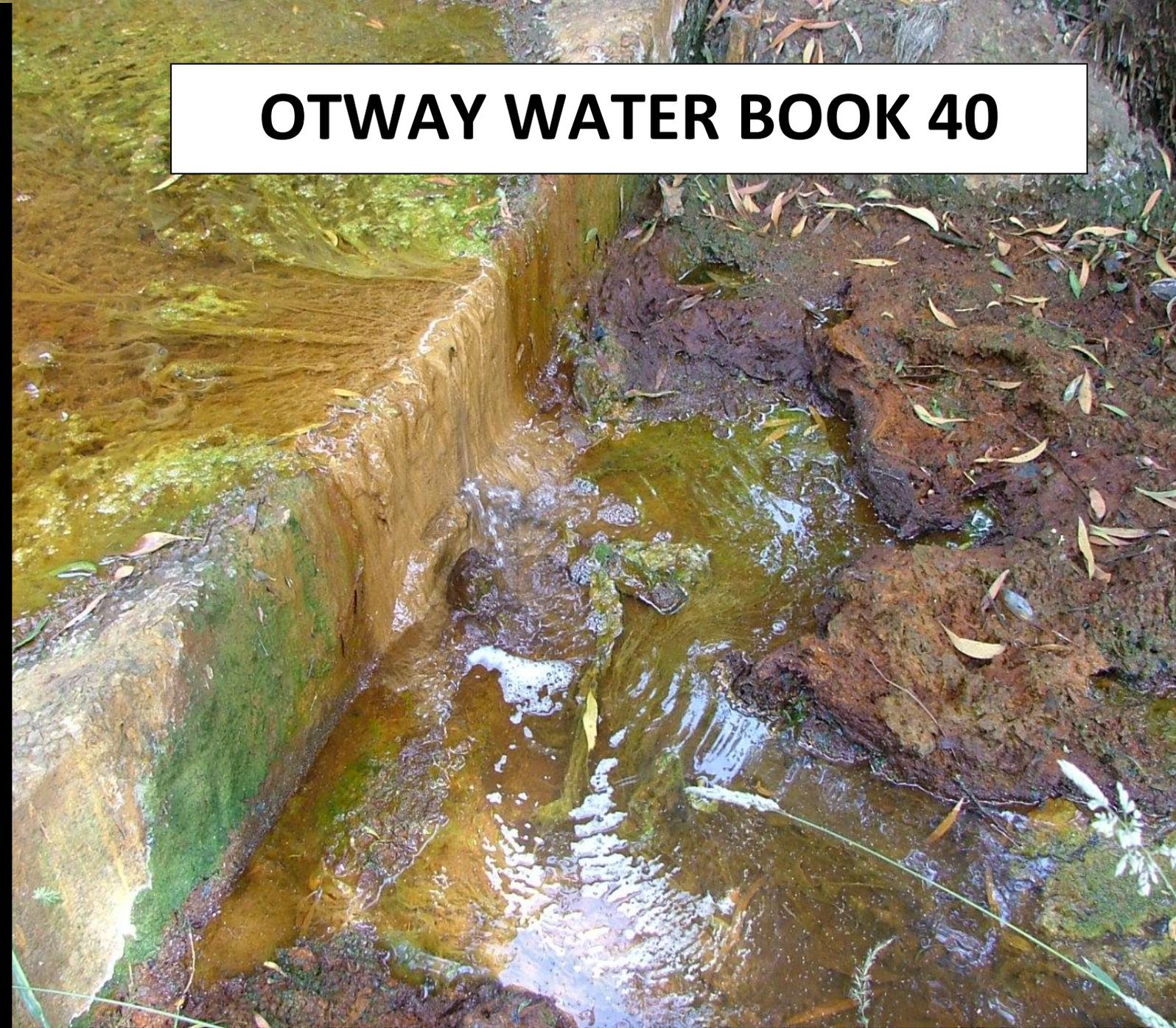


# **OTWAY WATER BOOK 40**



**“Review of Jacobs 2017 PASS Baseline Assessment.”**

**October 2017**

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***“The new monitoring program will increase understanding of the Barwon Downs groundwater system in its normal state.”***

(SKM 2015)

***“No evidence was found that declining groundwater levels caused by groundwater extraction at Barwon Downs had a negative impact on vegetation health in the catchment.”***

(Jacobs 2016)

***“...water table drawdown occurs during pumping, but no long-term environmental impacts have been linked to borefield operation.”***

(Barwon Water, February 2012: Water Supply Demand Strategy 2012-2062, Draft.)

### **As Far Back As 2008**

In an ABC Stateline production 10 October 2008 that included a ten minute segment specifically on the Actual Acid Sulfate Soil created in the Big Swamp at Yeodene, Victoria; Michael Malouf, Managing Director of Barwon Water, stated that up to this time Barwon Water was not aware of the Big Swamp situation and the accusations that its demise was linked to the Barwon Downs Borefield. Mr. Malouf did say in regard to the extraction licence ***“It is clearly monitored by a number of parties including Southern Rural Water, who issue the licence. The Corangamite Catchment Authority have a major interest in the catchment area and the Department of Sustainability and Environment from the State Government. All of these parties are involved in different ways and they’ve all given us a very good bill of health, if you like, in terms of how this aquifer is being managed and how it is being made to be sustainable.”***

The reason the ABC became involved was due to the lack of concern or proactive efforts by the very same ***“...number of parties...”*** failing to visit and investigate local claims that the Big Swamp was in a very poor state. Local LAWROC Landcare Group in desperation collected and had water samples from the site tested by a NATA approved laboratory in Warrnambool (see Appendix One, pages **21-23**).<sup>(6)</sup>

Up until LAWROC, at huge expense, commissioned scientists from Southern Cross University to come and carry out an Acid Sulfate Soil investigation,<sup>(7)</sup> not one of the nine State Government Authorities approached would have anything to do with this issue.<sup>(6)</sup> By the start of 2017 a comprehensive investigation still had not been done. ***“The purpose of this study (Jacobs 2017) is to assess the aquatic ecosystems of Boundary Creek and therefore it is beyond the scope to complete a comprehensive investigation of Big Swamp. Big Swamp will be the focus of a future, stand-alone study.”***<sup>(5)</sup> It is not the first time the Big Swamp has been dropped from investigation (see Appendix 4, pages **32-45**). Appendix 4 relates an alarming story worth a read at this stage.

### Jacob's Introduction in the PASS Baseline Assessment report 2017.<sup>(3)</sup>

Unfortunately, if something is repeated often enough it becomes accepted as fact whether it is a fact or not. A classic example is the following statement that was repeated over and over again in the late 1980s and early 1990s.

*“Because the use of groundwater usually has few adverse environmental effects, it is often favoured over surface sources which can have marked effects.”*

(Report No 8 Department of Water Resources, Victorian Government, June 1988)

This statement was repeated that often in reports of the time it became an accepted fact that groundwater extraction has few adverse environmental impacts.

In a similar fashion many of the New Monitoring Program Jacobs' reports contain similar statements. Some examples found in the introductory section of the 2017 PASS Baseline Assessment<sup>(3)</sup> report are:

1. *“The borefield is a critical back up source for Barwon Water ...”*  
The borefield has been a critical supply of water for Geelong in the past, but this is no longer the case. Barwon Water has over 30 GL of water in reserve in the Yarra Thompson system, and more to come this year. This statement that the groundwater is still a critical resource is no longer the case.
2. This so called reliance Geelong has on groundwater is then given as one of the reasons for conducting the present costly monitoring program.  
*“Driving the need for this monitoring program is the reliance on the borefield to provide water security for Barwon Water customers...”*
3. To reinforce this reliance on groundwater it is stated that to meet Geelong's demand for water during the Millennium Drought *“...52,684 ML was extracted from the borefield providing up to 70 per cent of Geelong's drinking water.”* (See Otway Water Book 34 for an analysis of this statement. The 70% appears to be one of these urban myths).  
The first reference found to this 70% notion is found in the ABC Stateline program in 2008 when Managing Director of Barwon Water stated that the Barwon Downs Borefield was *“...crucial to Geelong's water supply in a diversified sense. For example in the major drought period of 2006, the Barwon Downs aquifer provided over 70% of Geelong's water.”*
4. The Barwon Downs Borefield *“...licence makes provision for ... the protection of riparian vegetation, protection of stock and*

*domestic use and the protection of flows in the Barwon River tributaries.*" The 2004 licence may state that these provisions be made but unfortunately in reality none of them have been achieved. Because this is never stated the perception given is that they are in fact achieved. This statement has been made numerous times since 2004.

5. *"The township of Colac will soon be connected to the Geelong system through the construction of a pipeline between Colac and Geelong."* The pipeline sadly only goes to Barwon Downs then water is transferred to Geelong in an antiquated leaky open earthen channel to the evaporative bowl of the Wurdee Boluc Reservoir.

Other statements of doubtful reliability include:

- Depending on the source of the information depends on the amount of groundwater extracted over the years 1983-2016. The total quoted in the 2017 reports state 114,610 ML, well short of other sources.
- Through a Freedom Of Information request to Barwon Water in 2006 asking for groundwater extraction figures for the Barwon Downs Borefield, this was included in the answer. *"Please note there are no records prior to 1988."*<sup>(4)</sup>

Also, no explanation is given why the borefield has a production capacity of 55 ML/day when there are 6 extraction bores with a capacity to provide up to 12 ML flow a day per bore.

### **Some Confusion Over Terms.**

There also appears to be a miss match of terminology over the terms Acid Sulfate Soil (ASS); Actual Acid Sulfate Soil (AASS) and Potential Acid Sulfate Soil (PASS).

*"ASS refers to soils that contain pyrite, which forms under waterlogged conditions where there is little or no oxygen available. When saturated, these soils remain stable and are referred to as potential acid sulfate soils (PASS), posing little environment concern. If these soils are exposed to air (oxygen) as a result of declining groundwater levels or excavation, a natural chemical reaction takes place that produces sulphuric acid and can mobilise heavy metals. The end result is actual acid sulfate soils (ASS)."*<sup>(3)</sup>

This statement and many others made in the SKM/Jacobs documents make it extremely difficult to follow when AASS (Actual Acid Sulfate Soil) and ASS (Acid

Sulfate Soil) terms appear to be used as though they are the same thing. It is my understanding that PASS (Potential Acid Sulfate Soil) can change to AASS not ASS. Statements such as this one create the confusion. “...to detect a change from PASS to ASS.”<sup>(2)</sup>

An ASS profile can have both PASS and AASS present at the same time. Usually the AASS sits higher in the ASS profile than the PASS. It is very confusing when the regular use of ASS appears to also represent AASS.

ASS = PASS and or AASS and or Acid Neutralising Capacity (ANC)

Most work carried out and reports written in Australia deal with Coastal Acid Sulfate Soils. The 2017 Jacobs PASS Baseline Assessments deal with Upland Freshwater Acid Sulfate Soils. No mention is made of this distinction other than to say that much of the Coastal work is applied to and is appropriate to this current work. At this stage a re-read of pages 34 to 38 in Appendix 4 is worth a revisit.

### **Missing Data.**

Another difficulty encountered when reading through this SKM/Jacobs report is that many Figures referred to in the text cannot be found in the document.

### **BACKGROUND to the 2017 PASS Baseline Assessment.**<sup>(3)</sup>

The Jacobs 2013 Acid Sulfate Soil investigation required:

- the setting of a new baseline reference point,
- a selection of sites with the potential to have a presence of Acid Sulfate Soil, and
- sites with the potential to be impacted by significant watertable drawdown from borefield extraction in the future.<sup>(2)</sup>

Four Acid Sulfate Soil sites were finally chosen for the baseline monitoring program. These sites were identified within the extraction drawdown influence of the Barwon Downs Borefield. The sites would be used to gauge future influence from any borefield extraction, climate change, drought and or land use change.

*“The aim of the study is to provide a baseline condition assessment of four monitoring sites that are known to contain acid sulfate soils so potential changes to the sites can be monitored to understand key drivers.”*<sup>(3)</sup> Past impacts in known ASS sites from groundwater extraction drew little if any attention.

The 2017 Predictive Modelling Results concluded that *“The drawdown predicted at the PASS monitoring sites is within the range of drawdown experienced in the past and a baseline assessment in 2015 highlighted there is no evidence of drawdown from the borefield influencing PASS at these sites.”*<sup>(1)</sup> This gives the impression that the Actual Acid Sulfate Soil sites created within the area of drawdown influence has not been the result of the borefield, and, at these four sites there is no such evidence of any influence, and there should be no impact in the future. *“The sites selected are located in areas where groundwater levels have declined in response to pumping from Barwon Downs borefield...”* This quote further emphasises the notion that drawdown has not created any AASS problems. However, whenever the groundwater level is lowered in an ASS profile and PASS oxidises, the creation of Actual Acid Sulfate Soil follows. Pumping will bring this change about. If there has been drawdown then AASS will result in an ASS profile. How these statements can be made after a 7 month study (November 2015 to June 2016) is difficult to accept and cannot be regarded as a definitive investigation.

### **The Lead Up to the Selection of the Four 2015 PASS Sites.**

The process leading up to the selection of these four monitoring sites started with the first field inspection of nine chosen sites in 2013. The LAWROC Landcare Group representative and others members of the Barwon Downs Groundwater Community Reference Group (CRG) recommended that 5 additional sites be looked at.

Based on the method of selecting the 2013 sites and including the predictions of computer modelling the sites were reduced to 8. When it came time to conduct the field testing one landholder denied access permission and another access permission was not gained in time. 14 sites were reduced to 6. After the completion of the field work the sites were reduced to 4. The Big Swamp and another site in the Barongarook Creek catchment both already determined as Actual Acid Sulfate Soil (AASS) sites, were not included. Another severely impacted AASS at the Lower Yan Yan Gurt Creek was included. Each of these three sites were recommended because LAWROC had had these sites soil tested confirming Actual Acid Sulfate Soils (AASS), and there appeared to be a very strong case that the AASS had been caused by earlier drawdown influence from the Barwon Downs Borefield.

*“The initial process for site selection (SKM 2013) did not include sites where ASS was known, or highly likely to be present. Based on studies completed by Davidson and Lancaster (2011) and Glover and Webb (2012), it was considered that PASS at Big Swamp (on Boundary Creek) is well understood and hence no further soil sampling was recommended (SKM 2013).”*<sup>(2)</sup>

A site on the upper Porcupine Creek was also not included for the very same reasons as “...**sampling had already confirmed the presence of PASS and ASS.**”<sup>(2)</sup> (I think this was meant to be AASS.)

These sites may not require further sampling but they should have been included as sites for further monitoring. The Big Swamp is by far the best PASS/AASS site linking impacts to groundwater extraction at the Barwon Downs Borefield and should have been included. Even though groundwater extraction has stopped for some considerable time the influence and impact from the extraction continues. As stated above, PASS/AASS may “**well be understood**” at the Big Swamp but at no stage has the creation of the Actual Acid Sulfate Soils been accepted as anything other than a natural occurrence and any ongoing impacts will continue to be ignored. “**There are several naturally occurring areas in the Barwon River catchment with ASS. The most well known of these is Yeodene (Big) Swamp, which causes a water quality issues in the lower reach of Boundary Creek.**”<sup>(3)</sup> Yes, the Big Swamp is a naturally occurring Acid Sulfate Soil site but if this statement means that the massive creation of Actual Acid Sulfate Soils is a natural occurrence in this swamp, this is wrong. The depletion of the groundwater underneath the Big Swamp is from groundwater extraction. The oxidation of the PASS into AASS is a direct result of groundwater extraction. Going from PASS to AASS is a natural process, yes, but the catalyst setting this process off is the unnatural lowering of the watertable by extensive extraction of groundwater.

However, the statement that “**The overall purpose of the acid sulphate soils program is to establish the approximate extent and associated risks of potential acid sulphate soils occurring within possible impact zones, associated with groundwater extraction from the Barwon Downs borefield.**”<sup>(2)</sup> makes it quite clear, that any impact pre 2014 from groundwater extraction at the Barwon Downs Borefield was not to be considered in this particular Acid Sulfate Soil investigation. The starting or reference point for “potential” impacts was set at 2015 when the Acid Sulfate Soil Monitoring of the 4 PASS sites was conducted in November 2015, March 2016 and June 2016.<sup>(3)</sup>

Of the 4 sites finally assessed as suitable, “**This assessment makes the assumption that current conditions at the investigated sites are not materially affected by pumping from the borefield.**”<sup>(2)</sup> A fresh start from 2015 with an emphasis on **future impacts** and **potential impacts** post 2015, were to be the only consideration. No effort was to be made to ascertain the cause of any pre 2015 impacts.

***“This assumption is considered reasonable considering the hydrogeological setting of the sites (i.e. located within the MTD) and the apparent high watertable at the sites (as indicated by saturated conditions of the soil profile during field investigations).”***<sup>(2)</sup> There is considerable doubt that the watertable at the Lower Yan Yan Gurt site is anything like it was pre groundwater extraction at the Barwon Downs Borefield. This assumption needs verification. Springs feeding dams on this same property have long since ceased to flow indicating that the watertable replenishing these dams has been lowered a considerable amount.

It is difficult to make any further comment on the watertable level in the field investigation report,<sup>(2)</sup> as Figure 1 is missing and others appear to be incorrectly labelled. What sense that can be made of other figures presented does not appear to match the drawdown as reported in the Barwon Water yearly reports sent to Southern Rural Water. A discrepancy of 20m residual drawdown is quite substantial. Also it is worth noting that the drawdown in the Southern Rural reports is based on observable data whereas the Jacobs drawdown appears to be based on modelling and is an estimation. ***“The modelling used to estimate the watertable drawdown was conducted as part of SKM (2013). In turn this was based on Scenario 2 from SKM (2001).”***<sup>(2)</sup> This is a case of modelling based upon modelling and relies solely on the data put into the model. Modelling Scenario 2 has an average pumping rate of 4,000 ML/year, whereas during the last drought the actual pumping rate averaged over 11,000 ML/year. To state that ***“The model predictions for water table drawdown in the aquitard are based on conservative model assumptions, which include (among other things) high levels of borefield operation where the pumping is assumed to be an average of 4,000 million litres annually.”***<sup>(2)</sup> is clearly showing that the data put into the model is not even close to being representative of what actually takes place. As a consequence the model predictions cannot be relied upon.

Even Jacobs throws some doubt on the reliability of this modelling. ***“The likelihood of borefield related drawdown has uncertainty in that the estimate relies on modelled results, with associated uncertainty in input parameters and model conceptualisation.”***<sup>(2)</sup>

## **The Results of the Baseline Monitoring Used to Predict Future Impacts.**

The baseline monitoring was conducted over three visits to the four sites between November 2015 and June 2016. *“The four PASS monitoring sites were monitored three times between late 2015 and mid-2016.”*<sup>(3)</sup>

Page 11 of the PASS Baseline Assessment monitoring program states, *“The program is underpinned by scientific rigor using multiple lines of evidence-based techniques to establish the relationship between cause and effect for potential impacts caused by groundwater extraction.”* This statement highlights the declaration often made by Jacobs that the work being conducted in this New Monitoring Program is being done with *“...scientific rigor...”*

The following pictures taken at PASS site 1 throws some doubt on this rigor.



#### Appendix C. Site photos

##### C.1 PASS

##### C.1.1

**November 2015**

(page 77 in the Jacobs’ report – one of 5 photos)



#### Appendix C. Site photos

##### C.1.2

**March 2016**

(page 78 in the Jacobs’ report, one of 5 photos)

These are identical photographs taken months apart.

There were a total of 57

photos taken for comparison across the 4 PASS Sites covering the three visits. No explanation has been given why these two photos taken 4 months apart are the same photograph.

Having had very little to do with PASS 1, 2 and 3 sites, other than to say that it is difficult to understand how these sites can have Actual Acid Sulfate Soils and yet the water present is only slightly acidic, I will concentrate the following discussion on PASS 4.

#### **PASS 4 Sampling Site.**

This site was one of the sites that the LAWROC Landcare Group recommended be included in the ASS monitoring program. Ian Campbell the property owner concerned over his lack of success to grow anything at this site prompted him to have some soil testing carried out by FARMRIGHT in 2012. The result was extremely concerning (see Appendix Five, page 46).

The results were in fact alarming. The pH (1.5 water) was 3.5; pH (CaCl<sub>2</sub>) of 3.2, and Sulphur (KCL-40) of mg/kg 1639.7, prompted Ian to look further afield for advice. Having heard that LAWROC was interested in Acid Sulfate Soil sites, Ian thought LAWROC representatives may like to visit his farm.

In June 2012 LAWROC sent away 5 samples from the sight to the Southern Cross University Environmental Analysis Laboratory (see Appendix Six, page 47). The pH<sub>KCL</sub> levels were 3.9, 2.5, 2.51, 2.53 and 2.55. The Reduced Inorganic Sulphur levels were 10.61%, 0.04, 0.12, 0.07, 0.06%, and there was no Acid Neutralising Capacity. Considering the Victorian State Governments' Action Criteria Level for Reduced Inorganic Sulphur is 0.03%, there appeared to be a real problem with this site requiring further investigation.

Parts of the site had not had any vegetation growth for some years; sections of the paddock had slumped; tunnelling was taking place and fencing wire and



treated pine posts were being eaten away (see Appendix Two, pages 24-30).

Jacobs state... *“vegetation (many grasses) yellowed and experienced die-back at the site in summer months, resulting in patches of bare soil greater than 5m in diameter. The relative influence of acid sulfate soils and water availability on vegetation stress at the site*

*is however unknown.”* But this is not a true reflection of what the on ground

conditions were. The photo above shows no vegetation growth even when there is green grass indicating the growth season. Die-back in this patch is permanent and nothing grows.

(See Appendix 2, page 24)



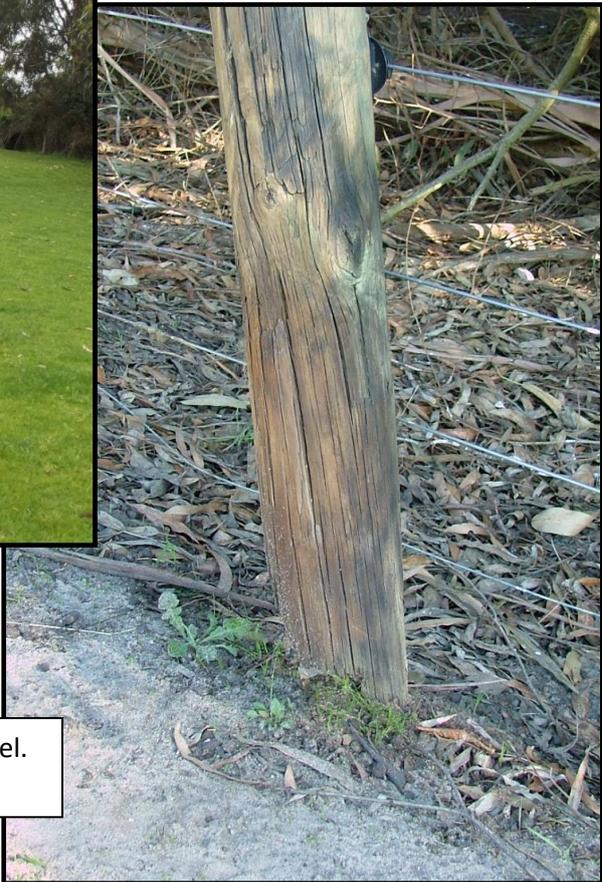
Oxidising peat will lose a substantial amount of its volume and could be responsible for the creation of the holes at the site.

The same could be said for the slumping taking place.

Tunnelling.



Slumping



Treated pine post eaten off at ground level.  
This post is swinging in the air.

(See Appendix 2 page 24.)



This photograph was taken in 2013 looking down into the Yan Yan Gurt Creek. The distinctive green colour of the water is an indicative sign of Actual Acid Sulfate Soil contamination. Unfortunately a water sample was not collected.

Given all of the indications that the Campbell site is a serious Actual Acid Sulfate Soil site it would have been reasonable to expect a thorough investigation of the cause and effects taking place at this site. When Jacobs carried out its work there seems to have been a glossing over of many of these indicators. There is no mention of tunnelling, slumping, post and wires being corroded, or patches of paddock that never grows any form of vegetation. Instead much of this early work that FARMRIGHT and LAWROC had already conducted, seemed not to exist. ***“PASS 4 was initially scoped as a potential site of investigation due to the very likely presence of shallow water tables and permanent saturation within the drainage line soils (SKM 2013).”*** The reason this site was initially looked at, and finally chosen was as a direct result of LAWROC’s suggestion it be included in the monitoring.

As for stating that the site had been subject to much altered landuse without any explanation seems extraordinary. ***“However, the much altered landuse at***

*the site suggests that the soils would likely have been exposed to oxidation in the past.*” What the land-use changes had been and why, requires answers, as does why the soil profile had “*...pervasive distribution of both PASS and AASS to a depth of at least 3 m (Jacobs, 2015).*” Some serious and detailed examination was required.

Another area of investigation that would appear critical to the understanding of what is actually taking place at this site, is investigating what the impact Barwon Downs Borefield groundwater extraction is having on the watertable in the area. “*...the impact of drawdown in the LTA on the overlying MTD is not known (Jacobs, 2015).*” Data shows the LTA has been lowered at this site by up to 6 m over the duration of the Barwon Downs Borefield extractions. Is the MTD vertically leaking downwards? How and why are the groundwater levels remaining artesian throughout the assessment period, and why the groundwater levels responded so differently to the other three PASS sites assessed, need to be answered. To state “*...presumably in response to increased rainfall in the catchment.*” does not explain why there are such difference between this site and the other three when they are all in the same catchment with similar rainfall for all four sites.

It is confounding to note in the 2017 report that “*Concentrations of iron, aluminium, manganese and zinc increased significantly between dry conditions in March and wetter conditions in June.*” And yet the pH levels stayed in the slightly acid range of approximately 6.5. Usually these metals stay locked up in a soil profile such as found at PASS 4, until drying, rewetting oxidation takes place producing acid, that in turn liberates these metals. A pH of 6.5 would appear not to cause such an influence.

“*When saturated, these soils remain stable and are referred to as potential acid sulfate soils (PASS), posing little environmental concern. If these soils are exposed to air (oxygen) as a result of declining groundwater levels or excavation, a natural chemical reaction takes place that produces sulphuric acid and can mobilise heavy metals.*” DSE guidelines (2010) indicate that the pH in AASS affected waters would be less than 4 pH. “*At two sites (PASS 2 and PASS 4), the pH of the surface and groundwater quality was neutral.*” That is a pH of 7. With the pervasive distribution of AASS at site PASS 4, it would appear to be impossible to achieve these neutral water levels.

#### **The Cirilo AASS Site (See Appendix 1, page 21).**

The reason given why this site was not included in the PASS assessment monitoring sites was that it did not come under the influence of drawdown from the Barwon Downs Borefield. Jacobs research may have found this to be

so but in the annual reports that Barwon Water have been submitting to Southern Rural Water for the last 13 years show that there is a residual drawdown effect below this very site.

The investigative work conducted by the LAWROC Landcare Group supports the notion that this site fulfils all the criteria for selection as an appropriate and worthy site to be included in the PASS assessment monitoring.

**Boomerang Swamp** at the headwaters of a tributary of Boundary Creek should also be monitored for future Acid Sulfate Soil impact. This swamp has a most interesting and chequered history of poor management since 2002. This wetland is dealt with in some detail in Otway Water Books 18 and 20. (Also see Appendix 2 and 3)

### Comment on Some of Jacobs' Summary and Key Findings<sup>(3)</sup>

- ✚ ***“Changes noted in ground conditions, surface water and groundwater were consistent with seasonal fluctuations.”*** This finding is to be expected if the groundwater is not under artesian pressure. If under artesian pressure then it would be expected that the PASSs would be buffered from conversion to AASS.
- ✚ ***“Groundwater levels are typically shallow (within 1 m below the surface) and display seasonal fluctuations of around 0.5 m, rising during the winter months and declining during the summer months.”*** However, at PASS Site 4 the ***“Groundwater levels are artesian...”*** which appears to be the exact opposite as described in the quote above.
- ✚ If Actual Acid Sulfate Soil are being generated it seems impossible that ***“At two sites (PASS2 and PASS4), the pH of the surface and groundwater quality was neutral.”*** When PASS is oxidised to AASS, then a natural bi-product is the creation of sulphuric acid. The only explanation is that the PASS sites have a greater Acid Neutralising Capacity than the amount of acid produced. This seems most unlikely in PASS 4 because the permanent bare patches of ground present, and considering that ***“At PASS 4, soil sampling indicated the presence of severe AASS and PASS.”***
- ✚ Of the 14 sites originally included for examination only 6 had soil samples taken and all were deemed to be ASS sites. ***“All sites were found to have ASS.”*** and were chosen in areas where the groundwater had declined due to groundwater extraction from the Barwon Downs Borefield.
- ✚ The final list for monitoring included 4 sites and ***“The sites selected are located in areas where groundwater levels have declined in response to pumping from Barwon Downs borefield.”*** Consequently any capacity for

the groundwater pressure levels to buffer these sites in drier rainfall periods would be reduced. For example the Big Swamp had been buffered from all droughts and dry periods from 1912 up to just after the drought extractions of 1982-83.

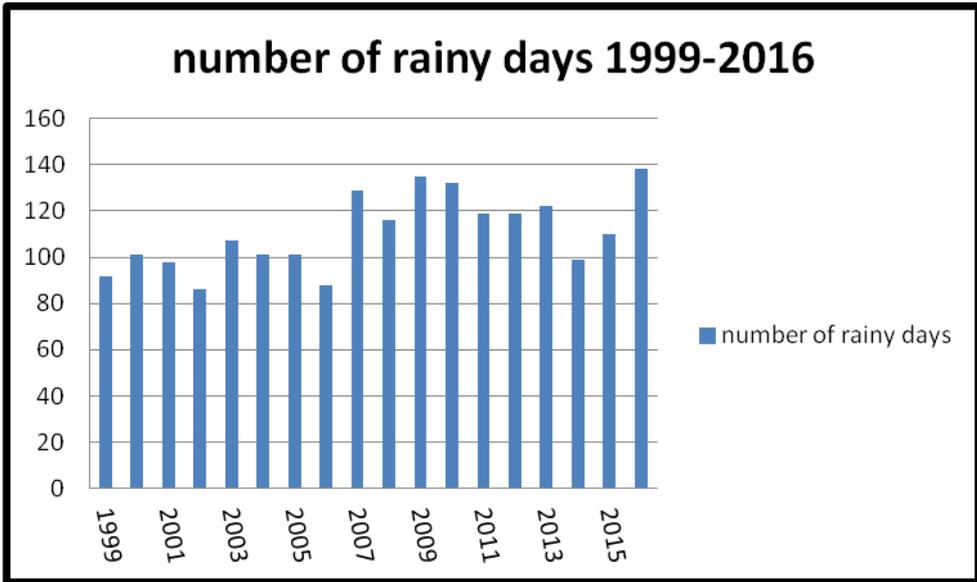
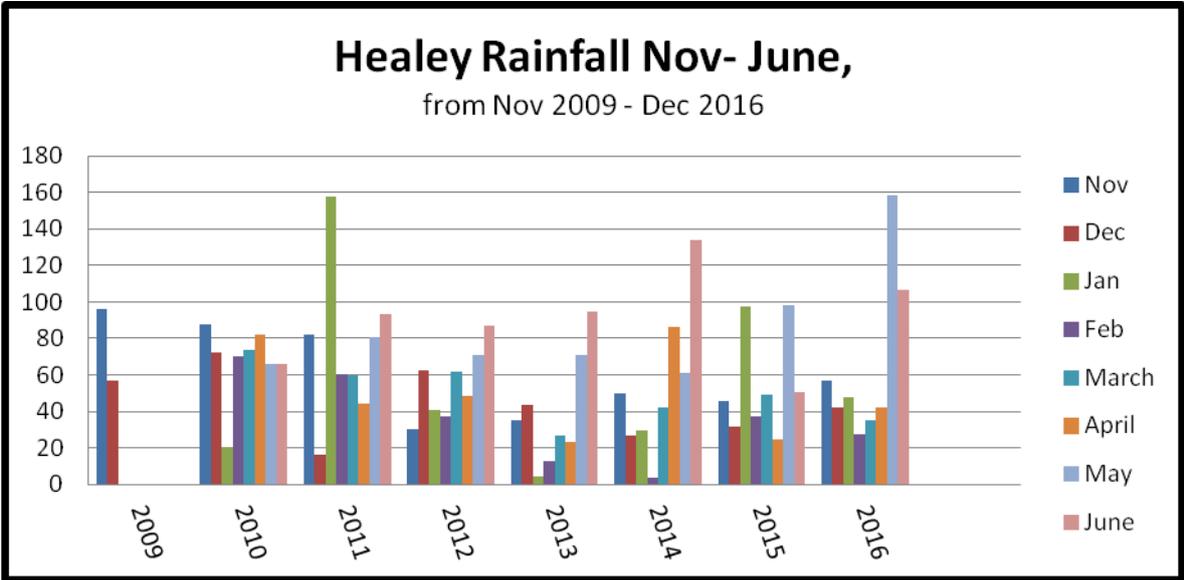
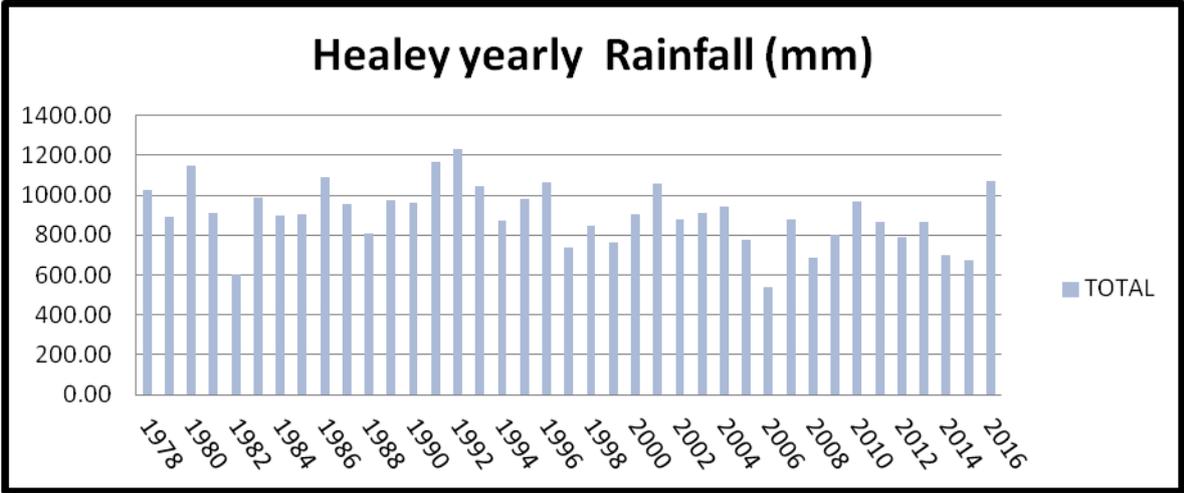
✚ ***“...these results illustrate the type of seasonal variability likely to occur at all PASS monitoring sites under drier than average conditions, and the absence of borefield induced drawdown.”*** Comment on the seasonal variability has already been made, but another interesting aspect seen in this quote is the inferred idea that the absence of induced drawdown no longer exists having an impact on the PASS sites. Two things are possibly taking place:

1. PASS 4 being at the extremity of the drawdown influence the groundwater in this outer reach could still be flowing from this area and into the void created from the earlier extractions. The LTAs still have not fully recovered and are not expected to for some considerable time.
2. During the last phase of the recovery stage the impact from no extraction would be the exact opposite to drawdown, namely drawup. This upward movement of the groundwater levels would have significant impact on the PASS sites and does not seem to be considered in this 2017 PASS assessment.

✚ The statement that there is no evidence of borefield related drawdown from the borefield influencing the PASS sites first appeared to be based on the monitoring period between November 2015 and June 2016, at best 8 months. However, the results in this report appear to have been based on only two months of observation and testing. ***“The groundwater trends observed were consistent with seasonal fluctuations and there was no evidence of borefield related drawdown at any of the baseline sites in the last two months.”***

✚ ***“The baseline took place between November 2015 and June 2016, when drier than average conditions were persistent throughout the area of investigation.”*** It has not been stated where the data came from to reach this determination but the rainfall records from the Healey rain gauge measuring station appears to paint a different picture.

The Healey rain gauge is located on the recharge area of the Barongarook High and the following charts suggest that the area of investigation was not drier than average.

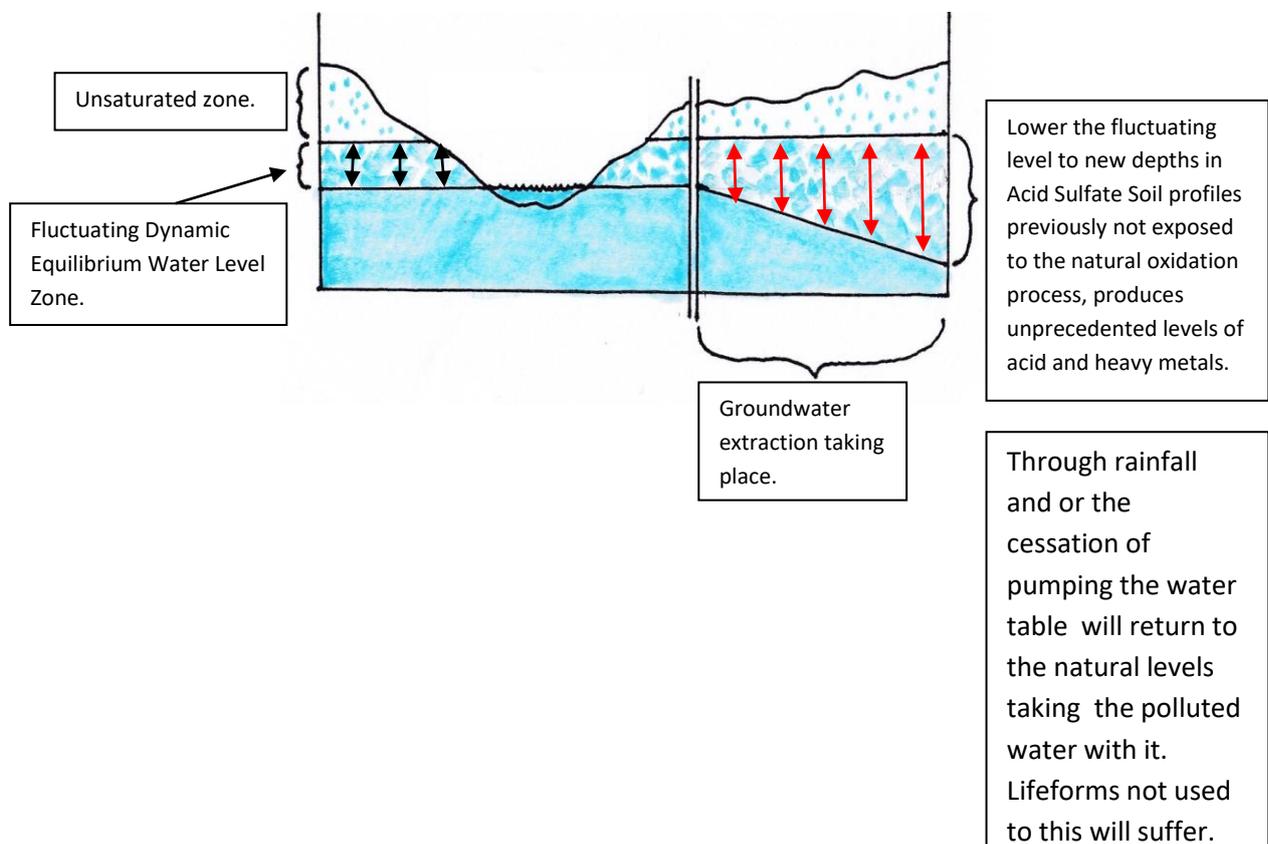


(See Appendix 6, page 48 for additional rainfall charts.)

✚ The recommendations contain an interesting statement. *“It is recommended that all PASS monitoring sites are monitored on an annual basis during the wetter months of the year, when there is expected to be surface water in the creeks.”* If a PASS site was to oxidise into Actual Acid Sulfate Soil this is most likely to start happening at the end of spring. The oxidation would continue and the most impact would be expected in the shoulder period between summer and winter when the first rains begin to fall. Wetter winter rainfall would then flush the acid and heavy metals that may be produced during the oxidation transition from PASS to AASS out of the system.

## CONCLUSION

Under the natural fluctuations of the groundwater table influenced by the Lower Tertiary Aquifers, those soils subject to creating Actual Acid Sulfate Soils and the resulting acid and heavy metals, would have reached a relatively stable and benign state. The ecosystem would have developed, maintained and reached a state where minor production of acid and metals would have become part of the natural fluctuation, developed over eons, and tolerated by the flora and fauna of the region. Lower the watertable way below this natural fluctuation and the ecosystem is faced with conditions alien to the tolerable levels adapted over the years.



Massive groundwater extraction has lowered the watertable in the LTA to unnatural and intolerable levels. One of the bi-products of this is the creation of Actual Acid Sulfate Soils in Acid Sulfate Soil profiles, and to a level unprecedented previously. The Big Swamp is a classic example of this and it would appear that PASS Site 4 may also fit into this category. The soil impacts in the Big Swamp are well documented and they have taken place with groundwater extraction rates as low as 2,000 ML/year, up to 11,000 ML/year. However, to exclude the Big Swamp from this study because the impacts are well understood is a failing in this study. The impact is obvious and observable but the cause of the impact must be documented and form part of this study, especially when every indication is that groundwater extraction is the cause of this wetland's demise.

Setting the baseline reference point at 2015 and only concerned with and noting changes from this time on, completely disregards the impacts from groundwater extraction that have already been created. Pumping has been taking place since 1982. Disregarding impacts from Actual Acid Sulfate Soils up to 2015 is far from satisfactory. To also state that predicted future impacts will be within the range of past impacts is not that comforting when considering the devastation created in the Big Swamp Acid Sulfate Soil wetlands.

By feeding data into the 2015 model that does not include the Big Swamp data, it is not surprising the four PASS Assessment sites used, returned with the result of there being no evidence that the drawdown from pumping is influential.

***"The drawdown predicted at the PASS monitoring sites is within the range of drawdown experienced in the past and a baseline assessment in 2015 highlighted there is no evidence of drawdown from the borefield influencing PASS at these sites."***<sup>(1)</sup>

But, perhaps this prediction from the model comes about when the model is working on the assumption that the current sites being studied have not been materially affected from previous groundwater extraction.

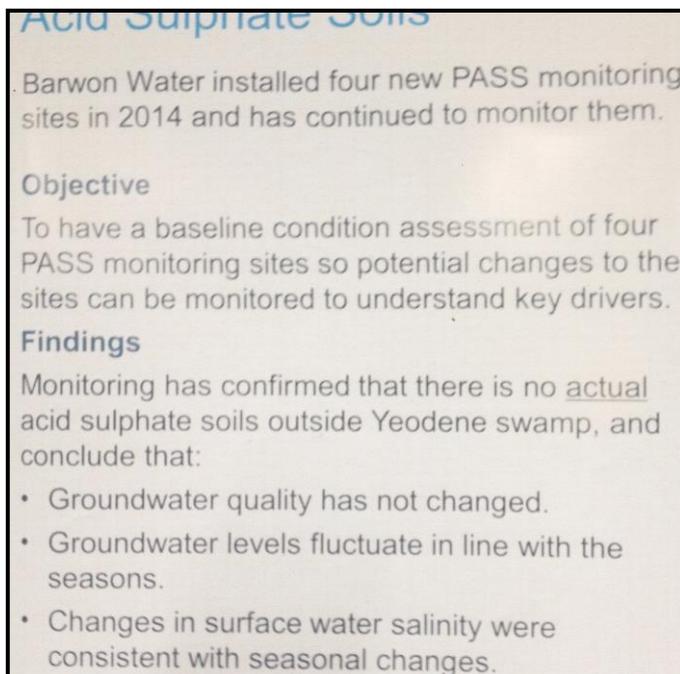
***"This assessment makes the assumption that current conditions at the investigated sites are not materially affected by pumping from the borefield."***<sup>(2)</sup> The model result will only be as reliable as the data being fed into it.

Further, the model has been asked to make its predictions based on a 4,000 ML/year extraction rate. Considering extraction rates have been thousands of megalitres over this rate on numerous occasions, the model should have been asked to make predictions at these higher rates. This coupled with feeding the Big Swamp data into the model, the predictions may well have come much closer to the observable impacts experienced pre 2015. Massive devastation.

This massive devastation appears to have been forgotten or lost in the latest Acid Sulfate Soil monitoring as evident in a **“Summary Overview: Future potential impacts of operating the Barwon Downs Borefield”** July 2017, when one of the key findings had this to say:

**“Predicted drawdown at the PASS monitoring sites is similar to the drawdown predicted from the historical impact assessment. This means that predicted future drawdown is not expected to be worse than what has been experienced in the past.”** The historical devastation in the Big Swamp, Boomerang Swamp and Cirilo’s farmland are not included in the historical calculations.

The Big Swamp is the highest Freshwater Actual Acid Sulfate Soil site in Australia **and** in the top three Acid Sulfate Soil sites with an assay over 16% $C_{sr}$ . Future impacts based on historical impacts and drawdown could not get much worse.



This photograph tells only a fraction of the story. There are other Actual Acid Sulfate Soils within the area of drawdown influence other than the one at the Big swamp in the Yeodene area (Yeodene swamp).

The SKM/Jacobs report falls way short of anything close to a comprehensive report on Acid Sulfate Soils in the drawdown area of influence from the Barwon Downs Borefield.

**Photograph SOURCE:** Display, 1 Aug 2017, at Barwon Water Offices Information Night, Geelong.

APPENDIX ONE



WATER QUALITY LABORATORY

Test Report

Lab. Ref. No. 08/307

2 September, 2008

Page 1 of 1

Mr. *McGardiner No. 3249*  
GELLIBRAND Vic., 3239

Dear Sir,

The following results were obtained on a sample as received on 15 August, 2008.

Parameter	Unit	Results
Iron	$\text{g.m}^{-3}$	480
Aluminum	$\text{g.m}^{-3}$	0.98
pH		2.7

All Tests have been conducted within the recommended holding period.

Yours sincerely,

*Kate Hill*  
Kate Hill  
Approved Signatory

*Malcolm John Gardiner*  
MALCOLM JOHN  
GARDINER

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

*Allan J McFallon*  
PRINCIPAL COLAC P.S.  
18<sup>th</sup> SEP 2008

$\text{g.m}^{-3}$  = milligrams per litre.



# WATER QUALITY LABORATORY

## Test Report

Lab. Ref. No.

08/347

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

1 October, 2008

Page 1 of 1

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 <sup>+</sup> B	pH		3.3	4.2	3.3
2510 B	Elec. Conductivity	µS.cm <sup>-1</sup>	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-SO <sub>4</sub> <sup>=</sup> 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. FM 0807037.  
All Tests have been conducted within the recommended holding period.

Yours sincerely,

Kate Hill  
Approved Signatory



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



# WATER QUALITY LABORATORY

## Test Report

Lab. Ref. No.

08/347b

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

22 October, 2008

Page 1 of 1

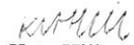
Dear Sir,

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

Method	Parameter	Sample 2-A 13/9	Sample 2-B 13/9	Sample 3 13/9
4500-H <sup>+</sup> B	pH	2.7	2.5	2.6

All Tests have been conducted within the recommended holding period.

Yours sincerely,

  
Kate Hill  
Approved Signatory



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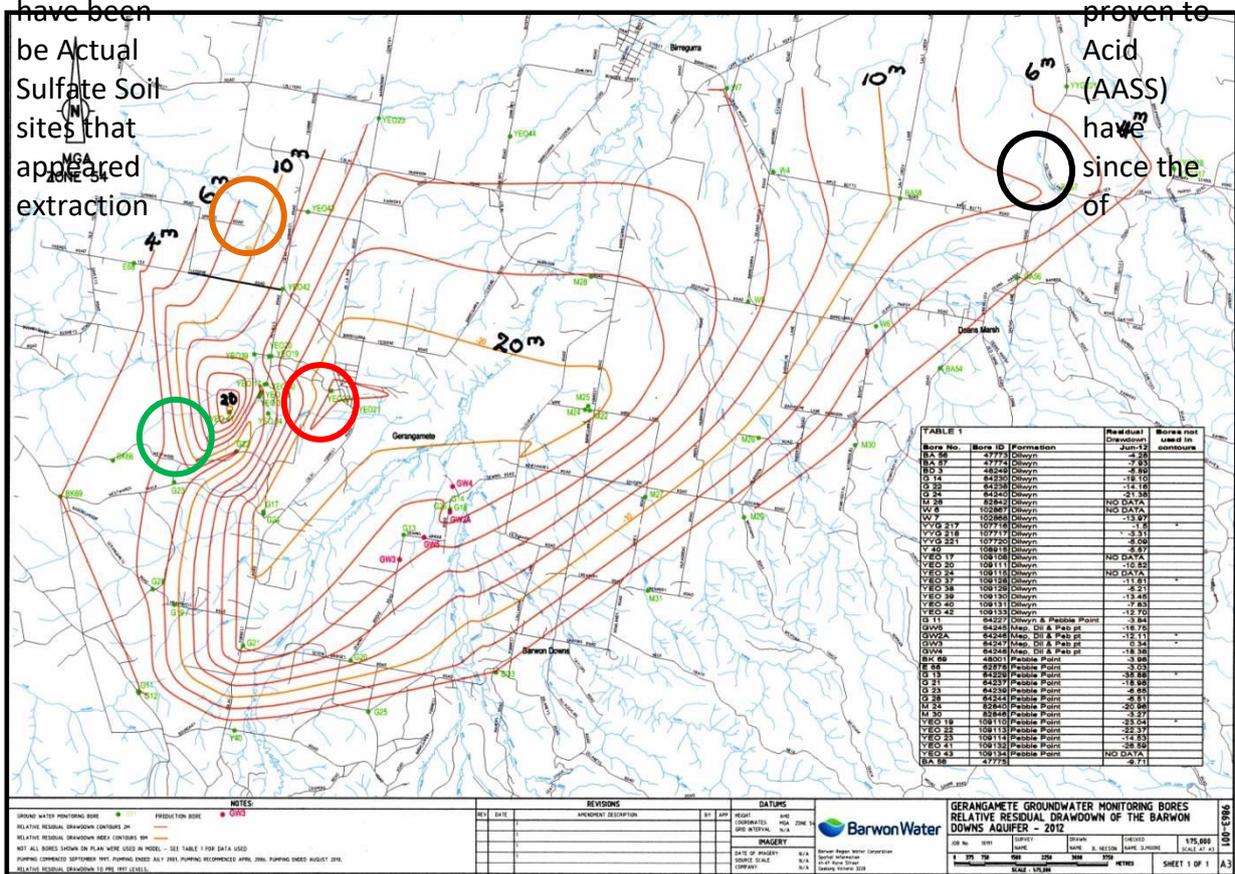
PO Box 423, Warrnambool, Victoria, 3280, Australia Telephone: (03) 5563 3481 Fax: (03) 5563 3462

**APPENDIX TWO** this Appendix is a direct copy of Chapter Two found in **Otway Water Book 20 "Unfinished Business," Feb. 2013.** Reference and page numbers have not been changed. Appendix Three on page 30 from Otway Water Book 18, shows others photographs taken at Boomerang Swamp.

# CHAPTER TWO

## The spread of AASS

The question whether the extraction of groundwater far in excess of the 1990 Permissible Annual Volume has been causing Potential Acid Sulfate Soil to turn into Actual Acid Sulfate Soil sites has been asked for years now. There is no doubt that three sites have been proven to be Actual Sulfate Soil (AASS) sites that appeared since the extraction of



Significantly there have been no other studies or reports that have identified any other inland actual acid sulfate soil sites in the Otway Ranges other than these found within the area of influence of the residual drawdown contours created by the Gerangamete/Barwon Downs Borefield. There may be many explanations for this phenomena and groundwater extraction may well be one of them. Until the Government authorities take the occurrences of these Actual Acid Sulfate Soil sites seriously and are prepared to finance the appropriate studies it is possible that the cause(s) may never be known.

**This site** is extremely well documented and is known locally as the Big Swamp and was knick named Jurassic Park by the CFA in 1997/98 fires. The LAWROC Landcare Group commissioned EAL of Southern Cross University to collect and analyse samples. The resulting report<sup>(5)</sup> confirmed the Group's fears that the Big Swamp was indeed an Actual Freshwater Inland Acid Sulfate Soil site. The La Trobe acid sulfate soil study that was commissioned by the Corangamite Acid Sulfate Soil Multi Agency Steering Committee confirmed this earlier finding. Three sites in Australia have had a soil sample test of over 16%<sub>SCR</sub>. The Big Swamp is one of those sites.

**This site** is not quite as bad as the Big Swamp but still had one assay test of 10%<sub>SCR</sub> (Reduced Inorganic Sulfur) which is approximately 333 times above the Victorian trigger standard for serious concern. At these levels if there was a bountiful supply it would make a profitable sulfur mining venture for the farming enterprise concerned.









This site  is borderline Actual Acid Sulfate Soil but most certainly has the potential to generate some unusual happenings. The site is Boomerang Swamp and Otway Water Book 18 deals solely with this site.



See Appendix 3 page 30

This star picket was placed in this dry swamp in 2008 and was inundated for a maximum of two months between October and December 2012. As the water receded to different levels the corrosion became most evident.

The latest site  is also well inside the influence of the residual drawdown and is also decimating farm pasture.



Time for concern? Most definitely. However, as the state authorities refuse to look at the causes of the Big Swamp's demise it is doubtful that anything will be done about these other sites other than to map them, and confirm what already is known; that they are Actual Acid Sulfate Soil sites.



In a letter dated 16 July 2009 the then secretary of the Department of Sustainability and Environment included this statement...  
"Evidence of the development of ASS in other parts of the catchment are starting

to appear..." (see page 88 ★ ). In January 2013 the secretary of the Department of Sustainability and Environment was asked for this evidence as well as a document produced by SKM (see page 88 ★ ).



**Department of  
Sustainability and Environment**

Ref: SEC009287  
File: CS/07/3073  


Mr Malcolm Gardiner  
1805 Colac Lavers Hill Road  
KAWARREN VIC 3249

8 Nicholson Street  
PO Box 500  
East Melbourne Victoria 8002  
Australia  
Telephone: (03) 9637 8000  
Facsimile: (03) 9637 8100  
DX 210098

Dear Mr Gardiner

**GROUNDWATER EXTRACTION AT BARWON DOWNS**

Thank you for your letter received by this Department on the 11 January 2013. In your letter you request a copy of the SKM report 'Recommendations for Groundwater Licence Conditions', and evidence of development of acid sulfate soils in 'other parts of the Barwon River catchment'.

The SKM report to which you refer was commissioned by Barwon Water. Please contact Justin Franklin at Barwon Water to request a copy.

LaTrobe University are currently conducting a PhD study into inland acid sulfate soils in the Corangamite Catchment Management Authority area. The study is due to be completed this year. For more details on the progress of the PhD, please contact Associate Professor John Webb at LaTrobe University on (03) 9479 1273 or email john.webb@latrobe.edu.au for information.

Thank you for raising this matter with me.

Yours sincerely

 12/2/13  
**Graeme Turner**  
Executive Director, Water Resources Division  
Water Group

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When Peter Harris wrote that evidence of other ASS sites were appearing in the catchment the LaTrobe university study was still being "scoped out." In fact the Corangamite Inland Acid Sulfate Soil Multi Agency Committee had difficulty gaining a forum at that stage, and meeting after meeting was postponed. Eventually, when the brief was given to LaTrobe University it included looking at only two sites, one south and one north of the Princes Highway. The one north of the highway which is outside the catchment, was eventually found to have sufficient buffering capacity to prevent Actual Acid Sulfate Soil and the other site was the Big Swamp. There were no other identified sites or even the slightest evidence of other sites in the catchment. More nonsense.

### APPENDIX THREE

Was photograph was taken at Boomerang Swamp at the headwaters of a tributary of Boundary Creek. There were numerous yabby skeletons spread across the swamp.



Peroxide testing indicated high levels of potential acid, and follow up soil analysis confirmed this (Otway Water Book 18 deals with the deplorable way in which this swamp has been managed).

**APPENDIX FOUR – this Appendix is a direct copy of Chapter Six found in Otway Water Book 20 “Unfinished Business.”**

## **CHAPTER SIX**

# **Who Decided to Drop the Big Swamp from the 2008-2009 Flora Survey.**

Material in this chapter has been taken from pages 86-100 out of Otway Water Book 18, *“The Boomerang Swamp.”*

Developments late in 2008 and early 2009 prompted asking the then secretary, Peter Harris, of the Department of Sustainability and Environment (DSE), whether it was true that officers of the DSE had made the decision to leave an inspection and reporting of the situation in the Big Swamp out of the 2009 Barwon Water Flora Survey. Shortly after the Flora Survey report was concluded a third party told me that DSE officers were responsible for the omission of the Big Swamp from the report. In a letter to Peter asking this very question he vehemently denied this was the case. At the time this seemed to be the end of the matter. However, a letter written in 2012 (see page 78 for an extract from this letter and pages 90-91 for the complete letter) prompts the re-telling of this story.

The following time line of events depicts a most interesting series of developments.

### **1993**

Stream flow gauging indicated a persistent and alarming drop in pH levels in the waters of Boundary Creek. Boundary Creek flows through the Big Swamp on its way to the Barwon River.

### **2004**

Barwon Water had its licence to extract groundwater at the Barwon Downs Borefield renewed. Part of the licence conditions was to monitor water sensitive wetlands with possible groundwater connectedness. A flora study of such sites had to be completed within 5 years, by the end of 2009.

### **August/September 2008**

Test results carried out by Deakin University, Warrnambool, indicated water coming from the Big Swamp was extremely acidic and contained toxic metal and metalloids.

### **October 2008**

Barwon Water was notified that test results indicated serious acid problems within the area of residual drawdown from their borefield at Barwon Downs. **Following no action after a series of formal complaints sent to several state authorities**, on 10 October ABC Stateline television ran a 10 minute grab on this very issue. The Barwon Water CEO was interviewed as part of this television presentation.

Barwon Water was aware and had been fully briefed by the Landcare Group, LAWROC, of data collected indicating a serious acid problem within the Board's sphere of influence.

## **November 2008**

Southern Rural Water was notified of and given copies of these test results indicating that the Big Swamp was an Actual Freshwater Inland Acid Sulfate Soil site.

## **Before Barwon Water's 2008-09 Flora Survey commenced**

### **17 December 2008.**

Chris Hughes of Southern Rural Water (SRW) was asked, among other things, what action was being taken in regard to the acid and heavy metal levels being detected in the Big Swamp. Part of his reply included this...

*"In accordance with condition 7 of the licence, SRW has required Barwon Water to undertake a detailed Flora Survey. Barwon Water has sought tenders from suitably qualified expert consultants and the successful tender has not yet been appointed. Barwon Water must consult with the Department of Sustainability and Environment regarding suitable consultants. The investigation into Acid Sulphate soils will be incorporated into the consultant's analysis and the completed report is expected by mid-2009."*

This letter was quite specific containing an assurance that the Big Swamp would be included in the Flora Survey. Whether there was an Acid Sulfate Soil problem or not the Big Swamp should have been included in the Flora Survey as a matter of course and especially so when it was abundantly clear that this wetland was well within the influence of the residual drawdown and was displaying serious detrimental environmental impacts. The swamp was not included in the Flora Survey study..

For some reason Chris Hughes had never been asked to explain why the Big Swamp had been omitted from the Flora Survey and in 2012 *several* queries were sent to Chris Hughes asking why the Big Swamp was not included. Eventually a reply came from Angus Ramsay (SRW) prompting another look at earlier excuses why the Big Swamp had not been included in the 2009 Flora Survey. His letter was dated 2<sup>nd</sup> July 2012. An extract from this letter is as follows...

*"Thank you for your email of 11<sup>th</sup> June 2012 requesting information regarding the investigation into Acid Sulfate Soils at the Big Swamp being included in a Flora Study being undertaken on behalf of Barwon Water relating to the Gerangamete groundwater licence.*

*At the time of our response letter of 17<sup>th</sup> December 2008, Southern Rural Water and Barwon Water were finalising the scope of the study and had included Acid Sulfate Soil's as one of the aspects to be looked at.*

*It was determined that the issue of Acid Sulfate Soils in the area was too **large and specialised** to fit within the scope of the study and the team assembled to undertake the flora based study. The study team did visit a location outside of the study area that was showing aspects of Acid Sulfate Soil's, but as the team didn't have any expertise in this area, they weren't able to offer a considered opinion on the issue."*

It would appear that the Big Swamp initially had been included in the Flora Survey but was at a later stage omitted because of a lack of expertise that SKM brought to the study. What

feeble excuses. Irrespective of an Actual Inland Acid Sulfate Soil problem or not, the Big Swamp's obvious demise merited inclusion in the Flora Survey. A decision was made to exclude the Big Swamp and who made this decision?

### **Lack of Expertise, too Specialised??**

In 2011 the Department of Primary Industries(DPI), Victoria, tabled a report, "**Acid Soils and Soil Acidification in Victoria – a review,**" written by Crawford, Heemskerk and Dressel. These [experts](#) were prepared to [offer a considered opinion on the issue](#) even if SKM and Southern Rural Water thought that it was outside their area of expertise or responsibility. This quote is taken directly from this DPI report.

Quote One. ***"It is understood that in Boundary Creek, AASS has been created by an unsuccessful attempt to extinguish the fire by draining the peat."*** (AASS – Actual Acid Sulfate Soil)

The main objective of the Barwon Water Flora Survey was to determine the **impacts** on any Groundwater Dependent Ecosystems within the Barongarook High Region. The Big Swamp most definitely satisfied this criteria, was easily reached; was, up to the 1980s a permanently saturated and healthy wetland, and in recent times exhibited serious impacts that could not be denied. From Quote One above it would appear that there was some justification in leaving the Big Swamp out of the Flora Survey as it was stated as a fire related issue. The DPI document gave no explanation how the wetland had been drained. In fact, such a notion of fire activities being suggested as the cause of the Actual Acid Sulfate Soils may have prompted Barwon Water to finally tackle and make comment on such a **"large and specialised"** issue. In Barwon Water's question and answer section of the Water Supply Demand Strategy 2012-2062 there appeared to be no reluctance to make the following statements:

Quote Two **Q. What is the cause of acid sulfate soils at Big Swamp on Boundary Creek at Yeodene?**  
**A. A range of factors are likely to have contributed to changes at this site, including:**

- **an outbreak of fire on the swamp in 1997 which started in an adjacent private property**
- **extensive drainage works conducted for fire management purposes**
- **extensive on-site fire management burning within the swamp to reduce fire risk**
- **an extensive drought between 1997 and 2009.**

There are many issues raised in these two quotes but it should be most obvious that you do not drain peat to extinguish a peat fire, nor does one carry out fuel reduction burns within a dry peat area. Both of these notions presented above are nonsense and display a high level of ignorance regarding the behaviour of peat fires. It is interesting to note that after the 1997 fire had supposedly been extinguished it surfaced again in 1998 and then smouldered for another 12 years before surfacing and causing another serious wild fire in 2010.

Perhaps the best people to ask about fire behaviour and to clarify the wild accusations made by the Department of Primary Industries and Barwon Water would be those people accused

of possibly causing the Actual Acid Sulfate Soils of the Big Swamp. Consequently a query was sent to the Colac branch of the Country Fire Authority (CFA) asking for comment on the two quotes cited above.

The CFA reply duly arrived...

**Subject:** Reply to acid sulphate letter  
**From:** Brian Brady (B.Brady@cfa.vic.gov.au)  
**To:** otwaywater@yahoo.com.au;  
**Date:** Tuesday, 24 April 2012 2:45 PM

Hi Malcolm, in response to the two quotes in your letter.

Quote 1..Draining the peat was never considered an option by CFA or any of the organisations that have been in a supporting role in dealing with this situation, it is certainly not documented as a control option, in fact it is quite the opposite to what we considered early on in the event and that was to flood the area, not to drain it.

Research has since indicated that the drier the peat the greater chance of it self combusting so draining it is not an option.

Quote 2..point two and three regarding the "drainage works" conducted, as in the first quote response, there were no drainage works conducted, the trench that was constructed was done so to create a physical break in the continuity of the peat so that it would burn to an edge and run out of "available fuel" when it reached the break. CFA have no technical expertise in draining swamps nor was any sought and, as above, draining the swamp would create more problems than it would have solved.

There was no fuel reduction burning (fire management burning in the quote) in the swamp area whatsoever. The area burnt within the swamp was that consumed during the two main fire events that occurred in the swamp area in October 1997 and March 2010.

One of the control strategies proposed after the 2010 fire was to burn out the dead vegetation within the swamp that had accumulated after the fire but this option was never acted on due to the fact that it may have set any unburnt peat alight and also it was considered too dangerous to have personnel walking on the peat surface in case the crust on the surface gave way and the personnel may have sunk into what may have been powdery ash under the crust which may still have been hot.

There is still the proposal to construct a clay plug along the eastern trench and part of the southern trench which is designed to increase the moisture level of the peat to prevent the peat drying out to the point of self combustion and to also extinguish any pockets of smouldering peat under the surface. The "plug" proposal is endorsed by Latrobe University and will be proceeded with if funding becomes available.

The matter of acid sulphate soils occurring after the fires and issues about the water table are completely outside CFA's scope of responsibility and expertise and therefore CFA will not involve itself in the resolution of these issues.

Regards

Brian Brady

Nothing surprising in this reply.

- CFA never considered draining the peat,
- no drainage works were conducted and
- no fuel reduction was done within the swamp.

As stated the Big Swamp had initially been included as part of the 2008-09 Barwon Water Flora Survey and it is interesting to note that Sinclair Knight Merz (SKM) the company conducting this survey, did not have the expertise to deal with the issue. This is most curious, especially when a local Landcare Group, LAWROC, appeared to be able to bring more expertise to the issue than the “specialists.” The LAWROC Group was able to identify severe impacts and provide the necessary experts and resources to positively have the Big Swamp declare an Actual Freshwater Inland Acid Sulfate Soil Site with the distinction of having a soil sample test out as one of the worst top three samples found in Australia. The Southern Cross University study that confirmed the Big Swamp as an Actual Inland Acid Sulfate Soil site was commissioned by LAWROC and paid for in 2010 after every other state authority denied any responsibility.

It is most surprising that SKM with all the resources at its disposal could not assess the state of the Big Swamp irrespective of it being an Acid Sulfate Soils site or not. However, what is more alarming is that SKM is Barwon Water’s major consultant for the Barwon Downs Borefield development and management. If SKM did have the Big Swamp site assessed who made the decision to omit it from the Flora Survey and on what grounds? At that stage the site presented massive detrimental impacts of some kind and the only people suggesting that there was a possibility that it was an Acid Sulfate Soil site were members of the LAWROC local community group. The Big Swamp could not be ignored, it was a site that fitted all the criteria of the Flora Survey that was attempting to assess impacts on wetlands within the drawdown area of the Barwon Downs Borefield.

The Big Swamp may not have been assessed but it most definitely was visited during the conducting of the Flora Survey. It is located closer to the Barwon Downs Borefield than the majority of the original 84 flora sites surveyed in 1993-94. Was the Big Swamp left out of the Flora Survey on Purpose? It looks that way.



This picture shows the galvanised dropper that was placed in the Big Swamp during this visit and the visual impact this site would have presented to those doing the survey. How could this site be ignored? The impacts are obvious to the most casual observation.

The following pictures give a glimpse of the scene the Flora Survey “expert” would have seen when visiting the Big Swamp.



It is my guess those people visiting this site would have been horrified and it was someone else that ordered the omission of this site from the survey.





Whether the “*team*” had the expertise to deal with acid sulfate soils or not when visiting this site, alarm bells should have rung loud and clear that this wetland had been subjected to a dramatic detrimental influence of some kind. The obvious degradation of effects on the water dependent

vegetation in this swamp was the very thing that the Flora Survey was aimed at investigating. How or why this site was dropped from the survey is beyond belief.

#### 4 March 2009

The flowing extract is from a letter sent from the Water Minister, Tim Holding, of the time (DSE Ref: DSE063402, File: CS/07/3073).

*“BW recently completed a flora study as part of the monitoring requirements of the groundwater extraction licence it has for Barwon Downs. Whilst acid sulphate soil (ASS) monitoring was outside the scope of the study, **no evidence** of acidification was found. Nonetheless, BW is now proposing to work with agencies to specifically investigate ASS impacts at local and regional sites.”*

In 2009 this response prompted a formal complaint being sent to Southern Rural Water, “the keepers of the watch.”

A similar letter of formal complaint was sent to all of the statutory authorities, including the Department of Sustainability and Environment (DSE), that had been approached over the demise of the Big Swamp asking that some action be taken.

### **3 May 2009**

This extract forms part of a letter from Peter Harris the then Secretary of DSE (His Ref: SEC005476, File CS/03/0445-3)...

*“In preparing the Barwon Downs licence in 2003/04, extensive hydrogeological and ecological investigations occurred. An independent panel considered that all identified wetlands in the area were sustained by a local shallow water table not connected to the regional groundwater resource that supplies the borefield. The panel recommended that the licence require Barwon Water undertake flora surveys to further investigate the connection between riparian vegetation and groundwater levels.*

*BW commissioned a flora study (2008-09) as part of the monitoring requirements of its groundwater extraction licence. Acid Sulphate soil (ASS) monitoring was outside the scope of the study, however **no evidence** of acidification was found. Nevertheless, BW is now proposing to work with agencies to specifically investigate ASS impacts at local and regional scales.”*

### **11 May 2009**

Peter Harris’s letter prompted this reply...

*Mr. Peter Harris  
Secretary  
Department of Sustainability and Environment  
8 Nicholson Street  
PO Box 500  
East Melbourne  
Victoria 8002*

*Dear Mr. Harris*

*Re; Groundwater Extraction at Barwon Downs.*

*Thank you for your reply to my formal complaint regarding the ASS,  
Your Ref. SEC005476,  
FILE CS/03/0445-3.*

*There are some points that you make in your reply that indicate that you are not being given up to date advice.*

1. *In spite of the protracted drought of 12 years there are streams and wetlands in the adjoining areas to the Barwon Downs borefield that are not being influenced like the wetlands of Boundary Creek. The groundwater extraction at Barwon Downs is causing serious problems along Boundary Creek.*
2. *Yes BW does release water out of its Colac to Otway pipeline into a tributary of Boundary Creek. But this most definitely does not address the impact on flows in Boundary Creek.*
3. *The area called the Big Swamp on Boundary Creek where the ASS is, seldom sees any of this released water.*
4. *The trigger level for release of this water into Boundary Creek has been exceeded for years and all that this water does is exasperate the ASS problem.*
5. *Unfortunately the extensive hydrological and ecological 2003/04 investigations that you refer to, must not have been looked at by the independent panel. The 14 May 2003 SKM "Recommendations for Groundwater Licence Conditions" quite clearly delineates that the wetlands in the Big Swamp on Boundary Creek have a direct connection to the EVF aquifer that BW is extracting groundwater from. For you to be advised that "...all wetlands in the area were sustained by a local shallow water table not connected to the regional groundwater resource that supplies the borefield" is almost beyond belief. The reports are available that quite clearly indicate the opposite.*
6. *The reason for the trigger level that implements releases from the Colac Otway pipeline is set at 158.5 AHD. It was set at 158.5 AHD because the hydrological investigations clearly stated that if the watertable dropped to 158 AHD the wetlands in the Big Swamp would begin to dry out. The AHD has been way below this level for years, consequently the production of acids and releases of toxic heavy metals – AASS into the Big Swamp area.*
7. *Adjoining aquifers most definitely have not suffered 50 m drawdown like at Barwon Downs.*
8. *Water Data Victoria pH levels for Boundary Creek clearly show the dramatic increase in toxic acid levels that should have triggered investigations years ago. Someone has not been doing their job of scrutinising the effects of groundwater extraction.*
9. *You talk of the early 2000s ecological investigations but it would appear that you were not informed that these studies began in 1986. Parts of the studies and their recommendations that have not been implemented. Your advisers would appear to have an extremely limited knowledge of these studies and their implications.*
10. *Yes the ASS may have been outside the scope of the 2009 flora study just completed. However the site was visited and the ASS should have been most apparent to the consulting team that finalised the study, considering the composition and expertise of this team.*
11. *What I find most disturbing is that DSE consultants on this team, indicated that when there was discussion on the ASS, this aspect of the study was not to be included in the final report.*

*I would appreciate you letting me know the reasons why officers from your Department insisted that any mention of the ASS was not to be included in this 2009 Carr flora study report?*

*I would also like to know why the Colac Otway Shire was not asked to have a representative on this consulting team.*

*I believe that you cannot make adequate decisions if your advisors are not fully informing you of all the facts. A site visit would seem most appropriate, preferably with your advisors present so that you can see for yourself and gain first hand knowledge information. I would recommend that if you plan to make a site visit that you invite me along as your guide.*

*I once again lodge a formal complaint that groundwater extraction at Barwon Downs is causing serious Actual Acid Sulfate Soils in the wetlands of the Big Swamp on Boundary Creek and that immediate site investigations should take place.*

*Yours sincerely,*

*Malcolm Gardiner*

*11-05-2009*

*PS I have included a few pages with water sample results of water along Boundary Creek. (PP 41, 63-66 Bk (8))*

## **16 July 2009**

Over two months later, a reply arrived from the Secretary and more startling revelations were revealed and very few questions received a reply (reply is found on page 87).

- As long as Barwon Water adheres to the licence conditions everything is in order and any suggestion of things to the contrary can be ignored.
- A compensation water release of a maximum 700 ML/year into the depleted aquifer is seen as adequate when 12000 ML/year is being extracted.
- Thoughts and discussion regarding different water compensating releases have remained just that for over three years, thoughts. No evidence has been presented that any discussion has taken place.
- Yes, there is evidence of other Actual Inland Acid Sulfate Soil sites appearing within the catchment but Peter failed to add that they ALL fall within the area of residual drawdown from the Barwon Downs Borefield.

Peter Harris, in his first reply stated that all identified wetlands in the area were not connected to the aquifer Barwon Water was pumping from. The fifth paragraph of his letter below, states exactly the opposite.

If it is accepted by Peter that Boundary Creek is connected to the deep water aquifer it also has to be accepted that many of the swamps along Boundary Creek are connected to this aquifer including the Big Swamp and Boomerang Swamp. The Boomerang Swamp is in the headwaters of one of the tributaries to Boundary Creek.

- One of the “*suitable licence conditions*” that SKM undertook for the State Government in the late 1990s, was that the Permissible Annual Volume should be set at 4000ML/year and not be exceeded. Despite this limit the 2004 licence given to Barwon Water was set at 20000 ML/year, five times greater than the level of anticipated and hopefully acceptable environmental impacts.
- It may have been characteristic that the Barwon River and other streams across the Barwon River Catchment had dried up but it was not the characteristic in the Gellibrand River Catchment, a catchment that was outside the direct influence of the Barwon Downs Borefield.



## Department of Sustainability and Environment

(4,5)

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Ref: SEC005678  
File: CS/07/3073

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Mr Malcolm Gardiner  
1805 Colac Beech Forest Road  
KAWARREN VIC 3249

Dear Mr Gardiner

**GROUNDWATER EXTRACTION AT BARWON DOWNS - FURTHER CORRESPONDENCE**

Thank you for your letter dated 11 May 2009 regarding acid sulphate soils (ASS) at Big Swamp, Boundary Creek.

Southern Rural Water (SRW) is the licensing authority responsible for administering Barwon Water’s (BW) licence to extract at Barwon Downs. SRW is satisfied that BW is adhering to its licence conditions including the release of a compensation flow into Boundary Creek. The flow is released when groundwater reaches 158.5 AHD (as stated in your letter) in the relevant observation bore.

The condition requires that a constant flow is released equating to two million litres. To enhance the benefits of the compensation release BW has proposed investigating the release of this water in flushes, rather than at a constant rate. It is considered that this may provide a more ‘natural’ flow for the creek. Should this be established BW would have to provide evidence to SRW that such an approach would be environmentally beneficial and the licence conditions would need to be amended.

The continuing dry climate is impacting water resources across the region. Stream flows have declined over the past 12 years. During the last 12 months, record low stream flows have occurred in a number of rivers across the region, including the Barwon River, which ceased to flow for a number of months during summer. This was repeated across the catchment, with many ephemeral streams having little or no flow through the whole year. The same trend is evident in wetlands with Lake Gnarpurt, classified as permanent under the Corrick classification system, drying out in recent times.

The connectivity of Boundary Creek and the Eastern View Formation aquifer is not in dispute. This is in fact the reason why the compensation flow condition, mentioned above, was included to BW’s licence.

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In regard to pH levels in Boundary Creek, it would take a comprehensive study to establish if changes to pH were the result of climate change or groundwater extraction. Sulfidic sediments which remain in saturated anaerobic conditions are not usually a problem and are termed Potential Acid Sulphate Soils. However, if exposed to air the impact of ASS can be significant. Evidence of the development of ASS in the other parts of the catchment are starting to appear and it is again unclear whether the prolonged dry conditions or the pumping of groundwater are key factors.

Assessing the impacts of ASS in the region falls under the responsibilities of the Department of Primary Industries (DPI). A mapping project has been proposed to look at statewide occurrences of ASS and the processes involved. This will allow DPI to identify whether ASS are caused by climate change or by other local influences for specific sites.



Officers from the Department of Sustainability and Environment (DSE) keep track of all studies relevant to the region. Investigations into the Barwon Downs borefield began in 1968 with a study of the groundwater potential of the region by S. Hancock. The first report which focussed solely on the environmental considerations of water resource use in the region is the 1986 report you mention by Quentin Farmar-Bowers. The recent SKM study "Recommendations for Groundwater Licence Conditions" was commissioned for the purpose of assessing BW's licence and provided adequate scope to determine suitable licence conditions.

As you are aware BW had to produce a flora study under the conditions of its licence. The findings of the flora study were formally presented to SRW and the Corangamite Catchment Management Authority, organisations with direct interest in the sustainable management of water resources in the region. Your assertion that officers from this department would direct the findings of an independent study commissioned by another body is unfounded.

Thank you again for raising this matter with me.

Yours sincerely

**PETER HARRIS**  
Secretary

16 / 7 / 09

- Someone made the decision not to include the Actual Inland Freshwater Acid Sulfate Soil site of the Big Swamp in the findings of the 2008-09 Flora Survey,
- despite Southern Rural Water insisting that it would be included and
- despite the fact that the Big Swamp was visited during the Flora Survey.
- Peter's Department had to be consulted regarding suitable consultants to do the work and his Department was fully aware of the issues involved.
- Aware of the issues why did the DSE not insist that the Big Swamp be included?
- Why didn't DSE involve the DPI as part of its responsibility?
- Considering the survey did not have to be finished until the end of 2009 there appeared to be an uncharacteristic rush by someone to complete the survey and publish the results by April 2009.

Have lies been told and perpetuated, is the Big Swamp and Boomerang Swamp demise just a case of incompetence, a problem too hard to deal with or just a situation whereby authorities believe they can say and do whatever they want with no fear of having to be held accountable for what they say and do? Was the decision to omit the Big Swamp from the 2009 Flora Survey another case of this type of management?

You be the judge.



2nd July 2012

Mr Malcolm Gardiner  
1805 Colac - Beech Forest Road  
KAWARREN VIC 3249

Dear Malcolm

**Subject: Acid Sulfate Soil site at the Big Swamp inclusion in the 2009 Flora study**

Thank you for your email of 11<sup>th</sup> June 2012 requesting information regarding the investigation into Acid Sulfate Soils at the Big Swamp being included in a Flora Study being undertaken on behalf of Barwon Water relating to the Gerangamete groundwater licence.

At the time of our response letter of the 17<sup>th</sup> December 2008, Southern Rural Water and Barwon Water were finalising the scope of the study and had included Acid Sulfate Soil's as one of the aspects to be looked at.

**"key drivers"**

These would be better called "causes." Four years on and still no study looking at the "key drivers" driving the creation of Actual Acid Sulfate Soils in the area of drawdown influence from the Barwon Downs Borefield.

It was determined that the issue of Acid Sulfate Soil's in the area was too large and specialised to fit within the scope of the study and the team assembled to undertake the flora based study. The study team did visit a location outside of the study area that was showing aspects of Acid Sulfate Soil's, but as the team didn't have any expertise in this area, they weren't able to offer a considered opinion on the issue.

The report states under Recommendations 6.4 – "it is recommended that a study be undertaken to determine whether Acid Sulfate Soil's are present in the catchment and assess the effect of drying conditions may have on these soils and the associated surface water systems (ie wetland and streams). The assessment should include the outcomes from the study identified in recommendation 1 to determine the key drivers of any identified impacts or risk due to the presence of Acid Sulphate Soil's". ↑

After the flora report was received and the results discussed, it was agreed that a group should be established to undertake a regional look at Acid Sulfate Soil's. The Corangamite Region Inland Acid Sulfate Soil's (CRIASS) Steering Committee was the group that was established. This multi agency steering committee has received some preliminary reports from the La Trobe University as part of the regional

investigation into Inland Acid Sulfate Soils and has released a bulletin on these findings. (Please find attached)

As more investigations are completed and findings made from the study, the steering committee will release these via bulletins with the final paper from the student released in due course.

If you have any further enquiries regarding this matter, please contact me on 55641713 or mobile 0419 509087 or email me at [angusr@srw.com.au](mailto:angusr@srw.com.au)

Yours sincerely



**ANGUS RAMSAY**  
Acting - Manager Applications  
Groundwater and Rivers  
Southern Rural Water

Page 2 of 2

Unfortunately many of the same policies, management practices, people, officials and government departments are presently involved in considering the connecting of the Colac Otway Pipeline water supply system into the Barwon Downs Borefield.

APPENDIX FIVE



TECHNICAL SERVICES

The Independent Alternative

FARMRIGHT PTY. LTD. - A.B.N. 38 816 254 454

Unit 7/1 Crichton Road Kyabram 3620

Telephone: (03) 5853 2484 Fax: (03) 5853 2485

Email: farmright@bigpond.com

<b>Client:</b> DPI		<b>Sample No:</b> FS 124134		
<b>Address:</b> 83 GELLIBRAND STREET COLAC 3250		<b>Received:</b> 27 February 2012		
		<b>Despatched:</b> 16 March 2012		
<b>Job Comment:</b> CLIENT: I & S CAMPBELL		<b>Interpretation:</b> Andrew McLennan		
<b>Sample Name:</b> BARE PADDOCK		<b>Sample Type:</b> DRYLAND PASTURES		
ANALYSIS	RESULT	NUTRIENT STATUS		
		LOW	MEDIUM	HIGH
Phosphorus (Olsen) mg/kg	14.2	[Bar chart showing Phosphorus level in the MEDIUM range]		
Potassium (Colwell) mg/kg	69.0	[Bar chart showing Potassium level in the LOW range]		
Sulphur (KCL-40) mg/kg	1639.7	[Bar chart showing Sulphur level in the HIGH range]		
pH (1:5 water)	3.5	Very strongly acidic		
pH (CaC12)	3.2			
Salinity (EC) (1:5 water) dS/m	2.91	High salinity levels		
Soil Texture	Clay loam			
Organic Carbon %	4.29	High organic matter levels		
Nitrate mg/kg	9.0	Low		
Ammonium mg/kg	57.0	High		
Phosphorus (Colwell) mg/kg	50.0			
				(% of CEC)
Calcium (Exch) meq/100 g	1.82	Very low calcium levels		22%
Magnesium (Exch) meq/100 g	1.76			21%
Sodium (Exch) meq/100 g	0.65	Elevated sodium levels		8%
Potassium (Exch) meq/100 g	0.12	Low potassium levels		1%
Aluminium (Exch) meq/100 g	4.06	Very high aluminium levels		48%
<b>Calculations</b>				
Sum of cations (CEC) meq/100 g	8.41	Moderate cation exchange		
Calcium/Magnesium ratio	1.0	Desired ratio > 2:1 to 6:1		
Sodium % of cations (ESP)	7.7%	Elevated above 6%		
Aluminium % of cations	48.3%	Very high		
<b>Site Information</b>				
High rainfall				
Note: mg/kg = ppm				

The Soil Test(s) reported have been performed in accordance with the terms of registration with the Australian Soil and Plant Advisory Council. This document shall not be reproduced except in full without the prior approval of Farmright.  
 Authorised signature:

# RESULTS OF ACID SULFATE SOIL ANALYSIS

10 samples supplied by Land and Water Resource Otway Ranges on the 7th June, 2012 - Lab. Job No. C0380  
 Analysis requested by Malcolm Gardner - Your Project: Peat Swamp

(1805 Colac - Lavers Hill Road, KAWMAREN VIC 3249)

Required if pH<sub>calc</sub> < 4.5

Sample Site	EAL lab code	TEXTURE (note 6)	MOISTURE CONTENT		TITRATABLE ACTUAL ACIDITY (TAA) (To pH 6.5)		extractable sulfate sulfur %S <sub>kd</sub>	Extractable sulfate sulfur (equivalent mole H <sup>+</sup> /tonne)	REDUCED INORGANIC SULFUR (% chromium reducible S)		RETAINED ACIDITY (HCL extract) (as %S <sub>kd</sub> - %S <sub>red</sub> )		NET ACIDITY Chromium Sulfite mole H <sup>+</sup> /tonne	LIME CALCULATION Chromium Sulfite kg CaCO <sub>3</sub> /tonne DW
			moisture of total wet weight (%)	moisture / g of oven dry soil (g)	pH <sub>calc</sub> (mole H <sup>+</sup> /tonne) (ACTUAL ACIDITY)	%S <sub>red</sub>			(mole H <sup>+</sup> /tonne) (POTENTIAL ACIDITY)	%S <sub>ret</sub>	(mole H <sup>+</sup> /tonne) (RETAINED ACIDITY)			
<b>Circle 1</b>	C0380/6	Fine	56.8	1.3	3.90	218	0.265	165	10.61	6617	0.02	10	6846	513.4
<b>Circle 2</b>	C0380/7	Fine	44.1	0.8	2.50	858	0.924	576	0.04	25	1.22	569	1452	108.9
<b>PP1</b>	C0380/8	Fine	50.8	1.0	2.51	612	1.234	770	0.12	75	0.00	0	687	51.5
<b>PP2</b>	C0380/9	Fine	59.2	1.4	2.83	924	0.574	358	0.07	44	2.01	940	1908	143.1
<b>Bracken</b>	C0380/10	Fine	34.2	0.5	2.55	517	0.451	281	0.06	37	1.93	904	1459	109.4

**NOTE:**

- All analysis is Dry Weight (DW) - samples dried and ground immediately upon arrival (unless supplied dried and ground)
- Samples analysed by SPOCAS method 23 (ie Suspension Peroxide Oxidation Combined Acidity & sulfate) and 'Chromium Reducible Sulfur' technique (Scr - Method 22B)
- Methods from Ahern, CR, McElnea AE, Sullivan LA (2004). *Acid Sulfate Soils Laboratory Methods Guidelines*. QLD DNRME.
- Bulk Density is required for liming rate calculations per soil volume. Lab Bulk Density is no longer applicable - field bulk density rings can be used and dried/ weighed in the laboratory.
- ABA Equation: Net Acidity = Potential Sulfuric Acidity (ie Scr or Sox) + Actual Acidity + Retained Acidity - measured ANC/FF (with FF currently defaulted to 1.5)
- The neutralising requirement, lime calculation, includes a 1.5 safety margin for acid neutralisation (an increased safety factor may be required in some cases)
- For Texture: coarse = sands to loamy sands; medium = sandy loams to light clays; fine = medium to heavy clays and silty clays
- ... denotes not requested or required. '0' is used for ANC and Strag cakes if TAA pH < 6.5 or > 4.5
- SCREENING, CRS, TAA and ANC are NATA accredited but other SPOCAS segments are currently not NATA accredited
- Results at or below detection limits are replaced with '0' for calculation purposes.
- Projects that disturb > 1000 tonnes of soil, the 20.03% S classification guideline would apply (refer to acid sulfate management guidelines).
- Results refer to samples as received at the laboratory. This report is not to be reproduced except in full.

(Classification of potential acid sulfate material if: coarse Scr ≥ 20.03% S or 19mole H<sup>+</sup>/t; medium Scr ≥ 20.06% S or 37mole H<sup>+</sup>/t; fine Scr ≥ 20.1% S or 62mole H<sup>+</sup>/t) - as per QUASSIT guidelines.

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

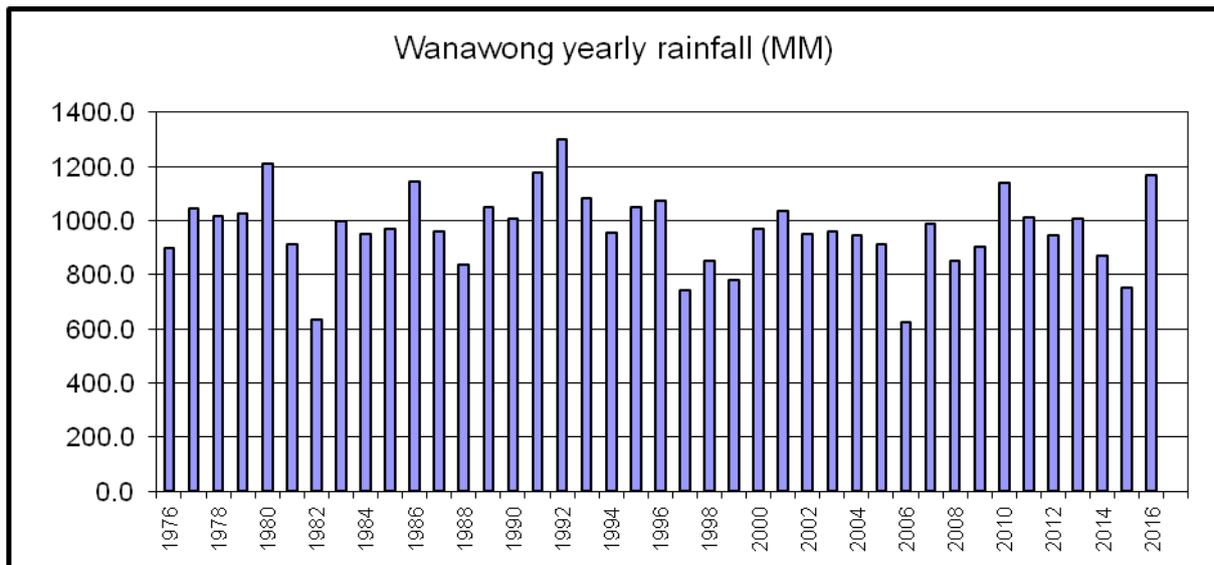
Graham Lancaster  
 Laboratory Manager



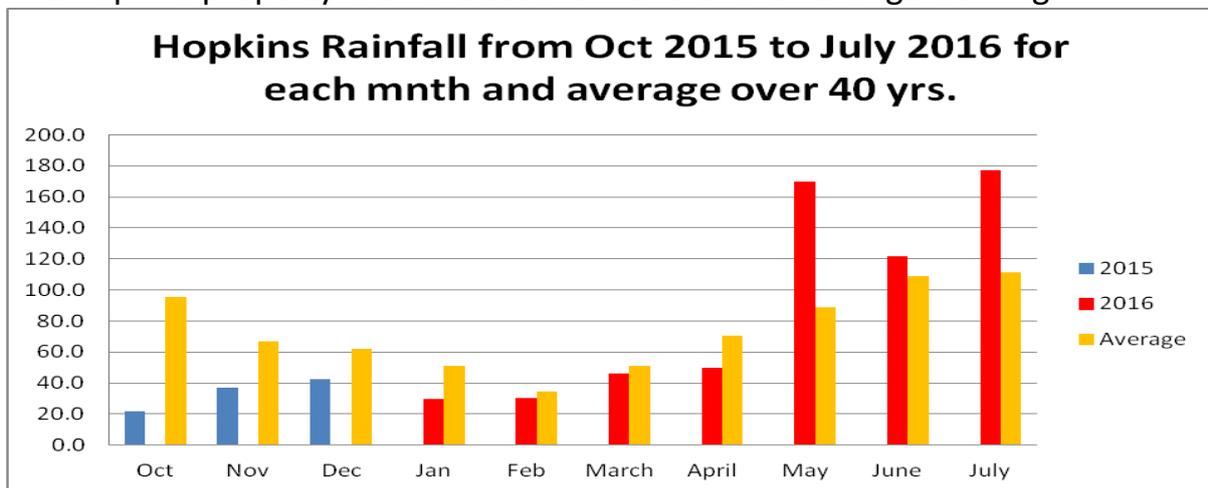
NATA  
 The Environment is lead in  
 accreditation with SQA  
 Accredited for compliance  
 with ISO/IEC 17025

*[Signature]*

**APPENDIX SIX**



The Hopkins property is on the southern end of the Barongarook High.



The Shalley property is on the eastern edge of the Barongarook High and is at one of the 4 PASS sites.

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6. Gardiner M, J. October 2008, Otway Water Book 8: One Giant Environmental Footprint.
7. Davison N. Lancaster G. Southern Cross Environmental Analysis Laboratory 25 February 2011: Preliminary Inland Acid Sulfate Soil Assessment Report. LAWROC Landcare.