Barwon Water

Anglesea Acid Sulphate Soil Investigation

2020

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Under the bulk entitlement for the Anglesea Borefield, Barwon Water has established a comprehensive Monitoring and Assessment Program (MAP) that has been reviewed by independent experts and approved by the Minister for Water. The objective of the MAP is to protect environmental values and the health of groundwater dependent ecosystems, whilst also continuing to collect data to build our understanding of the long-term sustainability of groundwater resources in the Anglesea area.

The acid sulfate soil investigation component of the MAP was included following the 2013 Bulk Entitlement and MAP review, which identified the need for further understanding of the distribution of acid generation across the Anglesea catchment. This information will help inform future reviews of the Bulk Entitlement and MAP with regard to existing acid sulfate soil issues in the Anglesea catchment, and the need for any measures that could be implemented in addition to the current groundwater level triggers to help ensure groundwater pumping from the Anglesea Borefield does not add to the existing acid generation processes.

Picture 1: Anglesea Swamp, October 2019 (Ecology Australia, 2019)

What we are doing

It has been well documented that the Anglesea River frequently experiences low pH conditions during and after high intensity rainfall events, which can result in fish death events, closure of the estuary to recreational activities, subsequently impacting local businesses.

Acidic discharges to the Anglesea River can occur as a result of the naturally occurring acidic peat swamps located in Salt Creek and Marshy Creek in the upper catchment of the Anglesea River, natural coal seams, or acid sulfate soils. The sources and relative contributions of acid into the Anglesea River from each of these sources in the upper catchment and sulfidic peat swamps is currently not well understood.

For this reason, in 2017, Barwon Water engaged Dr. Vanessa Wong from Monash University to conduct a study to investigate the distribution and characterisation of acid sulfate soils across the Anglesea catchment.

The objective of the investigation was to:

- characterise acid sulfate soil distributions and concentrations in the Anglesea and Salt Creek Swamplands;
- identify potential impacts from acid generation in the Anglesea and Salt Creek Swamplands;
- improve knowledge of acid generation and movement, particularly in the Anglesea Swamplands.

The information gathered through this investigation could then be used in conjunction with other groundwater information and modelling to inform future reviews of the Anglesea Borefield Bulk Entitlement and Monitoring & Assessment Program and ensure appropriate measures are in place to continue to ensure operation of the Anglesea Borefield is not contributing to the activation of acid sulfate soils in the Anglesea River Catchment.

The program for assessment of acid sulfate soils developed by Monash University was designed to align with the groundwater level triggers that are in place to protect the Anglesea swamp from drawdown of groundwater levels in the perched water table as a result of extraction of groundwater from the Anglesea Borefield.

The sampling program involved taking samples from 53 locations across the Salt Creek and Marshy Creek catchments as shown in Figures 1 & 2.

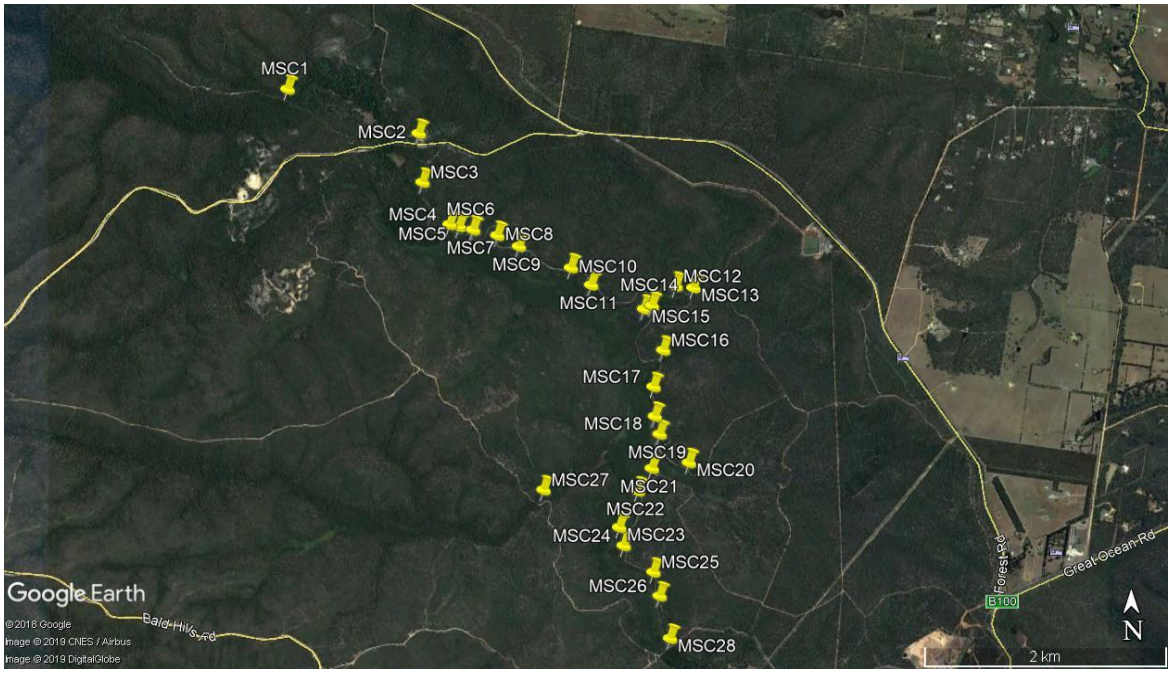

Figure 1 Location of Marshy Creek Sampling sites

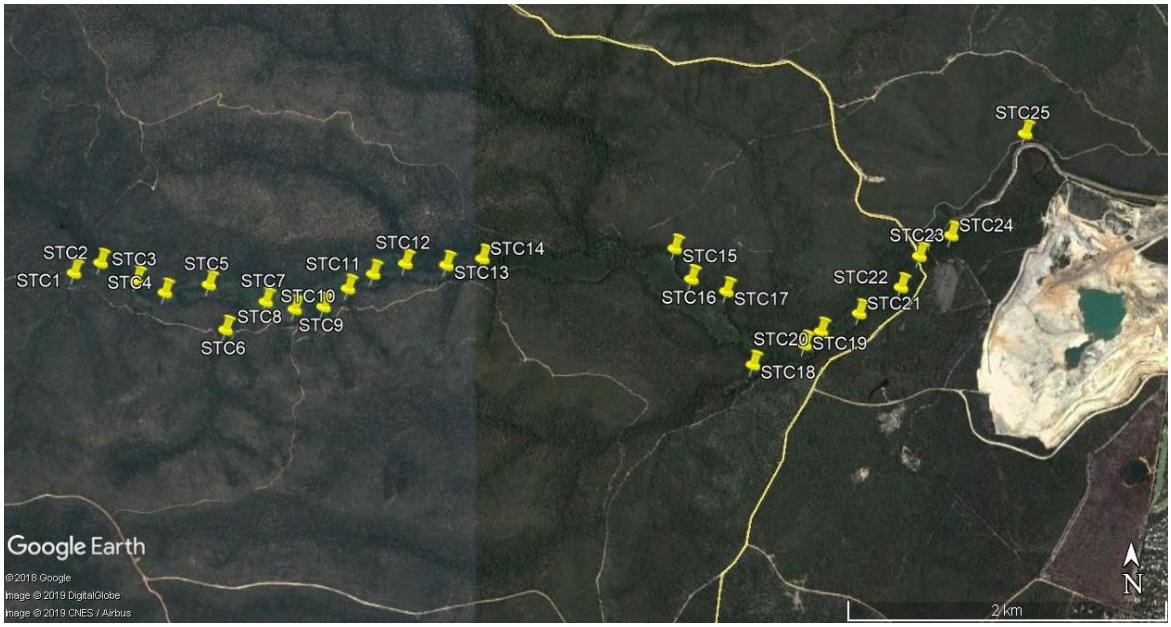

Figure 2 Location of Salt Creek Sampling sites

What we have found

The sites investigated in this study followed the course of the Anglesea Swamplands, with additional sites located in the tributaries of both Salt Creek and Marshy Creek, and in the Lower Channel of Salt Creek. The study identified the presence of three types of acidity at each site:

- labile acidity, which is the presence of existing acidity that has formed from previous oxidation and can be rapidly mobilised through water flow,
- retained acidity, which is the presence of existing acidity stored in minerals such as jarosite that can be slowly released over time,
- potential sulfidic acidity that could be generated from sulfidic sediments containing pyrite and monosulfides but has not yet been activated.

Analysis of the sampling from each site indicates that both Salt Creek and Marshy Creek contain substantial volumes of existing acidity in a form that can be rapidly mobilised.

Samples from Marshy Creek contained higher concentrations of acidity that can be transported readily in surface water and groundwater, while the Salt Creek samples contained higher concentrations of retained acidity, which can be slowly released over time.

The swamplands of Marshy Creek were all found to be acidic, saline and had high concentrations of soil organic carbon, whereas the tributaries in the upper catchment had higher pH values, lower salinity, and lower soil organic carbon concentrations. The Marshy Creek Swamplands were characterised by:

- significant existing acidification and metal mobilisation
- evidence of previous sulfide oxidation in most sites
- extremely high concentrations of soluble metals, including Al, Cu, Fe, Mn, Ni and Zn, which can directly contribute to shallow groundwater chemistry and have a detrimental impact on aquatic ecosystems.

The Salt Creek Swamplands, tributary and lower channel were all found to be acidic, but were not saline. While some sites had high concentrations of soil organic carbon, these concentrations were generally lower than those found in the samples from Marshy Creek. The Salt Creek Swamplands were characterised by:

- significant existing acidification and metal mobilisation
- evidence of previous sulfide oxidation in most sites, with the ratio much higher than those found at Marshy Creek, and at values high enough to suggest significant historical oxidation which may be more extensive than what has occurred at Marshy Creek
- extremely high concentrations of soluble metals including Al, Cu, Fe, Mn, Ni and Zn, which can directly contribute to shallow groundwater chemistry and deleteriously impact on aquatic ecosystems.

This information helps provide greater understanding of the type and extent of the different sources of acidification across both the Marshy Creek and Salt Creek catchments. Further analysis of this data in conjunction with groundwater data will help identify if any further measures, in addition to the existing groundwater level triggers, are required to continue to ensure that operation of the Anglesea Borefield does not impact the perched water table in the Anglesea Catchment and result in activation of additional sources of acid that could enter the Anglesea River system.

Monash's report will also assist agencies in the management of low pH events in the river, resulting from the existing acid inputs identified across both the Salt and Marshy Creek Catchments.

Next steps

The report by Monash University has recommended that further work be undertaken to:

- determine the connectivity between the perched water table (PWT) and underlying aquifers of the Upper Eastern View Formation (UEVF) and Lower Eastern View Formation (LEVF)
- if feasible given access limitations, determine the depth and thickness of the peat layer and sulfidic materials across the width of the swamplands, focusing on the mid-swamplands of both Salt Creek and Marshy Creek
- continue to review groundwater data, trigger levels and modelling as more data is collected
- review groundwater trigger levels specific to the Salt Creek Swamplands by determining the relationship to changes between the LEVF, UEVF and their effects on PWT levels, similar to the protective groundwater level triggers already established for the swamplands in Marshy Creek
- where possible, increase the frequency of monitoring of surface water quality monitoring sites in the upper, mid and lower swamplands in both Salt Creek and Marshy Creek as part of a strategy to monitor the effects of acid sulfate soils on surface water quality.

The information gathered through this study and its recommendations will be analysed in conjunction with other groundwater data to inform an upcoming review of the Anglesea Borefield Bulk Entitlement and Monitoring and Assessment Program.

More information

For more information about the Anglesea Borefield Bulk Entitlement and Monitoring and Assessment Program, please visit our web page: www.yoursay.barwonwater.vic.gov.au/anglesea-borefield

You can also contact a member of the project team at Barwon Water on 1300 656 007 or by emailing: info@barwonwater.vic.gov.au