"Preliminary Upland Inland Freshwater ASS Assessment of Wetland Habitats Around Wannon Water South Off-take Number 2 Pumping Station."

Sample Site 9.

LAWROC (Land And Water Resources Otway Catchments)

as

OTWAY-WATER Book 37

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May 2017

Land And Water Resources Otway Catchments, Landcare Group.
(LAWROC)

Prepared by: Andrew McLennan and Malcolm Gardiner
(LAWROC Landcare Group Members.)

Introduction

LAWROC Landcare Inc. Group has been commissioned by concerned Chapple Vale and Carlisle River residents to undertake preliminary soil investigations of sites within the stated drawdown impact area from a groundwater extraction borefield at the Gellibrand River South Off-take Number Two Pumping Station.

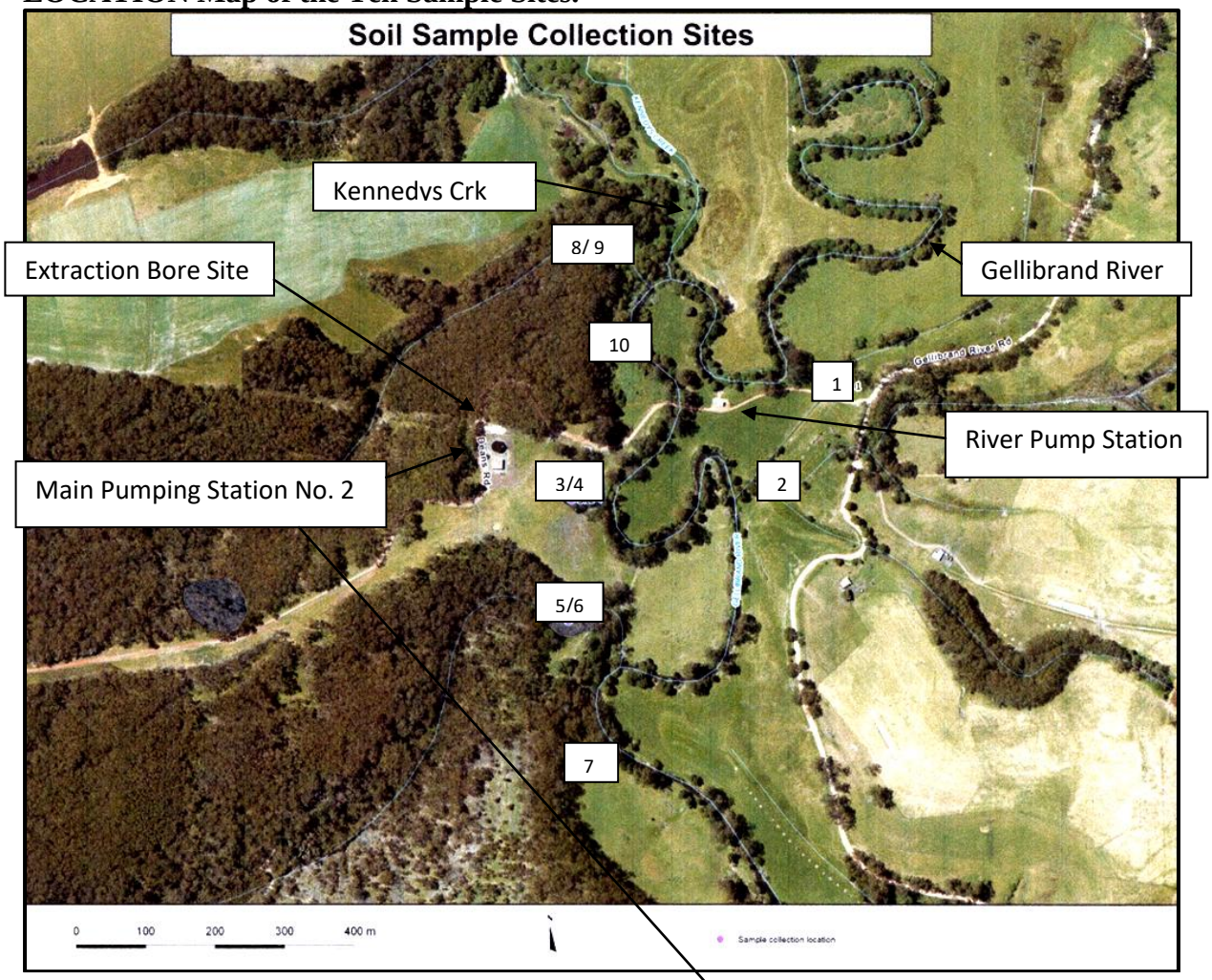
It is understood that no Environmental Impact Statement has been prepared or that any ASS assessment was to be carried out before bore construction was to commence.

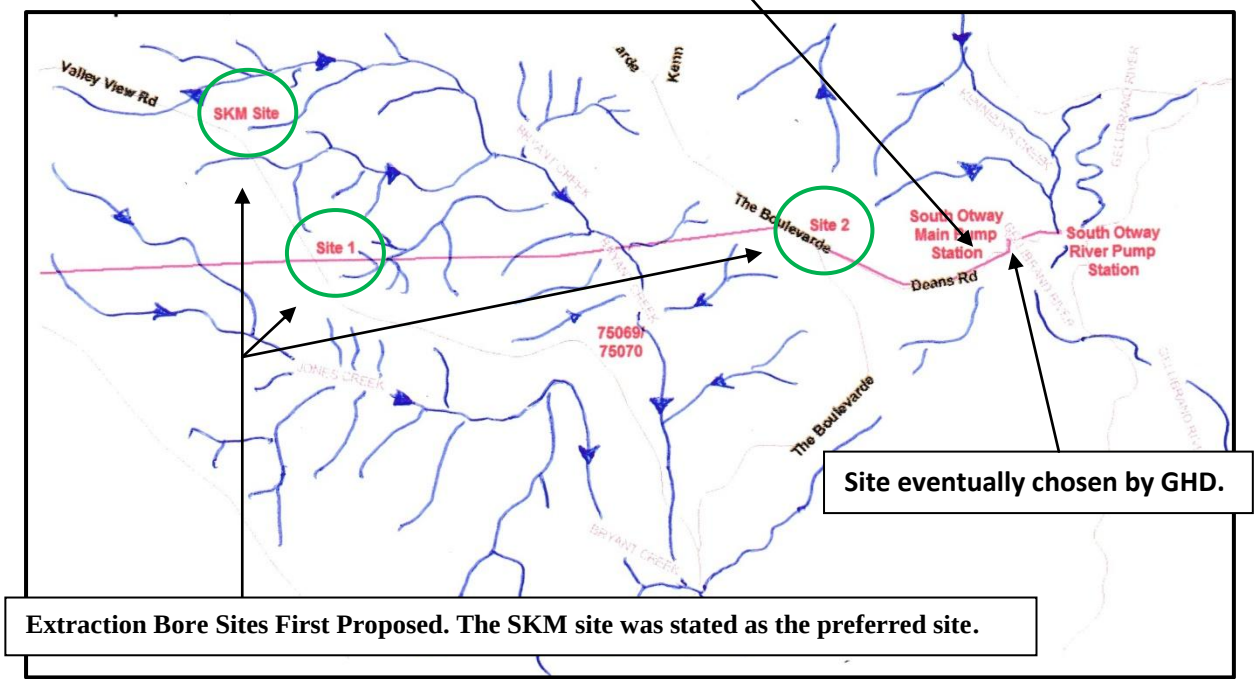
Objectives

1. To briefly show what impacts have taken place from Acid Sulfate Soil at sites found in nearby and adjoining catchments of the Otway Ranges.
2. To establish whether Acid Sulfate Soils are present in the 500 metre radius drawdown area of influence from the Chapplevale groundwater bore extraction site..
3. If there are Acid Sulfate Soils present does it warrant further investigation, and
4. to provide information that may assist in management and decision making processes.

Approximate location of the drawdown area and soil sample sites.

LOCATION Map of the Ten Sample Sites.





Extraction Bore Sites First Proposed. The SKM site was stated as the preferred site.

<u>SOURCE</u>: Wannon Water Handout.

Information Sources in Compiling this Report.

1. Sites chosen, descriptions and photographs by Andrew McLennan and Malcolm Gardiner.
2. Environmental Analysis Laboratory, Southern Cross University analysis results of samples taken on 26 April 2017.
3. The Department of Sustainability and Environment's (Victorian Government), "*Victorian Best Practise Guidelines for Assessing and Managing Coastal Acid Sulfate Soils. 2010*."

What can happen when Acid Sulfate Soils are disturbed?

Samples from Sites 11 -13(see below) were taken from the Big Swamp's Actual Acid Sulfate Soil impact caused by and under the influence of the Barwon Downs Borefield. These samples were taken from the same profile. Site 11 near the surface to Site 13 at 1400 mm depth. The water level in this profile was at 700 mm Below Ground Level (BGL). Pre ground water extraction-1982, this site was continually under water.

The sample from Site 11 is 31 times greater than the Action Criteria level(see Page 14 for Action Criteria Levels- shown in yellow). Site 12 sample is 31.7 times over and Site 13 is 138.4 times greater than the Action Criteria Level. What is frightening is that there has been an assay taken years ago that was 533 times over the Action Criteria Level and to this day not one government authority has been prepared to take on any responsibility and seriously look at this catastrophic problem. Frightening because it was stated in 1988 that groundwater extraction at Barwon Downs would not lead to such problems. Frightening because assurances were made that all safeguards had been put in place and especially frightening because the Chapple Vale project seems to be following a similar pattern of management.

Southern Cross University EAL Soil Test results for the Big Swamp & Maggios Swamp.

PAGE 1 OF 1

RESULTS OF ACID SULFATE SOIL ANALYSIS

16 samples supplied by Land & Water Resource Otway Range on 28th April, 2017 - Lab. Job No. F8933

Analysis requested by Malcolm Gardiner. Your Project: Acid Sulfate Soils

(1805 Colac-Lavers Hill Road KAWARREN VIC 3249)

Required if pH_{KCl} <4.5

Sample Site	EAL lab code	TEXTURE (note 7)	MOISTURE CONTENT (% moisture of total wet weight)	MOISTURE CONTENT (g moisture / g of oven dry soil)	TITRATABLE ACTUAL ACIDITY (TAA) pH_{KCl}	TITRATABLE ACTUAL ACIDITY (TAA) (To pH 6.5) (mole H^+/tonne)	Extractable sulfate sulfur $\%S_{Sul}$	Extractable sulfate sulfur (equivalent mole H^+/tonne)	REDUCED INORGANIC SULFUR (% chromium reducible S) (%Scr)	REDUCED INORGANIC SULFUR (% chromium reducible S) (mole H^+/tonne)	RETAINED ACIDITY (HCL extract) (as $\%S_{HCL}$ - $\%S_{Sul}$) ($\%S_{RAS}$)	RETAINED ACIDITY S_{RAS} (mole H^+/tonne)	NET ACIDITY Chromium Suite mole H^+/tonne (based on %Scrs)	LIME CALCULATION Chromium Suite kg $CaCO_3$/tonne DW (includes 1.5 safety Factor when liming rate is +ve)
Method Info.		**	**		(ACTUAL ACIDITY-Method 23)				(POTENTIAL ACIDITY-Method 22B)		(RETAINED ACIDITY)		** & note 5	** & note 4 and 6
Site 1														
Site 2														
Site 3														
Site 4														
Site 5														
Site 6														
Site 7														
Site 8														
Site 9														
Site 10														
Site 11	F8933/11	Medium	78.8	3.72	2.46	772	0.430	268	0.934	583	0.047	22	1,376	103
Site 12	F8933/12	Medium	79.7	3.93	2.28	858	0.539	336	0.952	594	0.090	42	1,494	112
Site 13	F8933/13	Medium	82.8	4.80	2.30	1,178	1.004	626	4.151	2,589	0.281	131	3,899	292
Site 14	F8933/14	Medium	28.2	0.39	4.12	50	0.006	4	0.012	7	0.001	1	58	4
Site 15	F8933/15	Medium	61.5	1.60	3.86	175	0.006	3	0.035	22	0.008	4	200	15
Site 16	F8933/16	Medium	35.5	0.55	3.90	73	0.005	3	0.038	24	0.003	1	98	7

Sites 1-10 are the Chappelvale soil samples & are dealt with later.

NOTE:
1 - All analysis is Dry Weight (DW) - samples dried and ground immediately upon arrival (unless supplied dried and ground)
2 - Samples analysed by SPOCAS method 23 (ie Suspension Peroxide Oxidation Combined Acidity & sulfate) and 'Chromium Reducible Sulfur' technique (Scr - Method 22B)
3 - Methods from Ahern, CR, McElnea AE , Sullivan LA (2004). *Acid Sulfate Soils Laboratory Methods Guidelines*. QLD DNRME.
4 - 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.
5 - ABA Equation: Net Acidity = Potential Sulfidic Acidity (ie. Scrs or Sox) + Actual Acidity + Retained Acidity - measured ANC/FF (with FF currently defaulted to 1.5)
6 - The neutralising requirement, lime calculation, includes a 1.5 safety margin for acid neutralisation (an increased safety factor may be required in some cases)
7 - For Texture: coarse = sands to loamy sands; medium = sandy loams to light clays; fine = medium to heavy clays and silty clays
8 - .. denotes not requested or required. '0' is used for ANC and Snag calcs if TAA pH <6.5 or >4.5
9 - SCREENING, CRS, TAA and ANC are NATA accredited but other SPOCAS segments are currently not NATA accredited
10- Results at or below detection limits are replaced with '0' for calculation purposes.
11 - **Projects that disturb >1000 tonnes of soil, the ≥0.03% S classification guideline would apply (refer to acid sulfate management guidelines).**
12 - Results refer to samples as received at the laboratory. This report is not to be reproduced except in full.
13 ** denotes these test procedure or calculation are as yet not NATA accredited but quality control data is available

(Classification of potential acid sulfate material if: coarse Scr≥0.03%S or 19mole H^+/t; medium Scr≥0.06%S or 37mole H^+/t; fine Scr≥0.1%S or 62mole H^+/t) - as per QUASSIT Guidelines

NATA
Accreditation No. 14960.
Accredited for compliance with ISO/IEC 17025.

checked: .....
Graham Lancaster
Laboratory Manager

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

BARWON DOWNS CATCHMENT IMPACTS.

Groundwater extraction.

Before look.

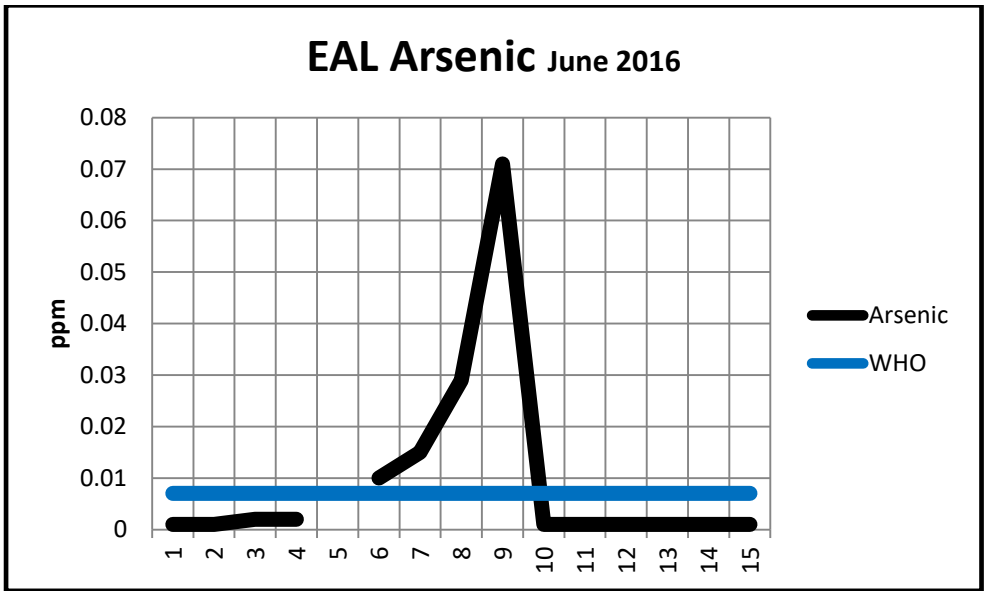
Barwon River at Conns Lane, dry for months on end.

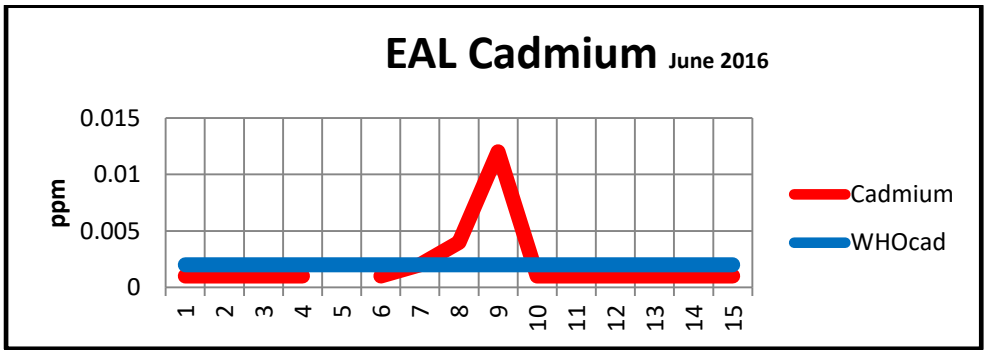
Acid and Aluminium creep.

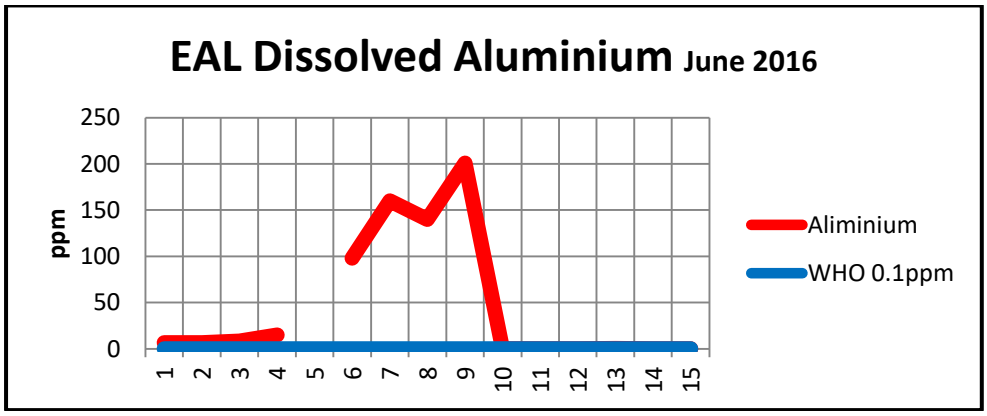
Site of 1997 fire. Photo taken in 2009.

Another site with treated pine post eaten off at ground level . It would appear that inland ASS such as the Big Swamp over in the Barwon River Catchment, is one of the first to be discovered in Victoria and is the highest upland freshwater site found in Australia and coincidently one of the worst.

Below are some of the analysis results of water taken during the 2016 thirty kilometre ***fish kill*** down the Barwon River. The contamination at Sites 6, 7, 8 & 9 along the Barwon River originated from the Big Swamp's Actual Acid Sulfate Soil.







Samples 14, 15 and 16 were taken from the same profile in another swamp under what is thought to be the early stages of influence from the Barwon Downs Borefield. These results show border line concerns and the data will be used as comparative data in later studies. The Actual Acid Sulfate Soil sites cited above are many kilometres away from the point of groundwater extraction.

The soil samples taken at Chapplevale were all within 500 metres of the extraction bore and within the stated area of influence.

Site IDs, Photographs and Descriptions **(see Map, Page 4.)****.**

SITE 1.
East side of the Gellibrand River in a drainage line (man made). The non flowing water level in the drain was approximately 500 mm below the pasture surface. The soil sample was taken 300 mm below the drain profile.

SITE 2.
This site was in a swamp situated in surrounding pasture. Cattle had access to the swamp. This was also on the east side of the Gellibrand River. There was running water. The sample was taken 300mm down the profile.

SITE 3.
This site is 50 metres from the west bank of the Gellibrand River in a slip area. It is located below the power lines running up to the No. 2 pumping station. Sample taken at 300 mm depth.

SITE 4.
This site is within metres of Site 3 and had iron floc visible with a trickle of running water. Sample taken at 300 mm.

SITE 5.
This site is also on the west side of the Gellibrand River at a creek with substantial flow of running water. Lots of organic matter present with vegetation in a very water logged area.

SITE 6.

Site 6 is on the same stream as Site 5 by approximately 100 metres upstream in a heavily fern and tree covered gully.

SITE 7.

This site is a soak in pasture and appeared to have been previously "scalded" from acid. West side of the Gellibrand River approximately 80 metres away.

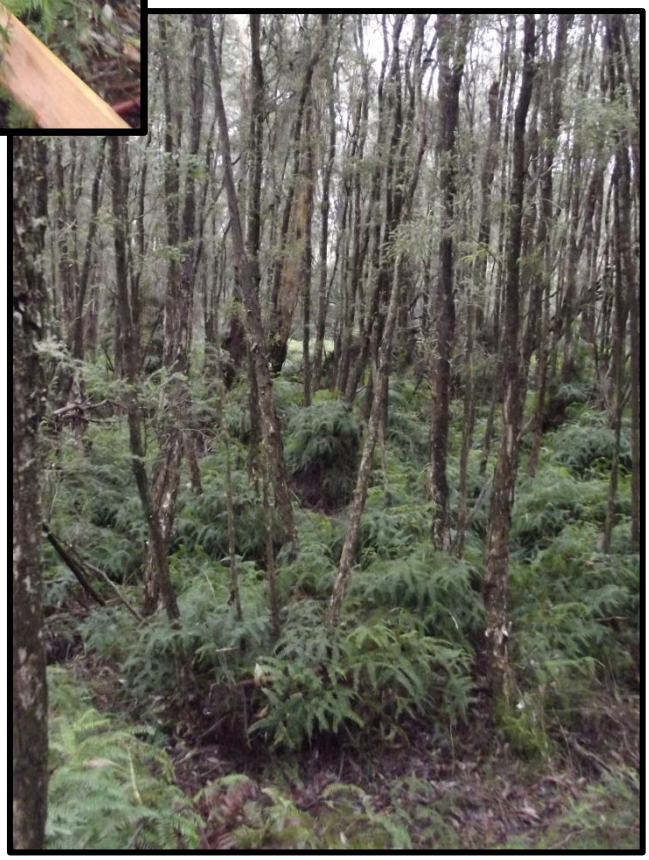
Looking down to the river.

Looking up from the river.

SITE 8 and SITE 9.

Samples were taken from the same profile.

Site 8 was approximately 400 mm below the surface. Site 9 sample taken was approximately 800 mm below the surface.



SITE 10.

This site is down on the flats in what appears to be a billabong area adjacent to the Gellibrand River. This site is on the west side of the river and the soil sample was taken at a depth of approximately 600 mm. The vegetation at this site was notably different to the other sites. Coprosma, Blackwood, Hazel Pomedaris and Ghania were present.

These sites and samples were selected and collected as a preliminary effort to determine whether there was a potential problem from Acid Sulfate Soils. From the Map on Page 4 it is obvious that there are many other sites that should also be investigated. No claim is being made that this work has been thorough or exhaustive.

Soil Sampling and Analysis Methodology.

1. Sampling was undertaken using decontaminated gloves between samples.
2. All samples were collected using a stainless steel auger, decontaminated between each sample.
3. All samples collected were stored in 75 ml vials, frozen and returned to EAL in a frozen state for Analysis.
4. All soil preparation and analysis conducted by EAL using NATA certified Analysis. All soil samples collected were dried at 80 degrees. Samples were ground in a ring mill grinder to a fine powder which was stored in sealed polypropylene vials.
5. All samples were subjected to Chromium Reducible Sulfur Analysis; including Tritratable Actual Acidity; CRS oxidisable sulphur and Extractable sulfate sulfur Analysis.
6. All Analysis methods used are NATA registered.

Southern Cross University EAL Soil Test results for Chapple Vale Impact Area.

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											Required if pH_{KCl} <4.5			
Method Info.		**	**		*(ACTUAL ACIDITY-Method 23)*				*(POTENTIAL ACIDITY-Method 22B)*		*(RETAINED ACIDITY)*		** & note 5	** & note 4 and 6
Site 1	*F8933/1*	Fine	50.4	1.02	4.05	170	0.012	7	0.022	14	0.024	11	195	15
Site 2	*F8933/2*	Medium	32.7	0.48	4.61	65	..	..	0.025	16	..	0	81	6
Site 3	*F8933/3*	Fine	27.8	0.38	4.49	51	0.005	3	0.027	17	0.005	2	70	5
Site 4	*F8933/4*	Fine	26.9	0.37	4.02	63	0.009	6	0.016	10	0.001	0	74	6
Site 5	*F8933/5*	Medium	55.4	1.24	4.31	138	0.019	12	0.314	196	0.006	3	337	25
Site 6	*F8933/6*	Medium	72.5	2.64	4.25	131	0.018	11	0.191	119	0.006	3	253	19
Site 7	*F8933/7*	Fine	21.9	0.28	4.39	42	0.003	2	0.013	8	0.001	0	50	4
Site 8	*F8933/8*	Medium	59.7	1.48	4.05	164	0.008	5	0.017	11	0.012	5	180	13
Site 9	*F8933/9*	Medium	54.7	1.21	4.10	92	0.007	4	0.021	13	0.004	2	107	8
Site 10	*F8933/10*	Medium	73.9	2.84	4.56	110	..	..	0.063	39	..	0	149	11

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(Classification of potential acid sulfate material if: coarse Scr≥0.03%S or 19mole H^+/t; medium Scr≥0.06%S or 37mole H^+/t; fine Scr≥0.1%S or 62mole H^+/t) - as per QUASSIT Guidelines

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checked: .....
Graham Lancaster
Laboratory Manager

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

(Calculation of Net Acidity.
Net Acidity=Tritratable Actual Acidity + Reduced Inorganic Sulfur + Retained Acidity - Acid Neutralising Capacity.**)**

Acid Sulfate Soils when disturbed and or dried out can become Actual Acid Sulfate Soil (AASS). The Actual Acid Sulfate Soils create the acid toxicity and other problems if there is insufficient Acid Neutralising Capacity (ANC) within the soil profile. The Samples tested have no Acid Neutralising Capacity.

ASS in an anaerobic state, saturated or under water create very few problems. However, the ASS profile could contain Actual Acid Sulfate Soil (disturbed and or dried out - oxidised) and Potential Acid Sulfate Soil (still in a harmless saturated state).

Discussion.

All samples show levels of acidity with varying degrees of Acid Sulfate Soil (ASS) characteristics. There is insufficient if any buffering capacity at any site capable of neutralising acid produced during oxidation. That is no Acid Neutralising Capacity(ANC).

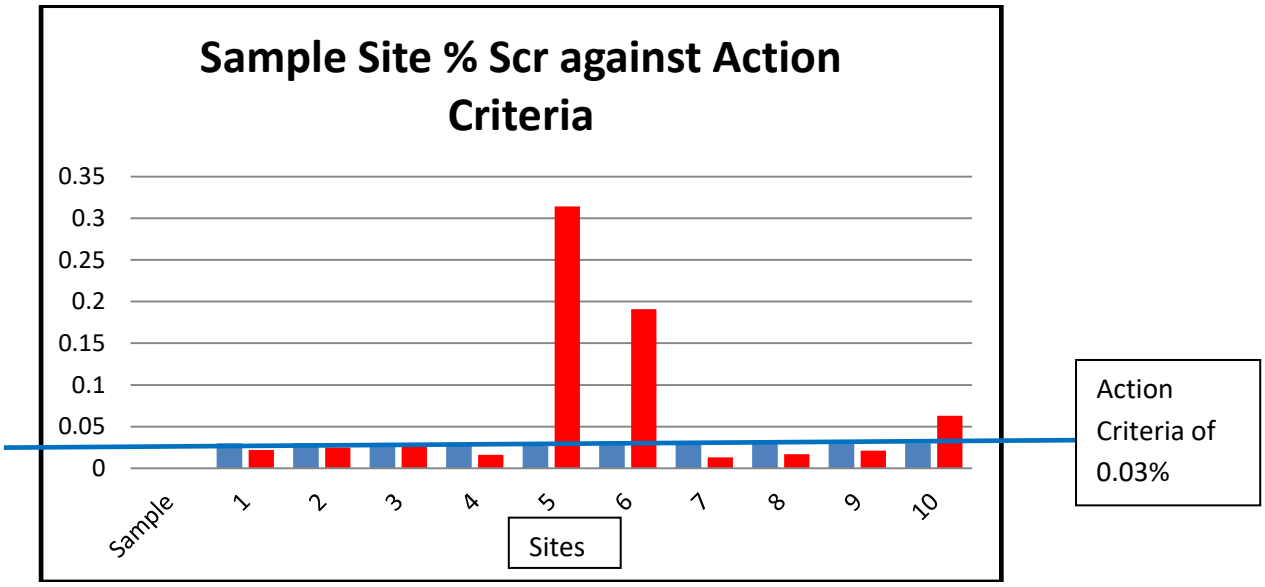
All samples have characteristics of acidity and can be regarded as Acid Sulfate Soil(ASS) sites. Samples 1, 2, 3 and 9 fall slightly under the Action Criteria and can be regarded as Potential Aicd Sulfate Soil(PASS) sites. However, Samples 5, 6 and 10 displayed acid generation potential over and above the trigger Action Criteria of the 0.03% S_{CR} (chromium reduced sulfurv– acid generating potential) and can be regarded as Actual Acid Sulfate Soil sites(AASS). The 0.03% S_{CR} level is regarded as the main indicator for action needing to be undertaken if any project is contemplated that will potentially oxidise these soils.
Sample 5 is 10.5 times over this 0.03% limit. Sample 6 is 6.4 times greater and sample 10 is 2.1 time over the Victorian Action Criteria limit. These cursory figures indicate a very real area of concern.

Comparison of EAL TEST results and the Action Criteria Tables.

Sample	Depth (metres below ground level)	Texture	**Tritratable Actual Acidity** (TAA) (moleH^+/tonne)			**Reduced Inorganic Sulfur** (%S_{CR}) **(A level over 0.03% for coarse, medium or fine texture is regarded as passing the Action Criteria.)**			**Net Acidity Chromium Suite** (moleH^+/tonne)		
Action Criteria			**Coarse**	**Medium**	**Fine**	**Coarse**	**Medium**	**Fine**	**Coarse**	**Medium**	**Fine**
			19	37	62	0.03	0.06	0.1	19	37	62
1		F	170			0.022			195		
2		M		65		0.025				81	
3		F	51			0.027			70		
4		F	63			0.016			74		
5		M		138		**0.314**				337	
6		M		131		**0.191**				253	
7		F	42			0.013			50		
8		M		164		0.017				180	
9		M		92		0.021				107	
10		M		110		**0.063**				149	

The three readings in red are of most concern and can be regarded as Actual Acid Sulfate Soils. All of the remaining readings indicate they are Potential Acid Sulfate Soil sites to be managed with some caution.

Chapplevale %S_{CR} Levels.



The Department of Sustainability and Environment (Victorian Government), "*Victorian Best Practise Guidelines for Assessing and Managing Coastal Acid Sulfate Soils. 2010,"* is also the manual used for Inland Acid Sulfate Soils

Even though Inland ASS is a relatively new phenomena it is accepted that the management of inland ASS sites should at this stage, follow the Coastal guidelines.

The 2010 Guideline Principles include the following:
1. Avoid disturbance.
2. Take the precautionary Principle approach.
3. Assess impacts before disturbing the soils.
4. Assessment to go beyond the boundaries of expected impact.
5. Consequences of Inland Acid Sulfate Soils disturbance to receptors has to be considered. (Receptors being landholders, environment etc.)

Stages of Management include
1. Make Preliminary Assessment. This can be done by person(s) with limited experience.
2. Make a detailed assessment if there are indications of ASS. This person(s) should be appropriately qualified and be an experienced practitioner of 5 or more years experience ***AND*** be professionally accredited.

These guidelines accept 0.03% S_{CR} as the Action Criteria Level. If sites are under the 0.03% level a project can proceed but with appropriate approvals and justification why Inland Acid Sulfate Soil assessment is not required.

Are there other considerations beside Acid Sulfate Soils that should be taken into account? The simple answer is yes. Some thoughts and suggestions are mentioned in the conclusion below, but other considerations would be best covered by an "*appropriately qualified and experienced practitioner."*

Conclusion.

There is absolutely no doubt that a thorough assessment of ASS sites, within the drawdown influence from a test groundwater extraction at the Number 2 Wannon Water Pumping Station at the South Gellibrand River Offtake, should be undertaken. This assessment by an appropriate and accredited ASS expert needs to be done before the test pump is to proceed. Base-line data must be collected.

Other considerations that should be taken into account during the collection and compilation of base data are:

1. Sinking of nested observation bores in the anticipated area of influence.
2. A comprehensive testing for ASS covering all suspected sites within the drawdown area and beyond, as recommended in the Coastal Acid Sulfate Soil management manual.
3. Determination of the recharge area and the amount of intake to the aquifer(s) anticipated to be impacted.
4. Soil analysis of the ASS sites for heavy metals and metalloids.
5. Determination of the amount of toxicity the Gellibrand River EPBC protected Grayling specie can tolerate from Actual Acid Sulfate Soil pollution, before a similar fish kill as happened down the Barwon River in 2016, takes place.
6. A stygofauna survey.
7. A vegetation survey, and
8. Assessment report for each of the data sets collected.

Contamination coming out of the Big Swamp.