OTWAY WATER BOOK 66

Crit on "Assessment of historical and current vegetation diversity and condition in Big Swamp." 18 December 2019,

prepared by Eco Logical Australia as part of the 2019 remediation of the Big Swamp Wetland Being Conducted by Barwon Water.



Disclaimer

This publication may be of assistance to you, but there is no guarantee that the publication is without flaw of any kind or is wholly appropriate for your particular purposes and therefore disclaim all liability from error, loss or other consequence that may arise from relying on any information in this publication.

This publication has been prepared, and supporting documents used, with diligence. Statements within this publication that originate from groups or individuals have not been evidentially tested. No liability is accepted from any action resulting from an interpretation of this publication or any part of it.

November 2021.

Malcolm Gardiner

www.otwaywater.com.au







INTRODUCTION.

In the Age Good Weekend October 2, 2021, one of the questions Benjamin Law asked Virginia Trioli (ABC broadcaster) was "What are your commandments for journalism?"

She answered...

"Be brave. Be truthful. Check your facts, check your facts, check your facts. And check your facts."

The following five extracts have been taken from the Introduction to Otway Water Book 62 and sets the background for the reason why this Book 66 has been written. The motivation is closely associated with the notion of checking facts.

"Since 1986 and especially leading up to the 2019 groundwater extraction licence renewal of the Barwon Downs Borefield, numerous reports have been prepared amounting to an enormous amount of text. Unfortunately, in this day and age there appears to be a reluctance by the "general Public" to closely scrutinise anything other than to browse through an executive summary; maybe a quick glance at the contents page and a read of the conclusion. Too often this is seen as an adequate review of a report. As long as a report reads well and appears to make sense from the data presented, then the report is "ticked" off as acceptable. However, to make informed decisions each of these reports needs to be read thoroughly as part of a review process, scrutinised, and be pulled apart piece by piece. The validity of content needs to be tested and an effort made to check source material. This is not an easy task and takes considerable time and effort to achieve."

"If critical resource management decisions are to be based on a report then the above review process must take place at three levels.

- 1. Firstly by the people producing the report,
- 2. Secondly by the people who commissioned the report, and
- 3. Thirdly by those people responsible for implementing courses of action based on the report."

"This review process of checking for validity and evidential verification should not be left to those impacted by any such decisions. However, in regard to the Barwon Downs Borefield development it appeared that very little checking of material on which decisions were being made was being done. This lack of review prompted the writing of the Otway Water Books."

"Otway Water Book 62 attempts to show how one inappropriate report after another is built upon doubtful and "shaky foundations" of previous reports."

"Future use and making of decisions being based on faulty and flawed reports can only result in future calamitous resource management decisions. The responsibility of making sure this never happens lies with the decision makers correcting their historical record."

To this end Otway Water Book 66 discusses this continuing process of one report relying on earlier reports to be accurate and correct, when in so many cases such reliance is mis-guided. This Eco Logical Australia report has referenced eight reports that have been examined in Otway Water Books and found to lack validation and or verification of statements.

Book 66 concentrates on and discusses the first 38 pages of the Eco Logical Australia report that relies heavily on these earlier reports as part of the *"Literature and data review"* process. There are a few other pages discussed where there are queries regarding statements that also appear to be based on reports found during Eco Logical Australia's literature and data review process.

Impossible to validate and or evidentially verify reference material.

Many references are made to Jacobs documents/reports in this Eco Logical Australia report that have not been recognised in such a way that verification and or follow up scrutiny of the references is difficult. In some cases this would appear impossible to do.

In the Eco Logical Australia text there are 53 references directly attributed to Jacobs that are not to be found In the Bibliography directly recognised as a Jacobs document. There are however, 9 different documents referred to by author(S) with a Jacobs recognition tagged onto the end of the reference, *"Jacobs Group (Australia) Pty. Limited*." Are these the Jacobs reports used in the text of Eco Logical Australia's report? Who knows?

For example:

"Hale, J, Boon, P, Griffiths, J, Woodman, A, Treadwell, S & Sharpe, A 2018, 'Low Flow Recommendations for Boundary Creek, Barwon Water', Jacobs Group (Australia) Pty Limited." Is this the Jacobs 2018 report being referred to as (Jacobs 2018) in the text? This is difficult to determine.

Especially when in the Bibliography there are 3 Jacobs 2018 authored reports. The same applies with text that credits work with (Jacobs 2017). There are 3 Jacobs 2017 authored reports. Which (Jacobs 2018) report(s) is being credited? Which 2017 report is the (Jacobs 2017) report(s) being referred to? Perhaps none of these at all. Otway Water Book 66 raises concerns regarding the use and interpretations of these reports made by Eco Logical Australia.

Important to Note:

It is important to recognise the in-field work, data collection and reporting of the Big Swamp ecological vegetation survey work conducted by Eco Logical Australia 2019, as a credit to the firm.

Eco Logical Australia brief set down by Barwon Water.

Barwon Water set out the following objectives regarding the work required from Eco Logical Australia.

"Eco Logical Australia (ELA) were engaged by Barwon Water to undertake a vegetation assessment of Big Swamp and provide commentary on how changing the wetting/drying regime in the swamp (from seasonal drying to permanently wet) would impact upon the existing vegetation class and health. The assessment was to inform the preparation of the remediation plan and therefore the objectives of the study were to:

 establish the baseline ecological characteristics for Big Swamp.
determine the hydrological requirements of past and current vegetation communities and advise likely responses to future surface and groundwater regimes.

Provide recommendations to improve ecological outcomes within the swamp, within the context of the broader objectives of the remediation plan.

Discussion.

Page V of the Eco Logical Australia report.

Eco Logical Australia conducted surveys of the Big Swamp on 21 and 22 August 2019 and to my knowledge this has been the very first Big Swamp comprehensive survey of this type to be recorded and recognised.

NOTE: When did Eco Logical Australia actually conduct the flora survey? **Page 36** of the Eco Logical Australia report states this. "*During the September 2019 flora survey, a total of 108 vascular plant species across the study area ...*" Is this the same survey as the 21 -22 Augst flora survey?

LAWROC Landcare Group commissioned Doug Frood in 2017 to attempt to resurvey sites previously done by Carr and Muir in 1994 (Ecology Australia). As part of this work Frood was asked to make a cursory visit to the Big Swamp. This visit is reported in Otway Water Book 31.⁽⁵⁾

However up to 2019.

Extensive efforts to gain records of any vegetation surveys of the Big Swamp resulted with the following findings.

- It was repeatedly stated that the Carr and Muir (Ecology Australia) 1994 survey did not include or complete a written record for a site in the Big Swamp. Maybe close, but not in the Big Swamp.
- 2. The 1994 report did include a statement that 82 sites were visited. However, only 81 sites were written up. *Strange.*
- 3. When Carr (Ecology Australia) conducted a follow up survey in 2002, the Big Swamp was stated as not being included.

- 4. Another vegetation survey was conducted in 2008 (including Ecology Australia participation in conjunction with SKM, now Jacobs) as part of the groundwater extraction licence conditions. Still no Big Swamp report.
- 5. Sites visited in 2008 were marked with a galvanised steel dropper.
- 6. The Big Swamp was not reported upon once again, despite community concern over the site and assurances it would be visited.⁽¹⁰⁾
- Otway Water Book 20 present a very convincing case that any visit to the Big Swamp was deliberately left out of any 2008-09 vegetation survey report.⁽¹⁰⁾
- 8. During one of my visits to the Big Swamp late in 2008 a galvanised steel dropper was found in the west end of the swamp at the 1997 fire site. *Very strange.*
- 9. There is still continued denial that the Big Swamp had ever been included in any of these vegetation surveys. *Extremely strange*.
- 10.Right up to 2016 Barwon Water supported Jacobs statement that "No evidence" could be found regarding negative impact on vegetation health.

Consequently the first comprehensive vegetation survey of the Big Swamp that is "officially" accepted is the one done in 2019 by Eco Logical Australia.

Page vi of the Eco Logical Australia report. Bainfall.

This is one of the assumptions Eco Logical Australia makes:

"Below average rainfall as a result of drought events in 1982 and between 1995 and 2010 (i.e. the Millennium drought."

Yes, this Healey rainfall graph from the recharge area of the Barongarook High supports a below average rainfall during these periods. However, still receiving around 600 mm/year mark tends to suggest that the below average rainfall for the area is not as dire a problem as is assumed. With this rainfall and the normal buffering capacity of the Lower Tertiary Aquifers this lower rainfall should not have resulted in such profound vegetation impacts in the Big Swamp.⁽¹¹⁾



Cease-to-flow.

"Yearly cease-to-flow events in summer and reduced winter flows (<20ML/day). Noting that 2 ML/day releases have <u>prevented</u> cease-to-flow events in recent years."

This statement does not match the ceases-to-flow events as recorded in Barwon Water and the Vic Water warehouse documentation (Also, see pages **26-27**).



<u>SOURCE</u>: Barwon Water/ Vic Water Warehouse. Graph Two.

Page x of the Eco Logical Australia report.

The following statement taken from Page x prompts a few comments. "From as early as the 1800s, the swamp has been affected by changing land and water use as vegetation clearance and agricultural practices expanded across the region. This activity has continued to the current day, with the extraction of ground water from the deep Tertiary aquifer, and subsequent reduction in surface flows into the swamp, the most recent pressure on the system. Unfortunately, the cumulative effects have come to a head over the past 20 years with drought conditions triggering intensive ground water extractions and severely limiting surface flows into the swamp. The result was the drying of the swamp through the 1990s and 2000s. While difficult to ascertain, the this drying may have commenced prior to groundwater extraction as the installation of MacDonalds Dam would have changed the flow regime along Boundary Creek from the late 1970s. As the water table dropped and drying occurred, both the vegetation and underlying soil layers rich in organic carbon became susceptible to fire, with two major events occurring in 1998 and 2011. The latter fire resulted in an almost complete loss of vegetation cover across the swamp, substantially altering the structure of the communities throughout."

- 1. The construction of McDonald's Dam should have been a minor disruptor of the flows into the Big Swamp if managed as per the licence conditions. A condition placed on the dam use was that all low flows into the dam had to be passed on.
- 2. Head water sections of Reach 1 of Boundary Creek upstream of the dam naturally dried up during summer.
- 3. Reach 2 below the dam and above the Big Swamp was a perennial groundwater gaining section.
- 4. The drying of the west end of the swamp in 1997 after one of the wettest periods on European rainfall record indicated that the water table was being dramatically lowered from groundwater extraction.
- 5. As the swamp dried out Actual Acid Sulfate Soil acid and heavy metal generation "crept" down through the swamp killing vegetation as it went. Leaving a trail of dry and dying vegetation.
- 6. The last major fire event was in March 2010 not 2011. And,
- 7. <u>all</u> vegetation cover in the swamp was burnt. Not "...almost..."

Page xiii of the Eco Logical Australia report.

Southern tributary through the Big Swamp.

It would be interesting to find out the source of the notion of a southern tributary and exactly where it runs through the Big Swamp. The idea of restoring flows along this tributary is also mentioned as part of the remediation measures in the Conclusion section.

Page 1 of the Eco Logical Australia report.

Increasing the Frequency of Cease-to-flow Periods.

"Recent technical work (Jacobs, 2018) confirmed that Barwon Water's pumping from the Barwon Downs borefield over the past 30 years is the main cause of a reduction in baseflow (groundwater contribution to streamflow) in the lower reach of Boundary Creek, increasing the frequency and duration of no flow periods."

The tenure of this quote is repeated many times through this Eco Logical Australia report and is a carry over from earlier scientific and technical reports "pushing" the same notion. If this statement is alluding to a fact that Boundary Creek had periods of cease-to-flow events prior to groundwater extraction at the Barwon Downs Borefield, then this statement has to be challenged. No such claim has ever been proven. Prior to pumping Boundary Creek never ceased-to-flow. In fact all evidence points to a completely contrary finding.

With each repetition of a mis-statement it gets closer to being accepted as a matter of fact.

Regarding Acid and Heavy Metals.

On this page there should also be a dot point with the inclusion of heavy metal generation impacts.

Page 8 of the Eco Logical Australia report.

Figure 3-1 in the Eco Logical Australia's report contains discrepancies.



- 1. Witebsky et al.⁽²⁾ calculated that the 1982-83 drought extractions amounted to around 8,000 ML. Not 3652 ML.
- 2. There were cease-to-flow events after the 1982-83 extractions and before the 1990's.
- 3. Up to 1997 there had been an extremely wet period followed by a dry period 1997-2001. Not 1995 to 2010 (see Healey rainfall chart above).
- 4. In 2011 Boundary Creek did not cease-to-flow.
- 5. Page 9 states in 2016 Barwon Water extracted 3,449 ML. Not 2,383 ML.



This Barwon Water document gives the 2016 extraction figure as 3,267ML. See Appendix One for the full year of extractions for 2016.

Nit picking? Perhaps. But if one can't get the little things right then what about the...

6. The CFA fire trenches in the Big Swamp were dug in 2010 not 2006.

Page 9 of the Eco Logical Australia report.

Many of the statements made in the Eco Logical Australia report such as the one below, date from recent years. Not including the date gives a wrong impression of how long the situation has existed.

"Groundwater and surface water conditions is monitored through a series of bores and gauges situated along the main channel of Boundary Creek."

The stream flow gauging stations except for the one at the Colac Forrest Road Bridge, have a very chequered record (see comments regarding **Page10**).

"The licence to operate the Barwon Downs borefield was issued by Southern Rural Water in 2004 and was due to expire in June 2019." The first licence to operate was issued back in the 1970's. And, it would have been informative to the reader of this report to know that Barwon Water had applied for a yearly extraction renewal of 12,000 ML in 2018. However, the Minister for Water decided otherwise capping the yearly extraction at 239 ML.

And, during this process of renewal an S78 Notice was served on Barwon Water to remediate the Big Swamp and surrounding area. It is misleading to state that "... the licence application for the Barwon Downs borefield was withdrawn in March 2019 over concerns about the environment and a commitment to the remediation of historical impacts caused by groundwater pumping." giving the impression Barwon Water voluntarily withdrew its application. Applying for a 12,000 ML/year licence shows how concerned Barwon Water was. The driving force behind the withdrawal was local concern. The commitment resulted from being instructed to comply to a Ministerial **order** to remediate. Far from being voluntary.

Page 10 of the Eco Logical Australia report.

"This was followed by a period of increased rainfall between 1955 and 1997 which spans the period before and after the implementation of the bore field (1985)." The borefield had been implemented and commissioned years before 1985.

Stream Flow Gauging Stations.

"The streamflow in Boundary Creek <u>above</u> the Big Swamp has been monitored since 1979 (Figure 3-3). There were additional stream gauges installed above and below McDonald's Dam in 1979 with an interval between 1994-2014 where gauges fell into disrepair (Jacobs, 2018)."

- 1. Why these gauges fell into disrepair is a question as yet unanswered.
- The three and only gauges <u>above</u> the Big Swamp in 1979 were decommissioned in 1994.

- 3. Two of these three were re-instated in 2014. Consequently, two decades of data had not been collected.
- Three new stream flow gauging stations have been commissioned. One in 2014 further above the dam. Two others. One above and below the Big Swamp. A total of six Stream Flow Gauging Stations on Boundary Creek.⁽¹³⁾
- 5. The Eco Logical Australia Figure 3-3 graph (see below), does not gauge upstream flows. This station is *below* not above the Big Swamp.



Page 11 of the Eco Logical Australia report.

SOURCE: Eco Logical Australia. Figure 3-3. Average monthly flow in Boundary Creek at Yeodene (Jacobs 2017)



SOURCE: Vic Water Data Warehouse. (Extract from Otway Water Book 41)

The graph for stream flow gauging station 233231, shows the decommissioned period of no data collection. Otway Water Book 41 deals in some detail with the flows along Boundary Creek.⁽¹³⁾

The fire trenches.

The first part of this statement is most definitely wrong. "Furthermore, a fire trench installed in 2006 around the southern and eastern edge of the swamp intersected an ephemeral drainage line that would have provided surface flows to the central part of the swamp." These trenches were dug during the 2010 fire. The 2006 fire in the peat upstream had approximately twenty acres of vegetation removed as part of a mineral earth policy at the time. No trenches. This confusion has been discussed and clarified numerous times with Jacobs and Barwon Water. This incorrect statement is still quoted as fact as are so many other incorrect statements. One of many statements remaining as historical "fact" to be repeated over and over again.

Page 13 of the Eco Logical Australia report.

This page of the Eco Logical Australia report drew my attention back to many statements made in earlier documentation as well in this report, of the numerous use of words such as "could be," "are likely," "likely," "unlikely," "appears," "may have" and "can be surmised." These words are scattered through this Eco Logical Australia document when trying to piece together what earlier reports have provided. When and if the earlier reports provide incorrect or partial information then the task of moving forward is quite difficult. In such cases this type of wording can be used as a "get out of jail" exercise.

Connectivity with the Lower Tertiary Aquifer.

What actually lies under the Big Swamp is not exactly known. Or is it? "The aquitard thins to the west and is absent upstream of the swamp, however the exact location where the aquitard is absent is not known. Shallow bores indicate that at the western end of the swamp the alluvial deposits overlie the regional aquifer."

The diagram below included on **page 13** suggests the exact opposite. The aquitard is clearly shown under the greater majority of the swamp (Figure 3-5). As does Figure 3-6 on **page 14** of the Eco Logical Australia report.

This notion of the Big Swamp sitting over an aquitard was first presented by Jacobs as a fact to the Barwon Water Community Reference Group around 2016. The two figures below continue to support this stance. Even today, 10 November 2021, it is still not known what the Big Swamp sits over.

As part of the remediation work on **Page 53**, Eco Logical Australia recommends that, "Assessment of the connectivity between the shallow and deep aquifer systems and relationship to the Big Swamp." be undertaken.

The discussion as written up on the next page further highlights the contradictions.



SOURCE: Eco Logical Australia. Figure 3-5. Working conceptualisation of the hydrogeology of Big Swamp (Jacobs, 2017)



SOURCE: Eco Logical Australia. Figure 3-6. Long section along Boundary Creek (Jacobs 2017)

Page 14 of the Eco Logical Australia report.

On **page 14** there are two contradicting statements. One, there is an aquitard under the Big Swamp. Two, it is not known for sure what lies under the Big Swamp.

One.

"Big Swamp is formed from saturated sediments that are <u>separated</u> from the underlying regional aquifer (Dilwyn Formation) by a less permeable, silty-clay aquitard (Mid-Tertiary Aquitard) (Jacobs 2017)."

Two.

"The aquitard thins to the west and is absent upstream of the swamp, however, the exact location where the aquitard is absent is not known (Jacobs 2017)."

The fact remains that no detailed drilling has been conducted through any cross section of the Big Swamp to determine what the earth structures are below. In 2021 it still remains a mystery where the aquitard starts and finishes.

Data Does Non Exist.

"Hydrogeological monitoring data from the Big Swamp before the Barwon borefield installation in 1985 is sparse."

It would indeed appear to be no data for this period. What is more, because the water industry authorities would not recognise local community concerns as credible, little if any hydrogeological monitoring of the Big Swamp was collected pre 2017.

The statement below highlights the fact that the Big Swamp was continuing to be ignored as a groundwater extraction problem to at least December 2016.

"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)⁽³⁾ At this stage the Big Swamp had not been included in any of the Barwon Water vegetation surveys of the region. The Big Swamp did not appear to exist despite the multitude of LAWROC Landcare Group reports and local concern.

(As previously stated the Borefield was installed years before 1985. At least as far back as the 1982-83 drought. Barwon Water states that 50% of it water came from the borefield during this drought.)

Not until 2017 was Pumping Impact Officially Identified.

"In 2017, environmental impacts from Historical management of groundwater pumping were identified." (page 267)⁽¹⁵⁾

Important to Note.

This following quote is confounding when it declares a stream gauge is unaffected by dramatic changes in streamflow. What this actual means is difficult to decipher.

"Furthermore, a stream gauge in the eastern section of the swamp has been unaffected by dramatic changes in streamflow providing further evidence for the presence of a shallow aquifer recharged by vertical seepage through the swamp and Boundary Creek."

Furthermore, it would appear that the authors of this document have not been informed that the Lower Tertiary Aquifers have recovered to artesian levels at the eastern end of the Big Swamp. This would have some influence on the second part of this statement but what the rest of the statement means is very confusing.



Photograph showing artesian flow at the east end of the Big Swamp (1 Nov. 2021).

Page 15

Table 4-5 Can't be Found.

There is a reference to Table 4-5 and Fig. 3-1 but Table 4-5 cannot be found and Fig. 3-1 does not appear to relate to the content of this page.

Page 18

How this statement can be made without supporting data. It most definitely does not match local knowledge and experience.

"This increased susceptibility to prolonged and sustained burning is evident in the intermittent fires that have occurred within the swamp over the past 20 years."

There is little if any evidence of prolonged and sustained burning of the Big Swamp. There was a fire in 1997 and one in 2010. There is much conjecture of other fires and I had wandered the Big Swamp numerous times since 2008 up to the 2010 fire, and, the only evidence of fire occurrence was in the western end of the swamp at the site of the 1997 fire. Dead and dying vegetation below this site showed no evidence of fire but the soil and water did show dramatically high levels of acid and heavy metals. At the time of the 2010 fire, acid water and heavy metal stressed vegetation could be seen throughout the swamp.

Pages 18 and 19

On October 10, 1997 a nearby dryland fire spotted into the Big Swamp burning approximately 1 hectare at the west end of the swamp. Back burning was conducted in the south and south eastern edges outside the Big Swamp perimeter. Fuel reduction burning in sections of the swamp was not possible due to the wet, saturated and soggy conditions.⁽¹⁴⁾

In March 1998 a fire in the vicinity south east of the Big Swamp caused 680 Ha of bush and grassland to be burnt. It was thought that the source of the fire was from the Big Swamp. This could not be confirmed.⁽¹⁴⁾

In 2006 a peat fire approximately 2 km upstream of the Big Swamp caught fire. A sprinkler system was incorporated to extinguish this fire. Later dismantled. Also, a mineral earth policy surrounding the site was adopted.

The Eco Logical Australia report states:

"In 1997, an escaped surface fire burnt over 1 hectare of the swamp resulting in the loss of mature trees and the presence of hot ash beds across the area. In 1997 and 1998, hazard reduction fires were ignited to secure the area, with a fire escaping from the swamp in May 1998. . A large (2m wide x 2m deep) trench was constructed along the southern and eastern edge of the Swamp

to prevent further sub-surface fires escaping to surrounding areas. There was a long dry period between 1998 and 2006, with a small upstream fire occurring in 2006."

- 1. In 1997 the Big Swamp caught on fire with ash spotting from a nearby fire. Under pre pumping conditions this would not have happened as the entire swamp wetlands would have been just that, wetlands.
- 2. Reduction burns around the perimeter of the Big Swamp fire were conducted.
- 3. Whether the swamp continued to burn and then escape from this area in May 1998 is debatable. The CFA report "Fire History, Risk Identification and Mitigation Plan Discussion Paper April 2010" does not specifically identify the source of the May 1998 fire. It could very well have started away from the swamp and then spotted once again into the swamp.
- 4. The 2m wide x 2m deep trenches were not dug until during the 2010 Big Swamp fire.
- 5. The 2010 fire did start in the Big Swamp at the site of the 1997 fire. I was present with three other persons at the time and reported the first kindle of smoke coming out of the ground at the Big Swamp 1997 fire site.
- 6. After the 1997 fire the 2006 fire upstream of the Big Swamp sent "shudders" of concern throughout the fire fighting communities. Once extinguished a mineral earth policy surrounding this 2006 fire site was put in place. Unfortunately this "safety" zone has not been maintained.
- 7. After the 2010 Big Swamp fire a sprinkler system along the southern edge of the swamp was *never* installed.

"In 2010, SKM advised the local agencies that creating a dam to flood the area and control the subterranean fires could have negative environmental consequences such as further mobilisation of acidic sulphate soil and heavy metals into Boundary Creek. <u>Sprinkler systems were installed</u> along the southern edge of the swamp to contain the subterranean fire and prevent spread to surrounding areas during high fire risk periods." The 2010 SKM advice has not been referenced. I was at the site of the 2010 fire with scientists collecting soil and water samples to confirm earlier test (see page 22 and 23 below) of an Actual Acid Sulfate soil Problem. A problem that ALL government and water management bodies chose to ignore.

8. The Frood report quoted and referenced as 2019 should read 2017. This report was commissioned by the LAWROC Landcare Group. Andrew McLennan and I were the two LAWROC representatives who accompanied and assisted Frood with his field trip.⁽¹²⁾

"A low or open Riparian Fern Scrub community as described by Frood (2019)."

9. The aerial photo, Plate 3 on page 21 of the Eco Logical Australia report is incorrect. Otway Water Book 18 deals with this in some detail. This wetland is locally called Boomerang Swamp and is at the headwater of one of Boundary Creek's tributaries.

"An aerial image of sub-community 6.2 taken in 1993 is provided in Plate 3." The aerial image was printed the wrong way around as explained below.



Plate 9, in Carr and Muir 1994, and the flipped horizontally version that matches aerial photographs below, Google Earth and the direction of southern hemisphere shadows.



2007 imagery.

1940 imagery.

Pages 20-25

The aerial imagery over the following few pages relates a most interesting aerial pictorial record of the Big Swamp.

Included are some comments regarding this historical record.

- 1. The 1946 photograph in the Eco Logical Australia report has to be viewed bearing in mind the sophistication of the technology of the time.
- 2. The 1969 imagery compares favourably with this 1946 imagery.

OTWAY WATER BOOK 66



Source: Eco Logical Australia. Figure 3-11 Aerial imagery of the Big Swamp from 1969.

3. The 1991 image shows a distinct change in vegetation health at the site where the 1997 fire caught hold.



Source: Eco Logical Australia. Figure 3-12 Aerial imagery of the Big Swamp from 2004.

4. The 2004 imagery shows two things of note.



Source: Eco Logical Australia. Figure 3-13 Aerial imagery of the Big Swamp from 2004.

a. The vegetation in the site of the 1997 fire had not recovered. These conditions persisted and vegetation impact continued right up to the 2010 fire. The 1997 fire site was still a barren hydrophobic site as seen in 2009 (person observation).⁽¹⁾



Site of the 1997 fire.

b. The vegetation downstream of the 1997 fire site was under stress and changing. Acid water and heavy metals were generated as the water tables dropped and Potential Acid Sulfate Soils were exposed in the lower levels of the Big Swamp wetlands area.

Strangely lead was at toxic levels in 2008 but with later testing was no longer an apparent problem.⁽¹⁾

PET	S	Test Re	port		Lab. Ref.	No.
						08/34
		Malaam Goodinaa				I October, 200
	18/ KA	WARREN Vic., 3249				Page 1 of
	Dear Sir,					
	The followin Method	g results were obtained or Parameter	n samples as ro Unit	eccived on 1 Sample 1-A 14/9	5 September, Sample 1-B 14/9	2008. 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 per All Tests h	formed.bs: Ary redited.I about ave been conducted within the	nn.NO 875 and recommended h	abieras on and olding period.	en plat FAMPAR	90.77913.
	Yours sir	iderely,				
	with	a				
	Kate Hill					
	Approve	f Signatory				
IN	ATA					
20	This de Accred This de Accred	scument is issued in accordation ited for compliance with ISC scument shall not be reprodu- ited Laboratory No. 2457	nce with NATA')/IEC 17025 aced except in fa	accreditatio di	n requirements	
PO) Box 423, Warmami	oool, Victoria, 3280, Australi	a Télephone ((03) 5563 346	11 Fax (03) 55	63 3462

5. It would have been interesting if Eco Logical Australia had included an image from just prior to the March 2010 fire to see how bad the vegetation impact had progressed from 2004.

Whilst "exploring" the Big Swamp in 2008 there was no sign of fire effect on the vegetation past the 1997 fire site, even though there were numerous indications that the vegetation was dying and under extreme duress. This was a surprise until water samples were analysed.



Water at this site was tested as low as 2.5 pH.

DEAN		- 63	WATER QUALITY LABORATORY					
-	E)	Test I	Report	La	b. Ref. No			
					i	08/3476		
	м	r. Malcom Gardiner,			22 Octob	er, 2008		
	18 K/	05 Colac-Lavers Hills AWARREN Vic., 3249	Rd,		Pag	elof1		
	Dear Sir, The followir	ng results were obtained	d on samples as rece	ived on 15 Sen	tember 2008			
	Method	Parameter	Sample 2-A	Sample 2-B	Sample 3			
	4500-H ⁺ B	pH	2.7	2.5	2.6			
	All Tests have	been conducted within the	ecommended holding p	eriod.				
×.,	Yours since	rely.						
	Kate Hill Approved Si	ignatory						



In places the windthrown vegetation was over a metre deep. Tall unhealthy Melaleuca squarrosa trees on the verge of this site could be easily pushed over by hand.





The pH at this site at the eastern end of the Big Swamp was 2.3 pH.

At first glance this area appeared to be relatively healthy. However, there was much fallen vegetation and signs of stress once entering closer - as evident in this photograph. The acid water level was below 3 pH.

6. This 2011 imagery gives an indication of the impact from the 2010 fire.



Source: Eco Logical Australia. Figure 3-14 Aerial imagery of the Big Swamp from 2011.

7. This image below taken from Google Earth October 2021 shows an aerial image of a vegetation cover not that dissimilar to the Eco Logical Australia 1969 image, Figure 3-11 seen on page 20 above.



It will be interesting to see how the opportunistic vegetation that has moved into the Big Swamp handles remediation measures and or the rising water table of the Lower Tertiary Aquifers.

Page 46

Discrepancies of Cease-to-flow days.

Graph Two, page 8 above, shows that Boundary Creek had many days of ceaseto-flow episodes in 2019 and this was despite a 2 ML/day release of supplementary flows into Boundary Creek out of the Otway to Colac Pipeline. This statement below resulting from modelling gives a totally different impression.

"Surface flow modelling undertaken by Jacobs (2019) indicates that even under relatively low flows (e.g. 2ML/day) water persists in the channel."

The context in which this statement was made by Jacobs may need checking and clarification, but whatever, it appears to have influenced the following statement made on **page 40** of the Eco Logical Australia report.

Under the heading 4.2.2 Post extraction, this statement is made.

"Yearly cease-to-flow events in summer and reduced winter flows (<20ML/day). Noting that 2ML/day releases have prevented cease-to-flow events in recent years." However, the Barwon Downs "Gerangamete Groundwater Management Area, Groundwater licence: BEE032496 2018-2019 report" sent to Southern Rural Water, presents observable data that is totally different to Jacobs(2019) modelling results.

The data in this 2018-2019 report only goes to the end of June 2019 but during this first half of 2019 Boundary Creek had 86 days of cease-to-flow when there were releases of 2 or more ML/day.

Date	Jul 2018	Aug 2018	5ep 2018	Oct 2018	Nov 2018	Dec 2018	Jan 2019	Feb 2019	Mar 2019	Apr 2019	May 2019	Jun 201
1	3.5	36.2	7.0	2.6	1.2	1.3	0.8	0.0	0.0	0.0	1.7	
2	3,4	28.6	9.2	2.5	1.1	1.1	0.8	0.0	0.0	0.0	1.0	
3	4,1	27.2	13.1	2.4	1.1	.1.1	0.7	0.0	0.0	0.0	2.7	-
4	5.1	19.5	11.8	2.5	1.1	1.2	0.7	0.0	0.0	0.0	2.0	
5	4.6	37.4	9.2	2.5	11	1.2	0.7	0.0	0.0	0.0	2.0	
2	33.3	20.1	7.5	2.4	1.1	1.1	0.7	0.0	0.0	0.0	1.9	
8	42.6	39.0	7.3	2.2	12	10	0.7	0.0	0.0	0.0	1.0	
9	20.1	56.5	7.3	2.4	1.1	10	0.7	0.0	0.0	0.0	1.9	-
10	41,1	51.1	7.3	2.3	1.1	0.9	0.6	0.0	0.0	0.0	13	-
11	22.5	26.4	7.3	2.2	1.1	1.0	0.6	0.0	0.0	0.0	1.7	
12	17.1	24.2	5.2	2.2	1.1	0.9	0.6	0.0	0.0	0.0	1.6	1
13	32.7	69.9	3.9	2,1	1.2	0.9	0.5	0.0	0.0	0.0	1.5	
14	29.3	92.8	3.6	2.1	1.3	0.9	0.5	0.0	0.0	0.0	1,4	
15	20.8	82.0	3.2	2.1	1.3	0.9	0.5	0.0	0.0	0.0	13	
16	14.0	38.4	3.3	2.1	1.3	1.3	0.5	0.0	0.0	0,0	1.2	_
17	10.6	24.0	4.8	2.2	1.2	1.5	0.5	0.0	0.0	0.0	1,1	
18	9,1	23.0	12.8	1.9	11	1,0	0.5	0,0	0.0	0.0	1.1	
20	10.1	93.1	11.0	2.0	10	2.0	0.6	0.0	0.0	0.0	1.0	
21	10.7	77.4	6.9	8.6	10	1.0	0.6	0.0	0.0	0.0	10	
22	28.3	46.3	5.5	9.4	10	1.0	0.6	0.0	0.0	0.0	10	
23	22.6	41.3	47	7.5	1.0	1.4	0.4	0.0	0.0	1.1	11	-
24	14.5	26.4	3.9	5.6	1.0	1.3	0.2	0.0	0.0	1.6	1.1	
25	15.3	18.0	3.4	3.7	1.0	1.2	0.2	0.0	0.0	1.4	1.2	
26	41.5	13.3	3.1	2.8	1.0	1.1	0,1	0.0	0.0	1,5	1.3	
27	22.8	10.5	2.8	2.2	1.1	1.0	0.0	0.0	0.0	2.3	1.4	
51	14.5	9.0	27	1.9	1.3	0.9	0.0	0.0	0.0	2.8	1,6	
:29	10.6	9.2	2.7	1.7	1,4	0.9	0.0		0.0	2,7	1.9	-
30	11.0	7.6	2.7	1.5	1.3	0.9	0.0		0.0	2.0	3.0	
- 21	36.7	7.1		-9.20		0.01					3.0	
Total Shou Relea	ald be se to Bo	108.62 2018 undary (188.49 Creek (M	91.20 L/day)	34.21	37.11	2019-	0.00	0.00	15.32	46.57	160
Celea Date	se to Bo	1108.62 2018 undary (Aug 2017	188.49 Creek (M Sep 2017	91.20 L/day)	34.21 Nov 2017	0.3 37.11	2019~ Jan 2018	0.00	0.00 0.00 Mar 2018	15.32 Apr 2018	46.57 46.57 May 2018	Jun 20
Date 1	629.46 Alcl be se to Bo Jul 2017 0.0	1108.62 2015 undary (Aug 2017 0.0	188.49 Creek (M Sep 2017 0.0	91.20 L/day) Oct 2017 0.0	34.21 Nov 2017 2.1	0.3 37.11 Dec 2017 2.1	2019~ Jan 2018 2,1	0.00	0.0 0.00 Mar 2018 2.1	15.32 Apr 2018 2.1	46.57 46.57 May 2018 2.1	Jun 20
Date 1 2	629.46 Ald be se to Bo Jul 2017 0.0 0.0	1108.62 2015 undary (Aug 2017 0.0 0.0	188.49 Creek (M Sep 2017 0.0 0.0	91.20 L/day) 0ct 2017 0.0	34.21 Nov 2017 2.1 2.1	0.3 37.11 Dec 2017 2.1 2.1	2019~ Jan 2018 2.1 2.1	0.00	0.00 0.00 Mar 2018 2.1 2.1	15.32 Apr 2018 2.1 2.1	46.57 46.57 May 2018 2.1	160 Jun 20
Total Celea Data 1 2 3	629.46 Ald be se to Bo Jul 2017 0.0 0.0 0.0	1108.62 2018 undary (Aug 2017 0.0 0.0 0.0	188.49 Creek (M Sep 2017 0.0 0.0 0.0	91.20 91.20 L/day) 0.0 0.0 0.0 0.0	34.21 Nov 2017 2.1 2.1 2.1	0.3 37.11 Dec 2017 2.1 2.1 2.1	2019 - Jan 2018 2:1 2:1 2:1	0.00 Feb 2018 2.1 2.1 2.1	0.00 0.00 Mar.2018 2.1 2.1 2.1	15.32 Apr 2018 2.1 2.1 2.1	46.57 46.57 May 2018 2.1 2.1 2.1	Jun 20
Date Date 1 2 3 4	629.46 ald be se to Bo Jut 2017 0.0 0.0 0.0	1108.62 2015 undary (Aug 2017 0.0 0.0 0.0 0.0	188.49 Creek (M Sep 2017 0.0 0.0 0.0	91.20 P1.20 L/day) 0ct 2017 0.0 0.0 0.0 0.0 0.0	34.21 Nov 2017 2.1 2.1 2.1 2.1	Dec 2017 2.1 2.1 2.1 2.1	0.0 14.52 2.019 ~ Jan 2018 2.1 2.1 2.1 2.1 2.1	0.00 Feb 2018 2.1 2.1 2.1 2.1	0.0 0.06 Mar 2018 2.1 2.1 2.1 2.2	15.32 Apr 2018 2.1 2.1 2.1 2.1 2.1	46.57 46.57 46.57 2.1 2.1 2.1 2.1 2.1	160 Jun 20
Total Celea Duto 1 2 3 4 5	629.46 Ald be se to Bo 0.0 0.0 0.0 0.0	1108.62 2018 undary (Aug 2017 0.0 0.0 0.0 0.0 0.0 0.0	188.49 Creek (M 549 2017 0.0 0.0 0.0 0.0 0.0 0.0	9120 0ct 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	34.21 Nov 2017 2.1 2.1 2.1 2.1 2.1 2.1	0.5 37.11 Dec 2017 2.1 2.1 2.1 2.1 2.1	0.0 14.52 2019 ~ Jan 2018 2.1 2.1 2.1 2.1 2.1	0.00 Feb 2018 2.1 2.1 2.1 2.1	0.0 0.00 Mar 2018 2.1 2.1 2.2 2.1	15.32 Apr 2018 2.1 2.1 2.1 2.1 2.1 2.1	6.0 46.57 2.3 2.1 2.1 2.1 2.1 2.1	Jun 20
Total Choc Celea Date 1 2 3 4 5 5	629.46 ald be seto Bo 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	1108.62 2018 undary (0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	168.49 Creek (M 5ep 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0	9120 0ct 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	34.21 New 2017 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	0.5 37.11 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	0.0 14.52 2019 Jan 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	0.00 Feb 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	0.0 0.00 Mar 2018 2.1 2.1 2.1 2.2 2.1 2.2 2.1 2.1	15.32 Apr 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	46.57 46.57 2.3 2.1 2.1 2.1 2.1 2.1 2.1	160 Jun 20
Total Cleba Date 1 2 3 4 5 6 7 8	629.46 ald be se to Bo 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1108.62 2018 undary (4ug2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	188.49 Creek (M Sep 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	9120 9120 0et 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	34.21 Nev 2017 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	0.5 37.11 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	0.0 14.52 2019 ~ Jan 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	0.00 Feb 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	0.0 0.06 Mar 2018 2.1 2.1 2.1 2.2 2.1 2.1 2.1 2.1 2.1 2.1	15.32 Apr 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	46.57 46.57 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	160 Jun 20
Total Clean Clean Class Clean Class Clean Class Clean Class Clean Class Clean Class Clean Class Clean Class Clean	629.46 alcl be set o Bo 	1108.62 2015 aundary (Aug 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	188.49 Creek (M Sep 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	91.20 91.20 0ct 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	84.21 Nev 2017 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	0.5 37.11 21 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2	0.0 14.52 2019	0.00 Feb 2018 211 21 21 21 21 21 21 21 21 2	0.0 0.00 21 21 21 21 21 21 21 21 21 21 21 21 21	15.32 Apr 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	46.57 46.57 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	160 Jun 20
Total Clats 1 2 3 4 5 5 7 8 9 10	629.46 ald be se to Bo 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1108.62 2015 Aug2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	188.49 Creek (M Sep 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	120 9120 0ct 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	84.21 Nev 2017 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	0.5 37.11 21 21 21 21 21 21 21 21 21 21 21 21 2	0.0 14.52 2.019 Jan 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	0.00 Feb 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	0.0 0.06 2.1 2.1 2.1 2.1 2.2 2.2 2.1 2.1 2.1 2.1	15.32 Apr 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	46.57 46.57 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	361 Jun 20
Total Choice Control 1 2 3 4 5 6 7 8 9 10 11	629.46 Ald be se to Bo 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	108.62 2018 undary (Aug 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	188.49 Sep 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	9120 9120 0ct 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	34.21 New 2017 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	0.5 37.11 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	0.0 14.52 2019	0.00 Feb 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	0.0 0.00 0.00 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	15.32 Apr 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	46.57 46.57 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	361 Jun 20
Total Clean Date 1 2 3 4 5 6 7 8 9 10 11 12	629.46 ald be se to Bo Jul 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	108.62 2015 2015 Aug 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	188.49 Creek (M Sep 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	9120 9120 0et 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	34.21 Nev 2017 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	Dec 2017. 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.	0.0 14.52 2019 ~ Jan 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.2 2.2 2.2	0.00 Fmb 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	0.0 0.00 0.00 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	15.32 Apr.2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	46.57 46.57 2.3 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	961 Jun 20
Total Claim	629.46 alcl be se to Bo Jut 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1108.62 2018 undary 0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	188.49 Creek (M Sep 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	120 9120 0et 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	84.21 Nev 2017 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	0.5 37.11 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	0.0 14.52 2019	0.00 Fitb 2018 211 211 211 211 211 211 211 2	0.0 0.00 0.00 211 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	15.32 Apr 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	46.57 46.57 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	160 Juin 20
Total Choice Conte 1 2 3 4 5 5 6 7 8 9 10 11 11 12 13 14	629.46 alcl be set o Bo Jut 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1108.62 2018 undary (Aug 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	188.49 Creek (M Sep 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	9120 9120 0et 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	\$4.21 New 2017 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	0.5 37.11 21 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2	0.0 14.52 2019	0.00 Feb 2018 211 21 21 21 21 21 21 21 21 2	0.0 0.00 0.00 21 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	15.32 Apr 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	46.57 46.57 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	Jun 20
Total Date 1 2 3 4 5 6 7 7 8 9 10 11 12 13 14 15	629.46 Aid be se to Bo Jul 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	108.62 2018 undary (Aug 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	188.49 Creek (M Sep 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	9120 9120 0ct 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	34.21 Nev 2017 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	Dec 2017. 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.	0.0 14.52 2019	0.00 Feb 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	0.0 0.00 0.00 2.1 2.1 2.1 2.2 2.1 2.1 2.1 2.1 2.1 2.1	15.32 Apr 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	46.57 46.57 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	Jun 20
Total Celea Ce	629.46 aid be se to Bo Jul 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1108.62 2018 aug 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	188.49 Creek (M Sep 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	9120 9120 0et 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	34.21 Nev 2017 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	Dec 2017. 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.	0.0 14.52 2019	0.00 Fmb 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	0.0 0.00 0.00 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	15.32 Apr.2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	46.57 46.57 2.3 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	160 Jun 20
Total Claim Cl	629.46 alcl be se to Bo Jut 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1108.62 2018 undary (Aug 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	188.49 Creek (M Sep 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	9120 9120 0et 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	34.21 New 2017 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	Dec 2017. 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.	0.0 14.52 2019	0.00 Fitb 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	0.0 0.00 0.00 21 21 21 21 21 21 21 21 21 21 21 21 21	15.32 Apr 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	46.57 46.57 2.3 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	160 Jun 20
Total Coste 1 2 3 4 5 5 6 7 8 9 10 11 2 3 4 5 5 6 7 8 9 10 11 2 3 4 5 5 6 7 8 9 10 11 2 3 4 5 5 6 7 11 2 3 4 5 5 5 10 11 12 3 10 11 12 12 10 10 11 12 10 10 11 12 10 10 11 12 10 10 11 10 11 10 10 10 10 10 10 10 10	629.46 alcl be se to Bo Jut 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1108.62 2018 undary (Aug 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	188.49 Creek (M Sep 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	9120 9120 0et 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	84.21 New 2017 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	0.5 37.11 24 21 21 21 21 21 21 21 21 21 21 21 21 21	0.0 14.52 2019	0.00 Fitb 2018 211 211 211 211 211 211 211 2	0.0 0.00 0.00 21 21 21 21 21 21 21 21 21 21 21 21 21	15.32 Apr 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	46.57 46.57 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	06 mut.
Total Celea 1 2 3 4 5 5 5 7 8 9 10 11 12 13 14 15 16 17 20	629.46 Aid be se to Bo 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	108.62 2018 undary (Aug 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	188.49 Sep 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	9120 9120 0ct 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	34.21 Nev 2017 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	Dec 2017. 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.	0.0 14.52 2019	0.00 Feb 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	0.0 0.00 0.00 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	15.32 Apr 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	46.57 46.57 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	06 mut.
Total Celea Date 1 2 3 4 5 5 6 7 8 9 10 11 12 3 4 5 5 6 7 8 9 10 11 12 3 14 15 15 16 19 10 10 11 10 10 10 10 10 10 10 10 10 10	629.46 aid be se to Bo Jut 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	108.62 2018 undary (Aug 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	188.49 Sep 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	9120 9120 0ct 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	\$4.21 New 2017 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	Dec 2017. 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.	0.0 14.52 2019	0.00 Fmb 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	0.0 0.00 0.00 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	15.32 Apr.2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	46.57 46.57 2.3 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	05 mut.
Total Celean Date 1 2 3 4 5 5 6 7 8 9 10 11 12 3 4 5 5 6 7 8 9 10 11 12 3 4 5 5 6 7 8 9 10 11 12 3 14 5 5 6 7 7 8 9 10 11 11 11 11 11 11 11 11 11 11 11 11	629.46 alcl be se to Bo Jul 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1108.62 2015 2015 Aug 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	188.49 Creek (M Sep 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	9120 9120 0et 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	34.21 Nev 2017 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	Dec 2017. 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.	0.0 14.52 2019	0.00 Finb 2018 211 211 211 211 211 211 211 2	0.0 0.00 0.00 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	15.32 Apr 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	46.57 46.57 2.3 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	06 mut.
Total Celean Date 1 2 3 4 5 5 5 7 8 9 100 11 2 200 21 1 2 200 21 1 2 2 2 3 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	629.46 alcl be se to Bo Jut 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1108.62 2018 undary (Aug 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	188.49 Creek (M Sep 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	9120 9120 0et 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	\$4.21 New 2017 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	Dec 2017. 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.	0.0 14.52 2019	0.00 Fitb 2018 211 211 211 211 211 211 211 2	0.0 0.00 0.00 211 211 211 212 212 211 211 211 211 2	15.32 Apr 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	46.57 46.57 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	06 mut.
Total Celea Andrew	629.46 Aid be se to Bo Jul 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	108.62 2018 undary (Aug 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	188.49 Creek (M Sep 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	9120 9120 0ct 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	34.21 Nev 2017 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	Dec 2017. 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.	0.0 14.52 2019	0.00 Feb 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	0.0 0.00 0.00 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	15.32 Apr 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	46.57 46.57 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	06 mut.
Total Celea Date 1 2 3 4 5 5 6 7 8 9 10 11 12 3 4 5 5 6 7 8 9 10 11 12 3 4 5 5 6 7 8 9 10 11 12 22 22 23 24 225	629.46 aid be se to Bo Jut 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1108.62 2018 aug 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	188.49 Creek (M Sep 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	9120 9120 0ct 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	\$4.21 New 2017 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	Dec 2017. 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.	0.0 14.52 2019	0.00 Fmb 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	0.0 0.00 0.00 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	15.32 Apr.2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	46.57 46.57 2.3 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	05 mut.
Total Puts 1 2 3 4 5 5 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 24	629.46 alcl be se to Bo Jul 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1108.62 2018 undary (Aug 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	188.49 Creek (M Sep 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	9120 9120 0et 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	34.21 Nev 2017 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	Dec 2017. 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.	0.0 14.52 2019	0.00 Finb 2018 211 211 211 211 211 211 211 2	0.0 0.00 0.00 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	15.32 Apr 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	46.57 46.57 2.3 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	05 mut.
Total Control Control	629.46 aid be se to Bo 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1108.62 2 0 1 % undary (Aug 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	188.49 Sep 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	9120 9120 0ct 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	34.21 New 2017 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	Dec 2017 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	0.0 14.52 2019	0.00 Fitb 2018 211 211 211 211 211 211 211 2	0.0 0.00 0.00 211 211 211 212 212 211 211 211 211 2	15.32 Apr 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	46.57 446.57 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	06 mut.
Total Celea Andrew	629.46 Aid be se to Bo Jul 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	108.62 2018 aug 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	188.49 Creek (M Sep 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	9120 9120 0ct 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	\$4.21 New 2017 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	Dec 2017. 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.	0.0 14.52 2019	0.00 Feb 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	0.0 0.00 0.00 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	15.32 Apr 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	46.57 46.57 2.5 2.5 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	031 05 mut
Total Celea Date 1 2 3 4 5 5 6 7 8 9 10 11 12 3 4 5 5 6 7 8 9 10 11 12 23 4 5 5 6 7 8 9 10 11 12 22 23 24 22 22 22 22 22 22 22 22 22 22 22 22	629.46 aid be se to Bo Jut 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1108.62 2018 undary (Aug 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	188.49 Sep 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	9120 9120 0ct 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	\$4.21 New 2017 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	Dec 2017. 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.	0.0 14.52 2019	0.00 Fmb 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	0.0 0.00 0.00 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	15.32 Apr.2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	46.57 46.57 2.3 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	06 mut.
Total Puts 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 12 22 23 24 25 27 7 28 29 30	629.46 alcl be se to Bo Jul 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1108.62 2018 undary (Aug 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	188.49 Creek (M Sep 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	9120 9120 0et 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	34.21 Nev 2017 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	Dec 2017. 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.	0.0 14.52 2019	0.00 Finb 2018 211 211 211 211 211 211 211 2	0.0 0.00 0.00 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	15.32 Apr 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	46.57 46.57 2.3 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	06 mut.
Total Control	629.46 aid be se to Bo 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1108.62 2 0 1 % undary (Aug 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	188.49 Sep 2017 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	9120 9120 0ct 2017 0 00 0 00 0 00 0 00 0 00 0 00 0 00 0	34.21 New 2017 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	Dec 2017 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	0.0 14.52 2019	0.00	0.0 0.00 0.00 21 21 21 21 21 21 21 21 21 21 21 21 21	15.32 Apr 2018 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	46.57 446.57 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	16 Jun X

Page 46 cont.

The location of the site where the following photographs were taken have been marked on Figure 4.1 taken from **Page 44** of the Eco Logical Australia report.



Figure 4-1. Ecohydrological zones within the Big Swamp

Photo 1.

Looking east down through the Big Swamp while standing on the mound of dirt at the start of the southern fire trench some-time around 2014.

This Statement on Page 46 Needs to be modified.

In the Eco Logical Australia report, section 4.3.3 Damp woodlands states...

"The community is now a dense stand of Swamp Gum less than 30 years old with a limited understorey." During the 2010 fire all vegetation in the Big Swamp including the Damp woodland was burnt out. This dense stand of Swamp Gum would have been no older than 9 years old when the Eco Logical Australia survey was conducted.

Also, in the few seasons after the 2010 fire, vegetation in the Big Swamp struggled to re-colonise in many areas of the swamp. Even at the site of the 1997 fire, eucalyptus trees in 2008 were still having trouble to survive. This Photo 2 taken in 2008 shows a tree in the west end of the Damp woodlands having to survive by spreading its roots out across the surface.



These trees were relatively easily pushed over. However, after the 2010 fire the first lot of eucalyptus and other flora species that attempted to re-colonise the swamp survived for only a short period, died and then tried again the next season. In some areas of the Big Swamp it took some seasons for these plants to survive.

The following pictures tell various stories of the return of vegetation and its survival in the first few years after the 2010 fire.

Photo 2.

Some areas recovered reasonably quickly while other sections struggled for some time.



This photograph was taken 20 months after the 2010 fire looking west across the Swamp Plain section (taken on 8 November 2011). The green foliaged trees in the background are south of the southern fire trench that had been dug around the Big Swamp (see pages 33, 34, 35 and 37 below).

Photo 3.



This photograph is looking east across the Damp Woodland (8 November 2011).

By 2019 this area had changed markedly. See below, Plate 11 from the Eco Logical Australia 2019 report.

Photo 4.





Plate 11. Eco Logical Australia report, **Page 45**.



9 April 2011 The vegetation in the foreground is struggling to survive and was eventually overtaken by eucalyptus trees being part of the Damp Woodlands.

Photo 5.



Photo 6.

Looking down southwards into the Big Swamp from the northern slopes (9 April 2011).

The 1997 fire site after the 2010 fire looking into the Damp Woodland.





OTWAY WATER BOOK 66





Looking north east across the southern fire trench and the Damp woodlands (taken 1 February 2012).



OTWAY WATER BOOK 66



Photo 8.

Around 100 metres around the corner from Photo 7 looking back the other way – north west – in Jan 2013, twelve months later.



2014.

This photo shows eucalyptus trees popping up over much of the Big Swamp. Some of these trees died in the struggle to re-colonise.



Photo 9.

This photograph was taken at almost the same site of Photo 3 and Photo 10 facing south. The vegetation in this area took some time, a few seasons, to successfully establish.



Photo 10.

This galvanised steel dropper appeared in the Big Swamp around the same time Ecology Australia conducted the 2008-09 vegetation survey for Barwon Water. Similar droppers were placed at all other sites visited and recorded. However, no record of a visit being made to the Big Swamp has ever been admitted to.⁽⁵⁾



Photo 11. This photograph was taken at the west end of the Damp Woodlands looking west on 25 May 2014 and shows an area that has really struggled to support the growth of eucalyptus and most other vegetation.



Photo 12.

This photograph, Photo 12, taken on the same day from another area further east showing how marked the difference in growth was.

This also shows the southern trench.





Photo 13 Looking through the Damp Woodlands (29 November 2014).

Photo 14

In the same area, same day, showing how some of the plants kept their roots very close to the surface. In many cases these trees died like the ones seen in Photo 13. However, many managed to survive.

OTWAY WATER BOOK 66



Photo 15. At the site of the 1997 fire looking south into the Damp Woodlands area in 2014.



Photo 16 taken in April 2017 at the same site as Photo 15 but looking north. The galvanised dropper placed in 2008 is just out of sight amongst these tea trees.

As Late as 2016 the official view was no vegetation impact identified.

In 2016 Jacobs had this to say, "... there have been no vegetation health issues identified that would influence the licence renewal."⁽³⁾ Dying and dead wetlands, acid water, heavy metal generation, hydrophobic soil created and elevated fire risk to any degree was refuted as an impact associated with the Barwon Downs Borefield operation.



Photo 17. In 2009 Just before the 2010 fire.

2016 at approximately the same site.⁽⁵⁾

Even by 2016 the writing was on the wall that the Borefield was largely if not completely responsible for many of the surface impacts that were associated with significant water tables dropping in the area.⁽¹¹⁾

Other things of Interest to note.

 Pages 36 – 38 of the Eco Logical Australia report mentions "special" plants found and the presence of burrowing crays (possibly two species). This is especially pleasing as it indicates there is a chance that there is little acid impact present any longer in those areas. When Boomerang Swamp (headwaters of a tributary of Boundary Creek) dried out there were cray skeletons all over the surface of the wetland.⁽⁴⁾ The next photograph was taken at Boomerang Swamp at the time.

John Day a landholder in Reach 3 of Boundary Creek laments the disappearance of much of the life forms in Boundary Creek at his property and writes about the loss of burrowing cray mounds.⁽⁷⁾⁽⁸⁾⁽⁹⁾



At the time of discovering the skeletons at Boomerang Swamp the soil tested extremely acid in this swamp.⁽⁴⁾

Photo 20



This is the galvanised steel dropper placed at Site 79 during SKM's 2008 vegetation survey⁽⁶⁾ in Boomerang Swamp. The dropper shows the amount of corrosion in just two months of inundation.⁽⁴⁾⁽⁵⁾



The soil in 2011 at Boomerang Swamp tested out at ~ 3 pH.⁽⁴⁾

- 2. **Page 45**. The notion of occasional fires in the Big Swamp is mentioned several times through this report giving the impression that the Big Swamp was burning more than it has. The west end of around 1 hectare was on fire in 1997. Possibly again in 1998 and not again until the fire of 2010. In the 2010 fire the remainder of the Big Swamp caught fire for the first and last time. This notion of occasionally needs to be revisited.
- 3. On **page 46** the Eco Logical Australia report it states that heavy iron flocculation was clinging to all vegetation currently under water. Inclusion of a photographs of this would have been good.



Floc has accumulated on anything that is not being swept away by the stream of water. The edge between the flowing water and the floc is very pronounced.

When the water level drops floc is left exposed on whatever it has stuck to (see the top photo).

- 4. The discussion on **page 52** regarding the benefits of wetting the swamp from the "top down" rather than from the bottom up will be interesting to see what eventuates. Perhaps the combination of both will benefit the natural re-colonisation of vegetation to pre groundwater extraction times
- 5. The idea of natural re-colonisation was also mentioned as a possibility as the vegetation matures. Also, the Damplands of Reach 2 above the Big Swamp may act as a nursery bank capable of re-colonisation vegetation species in the swamp.
- 6. Very few reference has been made of heavy metals. Eight times in fact. Three of these are repeat comments. No discussion has been included on the impact on vegetation from these metals. This seems quite strange as the releasing of heavy metals and impact on the health of vegetation can be extremely detrimental.

EROSION in the Big Swamp.

The last visit I made to the Big Swamp before the August 2019 Eco Logical Australia visit was in October 2018. At this time there was no evidence of erosion in any part of the swamp traversed. Very little had changed regarding the collapse, slumping, depression from burnt peat, other organic deposits or disruption of the soil profile since the 2010 fire. There was a pooling at the eastern end of the swamp but this was caused by the back up of water behind the soil excavated from the eastern fire trench. The photograph on the next page shows this fire trench with excavated soil heaped up on the Big Swamp side of the trench. In this photograph I am standing next to a log that lies beside the water course bed of Boundary Creek. Boundary Creek is not flowing and the log indicates the direction of Boundary Creek crossing the fire trench at right angles. This photograph was taken soon after the 2010 fire.



and then exit into a drainage trench in Stewart's property before returning back

OTWAY WATER BOOK 66

to the creek bed of Boundary Creek. This drainage trench had been dug many years previously in an effort to prevent high flows exiting from the Big Swamp across farmland before returning to Boundary Creek.



March 2010. Looking south down the eastern fire trench.

As explained above, the fire trench was deeper than the bed of Boundary Creek. Before any water would continue to flow down Boundary Creek there had to be a substantial flow in the creek.

In low flow periods the water would flow along the creek, drop into this trench, head south and flow out through a man made gap into the drainage trench that would then flow back toward Boundary Creek.

In this way farm land was not inundated unless there was a flood.



March 2010, the afternoon on the day the Big Swamp caught fire.

This photograph was taken during the collection of soil sampling in March 2010 by Southern Cross Univserity scientists. The sample was taken at the low point of the secondary flowpath from the Big Swamp that would happen during high flow pereiods. This water would flow down an impression and flood Stewart's farmland before returning to the bed of Boundary Creek. The yellow star in this photo is the same spot as indicated in the sketch on pages **44** and **47**.

In the next few years when Boundary Creek would flow the fire trench would fill first and bi-pass Boundary Creek, flowing out of the drainage line. It was not until there were high flows would Boundary Creek flow across the fire trench and continue on down the creek uniterrupted.



Looking west back into the Big Swamp from Stewart's property along the high flow secondary flowpath.



OTWAY WATER BOOK 66

Suggestions of Erosion.

Scattered throughout the August 2019 Eco Logical Australia report mention is made of the amount and effect of erosion that has taken place through the Big Swamp. The following fourteen quotes (in *blue*) have been taken from this report.

Pages vi-vii of the Eco Logical Australia report.

Surface flows through the swamp remain in the main channel around the northern edge. Where flows exceed the capacity of the channel, water moves through the flood plain along a limited number of channels that have been scoured and deepened by increased rates of erosion and collapse of soil structure following recent fire events...



Source: Barwon Water 2020-2021 Remedial Environmental Protection Plan report, page 32.

This overhead of the Big Swamp indicates the flow of water through the swamp. I walked across most areas of the swamp wetlands on 1 November 2021 and found the no evidence of scouring or erosion of or deepened flow paths.

In addition, drying of the swamp has caused a loss of soil bulk density with slumping now present across much of the swamp plain. This has

OTWAY WATER BOOK 66

been exacerbated by the burning of organic deposits further reducing soil bulk density. This loss of structure has likely been a key contributor to erosion within the swamp leading to the formation of a sediment plug, and an open water pool, at the eastern most end...

The first part of this quote describing a loss of soil bulk and slumping would have contributed to allowing flows through various parts of the swamp that normally would have required a much higher flow rate in Boundary Creek. Boundary Creek pre the 2010 fire when flowing around the west end for the swamp was only 30 cm deep. Higher flow rates and the water would disperse into a minor flood plain in the swamp. Now, with slumping and loss of soil bulk, water flows across the swamp at reasonably low flow rates.

Page x

The latter fire resulted in an almost complete loss of vegetation cover across the swamp, substantially altering the structure of the communities throughout. Subsequently, it appears erosion of the swamp plain, likely driven by large rainfall events combined with exposed post-fire soils, has concentrated surface flows into a primary channel that now bisects the plain. The resulting eroded sediment appears to have in part accumulated at the eastern end of the swamp in the form of a plug, leading to the formation of a small pool of standing water which now persists yearround.



12 June 2018. East.....West. Looking south.

This is the site of the 1997 fire taken in June 2018. Up to this time it had not had any flow of water through it at the western end of the swamp going back to at least 2008. The next two shots are at the same location looking west back towards Boundary Creek (see page 48).



12 June 2018



12 June 2018. Looking west.Eight years after the drought hadbroken and still no flow into this area.

On the visit on 20 June 2018 the first trickle of water was starting to flow into this area and then disappear at midpoint in this photograph.



These photographs were taken on the first of November 2021 at the 1997 fire site, the same location as the three photographs on page **50**.



Page xii

Given the significant and fundamental changes that have occurred to the substrate across much of the swamp as a result of fires and subsequent erosion...

The decline of soil structure and woody vegetation cover has increased susceptible to erosion within the swamp during high flow events. This erosion appears to have led to the formation of a single channel through the swamp plain with sediment being transported and deposited at the eastern end of the swamp.



April 2010. Looking south down into the Big Swamp. <u>All</u> vegetation was burnt. The north channel of Boundary Creek can be seen in the foreground.

Not very much vegetation was left through the swamp after the 2010 fire. By the time water began flowing through this area late in 2019 the vegetation had fairly well established itself stabilising the site. Many areas of the swamp had burnt and created an iron like crust that was not prone to be eroded.

Page 11

This erosion appears to have led to the formation of a single channel through the swamp plain... It is impossible to find this "new" or "single" channel.

Page 18

This has likely been exacerbated by sub-surface peat fires further reducing soil bulk density. This decline in structure may have led to erosion within the swamp

Page 22

An open water pool has formed at the eastern end of the swamp by 2011, potentially behind a sediment plug formed due to the erosion of exposed soils upstream.



10April 2016. East end of the Big Swamp.

This may be cause by changed drainage patterns, due to post-fire erosion and collapse of soil layers, reducing water availability at these locations,

OTWAY WATER BOOK 66

or poor conditions for regeneration due to changes in soil or water chemistry.



October 2018. Pooling just above the east fire trench.

The digging and placing of the soil from the east fire trench on the western side of the trench would have forced any flows through the area to back up in this part of the Big Swamp. This could have been recognised as the sediment plug in 2019. Not a plug caused from erosion back through the swamp.



13 October 2018. Pooling just above the east fire trench.

OTWAY WATER BOOK 66

Page 26

The majority of the EVC has been significantly modified by reduced surface flows and subsequent fires which burnt deeply into the soil, leading to loss of humous layers, collapse of soil structure and significant soil erosion.



8 November 2011. Slumping and burning impact not soil erosion.



8 November 2011.

This soil was "iron" hard and not subject to erosion. The fire had changed the chemical structure of the soil.



8 November 2011.

The exposing of root vegetation in this part of the Big Swamp was the result of the combustion of the soil and peat as evidence with the charred roots.

Page 33

...as well as a major change to the wetland bathymetry caused by post-fire erosion and soil collapse and the cutting of a channel on the southern side.

Page 40

Where flows exceed the capacity of the channel, water moves through the flood plain along a limited number of channels that have been scoured and deepened by increased rates of erosion and decline of soil structure following the numerous fire events.

Page 49

Subsequently, it appears erosion of the swamp plain, likely driven by large rainfall events combined with exposed post-fire soils, has concentrated surface flows into a primary channel that now bisects the plain. The resulting eroded sediment appears to have in part accumulated at the eastern end of the swamp in the form of a plug, leading to the formation of a small pool of standing water which now persists year-round.

In the diagram on **Page 51** there is a mention of erosion.

Page 52

Given the significant and fundamental changes that have occurred to the substrate across much of the swamp as a result of sub-surface fires and subsequent erosion and soil collapse...

Is the Notion of Soil Erosion Through the Big Swamp the Start of a New Myth?

It can be strongly argued that the "possibles," "maybes" and "likelys" of significant erosion through the Big Swamp creating scouring, eroding of sediments, deepening of flow channels and creation of one channel through the swamp leading to pooling at the eastern end, has the potential to morph into, be accepted and recognised as fact.

CONCLUSION.

It is difficult to tell what influence the inaccuracies of earlier Barwon Downs Borefield reports have had on the outcomes of Eco Logical Australia's findings and recommendations. However, there is considerable difference between local experience and knowledge when compared against the background content presented by Eco logical Australia.

The infield work and data collection of vegetation by Eco Logical Australia provides a comprehensive and extremely valuable baseline for comparative future studies.

APPENDEIX ONE.

These two pages have been taken from the Gerangamete Groundwater Licence reports, 2015-2016 and 2016-2017, prepared and sent by Barwon Water to Southern Rural Water as part of the Groundwater Extraction Licence.





Gerangamete Borefield - Groundwater Extraction 2015-2016

The total extraction of groundwater for 2016 adds up to 3,449 ML.

CONTENTS.

Page numbers in blue refer to the Eco Logical Australia report.

Introduction

Pages 3-5

- Virginia Tiroli Check facts
- Extract from Book 62 re: checking facts not done
- Earlier documentation used if contains mistakes impacts present report
- In many cases earlier reports accepted with little scrutiny
- Extremely difficult to validate work referred to in this document
- Interpretation of earlier work based on incorrect facts makes for more mistakes

Important Note Page 5

• Acknowledgement of comprehensive and valuable data collection of Eco Logical Australia's in field work

Barwon Water Brief for Eco Logical Australia's work Page 6 Discussion

Page V of the Eco Logical Australia Report Pages 6-7

- Confusion when ECA actually conducted the field work
- Doug Frood asked to re-survey vegetation sites of Carr and Muir
- Carr and Muir did not supposedly visit the Big Swamp
- In 2008 evidence the Big Swamp was visited galvanised dropper
- First comprehensive vegetation survey of Big Swamp is a credited to ECA

Page Vi Pages 7-8

- Healey rainfall chart
- Still 600 mm during the drought for the Barongarook High recharge area
- Cease-to-flow, claim that 2 ML/day of supplementary flows is enough to stop no flow days wrong graph shows this

Page x of the Ecological Australia Report Pages 8-9

- A few discrepancies with ECA statements made
 - McDonald's Dam minor disruption.
 - o Flows in the head waters of Boundary Creek in summer stopped
 - Reach 2 perineal flows
 - Early to mid 1990's wet
 - Creeping acid problem in mid to lower swamp not fires
 - Last fire date 2010 not 2011
 - All vegetation in the Big Swamp burnt

Page xiii of the Ecological Australia Report Page 8

Mention of the southern tributary through the Big Swamp but does not indicate what or where this is.

Page 1 of the Ecological Australia ReportPages 9-10

- Pushing the point that prior to groundwater extractions there were days of no flow
- Heavy metals are given little mention re: impact on vegetation

Page 8 of the Ecological Australia ReportPage 10

- Figure 3.1 has mistakes -extraction figures -no flow days
- Fire trenches dug 2010 not 2006.

Page 9 of the Ecological Australia Report Page 11

- Stream Flow Gauging not done continuously *above* the Big Swamp.
- The groundwater extraction licence given long before 2004
- Different reasons for withdrawal of licence application -local concern
- Different reason for remediation -directive from the Minister for Water
- Date wrong borefield implemented before 1985

Page 10 of the Ecological Australia Report Pages 11-12

• Stream Flow Gauging Station information "all over the Ship"

Page 11 of the Ecological Australia Report Pages 12-13

- Stream Flow Gauging Station graphs showing the 233228 gauge as being above the swamp -wrong
- And, gauge 233231 above the swamp with period of no data collection
- Incorrect fire trench information repeated

Page 13-14 of the Ecological Australia Report Pages 13-14

- Regular use of "likely" "most likely" "possible" etc.. (Epistemic)
- Contradictions re: connectivity between the LTA and Big Swamp
- Cross section diagrams below the Big Swamp area

Page 14 of the Ecological Australia Report Pages 15-16

- Data pre 1985 sparse
- No evidence of negative vegetation impact on the Big Swamp re: extraction (Jacobs 2016)
- Confusing statement re: dramatic changes in stream flow not affecting the Stream Flow Gauging
- LTA has recovered to artesian levels in the eastern end of the swamp
- Photo of artesian flow at east end of the Big Swamp

Page 15 of the Ecological Australia Report Page 17

- Table missing
- Figure does not appear to match the text

Page 18 of the Ecological Australia ReportPage 17

- Fire history in the Big Swamp is wrong
- Fire credited with vegetation death further down the swamp from the 1997 fire pre 2010 fire is wrong

Page 18-19 of the Ecological Australia ReportPages 17-19

- Fire history on the Big Swamp
- Mistake of fire history repeated again.
- A sprinkler system was never installed near the Big Swamp
- Carr and Muir 1994 incorrectly orientated Plate repeated
- Frood report incorrectly dated

Page 20-25 of the Ecological Australia ReportPages 19-26

- Aerial imagery of the Big Swamp 1946-2021
- Galvanised dropper at the site
- Acid "creep" photographs
- Vegetation dead and dying from acid "creep"
- 2008 soil and water tests by Deakin University (NANA accredited)

Page 46 of the Ecological Australia Report Pages 26-27

- Discrepancies re: cease-to flow, no flow days
- Jacobs statement referred to re: 2ML/day prevents days of no flow is wrong.

Page 46 of the Ecological Australia Report Pages 28-41

- Photograph story showing the struggling efforts of the vegetation recolonisation of the Big Swamp
- Dying eucalyptus
- Dead tea tree
- Age of regrowth needs to be reassessed
- Roots spreading across the surface
- Photographs of the southern fire trench
- Acid impacted galvanised dropper
- 2016 statement that there have been no vegetation health issues identified

Other things of note.

Page 36-38 of the Ecological Australia Report Pages 41-42

- Burrowing cray recovery
- Lohn Day's concerns re: burrowing crays
- Dead burrowing cray skeletons across the Boomerang Swamp
- Acid impacted galvanised steel dropper over two months

Page 45 Page 43

• Occasional fires in the Big Swamp disputed

Page 46 Page 43

- Iron flocculant clinging to vegetation
- Photo of iron floc covering underwater objects

Page 52Page 44

• Discussion on wetting the Big Swamp from top down and or bottom up

OTWAY WATER BOOK 66

• No mention of impact on vegetation from heavy metals.

EROSION Pages 44-57

- Sketches of how water releases from the Big Swamp
- Excavation soil forming a wall backing up and pooling water in the east end of the Big Swamp
- East fire trench with no water in it
- Bed of Boundary Creek at right angles to the trench and at a higher level
- Secondary flow path of water out of the Big Swamp pre 2010 fire

EROSION Pages 48-58

- Quotes suggesting erosion in the Big Swamp has created scouring, trenching etc.
- Photos show no erosion
- Photos of pooling at the east end of the swamp
- Photos of subsidence and or soil bulk reduction due to burning

CONCLUSION Page 59

APPENDIX ONE Pages 60-61

• Groundwater extraction figures for 2016

References Page 66

References.

- 1. Gardiner M.J., October 2008:<u>One Giant Environmental Footprint</u>. Otway Water Book 8.
- Witebsky S., Jayatilaka C. and Shugg A. J., November 1995: <u>Groundwater</u> <u>Development Options and Environmental Impacts. Barwon Downs Graben,</u> <u>South-Western Victoria.</u> Department of Natural Resources and Environment.
- 3. Jacobs. 12 December 2016:<u>Barwon Downs Technical Works, Integration</u> <u>Report</u>. Prepared for Barwon Water.
- Gardiner M.J., January 2013: <u>The Boomerang Swamp</u>. Otway Water Book 18.
- 5. Gardiner M. J., February 2017:<u>Hydrologicall Sensitive Vegetation Sites –</u> <u>Barwon Downs Borefield Area of Influence</u>. Otway Water Book 31.
- 6. Sinclair Knight Merz, 14 April 2009: <u>Barwon Downs Flora Study 2008.</u> Final1. Barwon Water, Victoria Australia.
- 7. Gardiner M. J., September 2009: <u>Barwon Downs Borefield Flora Studies</u> <u>1986-2009</u>. Otway Water Book 9.
- 8. Gardiner M. J., December 2012: <u>Groundwater Extraction and the Drying</u> <u>Out of the Big Swamp</u>. Otway Water Book 19.
- 9. Gardiner M. J., November 2017: <u>Review of Barwon Water's Boundary Creek</u> <u>Aquatic Ecology Investigation of 2017</u>. Otway Water Book 39.
- 10.Gardiner M. J., February 2013: <u>Unfinished Business</u>. Otway Water Book 20.
- 11. Gardiner M. J., June 2020: <u>Flow Paths, Drawdown, Recharge, Vertical</u> <u>Leakage and Perched Swamps, Within the Drawdown Influence of the</u> <u>Barwon Downs Borefield</u>. Otway Water Book 35.
- 12.Frood., March 2017: <u>Review of Vegetation in the Yeodene Groundwater</u> <u>Intake Area, Baron Downs Aquifer Outcrop Area, Victoria</u>. Prepared for LAWROC Landcare Group.
- 13.Gardiner M. J., August 2021: <u>Supplementary Flows down Boundary Creek</u>. Otway Water Book 41.
- 14. Country Fire Authority (CFA) April 2010: <u>Fire History, Risk Identification</u> <u>and Mitigation Plan</u>. Discussion Paper.
- 15. Victorian State Government 2021: <u>Central and Gippsland Sustainable</u> <u>Water Strategy – Discussion Draft</u>.