CURRENCY CREEK & FINNISS RIVER WATER QUALITY REPORT

Report 6, to 26 August 2009

OBSERVATIONS AT A GLANCE

- Limestone addition to Currency Creek increased pH to satisfactory levels at several sites. However, pH at two Currency Creek sites remains below the ANZECC guideline level for protection of aquatic ecosystems
- No acidity was recorded within the Currency Creek sites for this reporting period
- Alkalinity levels at most sites in Currency Creek remain low, indicating the water body is susceptible to further acidification.
- pH and alkalinity levels have increased at all Finniss River sites.
- Pore water transects along exposed sediments in the Goolwa Channel revealed subsurface water with low pH and high acidity.

BACKGROUND

The Environment Protection Authority and Department for Environment and Heritage are monitoring surface and pore water to assess potential water impacts associated with the exposure of acid sulfate soils and water level changes in the Goolwa Channel, Currency Creek and Finniss River region (Figures 1 and 1A).

WATER QUALITY PARAMETERS

A wide range of water quality parameters is being analysed in an integrated program across the Lower Lakes (see www.epa.sa.gov.au/lower_lakes). Key field-based parameters reported herein are pH, acidity, alkalinity and salinity.

***pH* is an indicator of acidity or alkalinity. Neutral water has a pH of 7, acidic solutions have lower values and alkaline solutions have higher values. Prior to the recent drying and re-wetting, the pH in the region was between 8 – 8.5.**

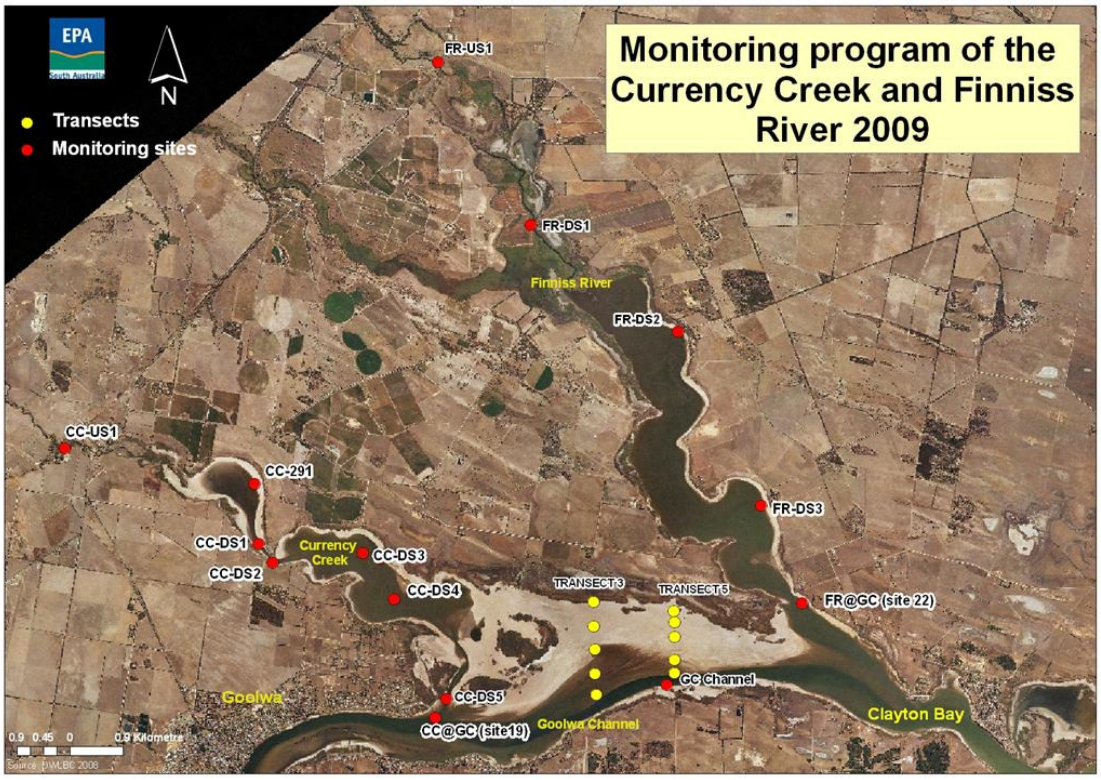
***Alkalinity* is a measure of the buffering capacity of water, or the capacity of the water to neutralise acids and resist pH change. Alkalinity within water bodies is consumed as acid is released from acid sulfate soils.**

Adding limestone contributes alkalinity to waters helping to neutralise any acid released from the sediments. Historically alkalinity levels within this region have been between 100 – 250 mg/L as $CaCO_3$.

Acidity is a measure of the acid (hydrogen ions) and dissolved metal ions (e.g. iron and aluminium) present in water bodies. Acidity is expressed as the volume of calcium carbonate (mg/L of $CaCO_3$) required to neutralise the acid. Acidity occurs when the alkalinity or buffering capacity has been consumed, and is not normally present in the Lower Lakes.

Salinity is a measure of the amount of dissolved salts in the water. Saline water conducts electricity more readily than freshwater so electrical conductivity (EC) is routinely used to measure salinity. As salinity levels increase it may become toxic to native freshwater organisms. Prior to drought conditions salinity was observed between 1 and 1.2 mS/cm (1000-1200 EC) within the region.

Figure 1 - Map of Sample Sites



A number of sites have been identified as high risk and as a result are being monitored as regularly as possible (in some instances up to 5 times per week). Table 1 includes basic descriptions and justifications for the selection of these monitoring sites within the Goolwa Channel, Currency Creek and Finniss River region.

Addition of New Currency Creek Sampling Sites

An additional sampling site has been included in this report and the monitoring program as a high risk site. This site is CCDS5 situated within the narrow channel that joins Currency Creek with the Goolwa Channel (see Figure 1). This new sampling point will be important for monitoring the flow and connectivity of potentially acidic water from Currency Creek (primarily surrounding CCDS3 and CCDS4) into and with the Goolwa Channel (prior to completion of the Currency Creek temporary regulator or once water level is higher than 0.0 m AHD).

Table 1 - Selection and description of high risk sites

Site	Location	Description
CC-291	Currency	On the northern margin of the upper Currency Creek representing the transition from creek to open channel. The site is located over sediments exposed in summer that have now been saturated or re-inundated due to rainfall events. Catchment inflows are now occurring.
CCDS2	Currency	A narrow midway bottle neck that formerly was a disconnected pool in summer. It is now reconnected to pooled water in the upper and lower Currency tributary due to rainfall events and inflows.
CCDS3	Currency	On the northern margin of the lower Currency Creek within the closest pooled water to Goolwa Channel. The site is located over sediments that were exposed in summer and now have been saturated or re-inundated due to rainfall events and inflows.
CCDS4	Currency	On the southern margin of the lower Currency Creek within the closest pooled water to Goolwa Channel. The site is located over sediments that were exposed in summer and have now been saturated or re-inundated due to rainfall events and inflows.
CCDS5	Currency	Part of the channel which connects Goolwa Channel with Currency Creek. The site is located over sediments that were exposed in summer and have now been re-inundated due to rainfall events and inflows. This site monitors connectivity between Currency Creek and the Goolwa Channel.
CC@GC	Currency/ Goolwa Channel	At the mouth of Currency Creek where it enters the Goolwa Channel. The site is located within the Goolwa Channel and has remained inundated. It is an important site to monitor the buffering capacity of Lake Alexandrina water and potential impact of outflows from the Currency Creek region.
FRUS1	Finniss	In the Finniss River before it enters into the lake system.
FRDS1	Finniss	Within the upper Finniss River and adjacent to wetlands that have shown signs of acid sulfate soil impacts upon rewetting. Minor flow in the region continued over summer and this has now increased with rainfall events and catchment inflows.
FRDS2	Finniss	On the eastern margin of the Finniss River downstream of where it initially enters Lake Alexandrina. The site remained inundated in summer although water levels declined markedly and nearly disconnected from the Goolwa channel.
FRDS3	Finniss	On the eastern margin of the Finniss River further downstream of FRDS3 and closer to where it connects with the Goolwa Channel. The site remained inundated in summer although water levels declined markedly and nearly disconnected from the Goolwa channel.
FR@GC	Finniss/ Goolwa Channel	Located at the mouth of Finniss River where it enters the Goolwa Channel. It is an important site to monitor the buffering capacity of Lake Alexandrina water and potential impact of outflows from the Finniss River region.

LIMESTONE MANAGEMENT RESPONSE

Trials of various pre-emptive or reactive (to water acidity) limestone additions have been undertaken in the area between April and July 2009 to mitigate the risk of acidification.

For details of locations and volumes refer to "*Currency Creek and Finniss River Report 5".*

It should be noted that there is likely to be lag effects in the water body response following limestone dosing (e.g. slow dissolution of limestone, transfer of acidic pore water to surface water, raising of the pH in the sediment enough to stimulate bioremediation activity) and therefore it will take time for alkalinity effects to be realised in the monitoring.

CURRENCY CREEK WATER QUALITY

Surface water quality results are discussed below for selected sites and parameters in the Currency Creek region. Please refer to graphs in Figure 2 for this section and to Figure 3 for rainfall at Currency Creek.

pH

- CCDS3 had shown some signs of improvement in pH after aerial limestone addition. However, the site has become quite variable in recent weeks with pH falling to 4.30 on the 17th August but levels have since improved and currently stand at 6.20 (25th August).
- pH at CCDS4 remains well below ANZECC guidelines (pH 4.44 on the 25th August).
- pH was 8.85 on 21st August at CCDS5 and CC@GC and remains within the ANZECC guideline levels for protection of aquatic organisms (pH 6.5 to 9.0).

Alkalinity

- Site CCDS3 within Currency Creek has shown some signs of improvement following the aerial limestone application. Currently alkalinity at this site is 54 mg/L (25th August), indicating the water body is still susceptible to further acidification.
- Alkalinity continues to remain low or absent at CCDS4 despite the additional aerial limestone application in mid July. This is likely due to further input of acid from the sediment to the water following wind seiching and highlights the difficulty in managing acidity once it has been generated. Currently alkalinity is 6 mg/L (25th August) which indicates the water body is very susceptible to further acidification.
- The alkalinity level at CCDS5 has been steadily increasing in recent weeks (116 mg/L on 21st August). This is likely due to increased

connectivity with the more alkaline Goolwa Channel water as the water level rises behind the Clayton regulator.

- CC@GC continues to exhibit an increase in alkalinity and currently stands at 116 mg/L (21st August).

Acidity

- Currently, there are no sites within Currency Creek showing acidity (as $CaCO_3$). This is likely due to a combination of aerial limestone addition, dilution from increased flow, and increased connectivity to the more alkaline Goolwa channel.

Salinity (EC)

- Salinity levels at CC@GC, CCDS5 and CCDS6 are influenced by both catchment inflows and mixing with Goolwa Channel water (higher salinity influence). Salinity levels at these sites have been variable in recent weeks due to high winds and recent rainfall event and currently range between 14.5 and 17.51 mS/cm (21st and 24th August).
- Salinity levels at all other sites within the Currency Creek region) have stabilised and range between 5.21 and 7.21 mS/cm (5210-7210 EC).

Figure 2 - Currency Creek Water Quality

(Blue shading indicates time period of aerial limestone dosing program)

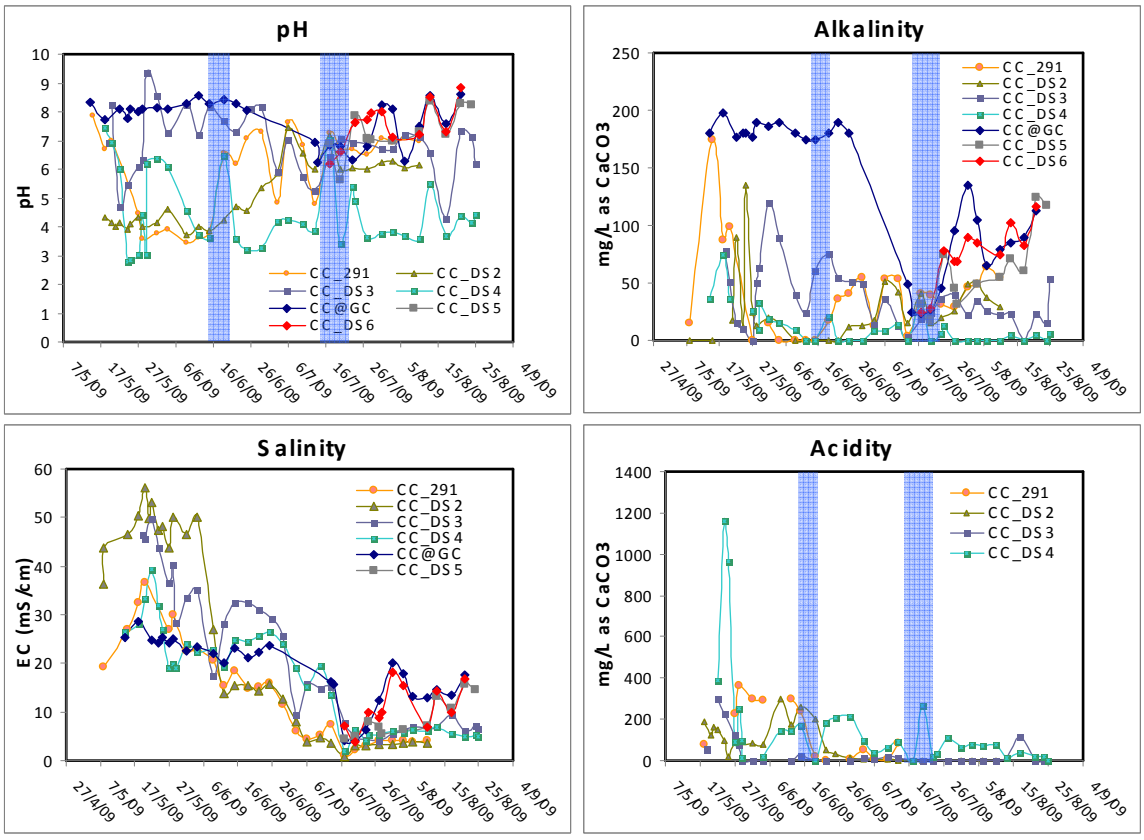
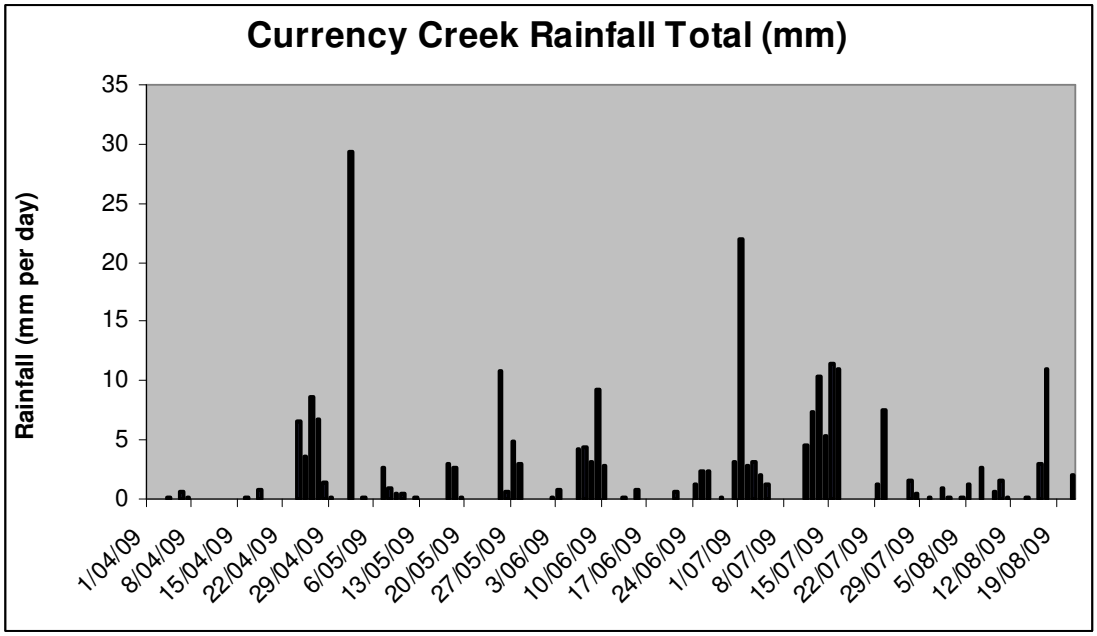


Figure 3 – Rainfall at Currency Creek



Data from South Australian Murray-Darling Basin NRM Board weather station (refer to http://www.samdbnrm.sa.gov.au/Portals/7/AWMN/awsview.php)

FINNISS RIVER WATER QUALITY

Water quality results are discussed below for selected sites and parameters in the Finniss River region**.** Please refer to the graphs in Figure 4 for this section.

Alkalinity

- Alkalinity at all Finniss River sites has increased in recent weeks.
- Currently levels range between 64 and 115 mg/L.

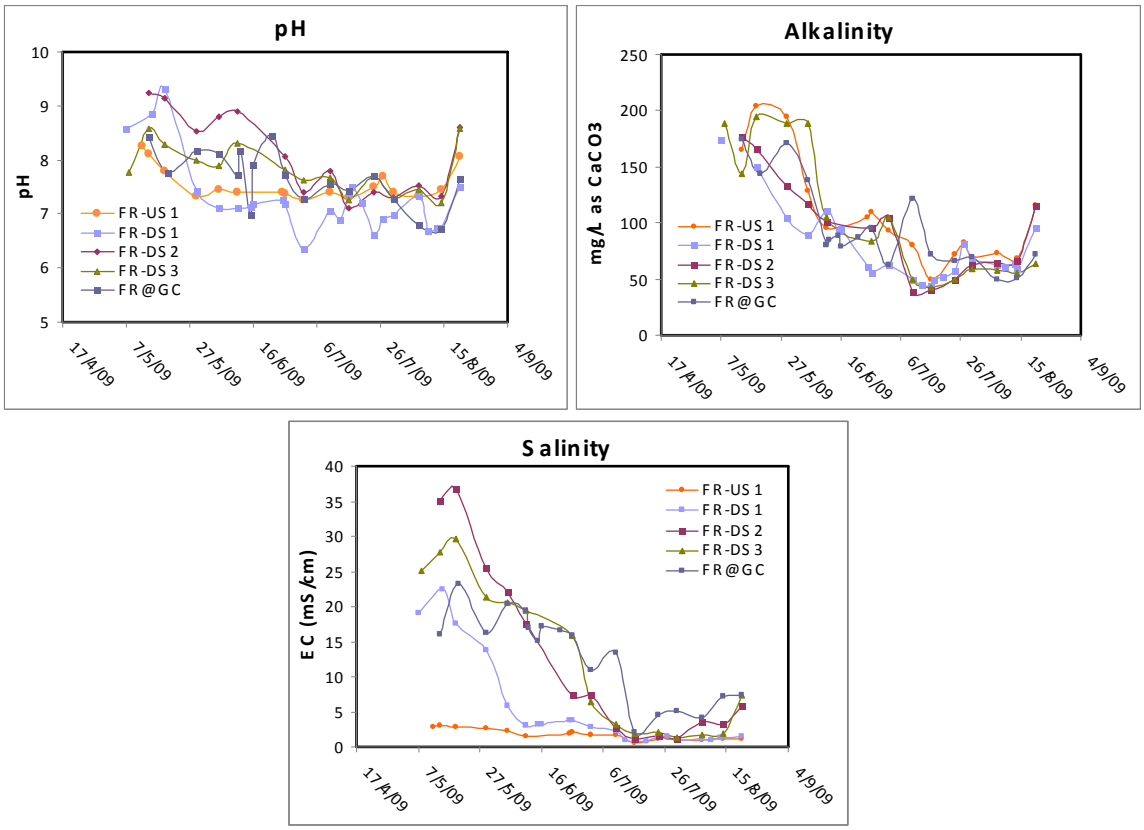
pH

- pH levels at all Finniss River sites remain within the ANZECC guidelines for aquatic ecosystems.
- Between the 14th and 20th of August, all sites exhibited noticeable improvements in pH.

Salinity (EC)

- Salinity levels at all Finniss River sites have stabilised between 1.20 and 7.38 mS/cm (1200-7380 EC).

Figure 4 - Finniss River Water Quality



GOOLWA CHANNEL TRANSECTS

On the 18th and 25th of August, pore water quality was analysed along two transects of exposed sediments in the Goolwa Channel (see Figure 1). The monitoring results (Table 2) show low pH and high acidities, highlighting the risk still posed by acid sulfate soils in the Goolwa Channel region.

Table 2 - Goolwa Channel Transect Data

Sample Name	Sample Type	pH	Acidity (mg/L as CaCO3)
GCT3_A	Pore	1.84	5380
GCT3_B	Pore	1.68	6420
GCT3_C	Pore	2.28	6680
GCT5_A	Pore	2.30	1250
GCT5_B	Pore	4.70	1085

Further information on water quality and quantity, and acid sulfate soils, can be found on the following websites:

- **Department for Environment and Heritage** http://www.environment.sa.gov.au/cllmm/
- **River Murray Data** http://data.rivermurray.sa.gov.au/ (real-time data)
- **Environment Protection Authority** www.epa.sa.gov.au
- **Department of Water, Land and Biodiversity Conservation** www.dwlbc.sa.gov.au
- **South Australian Murray–Darling Basin Natural Resource Management Board** www.samdbnrm.sa.gov.au
- **Murray–Darling Basin Authority** www.mdba.gov.au
- **Waterwatch** www.waterwatch.org.au
- **CSIRO acid sulfate soils** www.clw.csiro.au/acidsulfatesoils/murray.html