



LIVINGSTONE CREEK KEY SITE

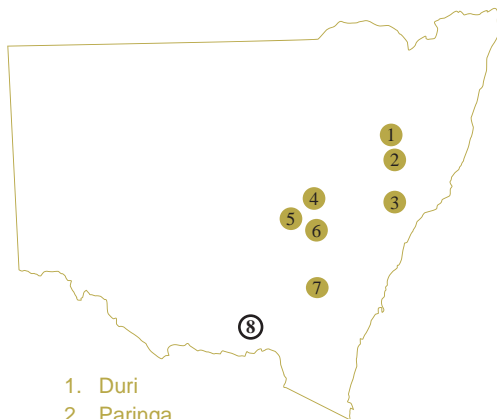
WHAT ARE WE ASKING?

What are the processes for the movement of water and salt to the stream?

What are the best management strategies to control water and salt movement and give better catchment outcomes?

Are hydrological salinity models predicting results that are consistent with catchment observations?

How do we account for water at a paddock scale and how does this relate to the catchment water balance?



1. Duri
2. Paringa
3. Hunter
4. Sloanes Creek
5. Baldry
6. Gumble
7. Boorowa
8. Livingstone Creek

WHY THE LIVINGSTONE CREEK KEY SITE?

Planting perennial species is generally seen as the answer to improved outcomes for salt and water management.

But research at the Livingstone Creek Key Site has shown that hydrological systems are often quite different from how they initially appear.

The site has shown that an understanding of the hydrological processes for catchment improvements is needed before investments take place.

The Livingstone Creek area near Wagga Wagga NSW is a priority for salinity management in the Murrumbidgee Catchment. Large amounts of salt are mobilised from this area, moving into the Murrumbidgee River system.

Originally it was expected that replacing annual crops from the alluvial plain with perennial species would reduce the amount of salt entering the creek.

However, Livingstone Creek Key Sites research has found that, while salt was being mobilised in the alluvial plains, it was occurring because of the saline groundwater flow from the upper catchment. The alluvial plain has a separate fresher groundwater system that responds rapidly to rainfall, flushing water and salts into the creeks. This groundwater system is connected to the saline groundwaters from the upper catchment.

Replacing the annuals with perennials would have resulted in saline water from upper catchment groundwater encroaching further onto the alluvial plain as the fresher groundwater system dries up. In this case, any investment into perennial species on the alluvial flats would have resulted in a deterioration of catchment health.



The National Airborne Field Experiment (NAFE) uses soil moisture and vegetation parameters from airborne and satellite platforms to measure components of the catchment water balance.

THE LIVINGSTONE CREEK KEY SITE

The Livingstone Creek Key Site is a 43 km² sub-catchment, 25 km south of Wagga Wagga. It is a major tributary of the Kyeamba Creek (catchment 602 km²) which contributes significant salt loads to the Murrumbidgee River.

The site was developed as part of NSW Government long-term approach to natural resource management - specifically to understand landscape processes of salt movement from the landscape to the stream in a dryland catchment.

WHAT IS KEY SITES?

KEY SITES is generating new knowledge in priority dryland salinity areas of NSW.

It is a research project with eight sites across upland fractured rock aquifers in local and intermediate groundwater flow systems.

These areas have been identified as being major salinity sources for NSW.

Each site addresses a different and locally relevant gap in salinity knowledge. The sites are not simply eight replicates of a single methodology.

The impact of all major land uses is being investigated, including: *annual cropping, improved annual and perennial pasture, native pasture, native forestry, planted forestry and rehabilitated open cut coal mine.*



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The site was initially fitted with instruments to monitor stream, ground, and soil water processes in 2000 by the Department Natural Resources. In 2005, NSW DPI assumed management of the site as part of the Key Sites research project.

A SNAPSHOT OF RESULTS

Knowledge generated by the research has shown that removing annual crops from the floodplain where responsive localised fresh groundwater systems exist would concentrate salts within that landscape and exacerbate the problem. Investment should be targeted to revegetating the upper catchment.

This research site has contributed to many other multi-institutional, national and international research programs including:

- Knowledge generated from the Livingstone Creek site was instrumental in refining the CSIRO

“3 Stores” catchment salinity model, where an alluvial store was added to allow for the water and salinity processes that provide connectivity out of these landscape features to the stream. The 2C Salt model further refined this concept and is the current Murray Darling Basin accredited salinity modeling framework which has also been used as part of the 2006 NSW Salinity audit.

- The National Airborne Field Experiment (NAFE) which uses soil moisture and vegetation parameters from airborne and satellite platforms to measure components of the catchment water balance.
- The national (OZNET) data monitoring program which aims at evaluating the land surface component of the Australian Bureau of Meteorology's operational weather forecasting model. This data will soon be incorporated into the World Climate Research Program's Coordinated Enhanced Observing Period (CEOP) database.

- The HYDROGRACE project which aims to provide the first in-situ based validation of terrestrial water storage observations from the GRACE (Gravity Recovery and Climate Experiment) mission launched by NASA. The aims of all these projects are to improve weather forecasting locally, nationally and internationally.

WHERE TO FROM HERE?

This research is being used to develop methods to extrapolate field results to other areas utilising airborne soil moisture measurements, terrain modeling and satellite imagery of vegetation cover.

Continued monitoring will capture variations in current climate patterns and will indicate how this variation affects the transport of salt from the landscape to streams providing better information with regards to climate change.

PUBLICATIONS

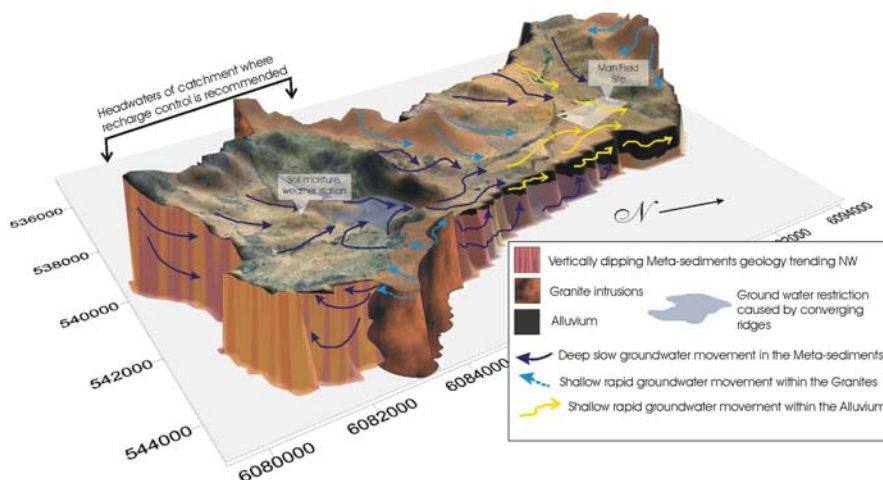
Summerell GK Tuteja NK Grayson RB Hairsine PB Leaney F (2006) Contrasting mechanisms of salt delivery to the stream from three different landforms in South eastern Australia. *Journal of Hydrology*.

Eight sites for dryland research, salt load mobilisation (November 2005) and Livingstone Creek insights for Basin (July 2006) *Agriculture Today*.

Summerell GK (2004) Understanding the processes of salt movement from the landscape to the stream in dryland catchments. PhD Thesis, The University of Melbourne.

Summerell GK Shoemark V Bernardi T Littleboy Management of a representative flat alluvial landscape generating salt loads in the upland Murray Darling Basin. 10th Murray–Darling Basin Groundwater Workshop.

Summerell GK Grayson RB Walker G Richardson P (in prep) Stream event lateral flow contributions from a groundwater paleochannel environment.



The conceptual model shows the Livingstone Creek Key Site is divided into two major landforms. The Upper catchment is characterized by steep sloping metasedimentary geology, contrasting with the alluvial flats of the lower catchment. The recharge from the upper catchment contributes to the saline groundwater and creates pressure which causes groundwater to push into the alluvial plains. Research, plus historical knowledge from landholders proves that clearing of trees in the upper catchment is responsible for the saline groundwater flows to the alluvial plains. To minimize the movement of salt in the creek will require revegetation with perennials in the upper catchment to restore the water balance. This will reduce recharge and, in turn, the pressure of the saline groundwater flows.

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Collaborators include local farmers who allow researchers access to their land; Catchment Management Authorities; University of Technology, Sydney; University of NSW; University of Sydney; University of Melbourne; CRC for Plant-based Management of Dryland Salinity; CRC eWater; and local landcare groups.

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