Implementing and monitoring salinity management practices within the Back Creek Catchment of Tasmania

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Introduction

The Back Creek Catchment of Tasmania, located approximately 25km south west of Launceston, has been the focus of salinity assessment, mapping and monitoring since the early 1990s. This catchment houses the Cressy Longford Irrigation Scheme (CLIS), one of the oldest irrigation schemes in Tasmania, supplying approximately 8000ML of Class 1 irrigation water to a diverse range of agricultural and cropping enterprises including: pasture, poppies, peas; potatoes, oats, wheat, broccoli etc. Surprisingly, dryland grazing still dominates up to 70% of land use within the irrigation scheme Hocking pers. comm. (2007).

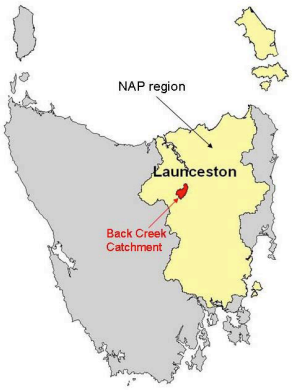

Figure 1 Location of the Back Creek Catchment, south west of Launceston

In 1995 it was identified that 1230ha of land within the CLIS was affected by salinity to varying degrees, along with the presence of large salt stores at depth. This conclusion was based on assessment and monitoring results gained from a suite of techniques, including: air photo interpretation; EM31 ground based mapping; airborne EM mapping; shallow and deep groundwater assessment; soil sampling; and visual ground truthing.

Since that time monitoring and management has continued to a limited extent, although awareness levels have still raised throughout the local community. With this growing awareness and interest in local, relevant and cost effective salinity management options, landholders were increasingly seeking more support in this area. Importantly, the growth of the CLIS irrigation scheme and introduction of centre pivot irrigation systems, saw both irrigators and Natural Resource Management bodies in Tasmania recognising an urgent need for more to be done to ensure the continued development would be sustainable. To adequately address the Catchment's salinity issues, it was identified that a much greater understanding of salinity processes was required to implement targeted and effective management activities.

Funded by the National Action Plan for Salinity and Water Quality through NRM Tasmania, the *Best Practice Salinity Management* Project began in March 2006. This project comprised two major components implemented by various specialist consultants, including:

1. 1 Research and investigations.
2. 2 Land management and extension activities.

Research and investigations

As the research component was conducted by a suite of specialty consultants, only a brief description of research activities will be discussed in this paper. Contributing consultants are listed in the acknowledgements. Data collection, monitoring and modeling included: electromagnetic induction surveys; groundwater monitoring; the identification of groundwater flow systems; predictive water and salt balance modeling under a range of farming practices

and crop rotations; soil pit profile descriptions, along with catchment scenario modeling under differing land use practices. This research component was specifically designed to build on the information previously gained within the Back Creek Catchment.

In summary, EMI surveys again confirmed the presence of salt storage at depth across specified areas of the focus farms studied. Targeted drilling and soil sampling showed statistically strong correlations between EC levels and actual soil salinity levels for all sites. Soil salinity varied within sites and across sites, with most spatial salinity maps generated reflecting visual signs of soil salinity. A salinity bulge generally occurred within the upper 1.5m of the soil profile, suggesting that potential reductions in surface soil salinity could be gained from strategically placed vegetation based management options within the Back Creek Catchment.

Groundwater drilling and groundwater flow system mapping revealed that most of the Back Creek Catchment is influenced by two local groundwater flow systems: deeply weathered clays and alluvial plains and slopes. Only one of the studied focus farms was found to be influenced by upward groundwater pressures from a regional tertiary sand aquifer. In general, recommended salinity management activities based on the identified groundwater flow systems were agronomic and drainage focused.

Estimates of the salt output/input ratios suggest the catchment exports almost three-time the salt which enters the catchment, with 40 mm/year less than 'average' rainfall for the past 10 years. Five differing landuse change scenario were modeled, they demonstrated that: doubling the number of centre pivots (eg. extra 26) would increase catchment groundwater recharge by 4 mm/year; increasing the grazing productivity over 50% of the grazing area would decrease groundwater recharge by 17 mm/year and lower the watertable significantly; installation of 1 metre effective drains would lower the watertable both on farm and at catchment scale; the removal of cropping broccoli in the centre pivot rotation has a marginal impact on the catchment water balance and the return to 'average' rainfall would increase the catchment groundwater recharge to another 16 mm/year and causing almost an addition 1000 ha of land with shallow watertable in the catchment.

The research and modeled data will provide land-managers within Back Creek Catchment with a superior understanding of both catchment and on-farm salinity processes, along with the potential impact of changed land-use and management practices. This will ultimately lead to targeted and more effective salinity management options. Other catchment issues such as drainage will require further research and monitoring and a coordinated approach to management.

Land management and extension activities

During the research phase, a range of management options were implemented based on previous landscape and salinity process knowledge, detailed site inspections and liaison with landholders. Cost effective management options that most landholders would be capable of adopting were generally chosen.

After a thorough review of salinity management options across Australia and abroad, workshops were conducted to determine the most appropriate management activities for salinity remediation within the Back Creek Catchment. Monitoring and management activities were targeted to the farms subjected to the research and investigation component of the project and were identified within four major categories:

1. Monitoring and mapping
2. Leakage reduction
3. Controlling flows
4. Productive uses of saline land

Many recommendations were incorporated into the on-ground management activities of this project, albeit limited by time and budget constraints. These included: fencing; salt tolerant pastures; mediterranean salt bush; drainage; trees in centre pivot corners; groundwater interception/shelterbelts; fertiliser trial; monitoring of soil salinity levels under centre pivots; groundwater monitoring; EM31 monitoring; monthly testing of effluent re-use irrigation water and analysis of soils receiving re-use water. Some of these are now explained in more detail.

Soil testing and landscape awareness

A thorough understanding of the local landscape, combined with several soil tests to 1.2m depth, provided the initial site information from which specific management details could be determined. Preferred management options were discussed in detail with landholders, ensuring that activities would be consistent with their future property management plans. In general, salinity levels varied considerably both within sites and between sites, ranging from 0.2dS/m up to 110dS/m. Soils were typically acidic and high in exchangeable sodium and magnesium. Soil types vary across the catchment, with salinity occurring in both lower lying and mid-slope areas.

Trees and shrubs for salinity management

A number of sites throughout the catchment were established with mixed native trees and shrubs, incorporating centre pivot corners, shelterbelts, groundwater interceptions zones and one discharge site. Sixteen different species of trees and shrubs were included in these plantings, chosen for their abilities to tolerate salts, waterlogging, frost and general hardiness. A number of species of eucalypts, acacias, melaleucas, casuarinas and callistemons were planted, along with *Callitrus oblonga* (South Esk Pine), *Atriplex halimus* (Mediterranean saltbush) and *Einadia nutens* (Native salt bush).

All sites were appropriately prepared with pre-planting herbicide application, mounding, smudging and fencing. All planting occurred within a two week period in mid September, with every tree and shrub bagged and staked to provide protection from browsing animals.

Incorporated into one of the plantations was a trial to determine the effectiveness of Bayer Initiator tablets on mixed native tree species. The Initiator tablet, which consists of an insecticide and herbicide mixture, has been found to provide eucalypts with 18 months of superior growth due to improved weed management and protection from insects. The Initiator tablet may therefore provide trees and shrubs planted in marginal conditions with a bonus start in life. Long term monitoring is essential to determine the potential of the Initiator tablet in saline environments across a broad range of tree and shrub species.

Fertiliser trial

A basic replicated fertiliser trial was established across a saline discharge site which had been unproductive for many years. The aim of this fertiliser trial was to determine fertilser requirements and the least cost options required to generate positive groundcover growth. A mix of lime, superphosphate, potash and the trace element sodium molybdate, were applied in various combinations and rates across 15 replicated treatments.

Although long term monitoring is again required to determine the true viability and cost effectiveness of this trial, some initial results have been observed. The most noticeable and replicated response was from the sodium molybdate. Clovers within the degraded pasture mix showed superior growth, delayed reproduction and a much richer green colour compared to other plots, particularly within the first couple of months. Grass species across the plots also showed improved colour and growth, particularly in the treatments receiving 200kg of superphosphate per hectare. In general all groundcover responded to the application of fertiliser showing improved growth and vigour, including salt tolerant indicator species such as Buck's Horn Plantain.

Based on these initial results, improving the fertility of the soil will improve groundcover and consequently reduce the severity of salinity. However, for more immediate and productive results, the introduction of salt tolerant pasture species is recommended for greater productivity.

Effluent re-use irrigation water and soil salinity

Over recent years the application of Cressy effluent re-use water has occurred on one property within the Catchment. Since initial benchmark conditions were established, there has been no on-going monitoring to determine the impact, if any, of applying the re-use water in irrigation. Soil analyses and water quality monitoring conducted during this project found that the conductivity of the re-use water ranged between 0.4dS/m and 0.7dS/m, the higher

readings recorded during the warmer, drier months of the year. Re-analysis of four soil pits over two centre pivots also found that conductivity levels had varied quite significantly. With five years of irrigation using the re-use water, increases and decreases in ECse levels were observed, with topographical location, soil types and inherent drainage capabilities driving such changes.

Salt tolerant pastures

Although fencing and site preparation occurred for a number of sites, direct drilling of only one site eventuated. Species sown included: Puccinellia; Summer Active and Winter Active Tall Fescues; Persian and Balansa Clovers. The success of this site to date has been very poor, attributable to a number of factors including insufficient Puccinellia seed, rapid drying of soils very high in organic content and some smearing of soil surfaces at the time of drilling. Ongoing management is likely to include the introduction of saltbush in mounds, fertiliser application, improved drainage and resowing of salt tolerant pasture seed where necessary.

Summary

While the majority of outcomes from this project are still very preliminary, research, monitoring and management activities have been extended via field days, workshops and training manuals to landholders within the Catchment. This transfer of knowledge is providing much needed skills and confidence to landholders within the Catchment and surrounding areas, generating further interest and already noticeable uptake of management options.

Recognising the widespread need for support and guidance in agricultural saline areas of Tasmania, NRM regions are continuing financial support for best practice management of salinity and water quality. Importantly, long-term monitoring will provide the opportunity to determine the real success or failure of management activities implemented.

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