CURRENCY CREEK, FINNISS RIVER AND GOOLWA CHANNEL WATER QUALITY REPORT

Report 10, to 6th November 2009

OBSERVATIONS AT A GLANCE

- A combination of limestone addition, inflows from Currency Creek and Finniss River, and pumping water over the Goolwa Regulator near Clayton has increased pH and alkalinity to satisfactory levels at all monitored sites.
- Alkalinity levels in the upper Currency Creek remain lower than other areas. Alkalinity levels adjacent to and downstream of the Goolwa Regulator have significantly increased due to pumping.
- Salinity has decreased substantially in the Goolwa Channel due to capture of fresh tributary flows behind the Goolwa Regulator, and pumping of less saline water from Lake Alexandrina.

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 are 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). The key field-based parameters for Currency Creek, Finniss River and Goolwa Channel covered by this report 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

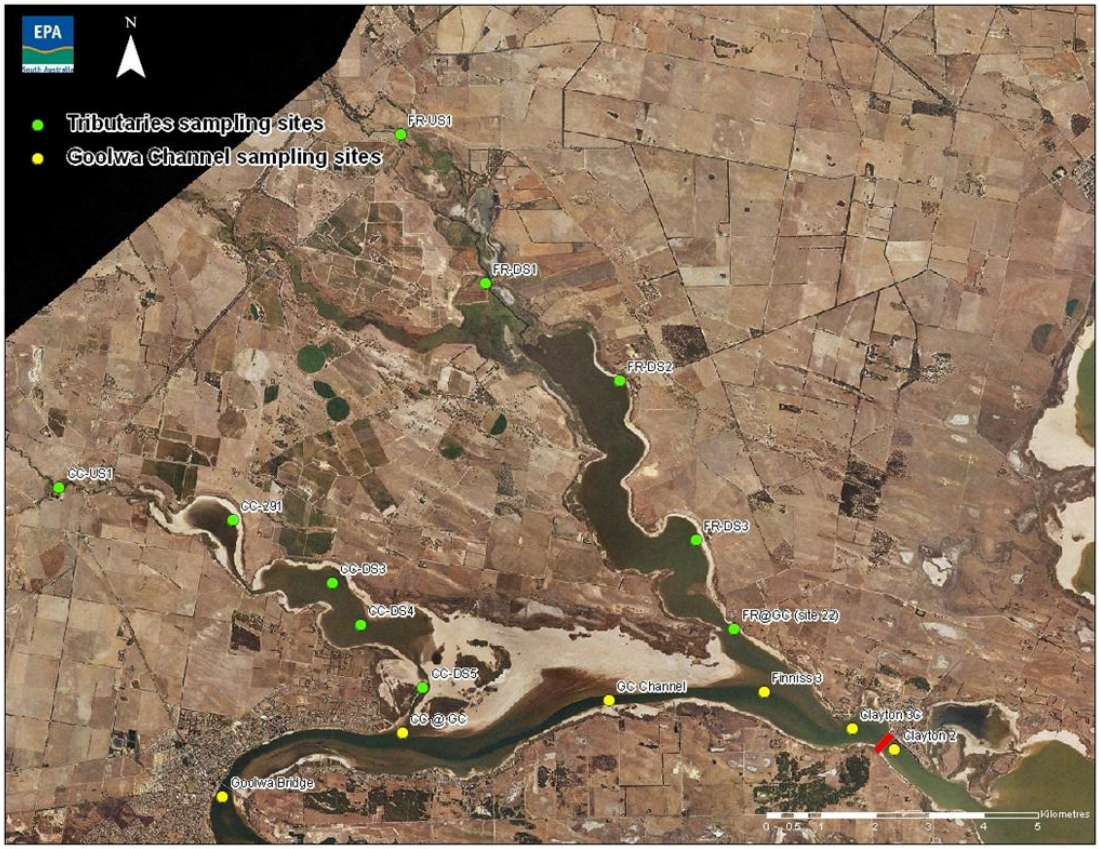
The sample sites where water quality monitoring is undertaken are shown in Figure 1. Several of these sites have been identified as high risk and as a result have been monitored as regularly as possible (in some instances up to 5 times per week).

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 7.26 and 8.41, 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 remains within ANZECC guideline levels and has shown a slight improvement from the previous level of pH 6.8 (20/10/09) to currently stand at 7.26 (5/11/09).

Alkalinity

- Although pH is satisfactory at all Currency Creek sites, alkalinity continues to remain quite low and variable at some sites.
    - Alkalinity at CCDS4 was 32 mg/L (6/10/09), however this has generally improved and currently stands at 94 mg/L (5/11/09).
    - Alkalinity continues to remain low at CC291 (49 mg/L; 5/11/09) compared to earlier readings (66 mg/L; 28/09/09).
    - Alkalinity at site CCDS3 currently stands at 127 mg/L (5/11/09).
    - Alkalinity at the mouth of Currency Creek at the Goolwa Channel (CC@GC) stands at 156 mg/L (5/11/09).
- The rapid refill of the pool behind the Goolwa Regulator has not resulted in significant acid release from acidic sediments that were reinundated. Alkalinity levels, while remaining low, are relatively stable or rising.

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 CCDS3 and CCDS4 have been quite stable since mid September. Current salinity levels stand at 8631 µS/cm at CCDS3 and 9132 µS/cm at CCDS4 (5/11/09).
- Salinity levels at CC291 have shown a slight increase from 3080 µS/cm (28/09/09) to 7302 µS/cm (5/11/09). This site appears to be showing increasing signs of mixing and interaction with the more saline water found downstream and/or less dilution due to declining tributary flows.

Figure 2 - Currency Creek Water Quality

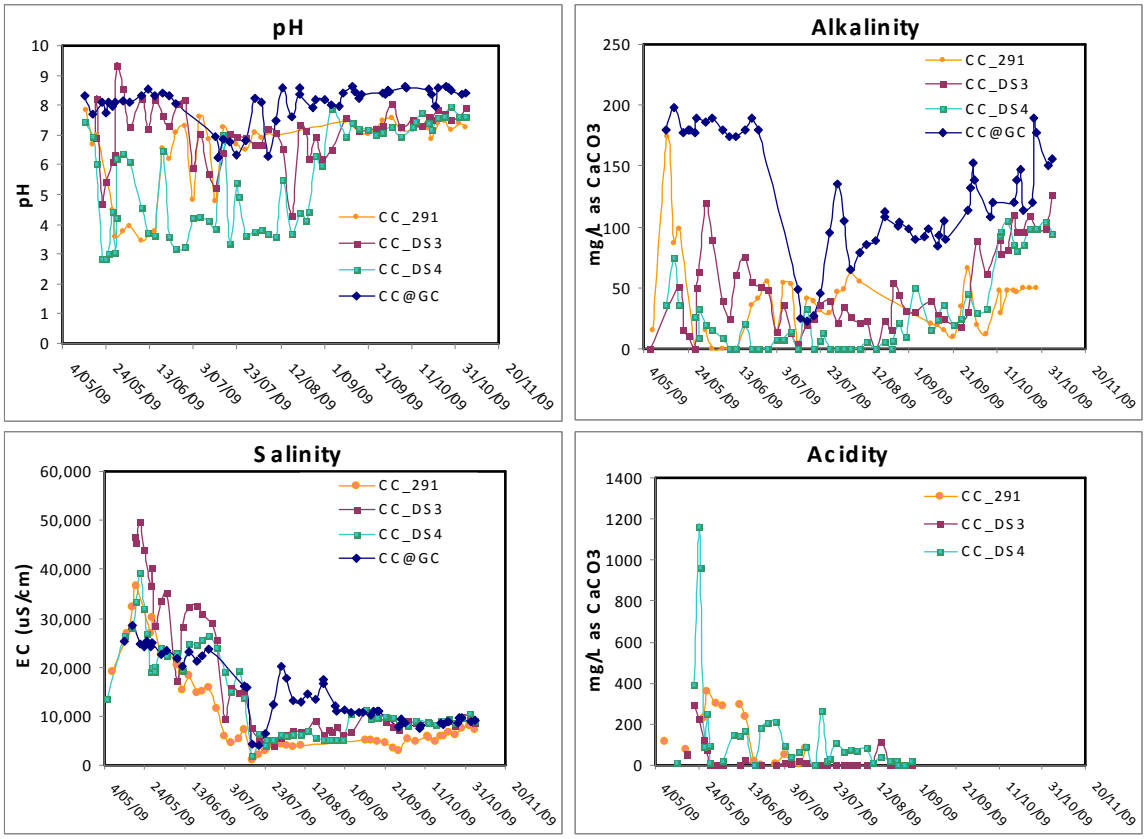
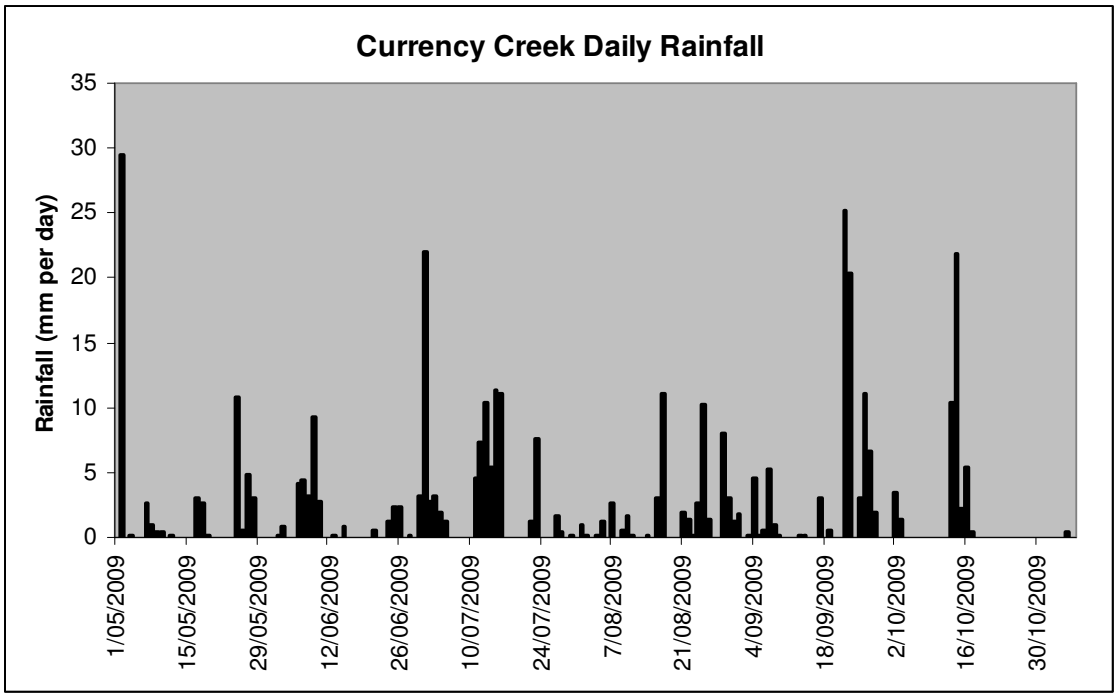


Figure 3 - Rainfall at Currency Creek



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.

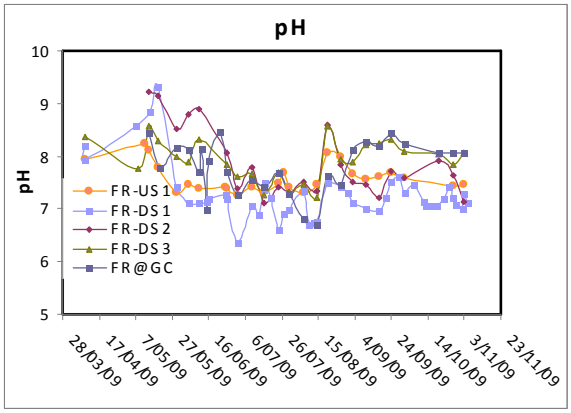
Alkalinity

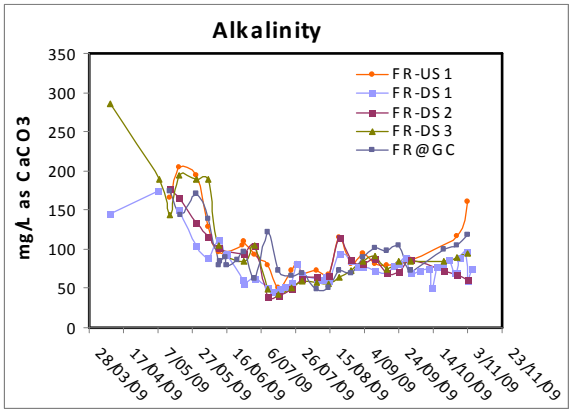
- Some sites within the Finniss River region (FR-US1, FR-D3 and FR@GC) have shown slight increases in alkalinity to concentrations between 95 and 161 mg/L (3/11/09). This is likely due to mixing with the more alkaline Goolwa Channel water being pumped over the Goolwa Regulator from Lake Alexandrina. Even so, alkalinity levels for FR-DS1 and FR-DS2 have decreased slightly to 75 and 61 mg/L (5/11/09 and 3/11/09), respectively.

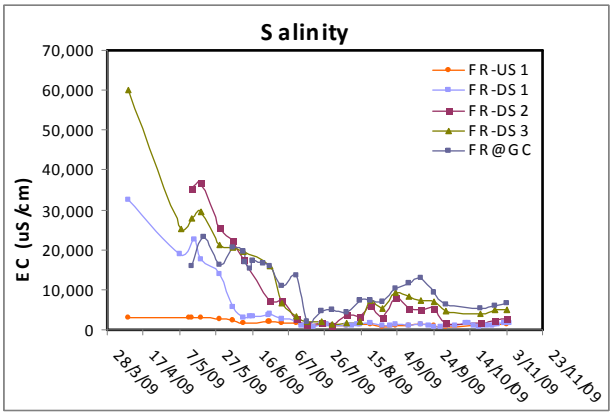
Salinity (EC)

- After showing an increase in salinity from August to mid September, sites FRDS2, FRDS3 and FR@GC declined slightly to stand at 1604, 4072 and 5283 µS/cm, respectively (20/10/09). This was likely due to dilution from recent rainfall events in the region between the 13th and 17th of October (40.2 mm see Figure 3). However, since the 20th of October salinity levels at the three sites have shown a slight increase. This is likely due to a decrease in rainfall and subsequent inflows from the Finniss River. Salinity levels currently stand at 6639 (FR@GC), 5010 (FRDS3) and 2535 (FRDS2) (3/11/09).

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. These sites were added as the Goolwa Regulator near Clayton neared completion and pumping began (11th September 2009). Pumping ceased on 9 November 2009.

pH

- The pH of all sites monitored in the Goolwa Channel is 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 144 mg/L; 5/11/09). As a result of pumping there has been a steady 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.

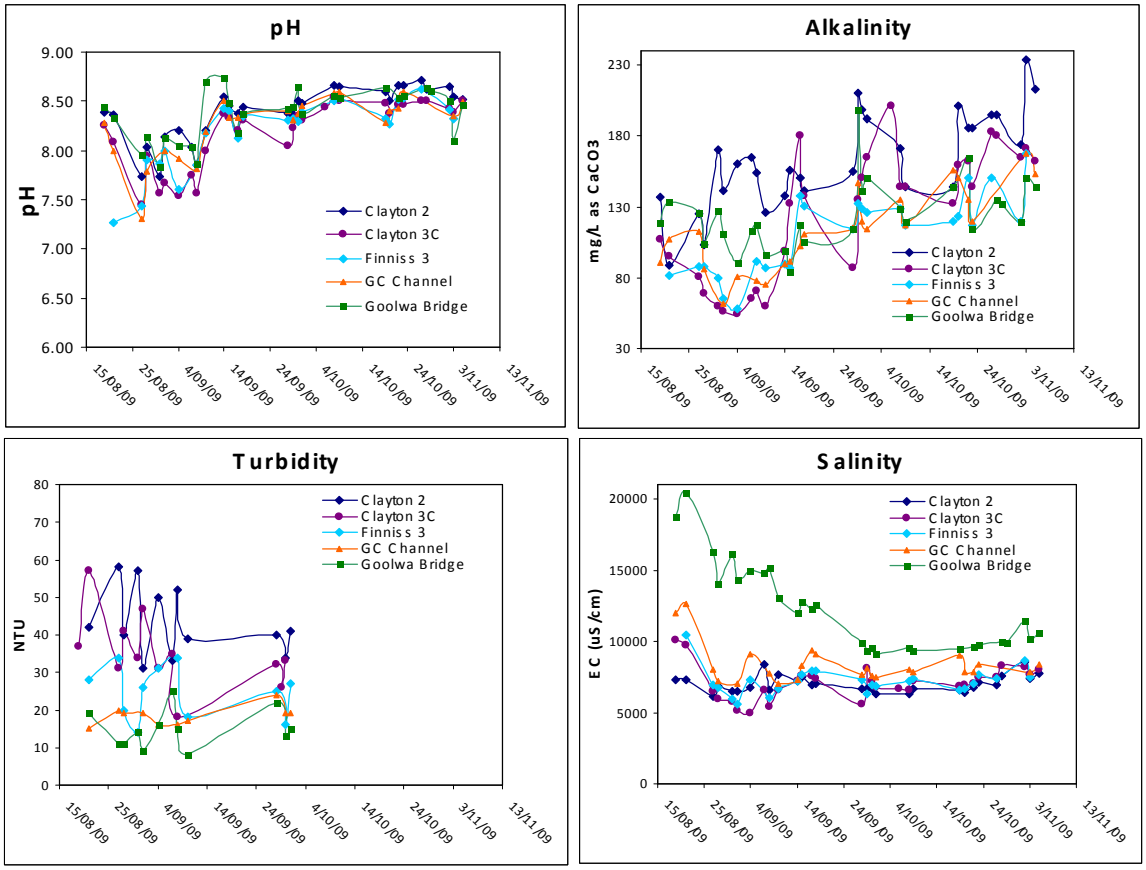
Salinity (EC)

- Salinity has decreased at all sites due to tributary inflows and pumping from Lake Alexandrina. Salinity at Clayton 3C levelled out at 7983 µS/cm (5/11/09). The Goolwa Bridge site (most saline site closest to the barrages) has shown the largest decrease in salinity and currently stands at 10956 µS/cm (5/11/09).

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