CURRENCY CREEK, FINNISS RIVER AND GOOLWA CHANNEL WATER QUALITY REPORT

Report 12, to 2nd December 2009

OBSERVATIONS AT A GLANCE

- pH and alkalinity remain at satisfactory levels at most sites.
- Alkalinity levels in the upper Currency Creek remain quite low (53 mg/L) indicating that the water body is susceptible to further acidification.
- Slight decreases in alkalinity have also been observed at Finniss River sites but the levels are still well above management guidelines.
- Salinities stabilised following 34.8 mm of rainfall recorded at Currency Creek between 21/11/09 and 1/12/09.

BACKGROUND

The Environment Protection Authority, Department for Environment and Heritage and Department of Water, Land and Biodiversity Conservation are monitoring water quality to assess potential water impacts associated with the exposure of acid sulfate soils and recent water level changes in the Goolwa Channel, Currency Creek and Finniss River region as a result of the Goolwa Channel Water Level Management Project. Further information regarding the project can be found at: http://www.dwlbc.sa.gov.au/murray/drought/gcll.html.

WATER QUALITY PARAMETERS

A wide range of water quality parameters is being analysed in an integrated program across the Lower Lakes (see http://www.epa.sa.gov.au/environmental_info/water_quality/monitoring_programs_and_assessments/lower_lakes). Key field-based parameters for Currency Creek, Finniss River and Goolwa Channel reported herein are pH, acidity, alkalinity, salinity and turbidity.

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 and 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 and 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 increases it may become toxic to native freshwater organisms. Prior to drought conditions salinity was observed between 1000 and 1200 µS/cm (EC) within the region.

Turbidity is a measure of the cloudiness or haziness in water caused by suspended sediment. Turbidity is expressed in Nephelometric Turbidity Units (NTU) and is measured using a relationship of light reflected from a given sample. Turbidity is very variable in the Lower Lakes and influenced primarily by wind events.

SAMPLING SITES

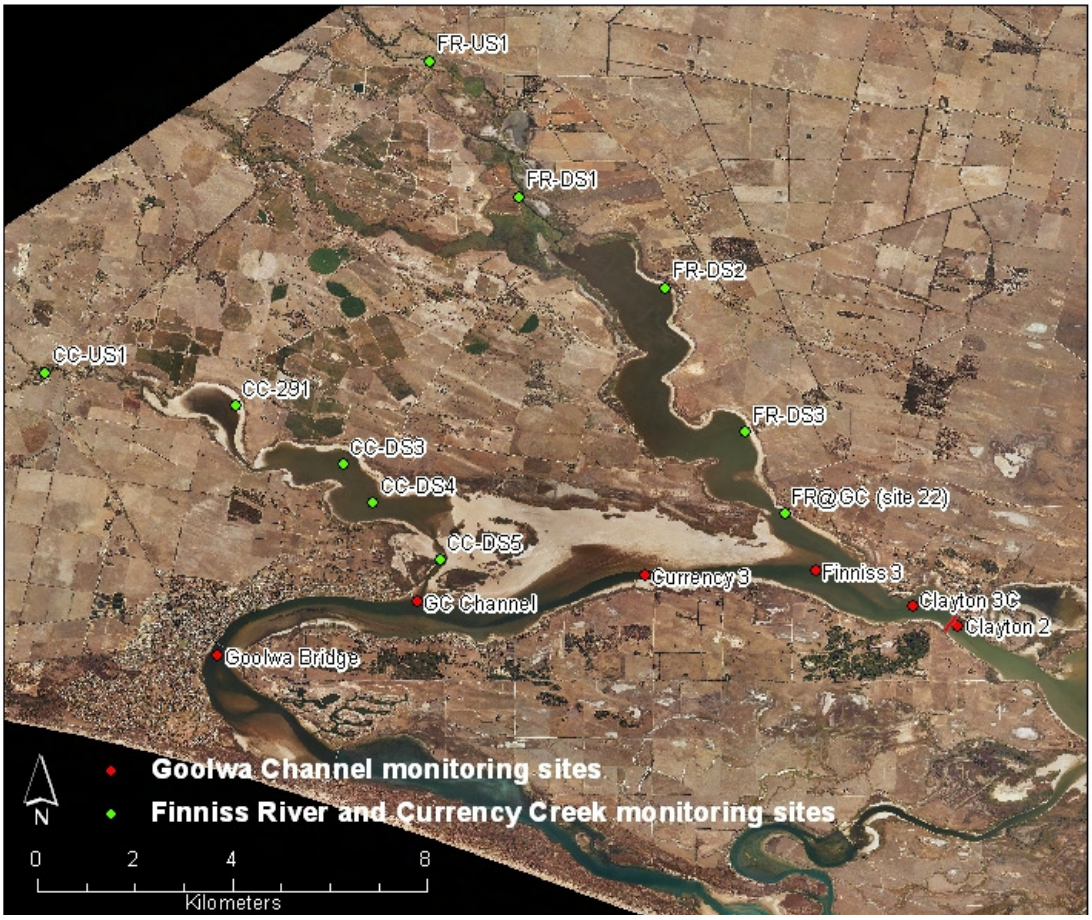
The sample sites where water quality monitoring is undertaken are shown in Figure 1. Several of these sites have been identified as high risk and as a result have been monitored as regularly as possible (in some instances up to 5 times per week).

Currency Creek and Finniss River site descriptions and justification for their selection are contained in prior reports (e.g. see Table 1, Report 7 on the EPA website).

Some of the sediment (groundwater) transects previously reported on are no longer being monitored as they have been reinundated with the rising water level behind the regulator.

The Goolwa Channel sites selected include sites both upstream (e.g. Clayton 2) and downstream (e.g. Clayton 3C, Finniss 3, GC Channel and Goolwa Bridge) of the Goolwa regulator near Clayton.

Figure 1 - Map of Sample Sites



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 Report 5 on the EPA website. Further limestone additions may be undertaken in the future as required.

CURRENCY CREEK WATER QUALITY

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

pH

- The pH levels of all sites within Currency Creek are now between 7.86 and 8.64 (30/11/09) which is within ANZECC guideline levels for protection of aquatic organisms (pH 6.5 to 9.0). Importantly, this includes the lower Currency Creek site (CCDS4) that previously had persistent low pH values.
- Site CC291 shows a slight improvement from the previous level of pH 6.84 (20/10/09) to currently stand at 7.86 (30/11/09). The overall trend

at this site is that pH has generally stayed above 7 since September 2009.

Alkalinity

- Although pH is satisfactory at all Currency Creek sites, alkalinity has been quite variable. In particular, alkalinity at CCUS1 has increased substantially to 342 mg/L since October despite showing some fluctuations between sampling events. This is most likely a result of the flow at this site being predominantly groundwater fed. This increase in alkalinity is consistent with high values observed in this system at the end of last summer.
- Site CC291 showed a slight increase in alkalinity since last monitored, however continues to exhibit low alkalinity (53 mg/L on 30/11/09) that is most likely due to several key factors:
    - The uppermost pool is restricted via a narrow channel from lower Currency Creek limiting mixing with the more alkaline water downstream.
    - The lower monthly rainfall has resulted in a substantial reduction in flow, which was previously a source of alkalinity to the uppermost pool.
- At most of the other sites alkalinity has either remained stable or slightly increased compared to the previous sampling period. This is most likely due to recent rains (34.8 mm between 21/11/09 and 1/12/09, Fig. 3) and subsequent increase in flow from Currency Creek
    - Alkalinity at site CCDS3 is relatively stable went from from120 mg/L (26/11/09) to currently stand at 116 mg/L (30/11/09)).
    - Alkalinity at CCDS4 increased from 82 mg/L (26/11/09) to currently stand at 120 mg/L (30/11/09).
    - Alkalinity at the mouth of Currency Creek at the Goolwa Channel (CC@GC) increased from 144 mg/L (17/11/09) to currently stand at 198 mg/L (24/11/09).

Acidity

- There is no water acidity recorded at the Currency Creek sites. This is likely due to a combination of limestone addition, dilution from increased flow from Currency Creek, sulfate reduction in the sediment (neutralises acidity), and increased connectivity and input from the alkaline water pumped into Goolwa Channel from Lake Alexandrina.

Salinity (EC)

- Salinity levels at CC291, CCDS3 and CCDS4 are generally stable but show slight decreases since last monitored and currently stand at 8850 µS/cm (from 9032 µS/cm), 9460 µS/cm (from 10438 µS/cm) and 9810 µS/cm (from 10850 µS/cm) respectively (30/11/09). This is most likely due to direct input of rainwater and some tributary flow driven by 34.8

mm of rainfall recorded at Currency Creek between 21/11/09 and 1/12/09 (Fig. 3).

Figure 2 - Currency Creek Water Quality

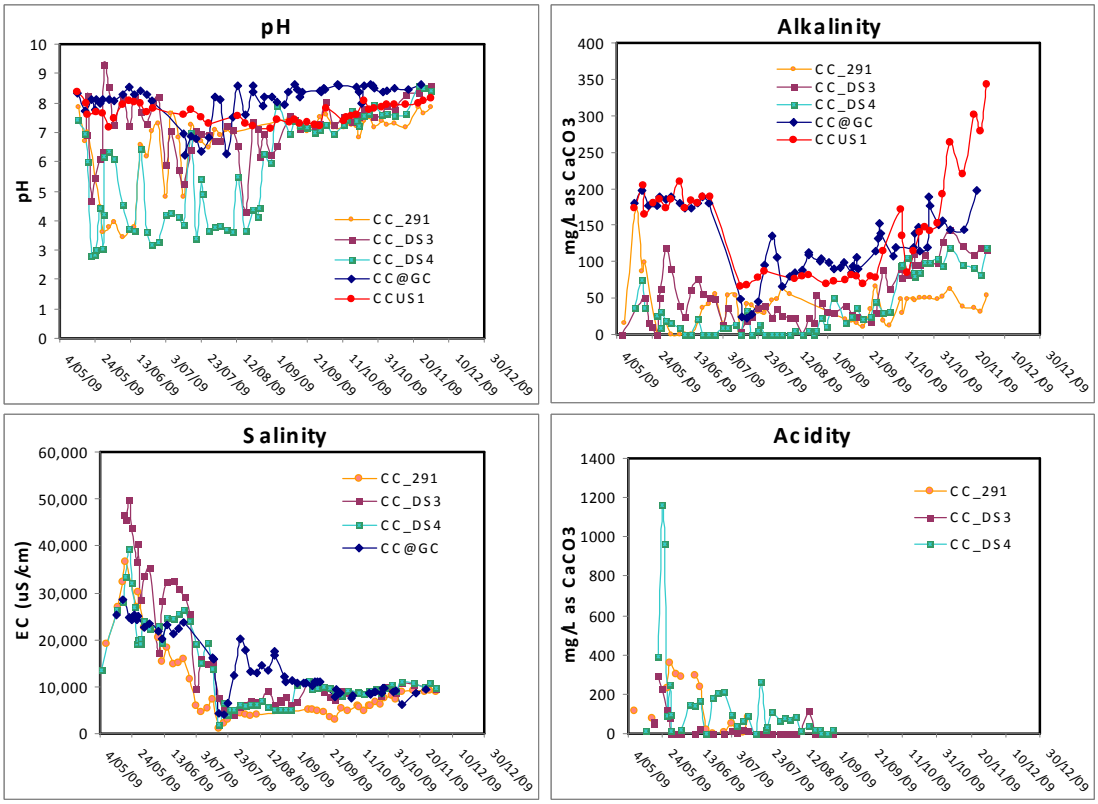
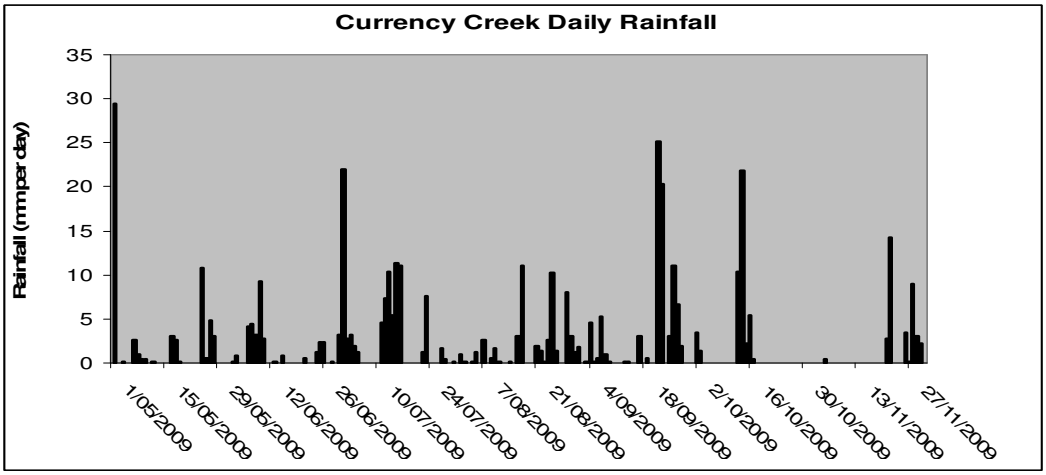


Figure 3 - Rainfall at Currency Creek



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.

pH

- pH levels at all Finniss River sites remain within the ANZECC guidelines for protection of aquatic ecosystems.

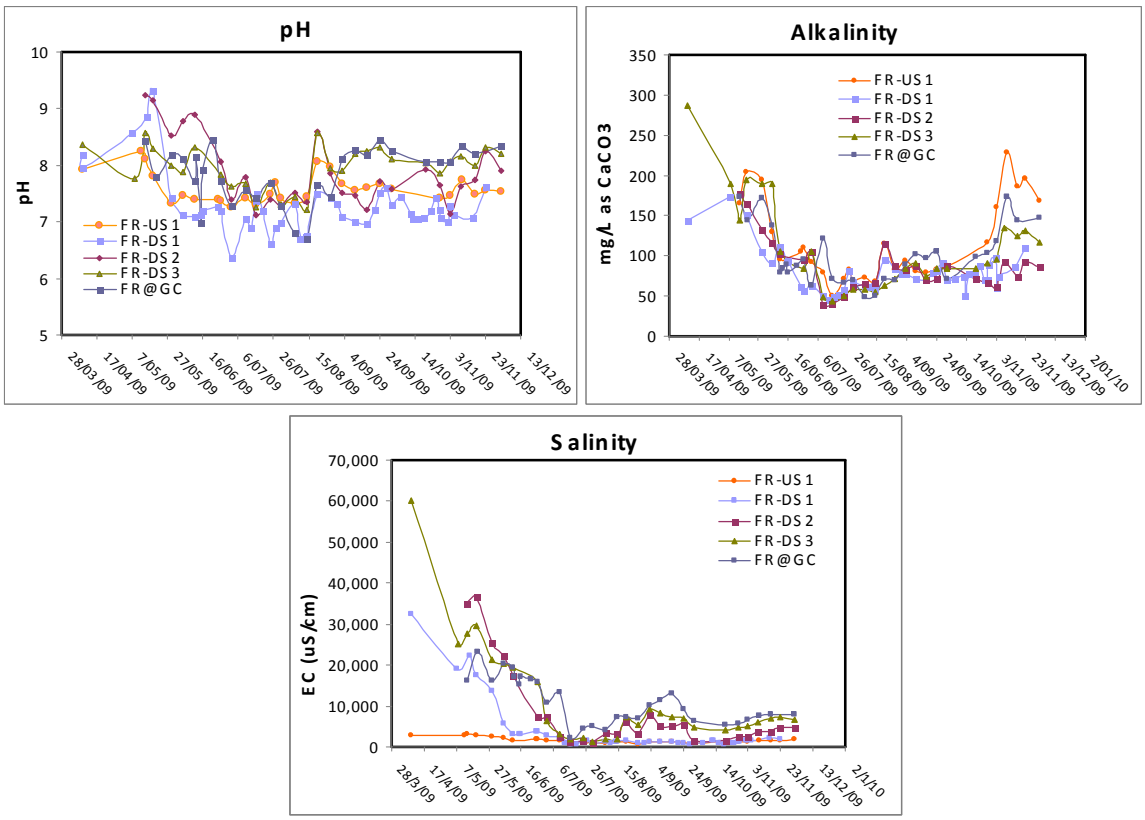
Alkalinity

- Sites in the Finniss River have satisfactory alkalinity levels (between 86 mg/L and 169 mg/L on 2/12/09).
- Alkalinity has generally been enhanced by the more alkaline Lake Alexandrina water pumped over the Goolwa Channel regulator between September and November. However sites FRDS1 and 2 show signs of a decrease in alkalinity around the 17th of November after pumping had ceased. This could indicate some form of diffusive acid flux from sediments, which may be a result of recent rainfall entering the system via groundwater processes.

Salinity (EC)

- An increase in Finniss River flow driven by recent rainfall has resulted in salinity levels remaining stable (countering some evaporation) since the sites were previously monitored (23/11/09). Currently salinity levels range between 1882 µS/cm and 8085 µS/cm (2/12/09).

Figure 4 – Finniss River Water Quality



GOOLWA CHANNEL WATER QUALITY

Surface water quality results are discussed below for selected sites and parameters in the Goolwa Channel region. Please refer to the graphs in Figure 5 for this section. Many of these sites were added as the Goolwa regulator near Clayton neared completion and pumping began on 11 September 2009. Pumping was ceased on 9 November 2009.

pH

- The pH of all sites monitored in the Goolwa Channel remain within the ANZECC guideline values for protection of aquatic organisms.

Alkalinity

- Alkalinity in the Goolwa Channel has remained at satisfactory levels at all sites (i.e. above 138 mg/L; 17/11/09). As a result of pumping there had been an overall increase in alkalinity at all sites in the Goolwa channel. This appears mostly due to the pumps drawing more alkaline water from the Lake Alexandrina side. There has been a slight decrease at the Finniss 3 site, the potential reasons for this are discussed above in the Finniss River section.

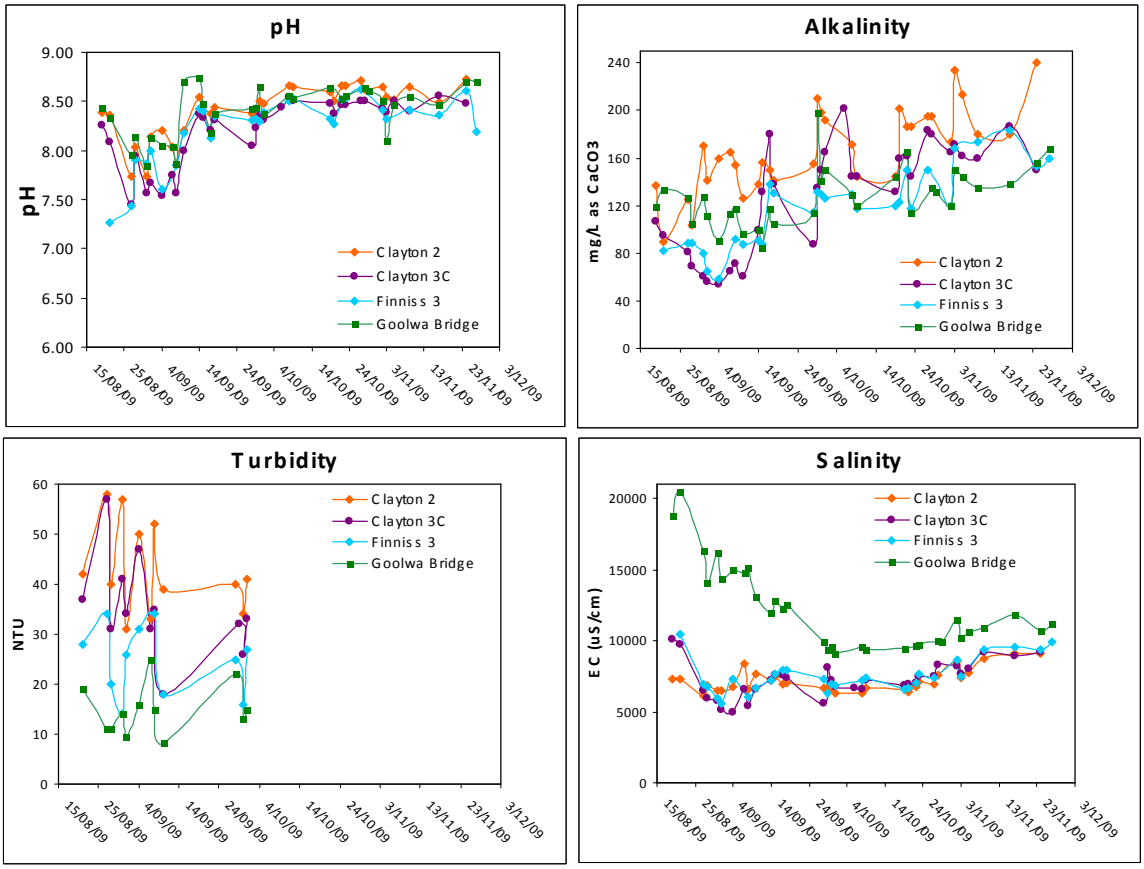
Salinity (EC)

- Salinity decreased substantially at all sites due to the tributary inflows and pumping from Lake Alexandrina. However since early November, salinity levels at all monitoring sites have began to steadily increase. Currently salinity levels at all sites remain between 9066 µS/cm and 11156 µS/cm (24/11/09 and 27/11/09).

Turbidity

- Turbidity has been monitored in the pool to identify whether pumping is suspending sediment into the water. Current indications are that while turbidity has been quite variable (influenced by wind), pumping has not contributed to increasing the overall turbidity of the pool. The more saline sites closest to the Goolwa Barrage have the lowest turbidity which is likely due to salt-induced aggregation and settling of suspended clay particles.

Figure 5 – Goolwa Channel Water Quality



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

- **Department for Environment and Heritage** 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 or for specific Lower Lakes data see www.epa.sa.gov.au/environmental_info/water_quality/monitoring_programs_and_assessments/lower_lakes
- **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