~~ DIMENSIONS OF CREEK FLOW
0·3 m x 0·3 m mod flow.
REF; ALLAN SHALLEY BOUNDARY CREEK BEGAN
FLOWING ABOUT 3-4 WEEKS AGO.

Barwon River Fish Kill June 2016.

Water Sample Site Number 07.

Water Sample Number 07.

GPS Co-ordinates E 5 38° 25' 288".

N E 143° 42 838" = E: 0736930
N: 5743932.

Time 18:00. Bate 21 / 6 /2016.

Site Description...

COLAC – FORREST ROAD BRIDGE @ GAUGING STATION

Visual Appearance of this Section of Water...

WATER CLEAR @ COLLECTION SITE

Samples Taken by...

ANDREW McGOWAN.

General Comments...

NO LIFE FORMS PRESENT IN OR ON WATER IN STREAM.

Barwon River Fish Kill June 2016.

Water Sample Site Number 08 .

Water Sample Number 08 .

GPS Co-ordinates E 38° 25.333' .

N E 143° 42.144' .

NOTE : GPS MK 18 .
TO DOWNLOAD
E: 0735917
N: 5743879.

Time 18:28 . Bate 21 / 6 /2016.

Site Description...

ON BOUNDARY B/T NEIL STEWARTS PROPERTY & KNOWN ACID SULPHATE SOIL RESEARCH SITE (PEAT SWAMP SITE) @ LOCATION WHERE NEW GATE HAS BEEN ERECTED.

Visual Appearance of this Section of Water...

RED RESIDUE PRESENT BASE OF STREAM. GENERALLY CLEAR

Samples Taken by...

ANDREW McLEAN .

Comments...

No LIFE FORMS PRESENT IN STREAM AT COLLECTION POINT FOR WATER SAMPLE

Barwon River Fish Kill June 2016.

Water Sample Site Number 09.

Water Sample Number 9.

GPS Co-ordinates E 0735434.

N 5743952.

CPS 19-20-21
19 38° 25.301', 143° 41.811',
20 38° 25.301', 143° 41.812',
21 38° 25.300', 143° 41.812

Time 18:49. Bate 21/6/2016.

Site Description...

WATER SAMPLE FROM WITHIN THE KNOWN ASS SITE.

Visual Appearance of this Section of Water...

SHALLOW ~~the~~ INSPECTION PIT 1.2m DEEP. IN THE PEAT SWAMP. (MOST SOUTHERN PIT USED BY PHIL HUNST STUDY).

Samples Taken by...

ANDREW McGENNAN.

General Comments...

APPROXIMATELY 0.3 M OF WATER WAS PRESENT IN BASE OF INSPECTION PIT.

0.9 M TO SURFACE OF PEAT THAT HAD BEEN BURNT IS DRY & HYDROPHOBIC! WONT WET UP FROM WINTER RAIN

*

Barwon River Fish Kill June 2016.

Water Sample Site Number 10. 10

Water Sample Number 10.

GPS Co-ordinates E 0735020.

N 5743827. NO GPS DATA COLLECTED.

Time 19:22. Bate 21 / 6 /2016.

Site Description...

CONCRETE FORD. - FROGS CAN BE HEARD IN CLOSE PROXIMITY TO THIS SITE. SAMPLE TAKEN ABOVE PEAT SWAMP.

Visual Appearance of this Section of Water...

-BELOW

Samples Taken by...

ANDREW MCLENNAN.

General Comments...

WATER IS GENERALLY CLEAR IN COLOR BUT HAS SOME COLLOIDAL PARTICALS PRESENT.

Barwon River Fish Kill June 2016.

Water Sample Site Number S 12

Water Sample Number S 12 12

GPS Co-ordinates E_____.

N_____. NOT RECORDED.

Time _____. Bate 21 / 6 /2016.

Site Description...

KILDEEN LANE.

Visual Appearance of this Section of Water...

CRYSTAL CLEAR. THROUGH PROFILE OF WATER IN BARWON RIVER

Samples Taken by...

OUTSIDE COLLECTOR. _____.

_____. _____.

General Comments...

GPS DATA TO BE COLLECTED & SENT FOR REPORT.

Barwon River Fish Kill June 2016.

Water Sample Site Number 13. 13

Water Sample Number 13.

GPS Co-ordinates E 0734618.

N 5743827.

Time 12:00 Date 21/6/2016.

Site Description...

Seven Bridges Rd. crossing West Branch of the Barwon River

Visual Appearance of this Section of Water...

Clear water - not crystal clear
No sign of dead fish or other animals. phydrion test 6-7 pH

Samples Taken by...

Mal Cearelin

General Comments...

Looked normal,

*

Barwon River Fish Kill June 2016.

Water Sample Site Number 14. 14

Water Sample Number 14.

GPS Co-ordinates E 0726534.

N 5739974.

Time 12:30. Bate 21/6/2016.

Site Description...

Weir @ Streamflow Gauging Station on Ten Mile Creek. No. 235239.

Visual Appearance of this Section of Water...

As it normally looks. Make regular visits to this site - re: streamflow gauging. pH 6-7 (phydrion paper test)

Samples Taken by...

Mal Gardiner.

General Comments...

Barwon River Fish Kill June 2016.

Water Sample Site Number 15. 15

Water Sample Number 15.

GPS Co-ordinates E 0723907.

N 5736007.

Time 1:30 pm. Bate 21/6/2016.

Site Description...

Pompa Bill Creek SFG Station.
Visited daily to stream flow measure.
No change apparent
6-7 pH (phydrion papers used.)

Visual Appearance of this Section of Water...

As per usual daily visit

Samples Taken by...

Mal Gardiner. (Mal's property).

General Comments...

Appendix Fifteen. Data Supporting Stance that *"Extensive studies in the area have been unable to determine the reason why the swamp has dried."* And, the scientific data supporting the stance that the Fish Kill is a *"Natural occurrence."*

From: **Malcolm Gardiner**
Subject: Re: Barwon River Fish Kill
Date: 14 July 2016 at 11:05
To: lisa.neville@parliament.vic.gov.au

(2) Dear Minister,
Have you had a chance to look at this request?
Kind regards,
Malcolm.

Malcolm Gardiner
Email otwaywater@yahoo.com.au
www.otwaywater.com.au
Phone +61 3 52358325

(1) On 6 Jul 2016, at 09:09, Malcolm Gardiner <otwaywater@yahoo.com.au> wrote:

> Dear Minister,
> The EPA, the Colac Shire, DELWP, the CFA, the Department of Health and Human Services, Barwon Water, Agriculture Victoria and the CCMA are all supporting the argument with multiple media release that the fish kills in the upper reaches of the Barwon River are a result of a natural occurrence.
>
> Can you provide me with the process undertaken, and the evidence collected on which this decision was made?
>
> Malcolm Gardiner
> Email otwaywater@yahoo.com.au
> www.otwaywater.com.au

(1)

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(3)

From: **Ministerial.Mail@delwp.vic.gov.au**
Subject: BARWON RIVER FISH DEATH EVENT
Date: 27 July 2016 at 11:42
To: Malcolm Gardiner [redacted]

Dear Mr Gardiner

Please find attached your reply regarding the above subject matter.

If you are unable to read the attached document you may download the program 'Acrobat Reader' from the Adobe web site at http://www.adobe.com/

Kind regards

Ministerial Mail Team

Please note that this is an unmanned e-mail address. In order to ensure prompt consideration of any further correspondence please email Minister Neville directly on Lisa.Neville@parliament.vic.gov.au.

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Department of Environment
Land, Water & Planning

8 Nicholson Street
East Melbourne, Victoria 3002
PO Box 500
East Melbourne, Victoria 8002
www.delwp.vic.gov.au

Mr Malcolm Gardiner

Ref: MIN018058

otwaywater@yahoo.com.au

Dear Mr Gardiner

BARWON RIVER FISH DEATH EVENT

Thank you for your email of 6 July 2016 to the Hon Lisa Neville MP, Minister for Water about the recent fish death event in the Barwon River. As this matter is in my area of responsibility, I have been asked to respond on her behalf.

When a fish death event occurs in a waterway, the Environment Protection Authority (EPA) Victoria responds by investigating the incident to determine if pollution is the cause. In the case of the Barwon River fish death event, EPA Victoria conducted water quality testing along the relevant sections of waterways. This included Boundary Creek; Barwon River at Seven Bridges Rd, upstream of the Boundary Creek confluence; Barwon River at Birregurra-Deans Marsh Rd; Barwon River at Winchelsea-Deans Marsh Rd; and Barwon River on the north-west side of the Princess Hwy. The results showed that acidic water was entering the Barwon River from Boundary Creek.

EPA Victoria liaised with Corangamite Catchment Management Authority (CMA) and Colac Otway Shire and declared that the acidic water was not a pollution event and that the fish deaths were likely due to the natural acidic water event.

The event is likely a result of heavy rainfall in the Boundary Creek catchment flushing acidic water from Big Swamp into the Barwon River via Boundary Creek. In the past, this water was quickly diluted in the Barwon River. Due to dry conditions across the catchment the Barwon River had reduced flows at the time and the acidic water was not adequately diluted, which resulted in fish deaths.

Like many wetlands, Big Swamp at Yeodene has naturally occurring acid sulfate soils. Drying of the swamp has caused conditions where acid is more readily transported from the soils. Extensive studies in the area have been unable to determine the reason why the swamp has dried.

The Corangamite CMA is currently undertaking increased monitoring to track the impact of the acidic water on the river.

VICTORIA State Government

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(5) If you would like more information about this matter, please call Stephanie Ryan, Department of Environment, Land, Water and Planning, Barwon South West Regional Office on 03 5226 4725.

Thank you for raising this matter with the Minister.

Yours sincerely

26/7/2016

Paul Bennett
Executive Director Integrated Water and Catchments

Tried to contact Stephanie R. on 03 52 26[illegible] 725.
on 27/07/2016. Appeared to be a fax. Tried twice.

28/07/2016 Tried this number again. Same result.

28/07/2016 Tried to contact Kirsten Shelly. 9637 9654.
Didn't get past Kirsten's "minder" Tristan.
Told him of the inability to contact Stephanie
on this number. He would pass this on.

(See (6), had already sent an email off to Minister Neville re: this trouble contacting Stephanie.)

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(6)

From: **Malcolm Gardiner**
Subject: Ref. Number MINO18058, mail from P Bennett
Date: 27 July 2016 at 15:22
To: lisa.neville@parliament.vic.gov.au

Hello Minister,
Paul Bennett sent me a reply to a Barwon River fish kill query I had and he included a contact to follow up. It would appear that the phone number for Stephanie Ryan that Paul gave is a fax. Can you follow this up, please?
Kind regards,
Malcolm.

Malcolm Gardiner
Email otwaywater@yahoo.com.au
www.otwaywater.com.au
Phone +61 3 52358325

(7) Was able to "track down" Stephanie's phone number. I realised I had contact in her re: infra red sensoring of peat fires.
Rang her 28/07/2016. She was perplexed but said she would contact Paul Bennett in an attempt to clarify things.

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(8)

From: **Stephanie.Ryan@delwp.vic.gov.au**
Subject: Contact for Extensive Studies
Date: Today at 12:15
To: Malcolm Gardiner otwaywater@yahoo.com.au

Malcolm

I have received contact from the Water and Catchments Division in Melbourne. The contact for information regarding the extensive studies into the Big Swamp is Trevor McDevitt at Southern Rural Water. He can be contacted on 5564 1701 or 0438 681 219.

Regards
Stephanie

Stephanie Ryan | Regional Manager Fire and Emergency Preparedness | Community and Services Division | Barwon South West Region
Forest, Fire and Regions | Department of Environment, Land, Water & Planning
83 Gellibrand St, Colac, Victoria 3250
T: 03 5233 5547 | **M**: 0429 172 433 | **F**: 03 5233 5574 | **E**: stephanie.ryan@delwp.vic.gov.au
Note: My work days are Mon to Thurs

FOREST FIRE MANAGEMENT VICTORIA

www.delwp.vic.gov.au

(9) Rang Trevor M° 03/08/2016. He was extremely perplexed – no idea what studies, extensive or otherwise, had been done. He thought Angus Ramsey may be able to help. Trevor will follow this up.
To assist him I sent him/forwarded on, copies (1/2), (3/4/5), and (8).

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(10) 03/08/2016

Angus rang and left a message to contact him on his mobile 0419 509 087.

(11) 03/08/2016 I ran Angus R. about 2:55p.m.

The only studies on the Big Swamp he is aware of are (1) The 2015 Vegetation study conducted by Barwon Water as part of the gnd. extract^n licence for the Barwon Downs Borefield, and

(2) Fiona Glover's thesis.

He (Angus) will email me the link to Fiona's thesis as it is extremely big. (I believe Stewart Anderson sent me this link a few days ago.)

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9/8/16

Dear Minister,
Thank you for your efforts to have the answer to my query as set out below(email 6 ~~June~~ July
Unfortunately, Paul Bennett could not provide an answer. He passed the task onto Stephanie Ryan who had no idea. After contacting Paul, Stephanie referred me onto Trevor McDevitt of SRW. He passed the task onto Angus Ramsay of SRW. An explanation was unable to be provided.

Consequently, I was wondering whether you could try someone else? That would be appreciated.

Paul also made this statement as part of his email...
"Extensive studies in the area have been unable to determine the reason why the *swamp has dried.*"

This was most encouraging. Unfortunately, none of the above named people could provide a study that has looked at the cause of the Big Swamp drying out. If you can provide me with the name of any studies looking at the causes of the swamp drying out *and how they could be sourced, that would also be appreciated.*
Kind regards,
Malcolm.

Malcolm Gardiner
Email otwaywater@yahoo.com.au
www.otwaywater.com.au
Phone +61 3 52358325
>
>> **On 6 Jul 2016, at 09:09, Malcolm Gardiner <**otwaywater@yahoo.com.au**> wrote:**
>>
>> Dear Minister,
>> The EPA, the Colac Shire, DELWP, the CFA, the Department of Health and Human Services, Barwon Water, Agriculture Victoria and the CCMA are all supporting the argument with multiple media release that the fish kills in the upper reaches of the Barwon River are a result of a natural occurrence.
>>
>> Can you provide me with the process undertaken, and the evidence collected on which this decision was made?
>>
>> Malcolm Gardiner
>> **Email** otwaywater@yahoo.com.au
>> **www.otwaywater.com.au**

12

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Department of Environment
Land, Water & Planning

8 Nicholson Street
East Melbourne, Victoria 3002
PO Box 500
East Melbourne, Victoria 8002
www.delwp.vic.gov.au

Mr Malcolm Gardiner

Ref: MIN019454

otwaywater@yahoo.com.au

31 AUG 2016

Dear Mr Gardiner

BARWON RIVER FISH

Thank you for your email of 9 August 2016 to the Hon Lisa Neville MP, Minister for Water about the fish death event in the Barwon River. As this matter is in my area of responsibility, the Minister has asked that I respond on her behalf.

As mentioned in the letter dated 26 July 2016, the Environment Protection Agency (EPA) Victoria determined that the fish death event was most likely due to a natural acidic water event. The acidic water event was likely due to heavy rainfall flushing acidic water from Big Swamp into Boundary Creek, which then entered Barwon River. Normally, this acidic water would be diluted once it reached Barwon River, but due to very low flows in the Barwon River at the time, the acidic water was not diluted sufficiently and resulted in fish deaths.

In relation to your query about Big Swamp, a comprehensive study was undertaken by La Trobe University that focussed on better understanding acid sulphate soils in inland areas of the Corangamite Catchment Management Authority (CMA) region. One of the sites in the study was Yeodene peat swamp on Boundary Creek (Big Swamp).

The study found that Big Swamp is an actual acid sulphate soil site and the sulphides within the peat that have oxidised are producing acid and sulphate, which are entering Boundary Creek. As mentioned above, there is usually no significant environmental impact downstream, unless Barwon River is experiencing very low flows. The study did not identify the reason for the peat drying out, but it could be a result of multiple factors, including land use change, climate change, or groundwater extraction.

Barwon Water are conducting extensive studies in the Barwon Downs region, which includes Yeodene, as part of their Barwon Downs groundwater licence. As part of this work, Barwon Water are monitoring groundwater levels and pressures with up to 40 groundwater monitoring bores in the area.

In 2012, Barwon Water decided to expand their monitoring program, with endorsement from the Barwon Downs Groundwater Community Reference Group of which you are a member, to:

- better understand any potential environmental impacts of groundwater pumping;
- recognise how drought and land-use practices contribute to environmental issues; and
- provide additional monitoring and data analysis to support licence renewal in 2019.

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The expanded monitoring program also includes monitoring of potential acid sulphate soils, with investigations due to be completed in June 2017.

Once Barwon Water have submitted their licence renewal application, Southern Rural Water will undertake a resource assessment that will consider the balance between urban water supply and any impacts to the environment. The licence renewal process if due to be completed by June 2019.

The La Trobe University study can be found at:
http://arrow.latrobe.edu.au:8080/vital/access/manager/Repository/latrobe:41963

If you would like more information about the Barwon Downs monitoring program, please call Peter Morgan, Barwon Water on 1300 656 007 or email peter.morgan@barwonwater.vic.gov.au

Thank you for raising this matter with the Minister.

Yours sincerely

Paul Bennett
Executive Director Integrated Water and Catchments

(14)

VICTORIA State Government

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Email 7/9/2016

Dear Minister,

Thank you for having Paul Bennett write to me again regarding the query I asked of the fish kill down the Barwon River - Paul's ref: MIN019454, 31 August 2016.

It would appear that the EPA made a decision that the kill was "...most likely due to a natural acidic water event." From one very unscientific and cursory visit to the site five Government authorities were able to put out press and media releases that "paints" a picture that this event was a naturally occurring event. Something that can be expected to take place at anytime nature reaches such a point. No scientifically based basis or comment on the cause of this event has been given. The Big Swamp has been identified as the source of the toxins but no comment on why this swamp is producing this material. The conclusion reached by these 5 government authorities is based on conjecture and scant evidence.

Paul has answered the process and evidence collected to justify calling it a natural occurrence, and has explained how the EPA went about the process. The EPA has provided me with the data collected from its examination . Consequently, I believe there is no evidence supporting the definitive stance the authorities have jumped to - a natural occurrence ,normal, unfortunate and unavoidable? Nothing could be further from the truth.

Also Minister, could you once again asked Paul to provide the documents that he refers to when making the statement..."Extensive studies in the area have been unable to determine the reason why the swamp has dried out." (Paul,s Ref:MIN018058, 26/07/2016).
To my knowledge there has not been one study done by any authority that has specifically looked at why the Big Swamp has dried out, extensive or otherwise. The request I ask is .... could I be given a copy of, or reference to these extensive studies?

There are also a few comments I would appreciate you passing onto Paul for me regarding his latest letter written on your behalf - Ref: MIN019454, 31 August 2016.

1. Regarding the 2012 Barwon Water expansion of their monitoring program and his mention of my involvement, there a few things he needs to get correct. He should not blindly assume the information he is being fed is the way it is.
1.1 the 2012 expansion monitoring program was budgeted at around $2.9 million, as proposed by SKM, AND with no local input. No endorsement from me.
1.1.1 On the 24th of May 2013 I was advised by an officer of Barwon Water that "... it would be best to submit an FOI request." to gain access to the 2012 documentation.
1.2 the next edition of the expanded monitoring program dated 2013 was downgraded by Barwon Water to around a $1.5 million program, AND once again without local input.
1.2.1 In September 2013 when I became aware of the 2013 edition of the expanded monitoring program and asked for it, it was not made available to the BDGCRGroup until the December 2013 meeting. At this stage in September the first meeting of the Reference Group had not taken place.
1.3 In October 2013 the first meeting of the Barwon Down Groundwater Community Reference Group met.
1.4 Discussion, comment and decisions where being made about this 2013 expanded monitoring program long before a copy was made available to the Reference Group.
1.5 Even as a member of the Ref. Group I have had to source relevant documentation via the FOI process.

2. Paul also needs to be bought up to speed on the Acid Sulfate Soil monitoring.

(15)

2.1 When the ASS topic was raised at the Ref. Group I was able to inform the BW that our Landcare Group had found at least two other sites within the drawdown area of influence from the Barwon Downs Borefield. These were not known to the authors of the expanded monitoring program and is another indication of the lack of local involvement.
2.2 Our Landcare Group gained permission for BW to visit these sites.
2.3 On May 2014 we visited these and other sites with an SKM person who was an acid sulfate soil expert. Samples were collected.
2.4 At the next Ref. Group meeting it was stated that a report would be given on the ASS sites at the September meeting.
2.5 In September no report because more testing of the samples was needed.
2.6 I have made several request for a report on this work. 2016, two years later, and still no report. The latest holdup being landholder permission allowing the information collected to be be passed on, had not been gained.

3. Paul stated that the reason for the peat in the Big Swamp drying out could be the results of multiple factors including land use change, climate change, or groundwater extraction. He goes on to say that the BDDGCRGroup endorsed part of the expanded monitoring program to include land use change. However, Barwon Water regarded land use change as too costly and time consuming to give it a high priority.
The following comments highlight this fact.
3.1 On Page 15 of the pre meeting notes for the first Ref. Group meeting it states that the program did not identify impacts of land use change prior to 1986, but considers recent changes such as irrigation and dam construction.
3.2 Also, on page 15 it states that once groundwater extraction and drought impacts have been calculated any residual impacts will be attributed to land use change.
3.3
3.4 SKM's presentation given on 18 December 2013 had this to say "Hard to isolate groundwater impact from dominant land use change
So hard, nothing has been done.
3.5 Early ranking of issues by BW listed land use change as a plantation issue.
3.6 The very last Reference Group Issues and Prioritisation Sheets placed land use change (plantations) as a low priority and put it on hold. Nothing has been presented to the Reference Group regarding any land use change impact investigation.
3.7 The latest issues priority sheets, 14 April 2016, show there is no mention of land use change in outstanding things to finalise.
3.8 December meeting 2015 minutes, page 4, probably best highlights that little to nothing has been done in regard to land use change impacts.

Sorry about the lengthy email, but unless these things are bought to your attention little seems to change.

I would appreciate a reply regarding where I can access copies to the extensive studies Paul has referred to regarding the investigations into the reason for the Big Swamp drying up.

Kind regards,
Malcolm

(16)

Malcolm Gardiner
Email otwaywater@yahoo.com.au
www.otwaywater.com.au
Phone +61 3 52358325

Scan_20160820_090158.pdf

extracts of Ref Corp data etc supporting email 7/9/2016 to the Minister.

(17)

Email 12 Sep 2016 @ 15:57

Dear Mr Gardiner,

Thank you for your email dated 7 September regarding the Barwon River and Big Swamp.

As per the email from Paul Bennett dated 31 August, a study was undertaken by La Trobe University to investigate acid sulphate soils in the Corangamite Catchment Management region (including Big Swamp). However, as per our discussion this morning I can confirm that we are not aware of any studies that have been undertaken to determine the cause of Big Swamp drying out. The Corangamite Catchment Management Authority also confirmed this.

In the email from Paul Bennett, dated 31 August, the information about Barwon Water's monitoring program was from the Barwon Water website and Barwon Water.

Southern Rural Water have confirmed that they will be meeting with the Barwon Downs Community Reference Group to discuss the Barwon Water licence renewal process before the end of October. If you need more information about this, please contact Patrick O'Halloran, Manager, Licensing- Groundwater and Unregulated Systems, Water Resources Division, DELWP, **T**: 03 9637 8068 **E**: patrick.o'halloran@delwp.vic.gov.au

If you have any questions, please feel free to contact me.

kind regards,

Fiona Spruzen

Dr Fiona Spruzen | A/Assistant Manager Waterway Health | Integrated Water and Catchments
Water and Catchments | Department of Environment, Land, Water & Planning
Level 11, 8 Nicholson St, East Melbourne, Victoria 3002
T: 03 9637 9962 | **E**: fiona.spruzen@delwp.vic.gov.au

www.delwp.vic.gov.au

please note I am unavailable on Tuesdays

(18)

From: Malcolm Gardiner <otwaywater@yahoo.com.au>
To: Fiona.Spruzen@delwp.vic.gov.au,
Date: 13/09/2016 10:48 AM
Subject: A meeting of the big wigs?

Thanks for your email, Fiona, much appreciated.

Having SRW talk to the Reference Group in October will be welcomed but it does not overcome the belief our Landcare Group holds, that unless the decision makers above SRW and BW stop making decisions on what they are told from these two bodies nothing will change. The truth appears to us as token local input, decisions, directions and projects decided upon regardless of the environmental and local community impact. BW set up the Reference Group, manipulates the agenda, sets objectives, makes access to documents difficult (documents on which decisions are being made, sight unseen) and *are guilty of allowing poor scientific vigour in their* data collection.

Another little thing noticed on the BW web site last updated 15 April 2016, had this to say about their monitoring program. Misdirection.
. Possible acid Sulfate soils at Yeodene peat swamp.
. *Possible increased fire risk.*
A small "whinge" but there has never been any doubt since 1997 re the fire problem and since 2008 re the acid Sulfate soils issue. This is a misrepresentation of the facts and is only a mild example of the spin disseminated by BW.

SRW and BW *continue to act like "Cowboys" being unaccountable to anyone. The* people that should be keeping these two authorities accountable need to do more than ask SRW and BW are they doing the right things.

Once again our Landcare Group asks that the decision makers "sit around a table" with our Group, SRW and BW and discuss incompetence, failure to follow licence conditions, poor scientific research data collection and lack of openness and transparency to actions being taken.

Fiona, I am not sure whether the majority of this email should be directed to you or Patrick O'Halloran. If not your area of concern could you pass this on, please?

Kind regards,
And thank you for your efforts,
Malcolm.

(19)

From: Patrick O'Halloran/DSE/VICGOV1
To: "Malcolm Gardiner" <otwaywater@yahoo.com.au>,
Cc: Fiona Spruzen/DSE/VICGOV1@VICGOV1
Date: 20/09/2016 06:11 PM
Subject: *Fw: A meeting of the big wigs?*

Dear Mr Gardiner,

Thank you for your email to Fiona Spruzen.

Barwon Water's Barwon Downs groundwater licence in the Gerangamete GMA is due for renewal in June 2019. SRW has recently drafted the proposed renewal process. SRW will consult the Community Reference Group on the draft process by the end of October. A transparent and robust process is proposed to ensure relevant issues are identified and addressed by Barwon Water's technical investigations/assessments, the technical work is independently reviewed, the community is consulted and has access to the technical work and independent review.

As a member of the Community Reference Group you will have the opportunity to ensure your concerns are raised and addressed by the renewal process.

Kind regards,

Patrick O'Halloran|Manager - Licensing - Groundwater and Unregulated Systems |Water Resources
Water and Catchments | Department of Environment, Land, Water & Planning
Level 10/8 Nicholson St, Melbourne, Victoria, 3000
T: 03 9637 8068 | **M:** 0458 385 069 |**E:** patrick.o'halloran@delwp.vic.gov.au

(20)

October 24 2016

Dear Mr Gardiner,

In my email below of 20 September 2016, I advised that SRW expected to consult with the Community Reference Group by the end of this month on the draft process for renewal of Barwon Water's Barwon Downs groundwater licence. Changed circumstances mean that this consultation will not occur by the end of the month.

While the exact timing of consultation is uncertain at this stage you can be assured that the community reference group will be consulted as previously advised.

If you have questions about the renewal process you should liaise with SRW who will be responsible for managing the renewal. You can contact Angus Ramsay, Acting Manager Licensing Administration at any time on [redacted] or email AngusR@SRW.com.au.

Kind regards,

Patrick O'Halloran|Manager - Licensing - Groundwater and Unregulated Systems |Water Resources
Water and Catchments | Department of Environment, Land, Water and Planning

Level 10/8 Nicholson St, Melbourne, Victoria, 3000
T: [redacted] | **M:** [redacted] |**E:** patrick.o'halloran@delwp.vic.gov.au

21

24|10|2016

Hello Patrick,,
Thanks for your email below.
It seems like a very good idea for SRW to talk to the Reference Group but even though our Landcare Group sees this as worthwhile, it is something entirely different to our Group's initial request and reason for Sabine and Randal meeting with us earlier this year.

What you are proposing misses quite a few points.
1. Our Group wishes to meet with the Water Minister not those people with whom our community has come to have no confidence in.
2. This proposed Reference Group meeting excludes both Tricia and Belinda from discussions which is seen as extremely rude.
3. The work of the Reference Group has a restricted brief that does not cover all of our Group's concerns and is an entirely inappropriate forum to adress these concerns. This is a reference group that can only make recommendations that may or may not be implemented. It is also seen as a group selected, run and directed by Barwon Water.

4. One of our major issues is the manner in which both SRW and BW conduct their implementation of the law, rules, regulations and policy of water management in our area of Victoria. Wanting to meet with the Minister is to speak and represent ourselves first hand.
5. It is seen as most apparent that there is a failure by anyone below the Minister to appreciate that our community has had 30 years dealing with these two authorities and have reached the stage where-by it is seen future meetings require an independent arbitrator directly responsible to the Minister. Someone without fear nor favour to report accurately to the Minister. We would prefer to meet with the Minister herself so she can gain first hand the deplorable manner in which the people she has placed responsibilities with, conduct these responsibilities.
6. Our Group has no questions about the groundwater renewal process. Our Group has been through it before and know that the Minister has the final word on the outcome. And, this is the crux of the whole deal. If the Minister is not fully informed then correct decisions will only happen by accident.

Kind regards,
Malcolm.
PS I have included Tricia and Bel's email that you may consider including in future emails.

(22)

Appendix Sixteen. Qualification of the Data Sent from Barwon Water FOI ref: F087261.

FOI Ref: F087261 (18 October 2016)

Quality Checked and Retrospectively Edited Flow Data - used for input to the Victorian Water Measurement Information System

Quality Checked Edited Data is the edited record of the Real-time Operational Data. Flow values are determined through a stage-discharge relationship, where measured water levels are used to derive flows using a previously determined flow rating curve. This may incorporate manual flow level readings which are obtained periodically to provide a quality assurance ("**QA**") check against the data from the level sensor. Consequently, the sensor-obtained data may be adjusted to reflect actual level readings obtained. When significant differences are found or the flow conditions have changed, works to establish a new rating curve will be undertaken. Once obtained, these new rating curves can be applied retrospectively to the historical data over the range assessed to be affected by the change in flow conditions. The delays from this data quality validation process can result in different flow values when compared to the Real-time Operational Data which had been used to determine flows at that time.

The Quality Checked Edited Data corresponds to the data available on the Victorian Water Measurement Information System: http://data.water.vic.gov.au/monitoring.htm. The flow data available through The Victorian Water Measurement Information System is subject to retrospective changes resulting from changes to the flow rating curves used to derive flow. As such the flow data sourced at a particular point in time may be subject to change.

Water Quality Data

Real-time Operational Data is the record of live data that has not been quality checked.
Quality checked and retrospectively edited water quality data may incorporate manual field readings which are obtained periodically to provide a QA check against data from the water quality sensor. Consequently, the sensor-obtained data may be adjusted to reflect actual readings obtained. The Quality Checked Edited Data corresponds to the data available on the Victorian Water Measurement Information System: http://data.water.vic.gov.au/monitoring.htm

Data Quality Codes

These codes indicate the quality of the edited data following the QA process. A definition for the relevant codes is provided with each data set. More information on Data Quality Codes can be found on the Victorian Water Measurement Information System: http://data.water.vic.gov.au/monitoring.htm

Appendix Seventeen. Request for a report on CCM Macroinvertebrate Data Sheets

Request

From: Malcolm Gardiner [mailto:otwaywater@yahoo.com.au]
Sent: Monday, 1 August 2016 3:16 PM
To: Amy Leith <Amy.Leith@ccma.vic.gov.au>
Subject: Re: Macro invertebrate surveys.

Hello Amy,
Is there any chance of a short report on what the macro-invertebrate results indicate?
Kind regards,
Malcolm.

Malcolm Gardiner
Email otwaywater@yahoo.com.au
www.otwaywater.com.au
Phone +61 3 52358325

Reply

From: Amy Leith <Amy.Leith@ccma.vic.gov.au>
Date: 2 August 2016 at 13:56:04 AEST
To: 'Malcolm Gardiner' <otwaywater@yahoo.com.au>
Subject: RE: Macro invertebrate surveys.

Hi Malcom,
We don't have a report, other than what has been logged into the Waterwatch data base, and I am currently down a staff member so don't have capacity within the team to pull one together.

Unfortunately I going to have to say no, the raw data reports are the best I can do.

Cheers, Amy

Amy Leith
Community Engagement Manager
Corangamite Catchment Management Authority

Appendix Eighteen. CCM Macroinvertebrate Data Sheets

ALT HABITAT SHEET

SITE (River and Location): Barwon Forest
DATE: 5/7/16
COLLECTOR: KL LS LB
SAMPLE: BARO 11.00am

FLOWING WATER HABITATS (use for rivers)	0% - 100 % (in 10% increments)
BOULDER, COBBLE, COARSE SUBSTRATE	
GRAVEL	
SAND/SILT DEPOSITIONAL AREAS	
LEAF PACKS	30
WOOD,SNAGS	30
AQUATIC PLANTS	40

STILLWATER HABITATS (use for wetlands/billabongs)	
OPEN WATER	
EDGE PLANTS, REEDS, RUSHES	
WATER PLANTS	
WOOD, SNAGS	
BARE AREAS, SILT, SAND, MUD	

WEATHER CONDITIONS (Tick - ✓)	FINE	BAD	REALLY BAD
		✓	Go home!

sample processed undercover? (circle) Y N

LIGHT CONDITIONS (Tick - ✓)	GOOD	PART SHADE	HEAVY SHADE
		✓	

Associated Photos (Site/Habitat):

Associated Photos (Unknown waterbugs/QAQC):

NOTES: Dead Fish

Ent 1/7/16

(1)

Site name							Date
Barwon Forrest							5/7/16

Groups/ pages	Names	raw count	1-2	3-5	6-10	11-20	>20	SIGNAL 2
1. Miscellaneous								
12	Phylum Nematomorpha, (gordian worms)							5
12	Phylum Nematoda, (roundworms)							1
12	Phylum Annelida, class Hirudinea, (leeches)							1
13	Phylum Annelida, class Oligochaeta, (worms)							1
13	Phylum Turbellaria,(flatworms)							1
13	Order Araneae (fishing and wolf spiders)							5
14	Order Acarina, (water mites)	1						(5)
14	Order Megaloptera, Family Corydalidae (toebiters)							10
14	Order Neuroptera (lacewings)							8
2. freshwater snails and mussels (Mollusca)								
15	Family Hyriidae (freshwater mussels)							5
16	Family Ancylidae (freshwater limpets)							4
16	Family Sphaeriidae and Family Corbiculidae (basket and pea shells)							4
17	Family Planorbidae, various genera (flat snails)							6
18	Family Hydrobiidae - *Potamopyrgus antipodarum* (species)	1			✓			(1)
19	Family Lymnaeidae (lim nay ids)							1
20	Family Physidae, Species *Physa acuta*							1
20	Family Planorbidae, various genera (planorbids)							2
21	Family Pomatiopsidae, Genus *Coxiella*							2
21	Family Hydrobiidae, Genus *Beddomeia*							8
21	Family Viviparidae, Genus *Notopala*							7
3. Crustaceans (Crustacea)								
23	Family Parastacidae (freshwater crayfish or yabbies)							4
24	Family Palaemonidae, Genus Macrobrachium (freshwater prawn)							4
24	Family Atyidae (glass shrimp)	10						(4)
25	Family Hymenosomatidae (five cent crab, false spider crab)							3
26	Order Isopoda, Family Phraetoicidae, (phraetoicids, cow shrimp)							4
27	Order Amphipoda (scuds, sideswimmers)	60						(3)
27	Order Isopoda, Family Janiridae (water slaters)							3
28	Order Anostraca (fairy shrimp and introduced sea monkeys)							1
29	Order Notostraca (shield shrimp, tadpole shrimp)							1
29	Order Conchostraca (clam shrimp)							1
4a. Adult Beetles (Coleoptera)								
31	Family Curculionidae (weevils)							2
32	Family Elmidae (riffle beetles)	6						(7)
33	Families Hydraenidae and Hydrochidae (crawling water beetle)							3.5
33	Family Hydrophilidae, Genus *Helochares*							2
34	Family Gyrinidae (whirligig beetles)							4
35	Family Hygrobiidae, Genus *Hygrobia* (screech beetles)							1
35	Family Hydrophilidae (water scavenger beetles)							2
36	Family Dytiscidae, Genus *Australphilus*							7
36	Family Dytiscidae, Genus *Carabhydrus* (waisted diving beetle)							7
36	Family Dytiscidae, various genera (little diving beetles)							1
37	Family Dytiscidae, various genera (mixed diving beetles)							1
37	Family Dytiscidae, various genera (stealth diving beetles)							1
38	Family Dytiscidae, Genus *Lancetes*							2
38	Family Dytiscidae, Genus *Eretes*							1
38	Family Dytiscidae, Genus *Rhantus*							1
39	Family Dytiscidae, Genus *Hyderodes*							2
39	Family Dytiscidae, Genus *Spencerhydrus*							5
39	Family Dytiscidae, Genus *Onychohydrus*							5

(2)

Site name							Date

Groups/ pages	Names	raw count	1-2	3-5	6-10	11-20	>20	SIGNAL 2
4b. Beetle Larvae (Coleoptera)								
41	Family Psephenidae, Genus *Sclerocyphon* (water pennies)							6
42	Family Scirtidae (marsh beetles)							6
42	Family Elmidae (riffle beetles)							7
42	Family Ptilodactylidae, Genus, *Byrrocryptus* (ptilodactylids)							10
43	Family Gyrinidae (whirligig beetles)							4
44	Family Hydrophilidae Genus *Berosus* (water scavenger beetles)							2
44	Family Hydrophilidae Genus *Hydrophilus* (Ugly Bob)							2
45	Family Dytiscidae, (taper-tailed tigers)							2
45	Family Dytiscidae, (two-tailed tigers)							2
46	Family Dytiscidae, (nosey tigers)							2
47	Family Dytiscidae, (crawling water tigers)							2
47	Family Dytiscidae, (swimming water tigers)							2
48	Family Hygrobiidae, Genus *Hygrobia* (screech beetles)							1
48	Family Haliplidae, Genus *Haliplus* (tortoise beetle larvae)							4
5. True Fly Larvae								
50	Family Blephariceridae (bleffs)							10
51	Family Athericidae (tasselled maggots)							8
51	Families Tabanidae, Dolichopodidae, Empididae some Tipulidae							4
52	Family Simuliidae (black fly larvae)							5
53	Family Chironomidae, several genera (blood worms)	5						1
53	Family Ceratopogonidae (pogs)							4
54	Family Chironomidae (chironomids)	5						3
54	Family Tipulidae (crane fly larvae)							5
55	Family Stratiomyidae (soldier fly larvae)							2
55	Family Psychodidae (moth fly larvae)							3
56	Family Dixidae ('U' bent midges)	1						7
56	Family Culicidae (mosquito larvae, wrigglers)							1
57	Family Syrphidae (rat tailed maggot)							1
57	Family Ephydridae and Sciomyzidae (wetland maggots)							2
58	Family Chironomidae, Genus Symbiocladius (backpack midge)							8
58	Family Chaoboridae (phantom midges)							2
6. Mayflies (Ephemeroptera)								
60	Family Caenidae (caenids)							4
60	Family Oniscigastridae, Genus *Tasmanophlebia* (oniscigastrids)							8
61	Family Coloburiscidae, Genus *Coloburiscoides* (stream horses)							8
61	Family Ameletopsidae, Genus *Mirawara*							7
62	Family Siphlonuridae (siphlonurids)							3
63	Family Baetidae (baetids)							5
64	Family Leptophlebiidae, Genus *Atalophlebia*	10						5
64	Family Leptophlebiidae, Genus *Jappa*							8
65	Family Leptophlebiidae (leptophlebs) various genera							8

3

Site name							Date

Groups/ pages	Names	raw count	1-2	3-5	6-10	11-20	>20	SIGNAL 2
7. True Bugs (Hemiptera)								
67	Family Hydrometridae (water measurers)							3
68	Family Gerridae (water striders)							4
68	Families Veliidae/ Mesoveliidae/ Hebridae (water treaders)							3
69	Family Gelastocoridae (toad bugs)							5
70	Family Nepidae, Genus *Ranatra* (slender water scorpions/stick bug)							3
70	Family Nepidae, Genus *Laccotrephes* (leafy water scorpions)							3
71	Family Pleidae (pygmy backswimmers)							2
72	Family Notonectidae , Genus *Enithares* (robust backswimmers)	5						1
72	Family Notonectidae , Genus *Anisops* (slender backswimmers)							1
73	Family Naucoridae, Genus *Naucoris* (creeping water bugs)	5						2
73	Family Belostomatidae, Genus *Diplonychus* (giant water bugs).							2
75	Family Corixidae , Genus *Sigara* (striped boatman)							3
75	Family Corixidae , Genus *Micronecta* (little brindle boatman)	6C						2
76	Family Corixidae , Species *Diaprepocoris* (Barry four-eyes)							6
76	Family Corixidae genus *Agraptocorixa* (static boatmen)							6
8. Dragonflies and Damselflies (Odonata)								
78	Family Megapodagrionidae							5
78	Family Synlestidae	1						3
79	Family Isostictidae							3
79	Family Diphlebiidae							2
80	Family Lestidae and Family Coenagrionidae							2
81	various families (spider mud eye)							5
81	Family Gomphidae (gomphids)							5
82	Family Telephlebiidae (teleflebs)	12						9
82	Family Aeshnidae (couta mud eye)							5
9. Stoneflies (Plecoptera)								
84	Family Eustheniidae (U sthenids)							10
85	Family Austroperlidae, Species *Acruroperla atra*							10
85	Family Austroperlidae, all other species							10
86	Family Notonemouridae (noto nemoor ids)							6
87	Family Gripopterygidae, various genera (hairy sprawler)							10
87	Family Gripopterygidae, Genus *Illiesoperla* (blond sprawler)							10
88	Family Gripopterygidae, Genus Riekoperla (spiky reek o perla)							8
88	Family Gripopterygidae, various genera (gripops or fluffy bums)							7
10. Caddis Fly Larvae (Trichoptera)								
90	Family Hydropsychidae (net spinning caddis)							6
91	Family Ecnomidae, Genus *Ecnomus* (bandit caddis)	1						4
92	Family Hydrobiosidae (hunter caddis)							8
92	Families Philopotamidae / Polycentropodidae Ecnomidae (ginger nuts)							7.5
93	Family Hydroptilidae (micro caddis)							4
94	Family Atriplectididae, Genus *Atriplectides* (vulture caddis)							3
94	Family Glossosomatidae, Genus *Agapetus* (igloo caddis)							9
95	Family Helicopsychidae, Genus *Helicopsyche* (snail caddis)							8
96	Family Tasimiidae (tasimiids)							8
96	Family Philorheithridae (attack caddis - highlander)							8
96	Family Leptoceridae, Genus *Oecetis* (attack caddis - lowlander)							5
97	Family Calamoceratidae, *Anisocentropus* (sleeping bag caddis)	1C						7
98	Family Calocidae, Species *Caenota plicata* (shingle caddis)							9
98	Family Leptoceridae, Species *Lectrides varians* (flat shack caddis)							4
99	Families Conoesucidae/ Calocidae/ Helicophidae (bullet caddis)							7
99	Family Leptoceridae Unidentified, various genera.							6
100	Family Leptoceridae, Genus *Triplectides* (stick caddis)	3C						4
100	Family Leptoceridae, Genus *Oecetis* (log cabin caddis)							5
101	Family Leptoceridae, Genus *Symphitoneuria* (dart caddis)							6
101	Family Leptoceridae, Genus *Notalina* (Headbanger caddis)							6

64 25

Signal Score

4

4

ALT HABITAT SHEET

SITE (River and Location): BARCLE Cedar Mason
DATE: 8/7/16
COLLECTOR: KL 11.00am
SAMPLE: Edge

FLOWING WATER HABITATS (use for rivers)	0% - 100 % (in 10% increments)
BOULDER, COBBLE, COARSE SUBSTRATE	
GRAVEL	
SAND/SILT DEPOSITIONAL AREAS	30
LEAF PACKS	
WOOD,SNAGS	30
AQUATIC PLANTS	40

STILLWATER HABITATS (use for wetlands/billabongs)	
OPEN WATER	
EDGE PLANTS, REEDS, RUSHES	
WATER PLANTS	
WOOD, SNAGS	
BARE AREAS, SILT, SAND, MUD	

WEATHER CONDITIONS (Tick - ✓)	FINE	BAD	REALLY BAD
	✓		Go home!

sample processed undercover? (circle) Y N

LIGHT CONDITIONS (Tick - ✓)	GOOD	PART SHADE	HEAVY SHADE
	✓		

Associated Photos (Site/Habitat):

Associated Photos (Unknown waterbugs/QAQC):

NOTES: Willows main instream veg edge sample only - flowing fast deep + fast.

(5)

Site name							Date
BARO16 CobcMurroon							8/7/16

Groups/ pages	Names	raw count	1-2	3-5	6-10	11-20	>20	SIGNAL 2
1. Miscellaneous								
12	Phylum Nematomorpha, (gordian worms)							5
12	Phylum Nematoda, (roundworms)							1
12	Phylum Annelida, class Hirudinea, (leeches)							1
13	Phylum Annelida, class Oligochaeta, (worms)	5						1
13	Phylum Turbellaria,(flatworms)							1
13	Order Araneae (fishing and wolf spiders)							5
14	Order Acarina, (water mites)	10						5
14	Order Megaloptera, Family Corydalidae (toebiters)							10
14	Order Neuroptera (lacewings)							8
2. freshwater snails and mussels (Mollusca)								
15	Family Hyriidae (freshwater mussels)							5
16	Family Ancylidae (freshwater limpets)							4
16	Family Sphaeriidae and Family Corbiculidae (basket and pea shells)							4
17	Family Planorbidae, various genera (flat snails)							6
18	Family Hydrobiidae - *Potamopyrgus antipodarum* (species)							1
19	Family Lymnaeidae (lim nay ids)	1						1
20	Family Physidae, Species *Physa acuta*							1
20	Family Planorbidae, various genera (planorbids)							2
21	Family Pomatiopsidae, Genus *Coxiella*							2
21	Family Hydrobiidae, Genus *Beddomeia*							8
21	Family Viviparidae, Genus *Notopala*							7
3. Crustaceans (Crustacea)								
23	Family Parastacidae (freshwater crayfish or yabbies)							4
24	Family Palaemonidae, Genus Macrobrachium (freshwater prawn)							4
24	Family Atyidae (glass shrimp)							4
25	Family Hymenosomatidae (five cent crab, false spider crab)							3
26	Order Isopoda, Family Phraetoicidae, (phraetoicids, cow shrimp)							4
27	Order Amphipoda (scuds, sideswimmers)	5						3
27	Order Isopoda, Family Janiridae (water slaters)							3
28	Order Anostraca (fairy shrimp and introduced sea monkeys)							1
29	Order Notostraca (shield shrimp, tadpole shrimp)							1
29	Order Conchostraca (clam shrimp)							1
4a. Adult Beetles (Coleoptera)								
31	Family Curculionidae (weevils)							2
32	Family Elmidae (riffle beetles)	1						7
33	Families Hydraenidae and Hydrochidae (crawling water beetle)							3.5
33	Family Hydrophilidae, Genus *Helochares*							2
34	Family Gyrinidae (whirligig beetles)							4
35	Family Hygrobiidae, Genus *Hygrobia* (screech beetles)							1
35	Family Hydrophilidae (water scavenger beetles)							2
36	Family Dytiscidae, Genus *Australphilus*							7
36	Family Dytiscidae, Genus *Carabhydrus* (waisted diving beetle)							7
36	Family Dytiscidae, various genera (little diving beetles)							1
37	Family Dytiscidae, various genera (mixed diving beetles)	5						5
37	Family Dytiscidae, various genera (stealth diving beetles)	5						5
38	Family Dytiscidae, Genus *Lancetes*							2
38	Family Dytiscidae, Genus *Eretes*							1
38	Family Dytiscidae, Genus *Rhantus*							1
39	Family Dytiscidae, Genus *Hyderodes*							2
39	Family Dytiscidae, Genus *Spencerhydrus*							5
39	Family Dytiscidae, Genus *Onychohydrus*							5

SIGNAL SCORE = 2

18 ROUGH

37

SIGNAL 2.

6

Site name							Date

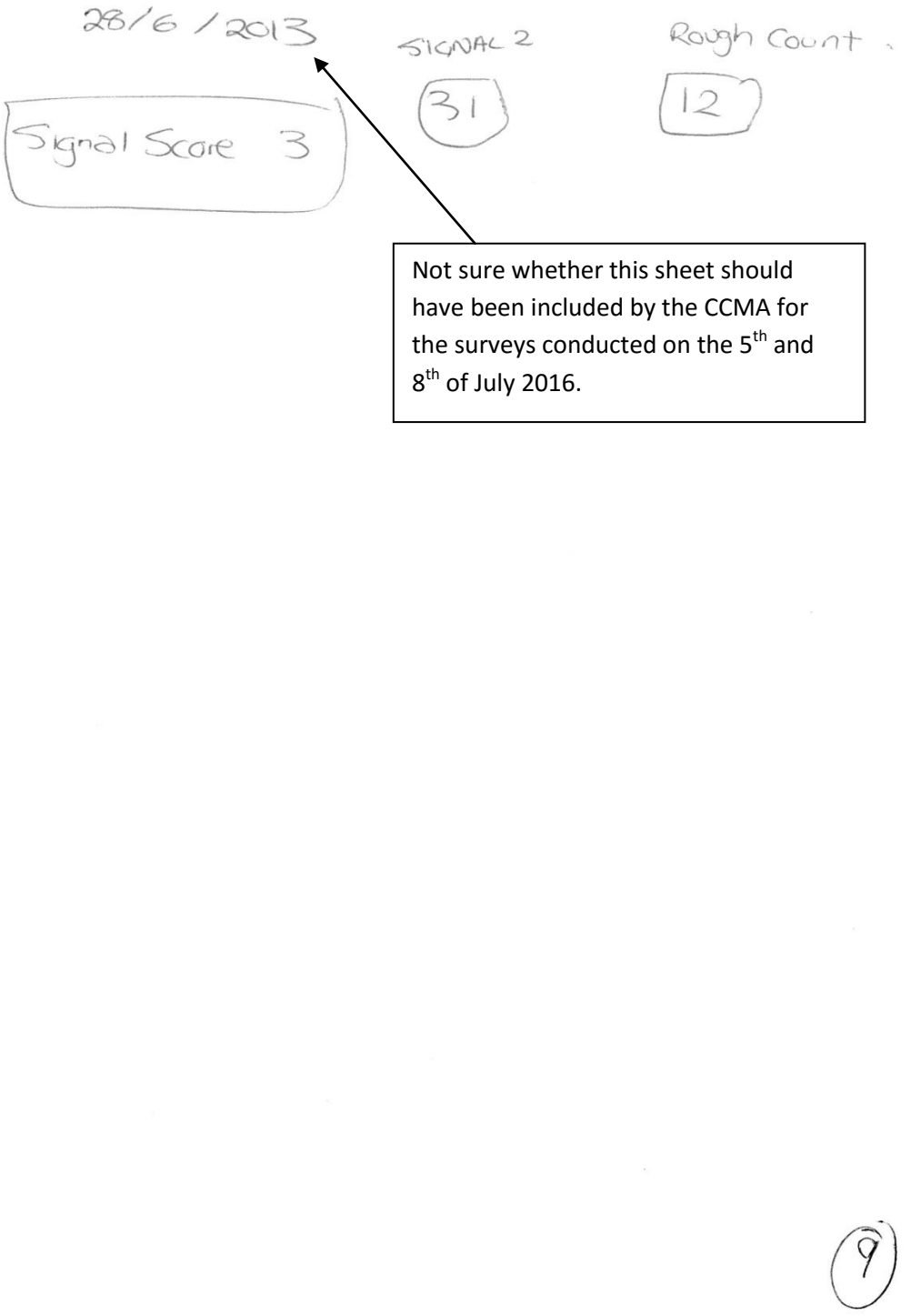
Groups/ pages	Names	raw count	1-2	3-5	6-10	11-20	>20	SIGNAL 2
4b. Beetle Larvae (Coleoptera)								
41	Family Psephenidae, Genus *Sclerocyphon* (water pennies)							6
42	Family Scirtidae (marsh beetles)							6
42	Family Elmidae (riffle beetles)							7
42	Family Ptilodactylidae, Genus, *Byrrocryptus* (ptilodactylids)							10
43	Family Gyrinidae (whirligig beetles)							4
44	Family Hydrophilidae Genus *Berosus* (water scavenger beetles)							2
44	Family Hydrophilidae Genus *Hydrophilus* (Ugly Bob)							2
45	Family Dytiscidae, (taper-tailed tigers)							2
45	Family Dytiscidae, (two-tailed tigers)							2
46	Family Dytiscidae, (nosey tigers)							2
47	Family Dytiscidae, (crawling water tigers)							2
47	Family Dytiscidae, (swimming water tigers)							2
48	Family Hygrobiidae, Genus *Hygrobia* (screech beetles)							1
48	Family Haliplidae, Genus *Haliplus* (tortoise beetle larvae)							4
5. True Fly Larvae								
50	Family Blephariceridae (bleffs)							10
51	Family Athericidae (tasselled maggots)							8
51	Families Tabanidae, Dolichopodidae, Empididae some Tipulidae							4
52	Family Simuliidae (black fly larvae)							5
53	Family Chironomidae, several genera (blood worms)	15						1
53	Family Ceratopogonidae (pogs)							4
54	Family Chironomidae (chironomids)							3
54	Family Tipulidae (crane fly larvae)							5
55	Family Stratiomyidae (soldier fly larvae)							2
55	Family Psychodidae (moth fly larvae)							3
56	Family Dixidae ("U" bent midges)							7
56	Family Culicidae (mosquito larvae, wrigglers)							1
57	Family Syrphidae (rat tailed maggot)							1
57	Family Ephydridae and Sciomyzidae (wetland maggots)							2
58	Family Chironomidae, Genus Symbiocladius (backpack midge)							8
58	Family Chaoboridae (phantom midges)							2
6. Mayflies (Ephemeroptera)								
60	Family Caenidae (caenids)							4
60	Family Oniscigastridae, Genus *Tasmanophlebia* (oniscigastrids)							8
61	Family Coloburiscidae, Genus *Coloburiscoides* (stream horses)							8
61	Family Ameletopsidae, Genus *Mirawara*							7
62	Family Siphlonuridae (siphlonurids)							3
63	Family Baetidae (baetids)							5
64	Family Leptophlebiidae, Genus *Atalophlebia*							5
64	Family Leptophlebiidae, Genus *Jappa*							8
65	Family Leptophlebiidae (leptophlebs) various genera							8

7

Site name							Date

Groups/ pages	Names	raw count	1-2	3-5	6-10	11-20	>20	SIGNAL 2
7. True Bugs (Hemiptera)								
67	Family Hydrometridae (water measurers)							3
68	Family Gerridae (water striders)							4
68	Families Veliidae/ Mesoveliidae/ Hebridae (water treaders)							3
69	Family Gelastocoridae (toad bugs)							5
70	Family Nepidae, Genus *Ranatra* (slender water scorpions/stick bug)							3
70	Family Nepidae, Genus *Laccotrephes* (leafy water scorpions)							3
71	Family Pleidae (pygmy backswimmers)							2
72	Family Notonectidae , Genus *Enithares* (robust backswimmers)	25						1
72	Family Notonectidae , Genus *Anisops* (slender backswimmers)							1
73	Family Naucoridae, Genus *Naucoris* (creeping water bugs)							2
73	Family Belostomatidae, Genus *Diplonychus* (giant water bugs).							2
75	Family Corixidae , Genus *Sigara* (striped boatman)							2
75	Family Corixidae , Genus *Micronecta* (little brindle boatman)	30						2
76	Family Corixidae , Species *Diaprepocoris* (Barry four-eyes)							6
76	Family Corixidae genus *Agraptocorixa* (static boatmen)							6
8. Dragonflies and Damselflies (Odonata)								
78	Family Megapodagrionidae							5
78	Family Synlestidae							3
79	Family Isostictidae							3
79	Family Diphlebiidae							2
80	Family Lestidae and Family Coenagrionidae							2
81	various families (spider mud eye)							5
81	Family Gomphidae (gomphids)							5
82	Family Telephlebiidae (teleflebs)							9
82	Family Aeshnidae (couta mud eye)							5
9. Stoneflies (Plecoptera)								
84	Family Eustheniidae (U sthenids)							10
85	Family Austroperlidae, Species *Acruroperla atra*							10
85	Family Austroperlidae, all other species							10
86	Family Notonemouridae (noto nemoor ids)							6
87	Family Gripopterygidae, various genera (hairy sprawler)							10
87	Family Gripopterygidae, Genus *Illiesoperla* (blond sprawler)							10
88	Family Gripopterygidae, Genus Riekoperla (spiky reek o perla)							8
88	Family Gripopterygidae, various genera (gripops or fluffy bums)	1						7
10. Caddis Fly Larvae (Trichoptera)								
90	Family Hydropsychidae (net spinning caddis)							6
91	Family Ecnomidae, Genus *Ecnomus* (bandit caddis)							4
92	Family Hydrobiosidae (hunter caddis)							8
92	Families Philopotamidae / Polycentropodidae Ecnomidae (ginger nuts)							7.5
93	Family Hydroptilidae (micro caddis)							4
94	Family Atriplectididae, Genus *Atriplectides* (vulture caddis)							3
94	Family Glossosomatidae, Genus *Agapetus* (igloo caddis)							9
95	Family Helicopsychidae, Genus *Helicopsyche* (snail caddis)							8
96	Family Tasimiidae (tasimiids)							8
96	Family Philorheithridae (attack caddis - highlander)							8
96	Family Leptoceridae, Genus *Oecetis* (attack caddis - lowlander)							6
97	Family Calamoceratidae, *Anisocentropus* (sleeping bag caddis)							7
98	Family Calocidae, Species *Caenota plicata* (shingle caddis)							9
98	Family Leptoceridae, Species *Lectrides varians* (flat shack caddis)							4
99	Families Conoesucidae/ Calocidae/ Helicophidae (bullet caddis)							7
99	Family Leptoceridae Unidentified, various genera.							6
100	Family Leptoceridae, Genus *Triplectides* (stick caddis)	5						4
100	Family Leptoceridae, Genus *Oecetis* (log cabin caddis)							5
101	Family Leptoceridae, Genus *Symphitoneunia* (dart caddis)							6
101	Family Leptoceridae, Genus *Notalina* (Headbanger caddis)							6

8


28/6/2013
SIGNAL 2
Rough Count
31
12
Signal Score 3
Not sure whether this sheet should have been included by the CCMA for the surveys conducted on the 5th and 8th of July 2016.
9

Appendix Nineteen. Analysis of CCM Macroinvertebrate Data Sheets

Stygo ecologia

Macroinvertebrate Assessment of the Barwon River for Otway Water, Survey July 2016.

From: **Peter Serov**
Subject: Report and invoice for the Macro samples.
Date: Today at 08:09
To: Malcolm Gardiner

2

Hi Mal

Here is the report on the macro sample data. There is a definite difference in the samples with the lower site being the most depauperate. It is difficult to give a definitive answer as to why this is so due to the data, location and time gaps such as the lack of water quality measurements at the sites and the one off sampling and the distance from the upstream site and no photo referencing of the sites at the time of sampling. There is also some confusion of what habitats were surveyed i.e. they describe taken edge samples in a riffle whereas edges normally refer to pools. I also have to say it was rather confusing in regards to location of the sites as there was no locality data lat/longs) attached to the survey sheets. I'm also confused as the siting of dead fish on the datasheets was recorded at the site at Forest which is supposed to be upstream of Boundary Creek. How is this so?? The impact is then likely to have been upstream of Boundary Creek and maybe as a result of cold water pollution. As a result I can only give an indication of stream condition and suggestions as to potential impactors given what has been reported.

I have issues with the water watch datasheets for the water watch users as they are unduly detailed for people who are not using a microscope and ambiguous in the separation of taxa which would no doubt lead to confusion in identification and double counting. I also think the samples should be kept for verification at a later date. I would strongly recommend that the volunteers adopt the AUSRIVAS field sampling, data collection and field identification methodology. Please be aware that I'm fully supportive of citizen science and see it as a fantastic way of getting the community involved with on the ground work however it does have it's limitations if it is to be used for this kind of assessments. I am actually working with other groups to figure out the best methods for citizen science to contribute to aquatic ecosystem monitoring. Maybe we can work together to come up with a more reliable way of using this valuable resource.

Please find the report attached. Have a read and give me a call during the week to discuss the implications.
Kind Regards

Stygoecologia

174 Galloway St, Armidale, NSW, Phone _____, Mobile _____

Email: _____

1.0 Introduction

This report is a brief examination and interpretation of two macroinvertebrate samples taken from the Barwon River in Victoria, The report was commissioned by Otway Water and LAWROC Landcare Group as a result of a 'Fish Kill' incident that occurred in mid-June 2016 in the Barwon River below the confluence with Boundary Creek. This report provides a preliminary environmental assessment of the status of the aquatic ecosystems of the Barwon River below the confluence of Boundary Creek and upstream on the Barwon River. The two samples were taken in July after the report of the dead fish being found in mid-June.

The river sites are assessed using a combination of environmental indices for aquatic macroinvertebrate diversity. These have been demonstrated by over forty years of research to be ideally suited for the assessment of riverine ecosystem health. The composition of the aquatic macroinvertebrate community reliably reflects both natural and threatening processes (i.e. changes in the physico-chemical environmental parameters) operating within a catchment. They are the major contributors to the processing of energy through a catchment and are intrinsically linked to the water source. Their ubiquitous distribution and specific habitat requirements at the species and community level enables the use of their biodiversity as an indicator of ecological disturbance within the catchment.

The site at Boundary Creek was sampled on the 7th July, 2016 and the second site on the Barwon River at Forrest upstream of Boundary Creek, just below the outflow from the West Barwon Reservoir was sampled on the 14th of July 2016. The sampling was done using the rapid assessment techniques of the Waterwatch program for aquatic macroinvertebrates. There was no water quality data recorded at the time at each survey site. Both sites during this survey were flowing due to recent rain events and the release of water by Barwon Water (pers.com M, Gardner) from the West Barwon Reservoir.

A total of 20 families were recorded. Four biological indices are used to determine the condition of the streams upstream and downstream of the Boundary Creek confluence.

Rainfall prior to the fish kill was minimal with both the Barwon River and Boundary Ck being dry.

As this is the first survey conducted from these two sites it is not possible to determine conclusively from the data provided if there has been a change in the aquatic condition and community composition. The results indicate that the overall aquatic biodiversity across the river sites (Sites BARO10 and BARO16) was moderately impacted at both sites however the downstream site at Boundary Creek (BARO16) had a significantly lower biodiversity with a marked reduction of disturbance sensitive taxa compared with the upper site.

2. Study Area and Sampling sites

The two sites are situated on the Baron River north of the Otway Ranges in Victoria near the township of Colac. The Barwon River drains the Otway Ranges and flows in a north east direction. The sites include an upstream site (Site BARO10) which is situated on the Barwon River at Forest and a downstream site situated below the confluence of Boundary Creek (BARO16) at Colac and Murroon Rd.

The riffle or flowing habitat was surveyed at each location. The habitat at Site BARO16 is described as fast flowing with a sandy bed , woody snags, instream willows and macrophytes. Site BARO10 is described as having woody snags and macrophytes. This site also recorded dead fish present with no further description of type and location of where the fish were found. There is also no description of flow conditions.

3. Methodology

3.1. Macroinvertebrate Sampling

Each site was sampled using the Waterwatch ALT Accreditation Program and the data recorded on ALT Habitat Sheets.

3.4. Identification

Specimens were identified to order and family where possible using the Waterwatch ALT methodology.

4. Data Analysis

4.1. SIGNAL, EPT Richness

SIGNAL. SIGNAL is an acronym for 'Stream Invertebrate Grade Number - Average Level', and is a biotic index of pollution tolerance or sensitivity of stream invertebrates and was originally developed for use in the lower Blue Mountains (Chessman, 1995). Chessman *et al.*, (1997) released a modified version; SIGNAL-HU97B, developed for the Hunter Valley, which is to the south, and its aquatic communities are more comparable to those found within the study area. See Table 3 for a breakdown of the SIGNAL-HU97B values and water quality status. SIGNAL 2 is the newer version which has versions to suit both family and order-class-phylum identification.

SIGNAL	Water Quality Status
>7	Excellent
6-7	Good
5-6	Fair
4-5	Poor
<4	Very poor

Table 3. SIGNAL Index band categories (Chessman *et al.*, 1997).

4.2. Comparative Indices (Number of Families)

Number of Families. All macroinvertebrate families are separated and counted. The number of families present generally decreases with decreasing water quality and is used as a comparative measure of community change over time.

5

4.3. Silt Tolerant Species

The aquatic fauna assemblages need to be assessed for silt tolerant fauna, as the presence of such fauna can provide an indication of the degree of heavy sediment pollution. The main indicator families are the Dugesiidae, Lymnaeidae, Ancylidae, Physidae, Planorbidae, Psephenidae, Chironomidae, Caenidae, Pyralidae and Ecnomidae.

The silt tolerant taxa values are best examined against the total number of taxa sampled from each site i.e. the silt tolerant ratio, as the variation of values is significantly reduced compared with examining the number of taxa alone. This index is used as a comparative measure of

community changes over time.

5. Results - Ecological Response - Macroinvertebrate Data

A total of 20 families were recorded from the two sites. The results of the survey and the indices values are summarised in Tables 1. The biodiversity values (i.e. number of families) at both sites is regarded as depauperate and varied significantly between the sites. The reason for the generally low number of families is unknown at this stage, however a much higher number is expected from this area, particularly give the presence of a number disturbance sensitive taxa. The lower numbers could be due to water quality such as the naturally low pH found in the river or it could a sampling and identification biase due to the methodology used to collect the sample. Site BARO10 contained 16 families which included a number of disturbance sensitive taxa such as the mayflies, caddis flies as well as the crustaceans, the Hydrobiidae gastropods, Dixidae flies, dragon flies and the aquatic beetle family Elmidae. The downstream site BARO16 recorded 11 families which consisted of generally disturbance tolerant species. There was a significant loss of sensitive taxa particularly among the EPT group and the gastropods and crustaceans. The reduction of families at the downstream site is attributed possibly to reductions in flows and water quality.

The aquatic macroinvertebrate taxa recorded are listed in Appendix 1 and represents a community consisting of a mix of disturbance sensitive species as well as species tolerant to moderate to high levels of disturbance. At both sites, the communities were dominated by the shredder/grazer feeding guild represented by the EPT and predator feeding groups such as Coleoptera, Hemiptera and the detritivore feeding groups including an array of Chironomidae and Oligochaete as well as the shredder/grazer guilds including the Ephemeroptera and Gastropoda.

Table 1. Summary Macroinvertebrate Indice data table.

Notable absences within the fauna were the Plecoptera (stoneflies) at the upstream site given the stream type and location as well as were the Mayfly families Caenidae and Baetidae from both sites. As mentioned earlier there is considerable discrepancy in taxa occurrence between the two sites. The other notable absences from the downstream site include Ephemeroptera, the Hydrobiidae snails, the Crustacean Shrimp family Atyidae, the two dragonfly families Synlestidae and Telephlebiidae. The absence of Ephemeroptera and Odonata families as well as the Calamoceratidae and Ecnomidae Caddis fly families is indicative of this site drying up completely prior to this survey. These groups are allocated the highest rating (10) in the SIGNAL index, as they are highly sensitive to pollution/disturbance and require flowing water habitats. Therefore, their presence in the river sites is indicative of a continued sustainability in surface water permanence and ecosystem condition whereas their absence is indicative of a lack of flow and flow related habitat.

The presence of the Amphipoda at both sites and the Chironomidae Flies and Oligochaetes (worms) are indicative a silty substrate that retains water and most likely has a groundwater baseflow. The Amphipoda are also indicative that both sites are groundwater fed. The low pH recorded along the Barwon River is also indicates strong groundwater/surface water connectivity. The presence of the Dytiscidae water beetles, Hemiptera, Lymnaeidae Gastropoda and the Leptoceridae Caddis fly indicate the presence of temporary to permanent pools although the Beetles, flies and Hemiptera (True bugs) are widely dispersible groups which can rapidly colonise denuded habitats after droughts.

5.1. SIGNAL

The SIGNAL values indicated that both sites were quite similar between the sites and in a poor condition with Site BARO10 recorded the lowest value of 4.06, while the downstream site recorded 4.09. The earlier version of SIGNAL HB97 however give each site a fair condition and differentiates clearly between the two sites by demonstrating that the lower site is more impacted. The smaller and more temporal nature of the lower site has a marked impact on the presence or percentage of high value or disturbance sensitive taxa such as the Ephemeroptera (mayflies) and Trichoptera (caddis flies). The still water conditions that typically dominate these sites are more suited to the disturbance tolerant taxa such as the Diptera (flies), Coleoptera (beetles) and Hemiptera (bugs).

5.2. Silt tolerant taxa

Table 1 illustrates the changes in silt tolerant taxa at each site. Although the official number of silt tolerant taxa was low the actual number particularly in the downstream site was considerably higher and contributed a significant proportion to the overall biodiversity. The results indicate that there is a substantial increase in the number of silt tolerant taxa at the downstream site. The increase in these taxa is particularly indicative of differences in flow regimes between the sites. These results indicate that there has been a decrease in water levels and flow within the lower site that has retained substantial amount of fine sediments in the stream and therefore increased the available habitat for this group of invertebrates.

6. Discussion

The fauna present at each site is strongly indicative of a range of habitat types and water flow regimes. The number of permanent flow dependant taxa in the upper site indicates relatively stable conditions have persisted throughout the year with minor changes in flow and water quality parameters such as salinity and pH. The change in community composition in the lower site is also indicative of highly variable flows and water quality. 7

All biological indices indicated a generally moderately impacted ecological condition for each of the sites with the downstream site BARO16 being the more degraded of the two. The higher numbers of silt tolerant taxa recorded at the river site BARO16 and higher number of numbers of the Shredder feeder guild in the upper site BARO10 separate the two sites. Although the biodiversity has demonstrated differences between the two sites it does not and cannot in itself conclusively prove what has contributed to the differences. To answer this question would require a more comprehensive and standardised assessment combining biological, water chemistry/quality, flow and rainfall data at a number of locations over a number of sampling events.

A number of suggested reasons for the differences between the sites however, are given below. These include:

- Permanence of flow. The biodiversity and community composition in each site is indicative in differences in flow regimes. The fauna recorded in the lower site is indicative of a highly variable flow regime with the likelihood that this site has dried out recently whereas the upper site is indicative of a more permanent flow regime.
- Water Quality. The biodiversity and community composition in each site is indicative in differences in water quality. pH has been recorded as significant issue regarding the lower site that is below the confluence of Boundary Creek. Boundary creek has recorded very acidic conditions within Boundary Creek which has been attributed to a recent significant lowering of pH and possible fish kill event within the Barwon River. There have also been reports (M. Gardner pers com) of clear water with a blue ting and a turbid bottom layer in the pools. Although these reports are circumstantial evidence they do suggest an acid contamination event and/or a saline discharge event during a flood event or higher salinity groundwater seepage into the river during low flow conditions. The two possible scenarios are as follows

Scenario 1: Acid sulfate soils and flood events. Low lying coastal areas are often associated with acid sulfate soils. These soils are normally found in permanent wetlands that are fed by high groundwater levels. In this case if the water level drops due to extraction or drought and the soils become exposed to the air the pyrite within the soils oxidise and leach sulphuric acid. The waters in these wetlands are highly acidic, depleted in oxygen and aquatic biodiversity and have very low turbidity i.e. can usually very clear or tannin coloured depending on the surrounding vegetation community. During low flow periods the acid can then build up and during a flood event is flushed downstream impacting aquatic life.

Scenario 2: Saline soils and groundwater and high flows. Coastal soils and floodplain soils in the south and western regions of Victoria typically have elevated levels of salt resulting accumulations of salts in wetlands during periods of drought due to evaporation. In a similar fashion to acid sulfate the waters become anoxic, clear and devoid of life and during a flood event is flushed downstream impacting aquatic life.

Scenario 3: Saline groundwater and low flows. Coastal and floodplain groundwaters in the south and western regions of Victoria typically have elevated levels of salt resulting accumulations of salts in wetlands and steams during periods of low flow. This is particularly the case where shallow groundwaters contribute to the baseflow of these systems. During low flows the contribution of highly saline groundwaters into rivers can be substantial. As salt water is heavier than freshwater it accumulates in the depressions such as the bottom of pools and creates halophilic and thermal stratification. This can be seen as very clear waters in the top of the water column and discolored or cloudy layer in the bottom of the pools or riverbed depressions. The waters in the pool will usually become anoxic, and devoid of life. During a flood event this deoxygenated water can be flushed downstream impacting aquatic life.

- Habitat. Geomorphic differences such as substrates type in a riverbed dictate

the flow patterns and habitat type and availability for macroinvertebrates> It therefore dictates the community composition found in each locality. For this reason environmental assessments require the repeated surveys at the same location at the same time of year in order to determine if there have been any changes occurring in an ecosystem. The site is compared with itself. Therefore although there are differences between the two sites as there has only been one sampling event we cannot at this stage determine if the differences are attributed to a pollution event or differences in habitat type.

8

In conclusion, the results from the current survey suggest that there is a significant difference in community composition and therefore stream condition between the sites with the downstream site below Boundary Creek having the lowest ecological condition. Based on the macroinvertebrate data provided alone the reason for this difference cannot be confirmed although it is more likely to be a change in flow conditions and or water quality.

7. Acknowledgements

We are grateful to Malcolm Gardner for providing background information.

8. References

Anonymous. 1994. National River Processes and Management Program Monitoring River Health Initiative. River Bioassessment Manual Version 1.0. Department of the Environment, Sport and Territories, Canberra.

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Turak, E., Waddell, N. and Johnstone, G. 2004. New South Wales (NSW) Australian River Assessment System (AUSRIVAS) Sampling and Processing Manual. (http://ausrivas.canberra.edu.au/Bioassessment/Macroinvertebrates/)

Williams, W.D. 1981. Australian Freshwater Life. The Invertebrates of Australian Inland Waters. Macmillan Education Australia Pty Ltd. Melbourne.

Appendix 1. A list of macroinvertebrate recorded at the two sample sites in July, 2016.

	Date	5/7/2016	14/7/2016
		BARO10	BARO16
Order	**Family**	**Barwon Forrest u/s**	**Colac - Morroon Rd, d/s**
Acarina		*	*
Coleoptera	Dystiscidae		*
Coleoptera	Elmidae	*	*
Amphipoda		*	*
Decapoda	Atyidae	*	
Diptera	Chironomidae	*	*
Diptera	Dixidae	*	
Ephemeroptera	Leptophlebiidae	*	
Gastropoda	Hydrobiidae	*	
Gastropoda	Lymnaeidae		*
Grypopterygidae			*
Hemiptera	Corixidae	*	*
Hemiptera	Naucoridae	*	
Hemiptera	Notonectidae	*	*
Odonata	Synlestidae	*	
Odonata	Telephlebiidae	*	
Oligochaete	Lumbriculidae		*
Trichoptera	Calamoceritae	*	
Trichoptera	Ecnomidae	*	
Trichoptera	Leptoceridae	*	*
Families	20	16	11

6. Discussion

The fauna present at each site is strongly indicative of a range of habitat types and water flow regimes. The number of permanent flow dependant taxa in the upper site indicates relatively stable conditions have persisted throughout the year with minor changes in flow and water quality parameters such as salinity and pH. The change in community composition in the lower site is also indicative of highly variable flows and water quality.

All biological indices indicated a generally moderately impacted ecological condition for each of the sites with the downstream site BARO16 being the more degraded of the two. The higher numbers of silt tolerant taxa recorded at the river site BARO16 and higher number of numbers of the Shredder feeder guild in the upper site BARO10 separate the two sites. Although the biodiversity has demonstrated differences between the two sites it does not and cannot in itself conclusively prove what has contributed to the differences. To answer this question would require a more comprehensive and standardised assessment combining biological, water chemistry/quality, flow and rainfall data at a number of locations over a number of sampling events.

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In conclusion, the results from the current survey suggest that there is a significant difference in community composition and therefore stream condition between the sites with the downstream site below Boundary Creek having the lowest ecological condition. Based on the macroinvertebrate data provided alone the reason for this difference cannot be confirmed although it is more likely to be a change in flow conditions and or water quality.

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Appendix 1. A list of macroinvertebrate recorded at the two sample sites in July, 2016.

	Date	5/7/2016	14/7/2016
		BARO10	BARO16
Order	**Family**	**Barwon Forrest u/s**	**Colac - Morroon Rd, d/s**
Acarina		*	*
Coleoptera	Dystiscidae		*
Coleoptera	Elmidae	*	*
Amphipoda		*	*
Decapoda	Atyidae	*	
Diptera	Chironomidae	*	*
Diptera	Dixidae	*	
Ephemeroptera	Leptophlebiidae	*	
Gastropoda	Hydrobiidae	*	
Gastropoda	Lymnaeidae		*
Grypopterygidae			*
Hemiptera	Corixidae	*	*
Hemiptera	Naucoridae	*	
Hemiptera	Notonectidae	*	*
Odonata	Synlestidae	*	
Odonata	Telephlebiidae	*	
Oligochaete	Lumbriculidae		*
Trichoptera	Calamoceritae	*	
Trichoptera	Ecnomidae	*	
Trichoptera	Leptoceridae	*	*
Families	20	16	11

From: **Peter Serov** stygoeco@gmail.com
Subject: Re: Report and invoice for the Macro samples.
Date: Today at 13:56
To: Malcolm Gardiner otwaywater@yahoo.com.au

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Hi Mal

Just checking to see if you or the group have any feedback or questions for me regarding the report. A quick additional thought is that the only taxa that may indicate an acid spill is the crustaceans and snails as their shells are adversely impacted by low pH more so than insects. The Hydrobiidae and Atyid shrimps were not present in the lower site which may be an indicator. the other snail and the amphipods are potentially more resistant to short term pulses of acidic waters in the lower site as the snail taxa present has a thicker shell and the amphipods are burrows and therefore can be buffered by the sediment. This is however only indicative without a number of prior surveys and may also be habitat dependent.

What is the next step for your group with this issue. Also can you find out for me what the payment period is for the LAWROC Landcare Group?

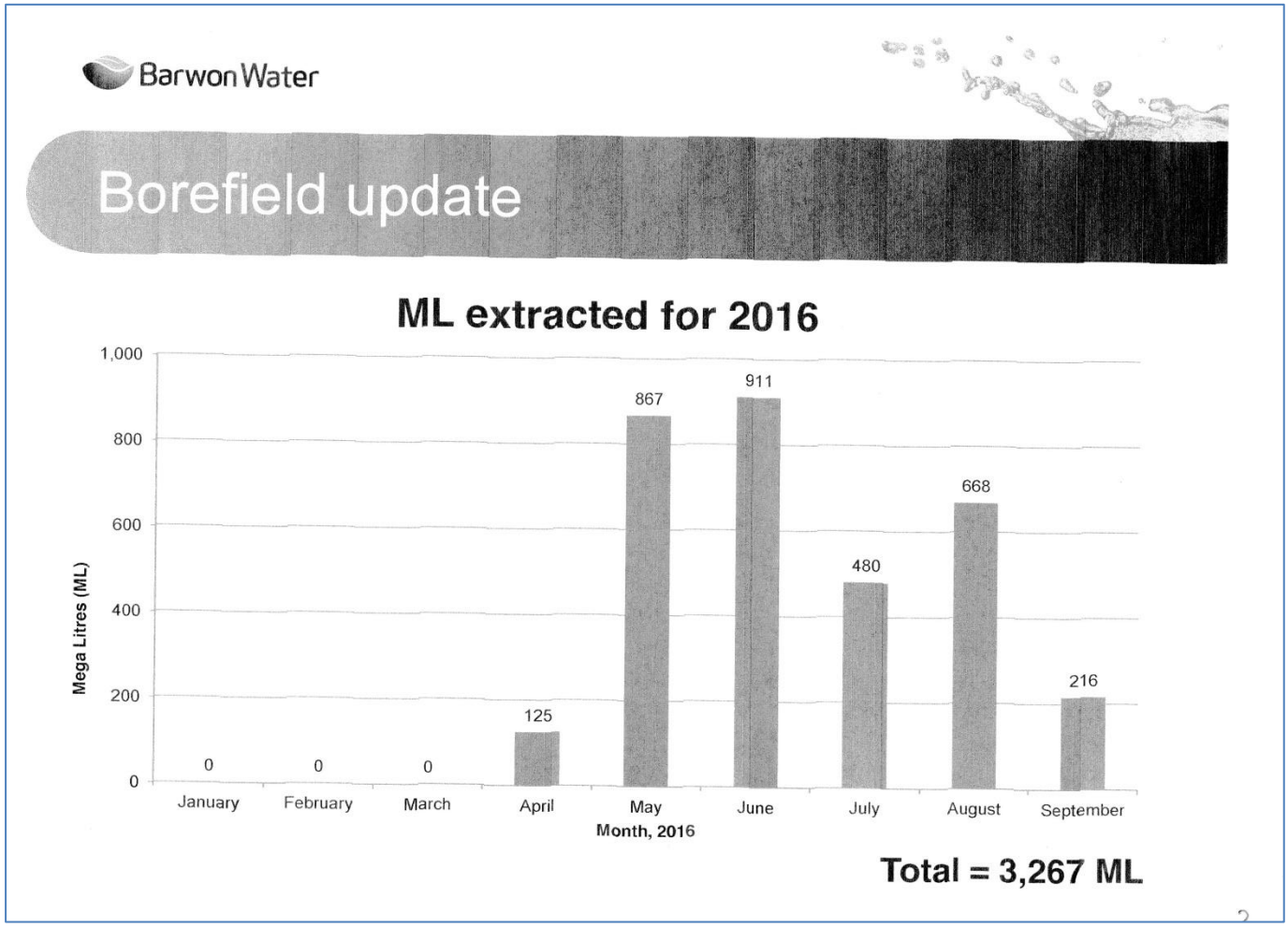
I'm happy to field any questions re: the report.

Kind Regards

Peter Serov

Stygoecologia

Appendix Twenty. **4 October Barwon Water Groundwater Community Reference Group (BWGCRG) Meeting Overhead of Groundwater Extractions 2016.**



Appendix Twenty One. **4 October (BWGCRG) Meeting Overhead regarding the Fish Kill.**