Angas Bremer Irrigation Management Zone 2009 – 2010 Annual Report

Project Coordinator: Sylvia Clarke

Angas Bremer Water Management Committee Inc

Supported by

Government of South Australia
South Australian Murray-Darling Basin
Natural Resources Management Board

Report Contents

Angas Bremer Water Management Committee Inc.

Committee Members 2009-2010

Chairman – John Pargeter
Vice Chairman – Sarah Keough (Sept 2009- May 2010), Colin Cross (May 2010- Aug 2010)
Treasurer – Rick Trezona

Committee
Colin Cross, John Follett, Phil Reilly,
Brian Wyatt, Mac Cleggett, Rob Tonkin, James Stacey and David Eckert. Tony Thomson from DWLBC was a member until Sept 2009.

Non-elected members of the Committee
Secretary - Barbara Blaser
Program/Project Coordinator - Sylvia Clarke
Lian Jaensch -*Langhorne Creek Wine Industry Council (now Langhorne Creek Grape and Wine Inc)*
Lyz Risby, Cameron Welsh and Michael Cutting – *SA Murray Darling Basin NRM Board*

Report of the Activities of the Committee 2009-2010

1. Flood Plain Study

The monitoring of well-water-levels and soil moisture along the Angas and Bremer River flood plains began in late 2002. The data collected has helped the Committee and the Department for Water (DFW, previously DWLBC) to understand the groundwater system.

Over the 2009-10 year there were up to 33 of the committee's electronic loggers in Government observation wells, 14 in the confined aquifer (T aquifer) and 16 in the unconfined aquifer (Q aquifer) measuring standing water levels in these wells, and 3 measuring salinity in the confined aquifer. In January 2010 the four loggers measuring unconfined aquifer levels in Redgum Swamps and nearby areas were removed after 7 years of data collection. It is hoped that the data collected in the swamps will be analysed and reported on in the future. DFW received funding from the Bureau of Meteorology to establish their own set of dataloggers in Observation Wells in the Angas Bremer Prescribed Wells Area. To avoid duplication of effort, the remainder of the committee's loggers were removed in October 2010 and DFW will continue to monitor the aquifers.

This information and the large amount of data collected by the committee over the last few years will be made publicly accessible on the DFW website by early 2011.

The company Aquaterra was commissioned by the Department of Water (previously DWLBC) to develop a new hydrogeological and solute transport model of the aquifers (see article and transcript of presentations from Annual Public Meeting below) and the data collected from the committee's loggers was used in its development and calibration.

As well, there were 8 soil moisture monitoring sites in vineyards on the flood plains and these are located as near as possible to the Govt. observation wells being monitored. The soil moisture logging used gypsum blocks connected to electronic loggers. The gypsum blocks have a finite life and the Committee decided that each block would not be replaced as the blocks fail but logging would continue until all the blocks have failed. As it became clear during the 2009-2010 year that the committee's future funding from the SA Murray Darling Basin NRM Board was no longer assured the Committee decided to cease the collection of data from the soil moisture gypsum block loggers and to use funds that might become available in the future to contract an expert to analyse the many years of data already collected. The last downloading of information and removal of the soil moisture loggers occurred in March 2010.

With the increase in Aquifer Storage and Recovery, now referred to as Managed Aquifer Recharge (MAR), over the last couple of years and the increasing salinity of the water in the confined aquifer, the data collected by the committee plus the new information being collected by DFW will allow us to keep a close eye on changes within the groundwater resource, keep the new hydrological model calibrated and allow more informed management decisions to be made.

2. Groundwater modelling

Following the approval of funding for the Angas Bremer Groundwater Modelling Project as part of the Murray Futures Program, the Department for Water (DFW) engaged consultants Aquaterra to construct a 3D multi-layered groundwater flow and solute transport model to assess the capacity of the limestone aquifer to store off-peak water supplied by the Irrigation Pipeline project.

The model was successfully constructed and calibrated. The model was independently reviewed by a recognized expert in the field of groundwater modelling and was considered "fit for purpose". After consultation with DFW, the NRM Board and the Angas Bremer Water Management Committee, Aquaterra ran several prediction scenarios.

The model outputs to date have shown that there are no adverse impacts on the groundwater resource when the "worst case" of 13.5 GL are injected and extracted annually for 30 years. The predictions also show that even with modest injections of 3 GL/yr, freshening of the aquifer occurs in the long term. The model will be transferred to DFW where further refinements will be made, and additional scenarios run to assist in the development of management policies for the Water Allocation Plan.

3. Angas Bremer Database and Website

The Committee received $5963.64 from the Commonwealth Government Community Action Grants this year to upgrade the Irrigation Annual Reporting database and its website. The changes to the database are underway and will be completed in time for

next year's (2010/11) reporting. On-line submission of reports will be available from next year and a workshop will be held before the next round of report forms are sent out to explain all the changes to the reporting framework and website and to demonstrate how to submit forms online. Hopefully through theses upgrade we will be better able to account for the different ways that irrigators are using water in the region. We welcome any feedback during this process.

4. Managed Aquifer Recharge Risk Assessment Project

The Aquifer Storage and Recovery (ASR) risk assessment project was developed with the aim of identifying whether or not there were contaminates present in the surface water used for ASR, now referred to as Managed Aquifer Recharge (MAR),and if present, what impacts could this cause to the aquifer and water users.

In 2007, the Australian Water Quality Centre (AWQC) was contracted to collect water samples and undertake chemical analysis, from the Angas and Bremer Rivers, Lake Alexandrina and in 2008 the rivers and lake and a well used for artificial recharge on a property in Langhorne Creek were sampled. In 2009, the water levels in the lake were too low and the water quality too poor to be used by irrigators for artificial recharge so no samples were collected from Lake Alexandrina. The sample from the Bremer River was collected by an automated sampler (near Wanstead Road Ford) installed by the SA Murray Darling Basin NRM Board in 2009. Groundwater was also sampled from a second well that was not used for artificial recharge. This site was up gradient of any artificial recharge sites and gives a good indication of the chemistry of the native groundwater.

The results were then compared with the Environmental Protection Water Quality Policy EP(WQ)P Guidelines. The results from 2009 showed a small number of parameters from the river water, including turbidity and faecal bacteria, exceeded the guidelines for potable water as they had done in the previous years. The results also indicate that in order to be compliant with the EP (WQ) guidelines, filtration and UV sterilisation will be necessary.

The sample of water taken in 2009 from the well not used for artificial recharge had relatively high levels of Total Dissolved Solids, Iron, Chloride and also a small amount of bacteria. The MAR well sample from 2009 had higher levels of a number of analytes than the native groundwater sample. Of these, turbidity and manganese were above the drinking water guidelines in the recharge bore sample.

Ideally, to make improved comparisons of the quality of recharge water and native groundwater, more than one well of each type should be sampled each year. Unfortunately, despite the large amount of recharge that occurred and the high chance that a contaminant could have entered the aquifer, funds could not be sourced to repeat this project in 2010. Hopefully in 2011, the sampling will occur again.

5. Mundulla Yellows Project

The Full report (with photos) can be found on the website (www.angasbremerwater.org.au)

The cause of Mundulla Yellows (MY) is largely unknown but is believed to be related largely to soil properties. It was advised that the use of iron (Fe) implants could improve the health of the trees in the short term.

The ABWMC resolved to conduct a trial at 3 sites in the Angas Bremer Prescribed Wells Area, with the aim to:

1. confirm the diagnosis of MY, and
2. test the effectiveness of Fe implants for treatment of the symptoms of MY.

Three sites were selected:

- Site 1. Brian Meakins Horse Radish Farm
- Site 2. Peter Silvers Lucerne Farm
- Site 3. Wellington Road

Soils were analysed for pH, electrical conductivity (EC) and ion concentrations. Foliage samples were analysed for total nutrient concentrations. The initial diagnosis of MY as being the primary cause of the decline in tree health was supported by both the soil and foliage properties. At the Meakins and Silvers sites, iron implants were inserted into holes drilled in 2 trees, while a third tree was left as a control for comparison. At the Wellington Rd site 2 branches on one tree were treated and a third branch left as a control. Photographs of each site and tree were taken prior to inserting the iron implants on 31st August 2007, and again on 14th January, 12th August, 13th November 2008 and 29th May 2009. The purpose of the photographs was to record how the trial trees responded to the treatments.

From the photos taken in January, 6 months after the insertion of the implants, it appeared that the control trees had continued to decline in health, while the results of the iron treatment were mixed. New, deep green growth was observed in at least one of the treatment trees or branches at each site, but others showed no improvement.

Photos were taken over the next couple of years and neither the treated nor the control trees appeared to be very healthy and many of the treated trees were displaying yellowing of the leaves again. The climatic conditions over this time have not been ideal for new growth, particularly the lack of spring rainfall. From these results it appears the iron implants have not been very successful for treating the red gums under these conditions. The trees were opportunistically visited and photos taken over the 2009-2010 year, thanks to the Langhorne Creek Wine and Grape Inc and the Goolwa to Wellington LAP. While fresh new growth was seen on some of the trees thanks to the increased rainfall, most still had very little canopy and one of the control trees appears to have died over the year.

If funds permitted, it would be interesting to repeat the iron implant experiment now that a couple of wetter seasons have passed, to see if any improvement would be seen under better conditions.

6. Salt trends

Richard Stirzaker from CSIRO Land and Water has again provided a report on soil salt trends in the Angas Bremer region. The full report will be available on the committee's website.

This year Richard Stirzaker focussed on a number of properties with good historical FullStop data and differing irrigation regimes. A summary is presented below.

Up to now Richard Stirzaker's reports had shown general trends across the district by averaging all the available data. However it is now clear that some growers are experimenting with different leaching strategies and this is providing valuable lessons. Therefore this report focuses on data from certain properties, to help identify and draw

principles from what different growers are doing. The 2008-09 season was also very different from what went before. Lake water had risen from 800 ppm to 2500 ppm, and early in the season the lake supply ran dry. Some growers switched back to groundwater, usually in the 1500-2000 ppm range. Others stopped irrigation altogether. Both actual and modelled data was looked at for a number of properties.

The conclusions reached suggest that;

- Salt levels generally increase during the season and reach levels that are normally considered to be harmful to grapevines.
- In some cases the salt is building up very close to the surface (top 30 cm) and frequent small irrigations tend to lead to salt accumulating at shallower depths.
- Salt can be pushed down the root zone, but it still appears to accumulate at 50 or 100 cm depths.
- If growers start the season with high salt levels, attempts to leach during the season will most likely prove unsuccessful.
- Leaching events during the season will only have a temporary benefit.
- Most of the 'effort' the vines must exert to get water out of the soil is due to the salt not the soil dryness.
- Monitoring water status will give a wrong impression of what is happening in the root zone unless the salt is accounted for (particularly monitoring suction)
- There are a few 'outlier' situations, where salt levels decline during the season or build up to lower levels than usual.

These results, and the fact that many of the FullStops on people's properties are now failing, has prompted the Angas Bremer Water Management Committee Inc, the SA Murray Darling Basin Natural Resource Management Board, the Langhorne Creek Grape and Wine Inc and Richard Stirzaker (CSIRO) to design a new project to provide information for all irrigators on rootzone salinity.

At least six demonstration sites will be established on irrigated vineyards with varying soil types, irrigation, water quality, irrigation management practices, and good past root zone salinity record keeping. FullStop devices and SoluSamplers (to demonstrate another device), will be installed at varying depths. Once the sites are established and irrigation has commenced, water samples will be collected by the irrigators. All irrigators will be informed of the progress of the project via field days, fact sheets, newsletters, website, and a final report.

Funds have been successfully applied for through the Commonwealth Government's Community Action Grants, adding just under $9000 to assist with this project.

Irrigation Annual Report Forms

Irrigation Annual Report forms (IAR's) were mailed to 138 irrigators, 101 irrigators who returned their completed forms on time have achieved "Accredited Irrigator" status and will be issued with accreditation certificates, 29 IAR's that were received by the Committee after the due date did not achieve accreditation and a further 3 irrigators have not (at the date of this report) returned their IAR forms. The data from 128 irrigators has been collated and that data is presented in the following graphs and tables. Comments are included with each graph/table.

Flooding:- Flooding by diversion or pumping was reported by a large number of irrigators. The flooding events occurred during July, August and September and into early October 2009. 525 ha were flooded compared with 215 ha last year; these figures include some properties that were flooded twice or three times.

Revegetation: - The total area of re-vegetation reported in the Irrigation Annual reports is 1647.35ha. This total is made up of;

- 1338.25ha of privately owned
- 200.4ha jointly owned
- 44ha of leased revegetation
- 54.1ha of Community plantings; and
- 10.6ha of revegetation on Council Reserves for which irrigators have an agreement with the Alexandrina Council.

Red Gum Health:- 73 Irrigators reported on the health of the red gums on their properties. Health, or otherwise, was rated from 0 to 5, 5 being healthy and 0 being dead. Most irrigators reported no change or an increase in the health of their red gums over the year, which is a positive change from the declines noted in previous years. Many commented that the trees appeared to be responding to the increase in rainfall and flooding events providing water to red gums along the rivers and in swamps. 21 irrigators reported that 100% of their red gums were healthy, while only 13 irrigators had reported this in the previous year.

Water Leasing:- Table 1 below shows the amount of water leased in 2009-10 compared with water leased in 2008-2009. This table shows that there was a shift in the way water was traded within the Angas Bremer Irrigation Management Zone over this last year. The amount of River Murray water traded within the zone was higher than last year; while the amount of Groundwater leased was only a quarter of what it was the year before. The volume of River Murray water traded to irrigators outside the region was only slightly higher than last year but a large increase of over 2000 Megalitres was noted in the amount leased into zone, as the new pipeline brought Murray water into the region again.

Table 1

Type of Lease	Megalitres 2008-2009	Megalitres 2009-10
RM water leased from ABIMZ to outside ABIMZ	361.10	412
RM water leased from outside ABIMZ to inside ABIMZ	1347.72	3428.2
RM water leased from inside ABIMZ to inside ABIMZ	445	705.17
Groundwater leased from AB licence to AB licence	1613.12	404.7

Chart 1: Angas and Bremer Rivers Water Extractions 2005-2010:- Not all of the water taken from these Rivers is accounted for, such as the water diverted through weirs and sluices. The volumes on this graph are metered volumes as well as the amount recharged into the aquifer as reported on the Irrigation Annual Reports. It is interesting to note that the amount of water extracted from these rivers increased substantially in 2009-2010 with a lot more water available from the rivers, although the moratorium is still in place.

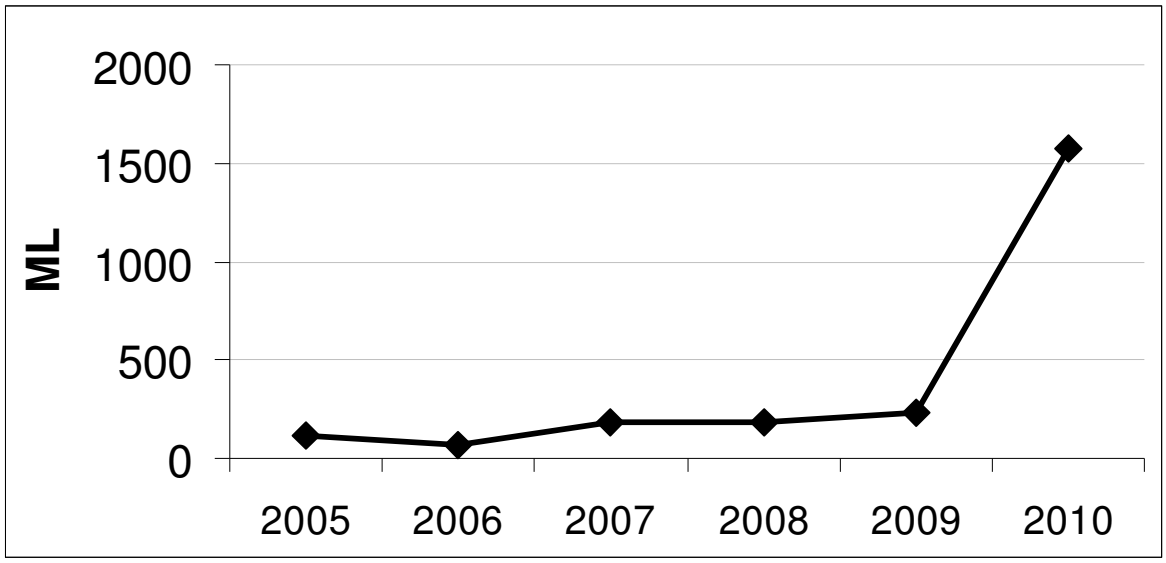


Chart 2: River Murray Water Entitlement and Extraction 2005-2010:- Entitlement is the volume of water endorsed on licenses and does not include any credits for rollover, recharge etc. Extraction is the volume of water that was used during the irrigation years. The entitlement for 2010 was 28,200.4 ML and the recorded use was 14,075.24 ML. The amount of River Murray water used during the year was much greater than in the previous year as access to River Murray water was possible again for many irrigators thanks to the installation of the Creeks Pipeline Company pipeline.

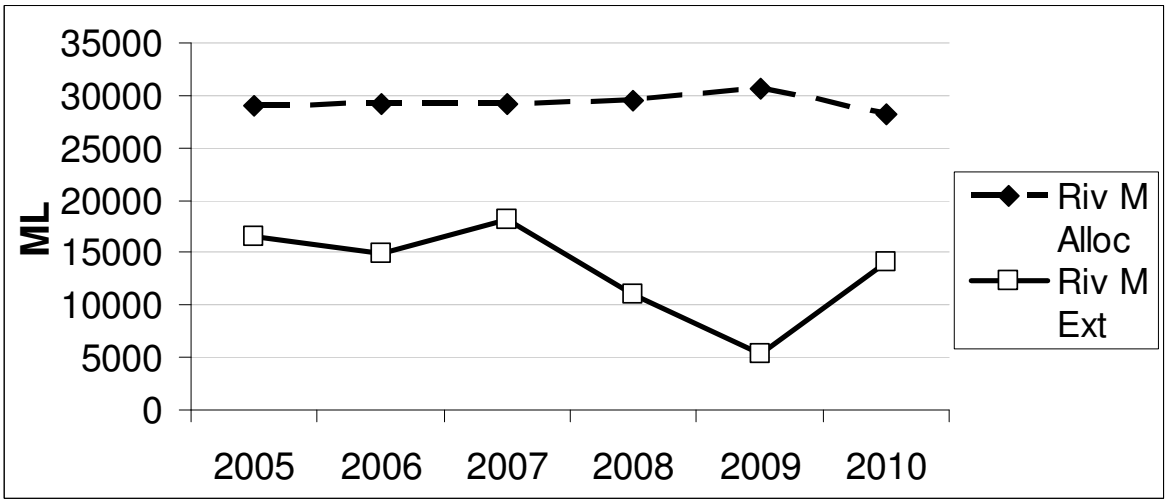


Chart 3: Groundwater Entitlement and Extraction 2005-2010:- The maximum entitlement for 2010 was 6,500ML and the recorded use was 2,930 ML. This is much lower than the 7,700 ML used in the previous year. The impact on the aquifer was reduced because most irrigators preferentially used the better quality water available from the Angas, Bremer and Murray Rivers.

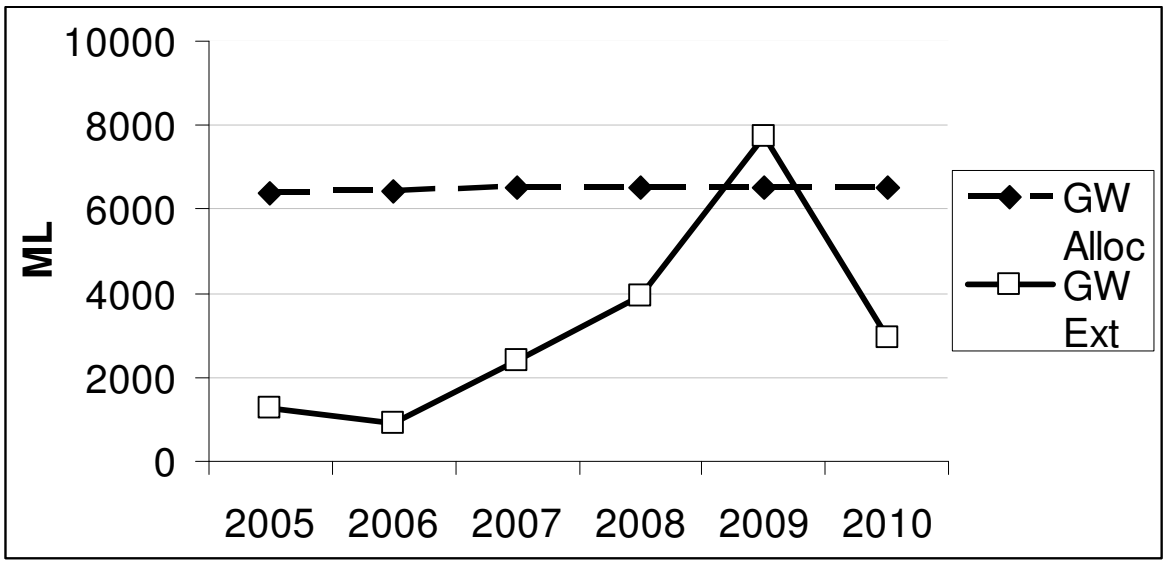


Chart 4: Managed Aquifer Recharge (formally termed Aquifer Storage and Recovery (ASR)) :- This chart shows the total volume of water artificially recharged to the aquifer from 1985 to 2010. The **5037 ML** recharged from the rivers in 2009-2010 was much higher than in the previous year and in fact is the highest volume ever recorded. The recorded salinity of all water recharged to the aquifer varied between 150 and 1400ppm. The River Murray water varied between 150-600ppm. With continued Managed Aquifer Recharge this should lead to a long-term freshening of the groundwater in the confined aquifer.

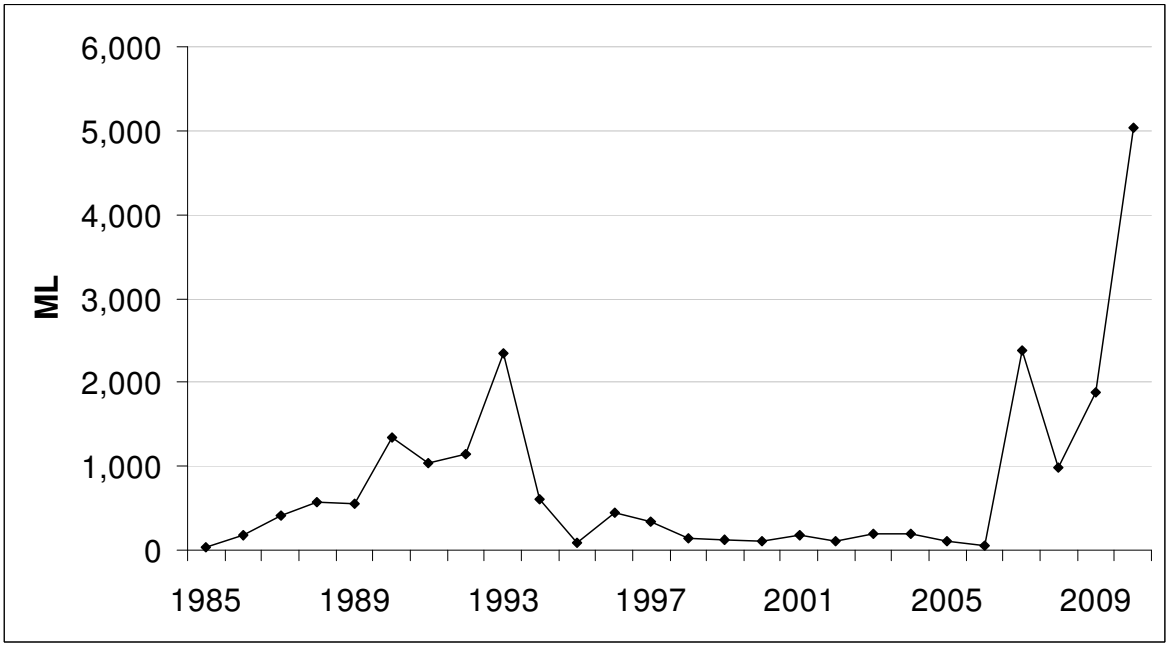


Chart 5: Total volume of water used 2009-2010: - The total volume of water used from all sources within the region was **18,479 ML** well above last year's total of 14,766 ML.

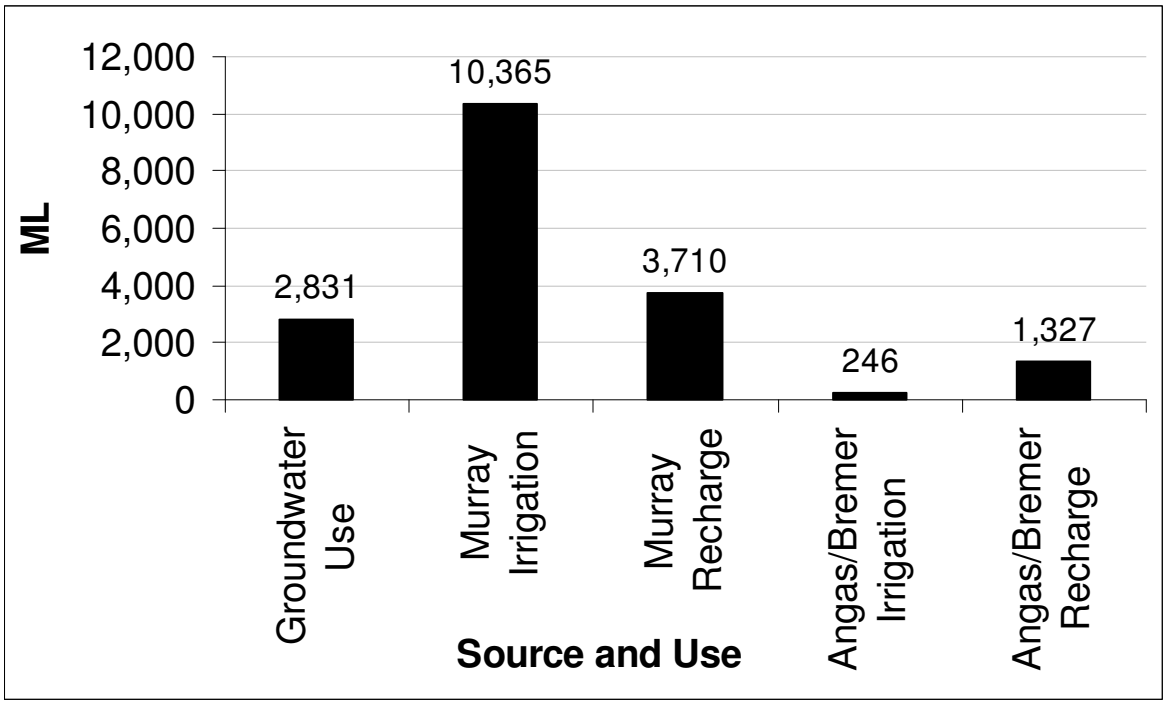


Chart 6: Total volume of water used for each crop type: - This volume is the total used from all sources; groundwater, watercourse water and River Murray water that was applied to each crop type (grapes excluded). **The total volume of water applied to grapes was 13,718.65ML in 2009-10 compared with 10,738.03ML in the previous year.**

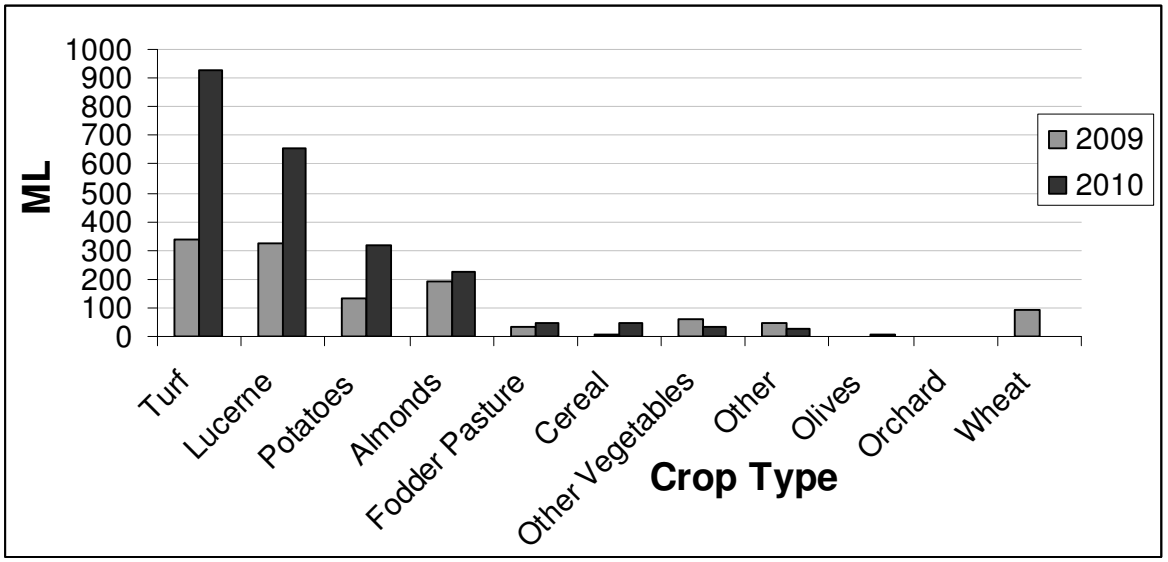


Chart 7: Area Irrigated by Crop Type: - The area of each crop irrigated is shown in hectares. **The area of grapes in 2009-2010 was 5971.26Ha, lower than the previous year's total of 6748.02 Ha.** A small amount of this difference may be accounted for in reports not yet submitted. The total area under irrigation in 2009-10 was 6578.16Ha compared with 7296.82Ha in 2008-09.

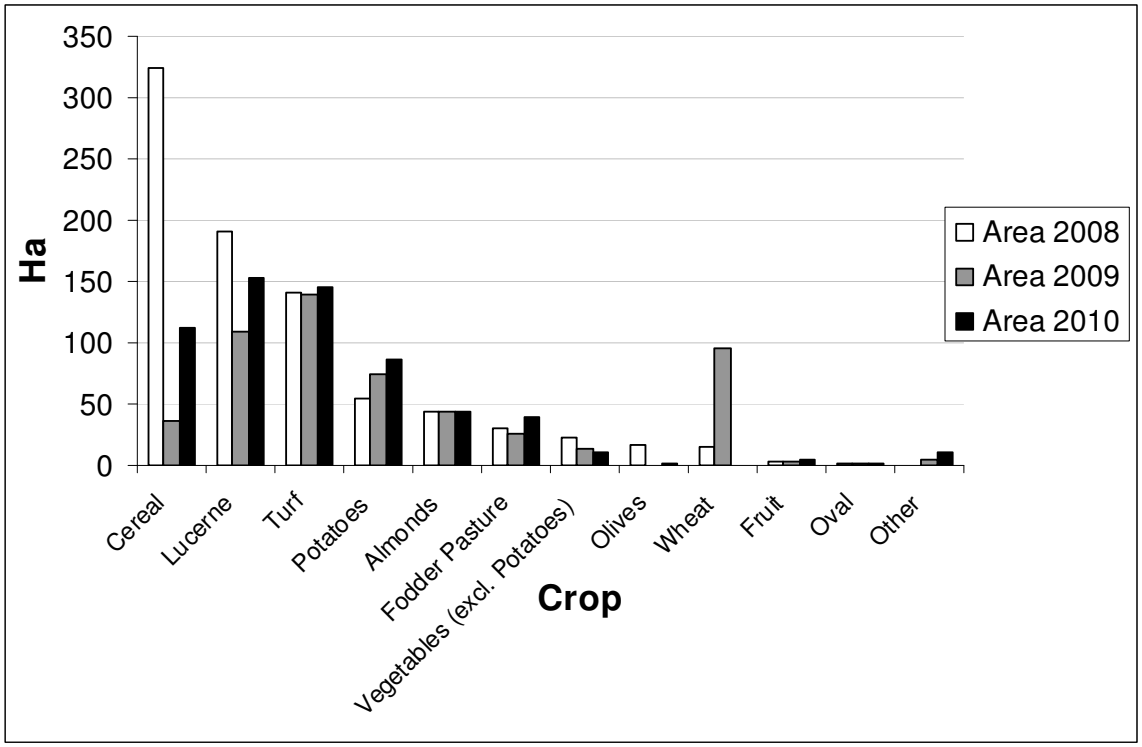


Chart 8: Number of Irrigators for Each Crop Type: - The number of irrigators growing each crop type in the region does not appear to have changed substantially over the last couple of years.

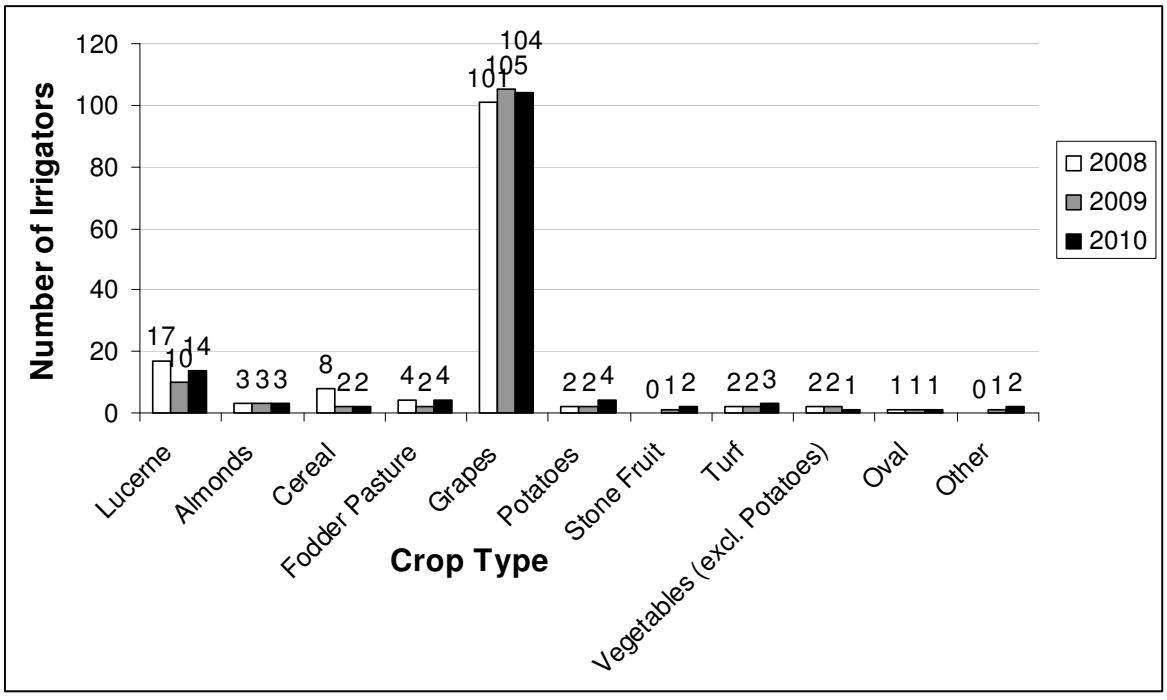


Chart 9: Average total irrigation for the year by crop type:- Irrigation is shown in mm for 2008-09 and 2009-2010.

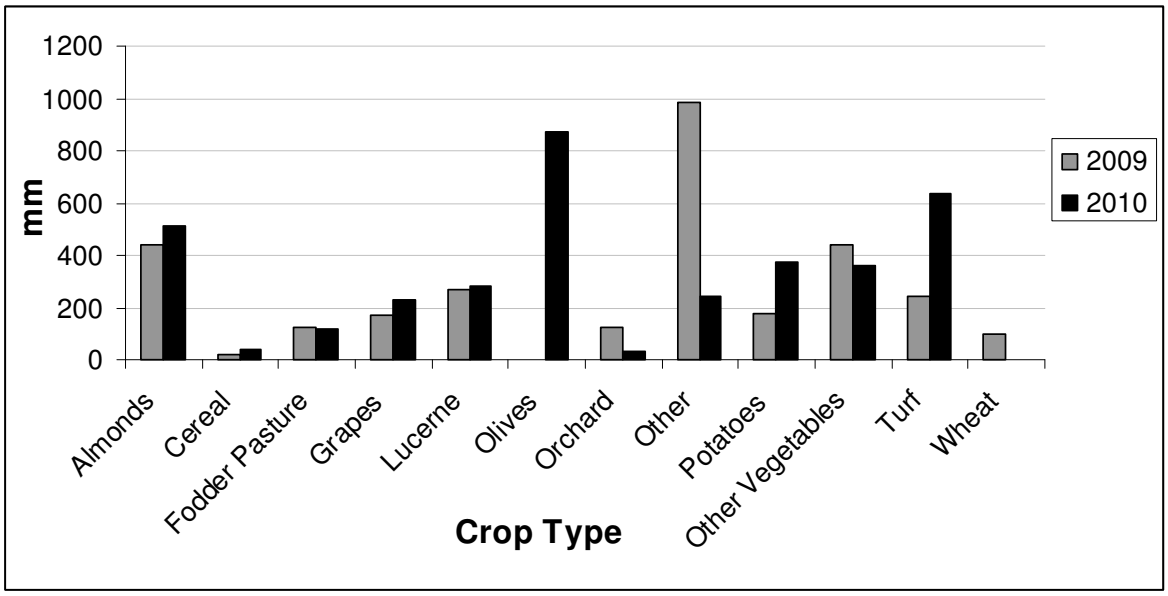
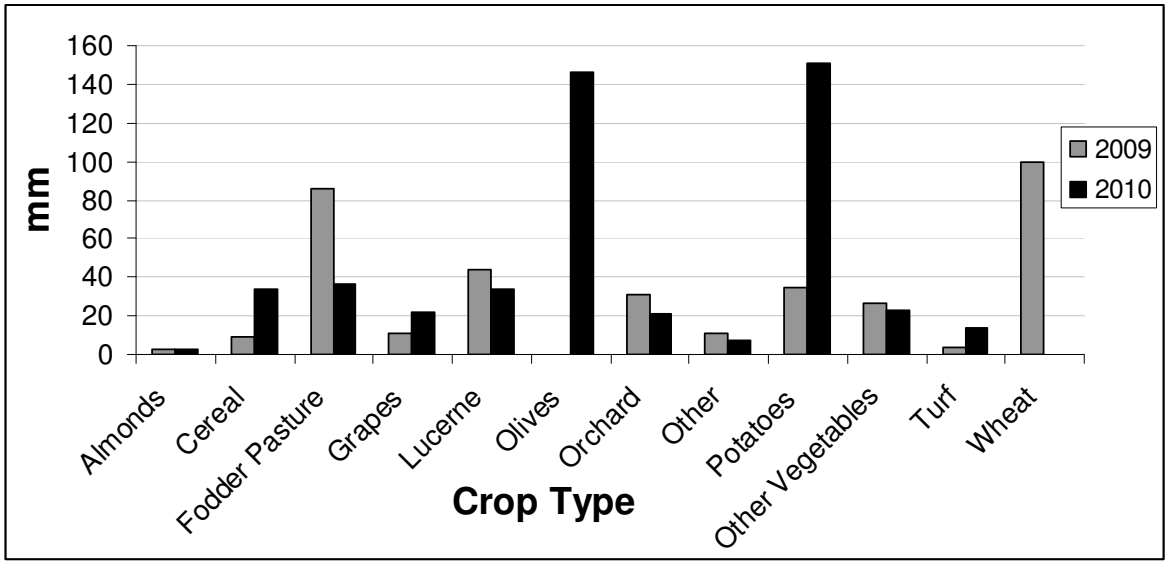
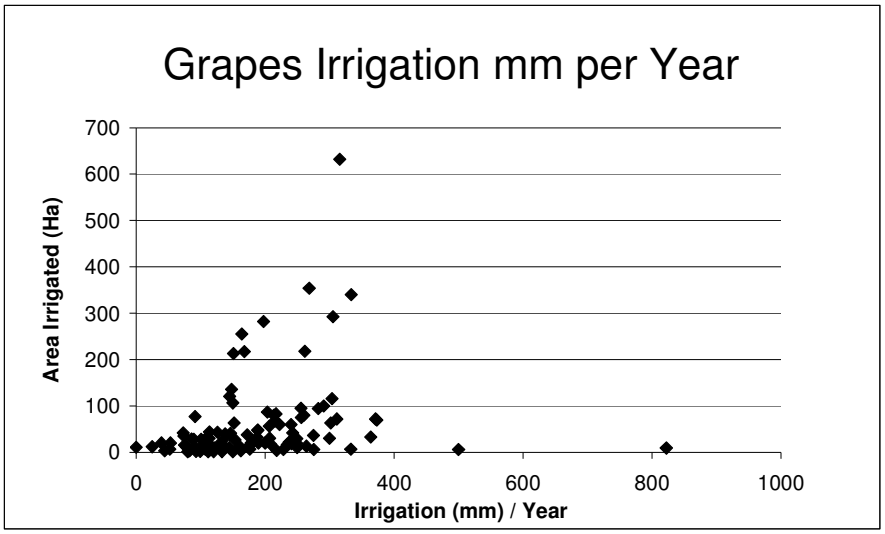


Chart 10: Average mm of water applied per irrigation for each crop type for 2008-09 and 2009-2010.

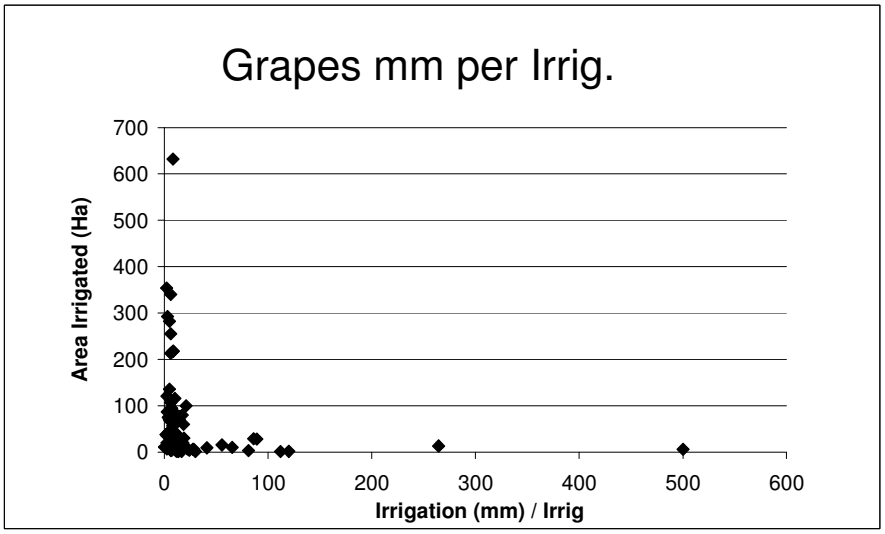


Charts 11 to 15:- These charts are for the larger crops. **For each crop one chart shows (a) the mm per year and (b) the mm per irrigation**. For grapes an additional chart (11c) has been included. It excludes those irrigators who used winter flooding that applied a large volume of water in a single irrigation.

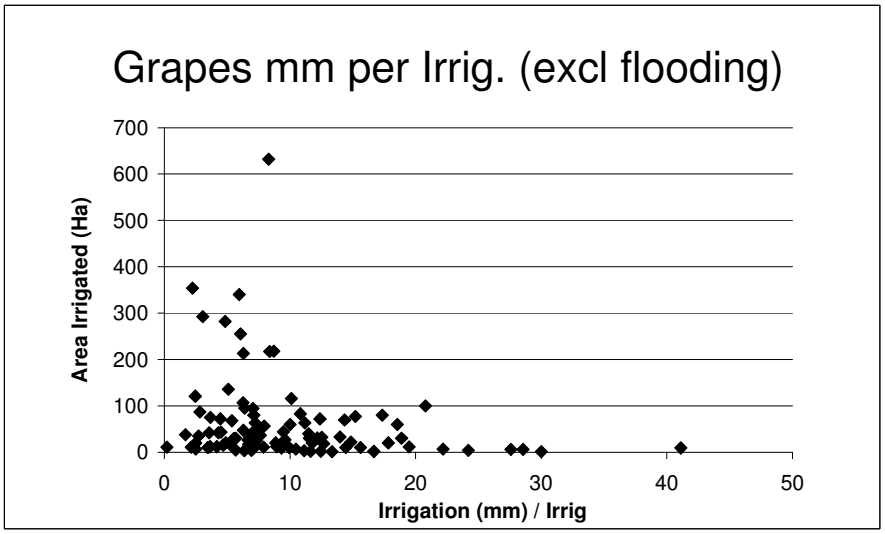
11a)



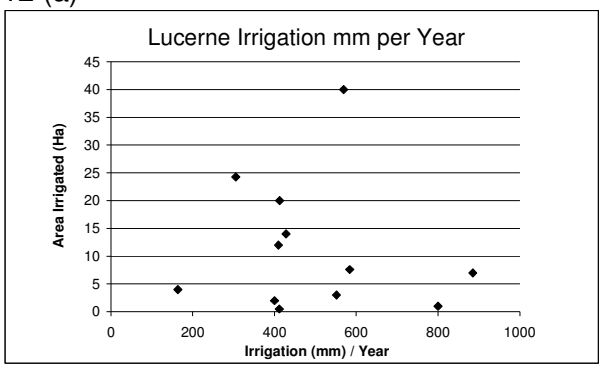
11b)



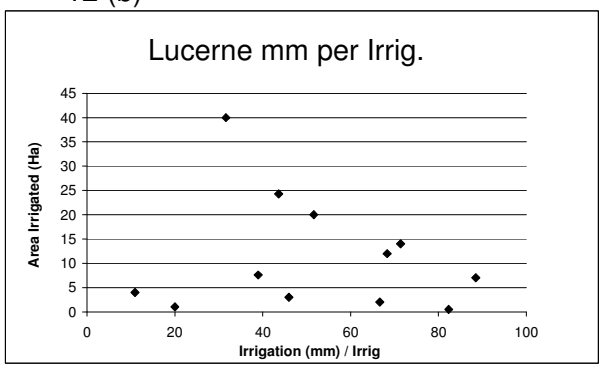
11c)



12 (a)



12 (b)



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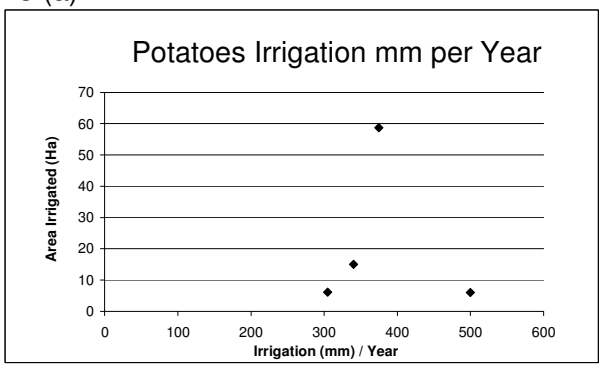

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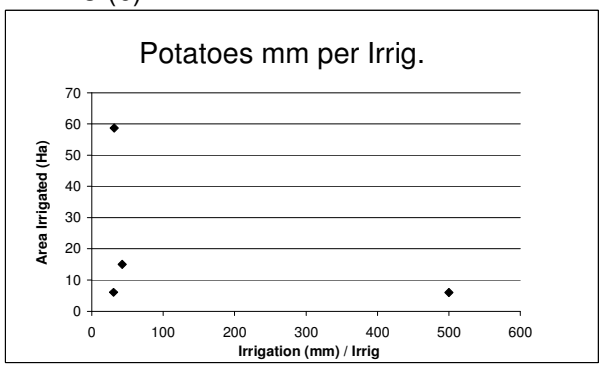

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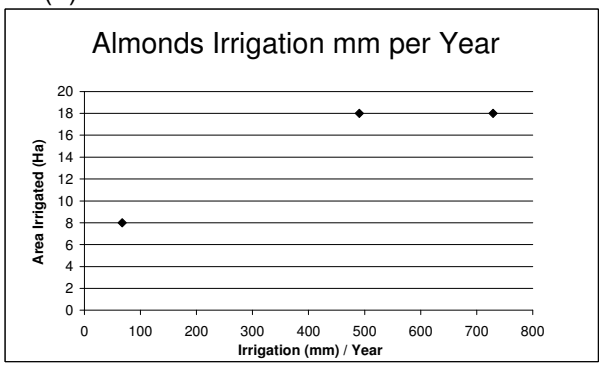

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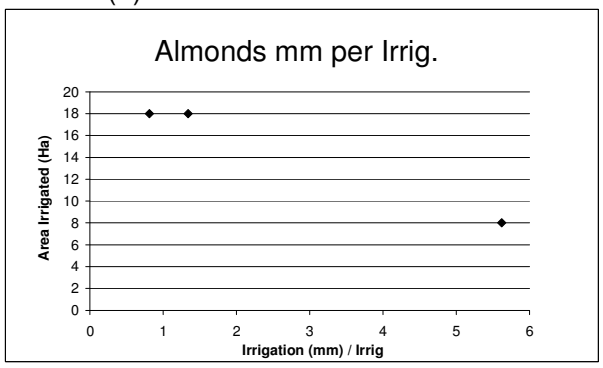

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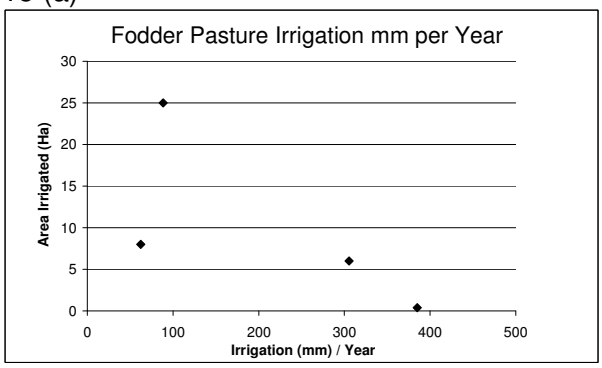

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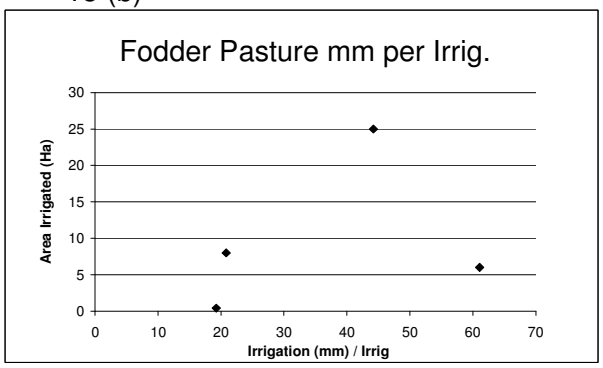


Chart 16: Number of growers using Soil Moisture Monitoring devices:- "Resistance" includes Gypsum Blocks. "Capacitance" includes Agwise soil moisture probes, Agrilink C probe, Dataflow Gopher, Sentek Diviner and Sentek EnviroSCAN. "Dig hole" includes Dig stick, spade, auger and post hole digger.

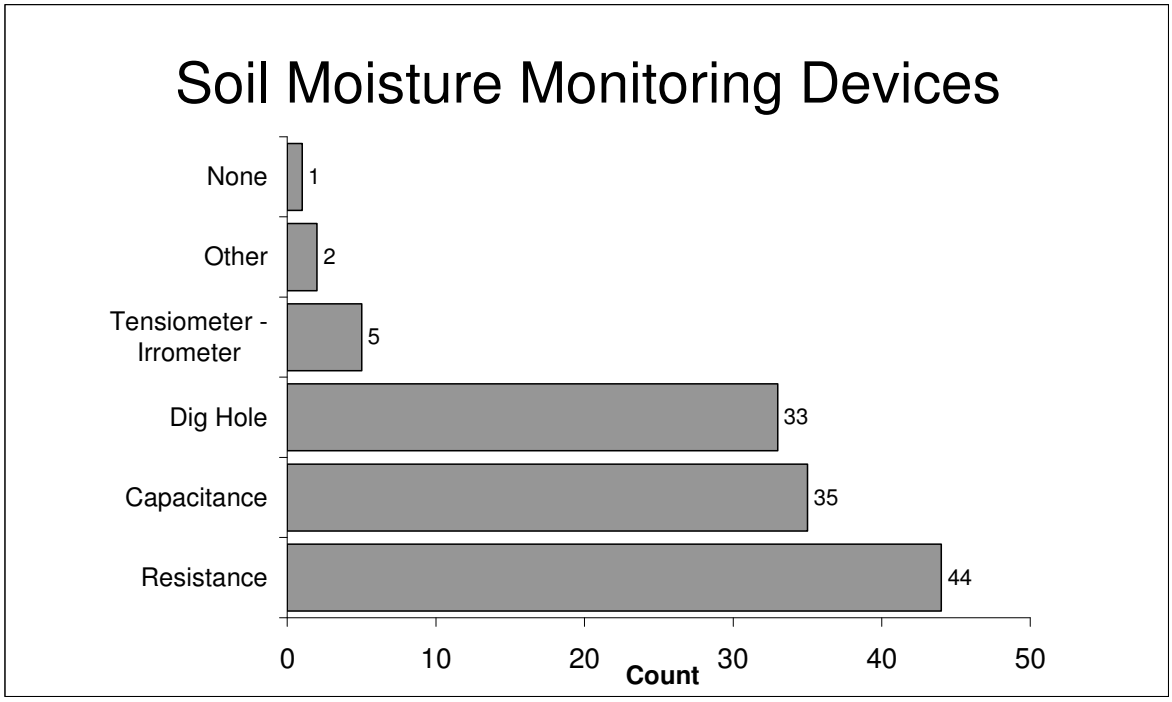


Table 2: Average ML/ha per crop per year:- This table shows the average ML/ha of irrigation water applied to different crop types and compares 2010 with previous years. This information is also displayed in the following chart 17.

Year	Grape	Lucerne	Other	Vegetable	Potato	Fodder	Almond	All Crops
2009-2010	2.3	4.32	4.49	3.6	3.72	1.2	5.11	2.47
2008-2009	1.73	2.99	1.81	4.38	1.74	1.24	1.04	1.78
2007-2008	1.97	4.36	1.57	7.8	2.51	2.36	5.24	2.07
2006-2007	2.04	5.13	1.05	6.43	4.12	1.7	5.23	3.67
2005-2006	1.8	4.23	1.53	5.04	2.99	1	4.06	2.95
2004-2005	1.99	5.22	1.69	5.18	3.67	2.74	4.79	2.25
2003-2004	1.97	4.5	2.5	8.8	3.5	2.7	4.2	2.28
2002-2003	2.2	6.8	2.4	6	3.8	4.3	4	2.61
2001-2002	2.1	4.4	1.7	5.1	4	3.3	4.5	2.5
2000-2001	2.1	4.8	2.4	5.7	3.6	4.7	3.1	2.6
1999-2000	2.1	6	1.7	6.3	3.7	3.7	2.8	2.6
1998-1999	2.2	5.1	1.3	4.5		3.8	2	2.7
1997-1998	1.6	4.2	2.6	3.9		4.1	2.4	2.5

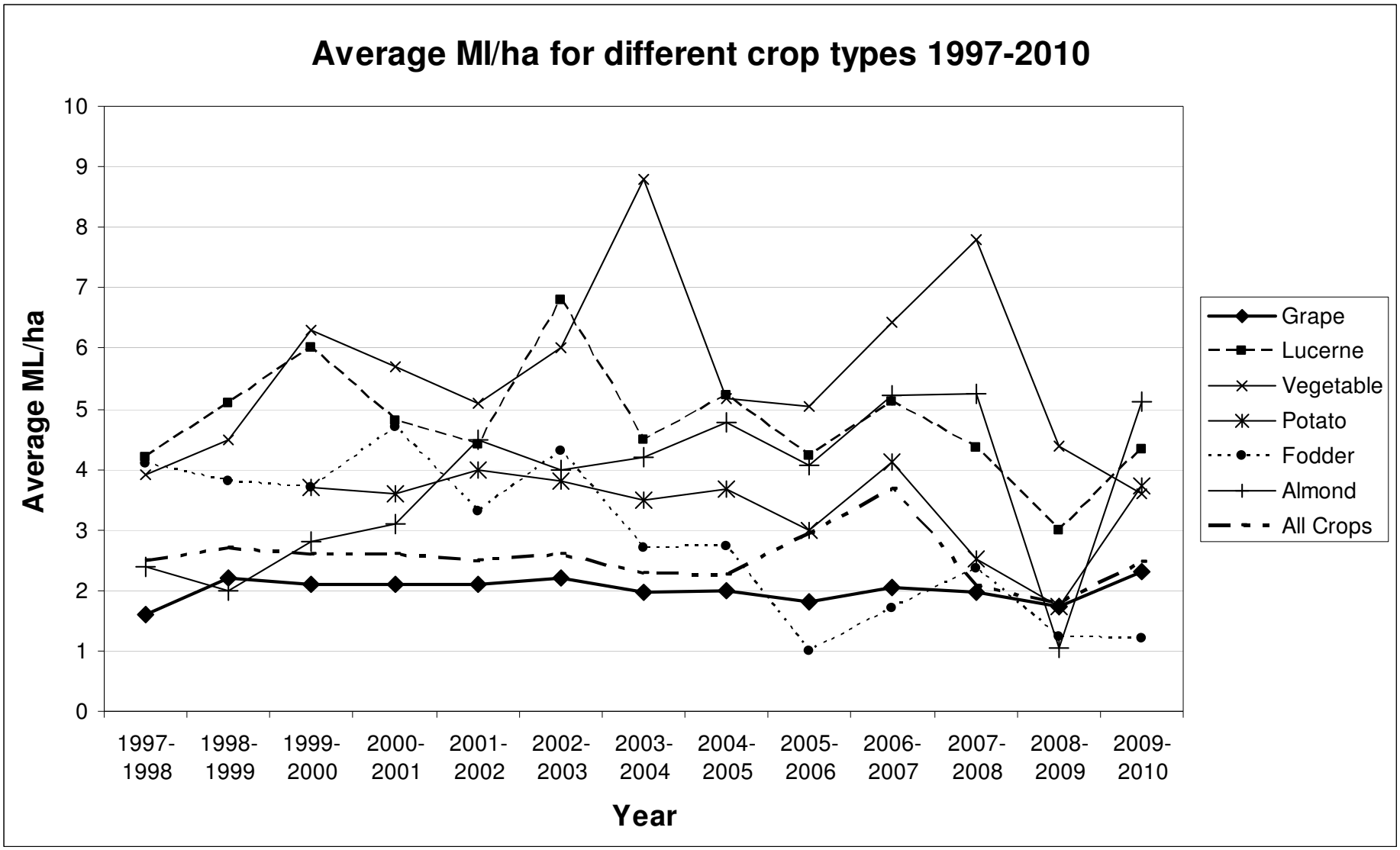

Average Ml/ha for different crop types 1997-2010
Average ML/ha
10
9
8
7
6
5
4
3
2
1
0
1997-1998
1998-1999
1999-2000
2000-2001
2001-2002
2002-2003
2003-2004
2004-2005
2005-2006
2006-2007
2007-2008
2008-2009
2009-2010
Year
Grape
Lucerne
Vegetable
Potato
Fodder
Almond
All Crops

Table 3 - ML used and ha irrigated comparison chart:-

	2009-2010	2008-2009	2007-2008	2006-07	2005-06	2004-05	2003-04	2002-03	2001-02	2000-01	1999-00	1998-99
Total ML	**16,241**	**12,001**	**14,743**	**20,911**	**15,811**	**17,719**	**17,154**	**20,715**	**17,428**	**17,467**	**16,961**	**16,509**
Total ha	**6,578**	**6,748**	**7,049**	**8,370**	**7,739**	**7,869**	**7,509**	**7,934**	**7,089**	**6,788**	**6,625**	**6,153**
Grape ML	13,718	10,738	12,330	12,827	11,293	11,.688	11,927	13,165	11,159	10,626	10,021	8,864
Grape ha	5,971	6,199	6,245	6,271	6,170	5,876	6,059	6,059	5,357	4,991	4,665	4,084
Lucerne ML	657	326	675	1,437	1,378	1,791	1,608	2,560	2,051	2,040	2,491	3,526
Lucerne ha	152	109	155	280	325	343	354	376	471	429	418	698
Veg ML	36	57	179	373	363	638	605	647	651	769	761	2,355
Veg ha	10	13	23	58	72	123	69	108	103	134	121	518
Potato ML	320	131	136	1,200	1,171	1,278	1,280	1,504	1,719	1,773	1,812	
Potato ha	86	75	54	291	392	348	360	394	425	490	485	
Fodder ML	47	32	53	222	144	505	399	752	316	742	358	906
Fodder ha	39	26	23	130	144	184	146	173	97	157	96	241
Almond ML	225	193	231	251	195	230	203	188	246	172	164	119
Almond ha	44	44	44	48	48	48	48	47	55	55	58	61
Other crops ML	1,238	524	795	2,004	900	1,589	1,132	1,899	1,286	1,259	1,354	738
Other crops ha	276	282	505	906	588	936	443	777	583	533	777	555

Chart (s) 18 a + b (Pg 21-22) These are contour maps of the Quaternary (Q) unconfined aquifer. The first is from the 2009-2010 water use year, the second from the 2008-2009 irrigation season. The shallowest reading from each monitoring site over the year or season has been mapped. The data for each map came from the growers monitoring wells and from Government Quaternary aquifer observation wells. The numbers on the maps are metres below ground level of the standing water table. These and the following charts were produced by the Dept for Water (formerly Dept of Water Land and Biodiversity Conservation).

Chart 19 (Pg 23) The next chart shows the potentiometric surface contours of the Tertiary (T) confined aquifer in March 2010 (post irrigation) and October 2010 (pre irrigation). The data for the chart came from the Government confined observation wells. There is a large difference in water level between the maximum drawdown at the end of the 2009-10 irrigation season and the recovered level prior to irrigation beginning again for 2010-11 even though extraction was relatively low compared with 2008-2009.

Chart (s) 20 a+ b (Pg 24-25) The salinity maps below shows the salinity contours of the confined aquifer. They were produced using the most recent value obtained from each monitoring point during 2009-2010 and 2008-09 respectively. The data for these maps comes from the Government observation wells and from the water samples submitted by the growers at the start and end of the irrigation season. The numbers on the maps are in mg/litre (same as ppm). Salinity values appear to have increased in many parts of the region since 2008-2009. However, in some areas nearer to the lake, the salinity has lowered.

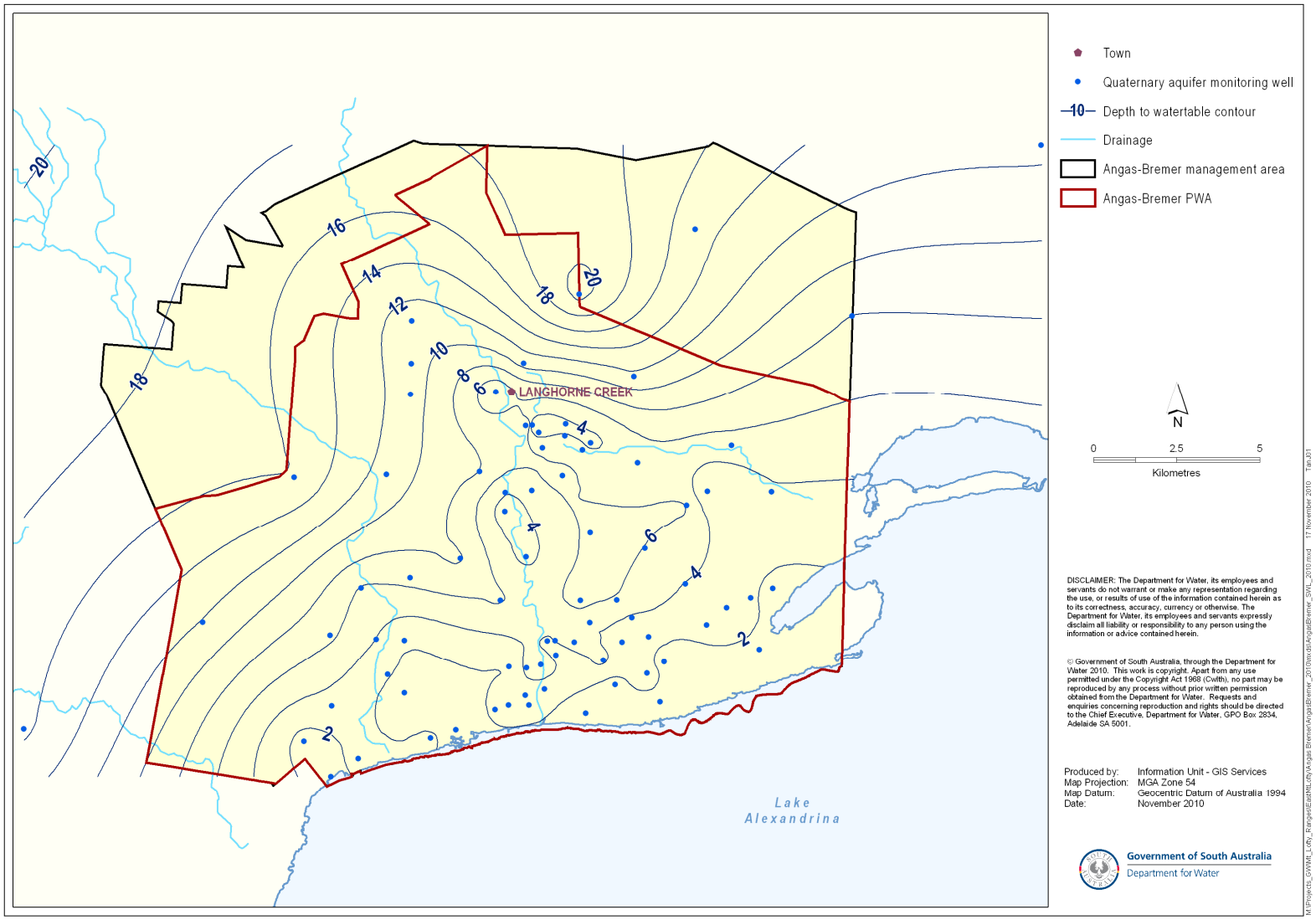


Chart 18a Standing Water Level in Quaternary Unconfined Aquifer 2009-2010

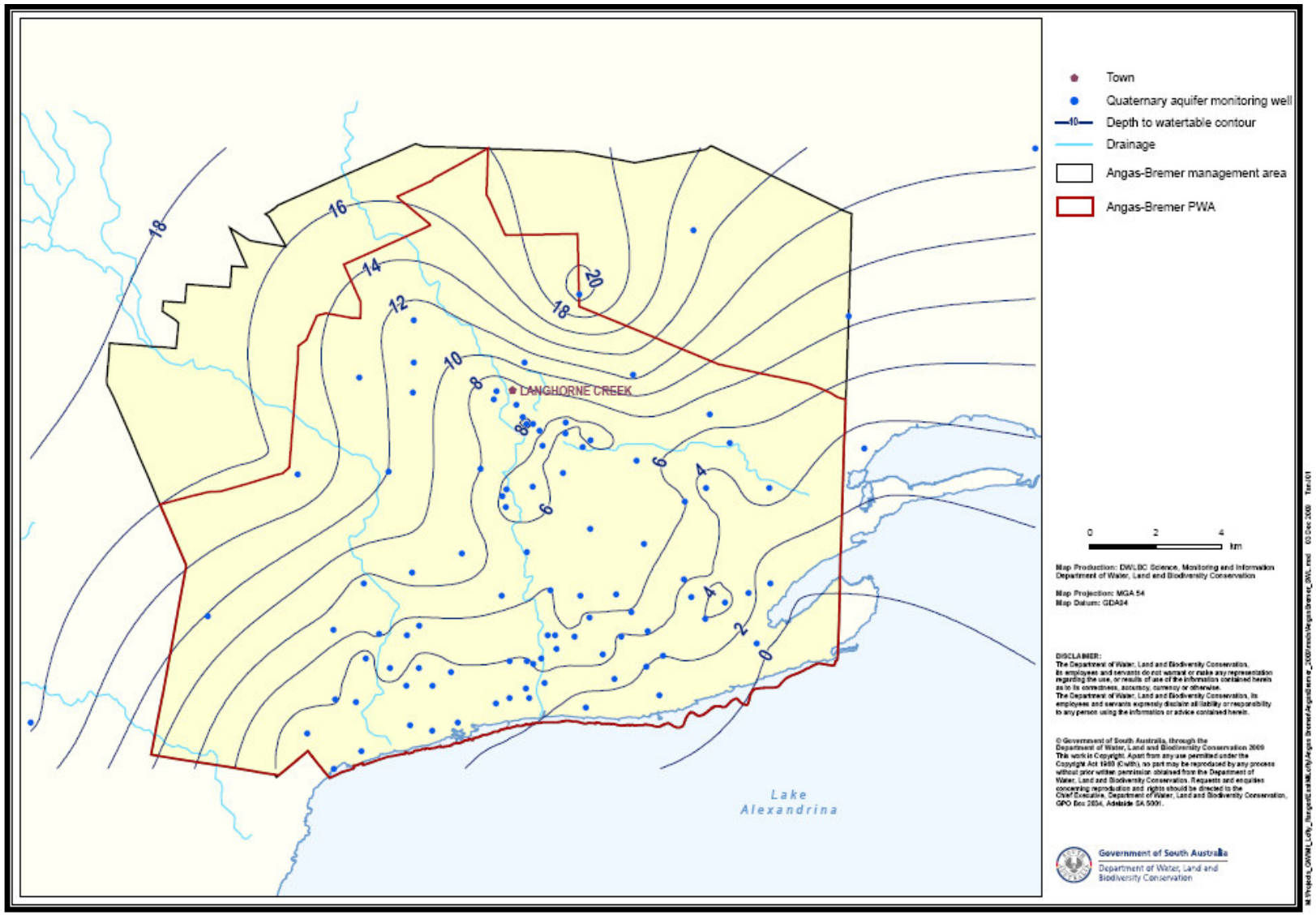


Chart 18b Standing Water Level in Quaternary Unconfined Aquifer 2008-2009

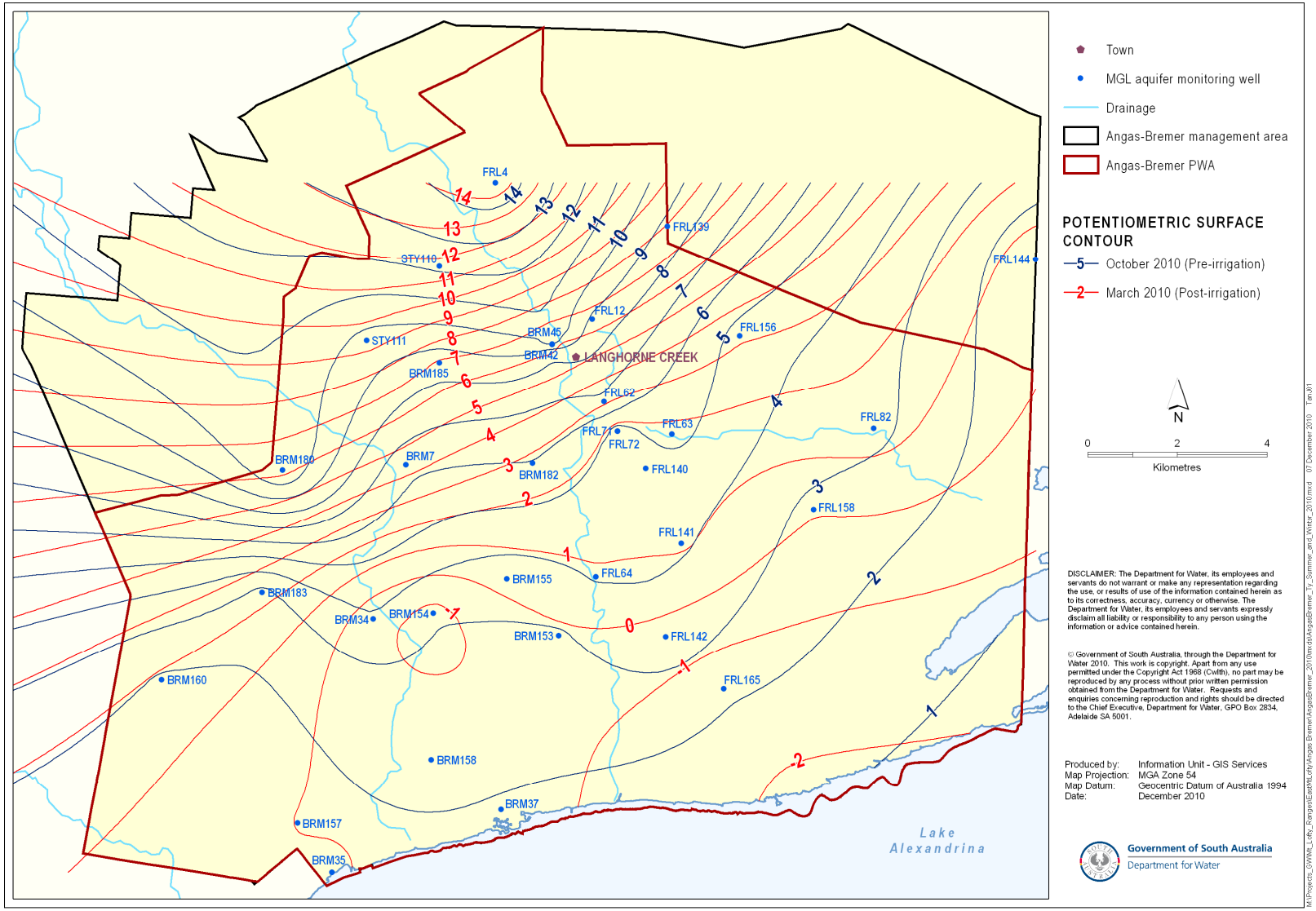


Chart 19 Potentiometric Surface in Tertiary Confined Aquifer Post (March 2010) and Pre (October 2010) Irrigation

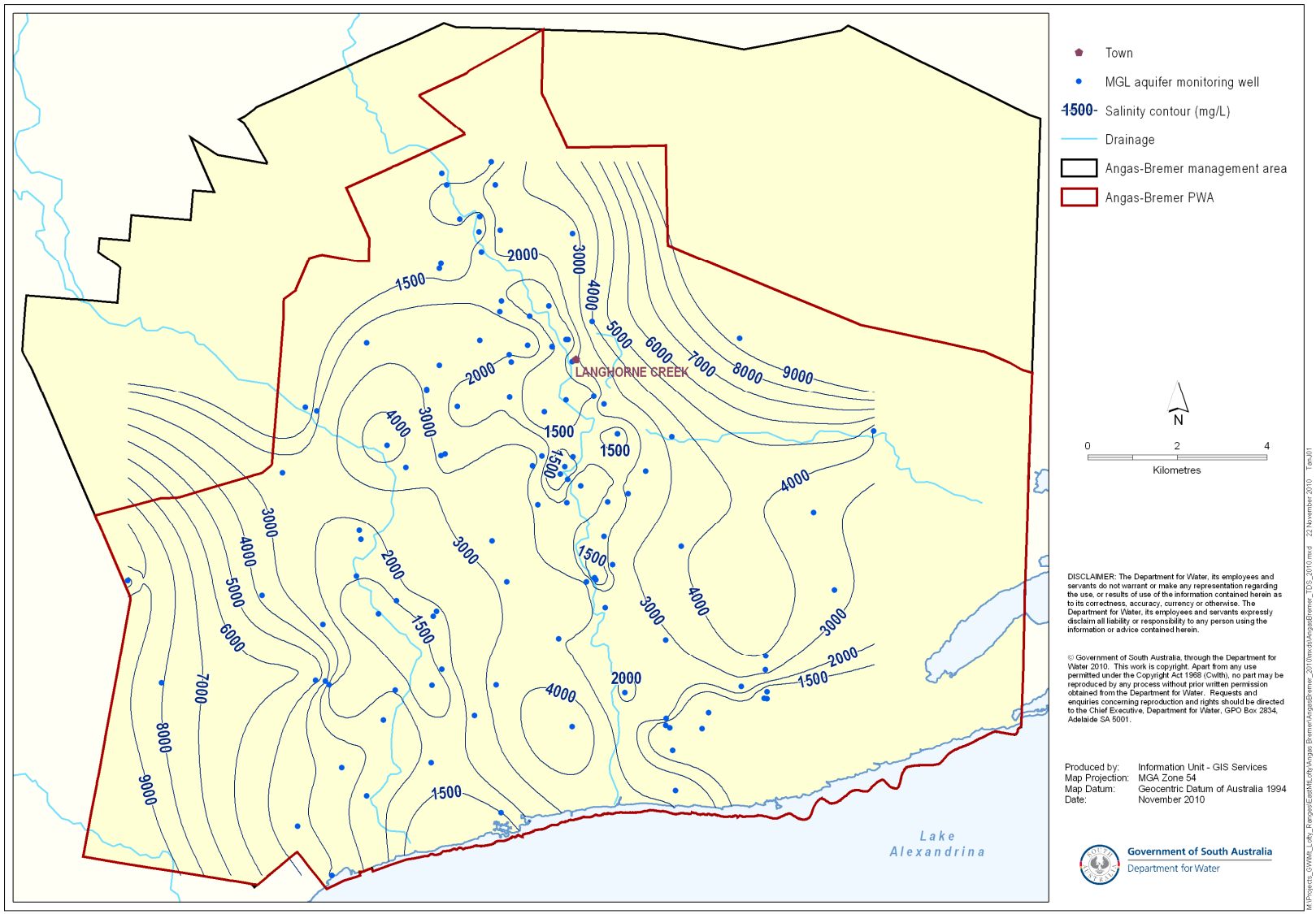


Chart 20a Salinity contours in Tertiary Aquifer 2009-10

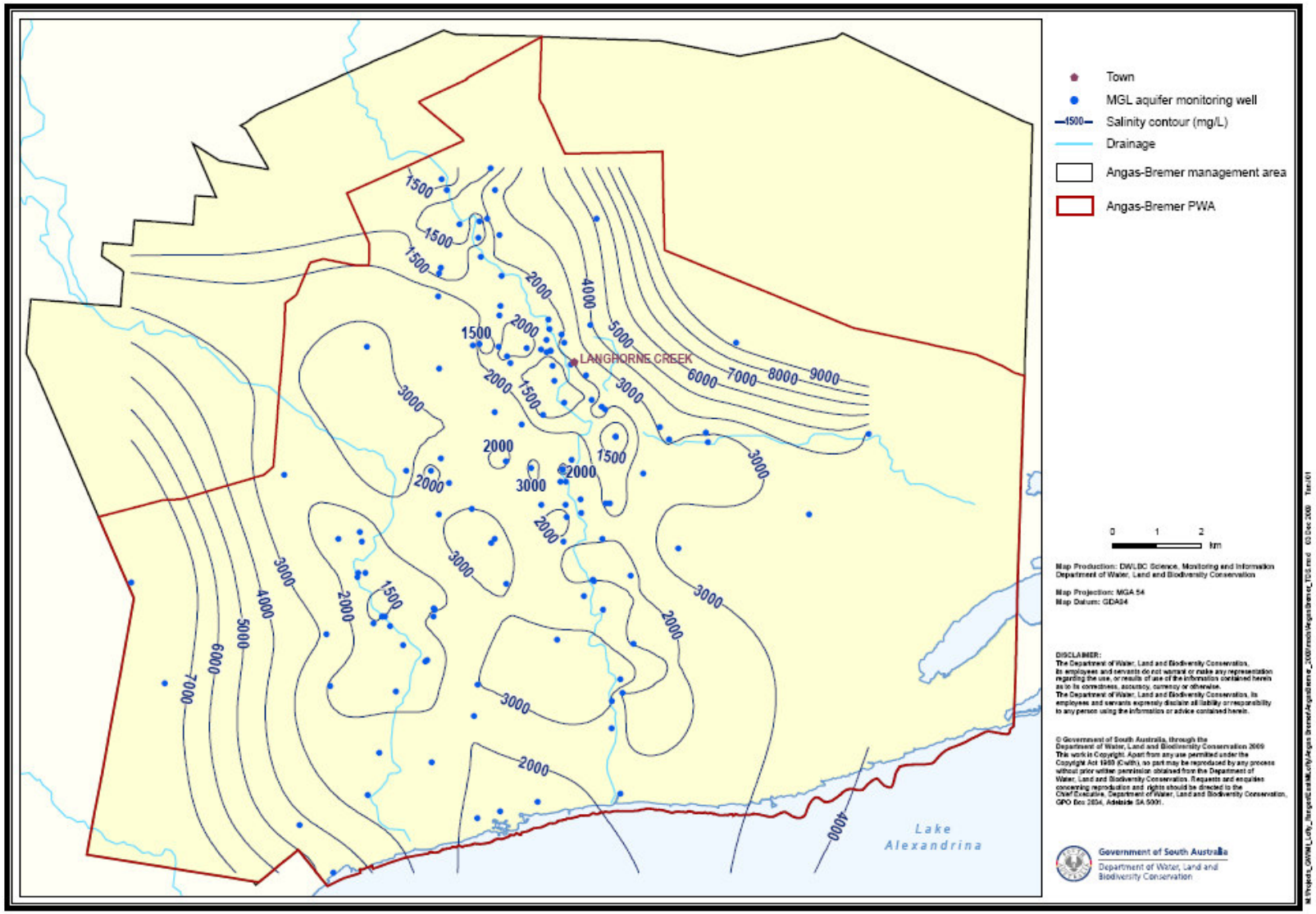


Chart 20b Salinity contours in Tertiary Aquifer 2008-2009

Langhorne Creek Weather Station Statistics

Background

An automatic weather station owned and operated by the SA Murray-Darling Basin NRM Board was installed at Lake Breeze vineyard in November 2006 and has been collecting local weather information since this time.

The Langhorne Creek station is part of an extensive automatic weather monitoring network operated by the NRM Board that consists of 29 automatic weather stations and 7 rainfall only monitoring sites. All sites report data to a dedicated website on an hourly basis which is available for viewing at: www.samdbnrm.sa.gov.au/Portals/7/AWMN/awsview.php

2009/10 Seasonal Summary

As illustrated in **Chart 21**, 420.8mm of rainfall was recorded at the Lake Breeze station during 2009/10 (July – June) which was significantly higher than the 2008-09 figure of 304.4mm. The 2009/10 evapotranspiration levels were slightly higher than those recorded in 2008/09 however the overall evaporative deficit level (evapotranspiration – rainfall) was significantly less due to the increased rainfall received during 2009/10.

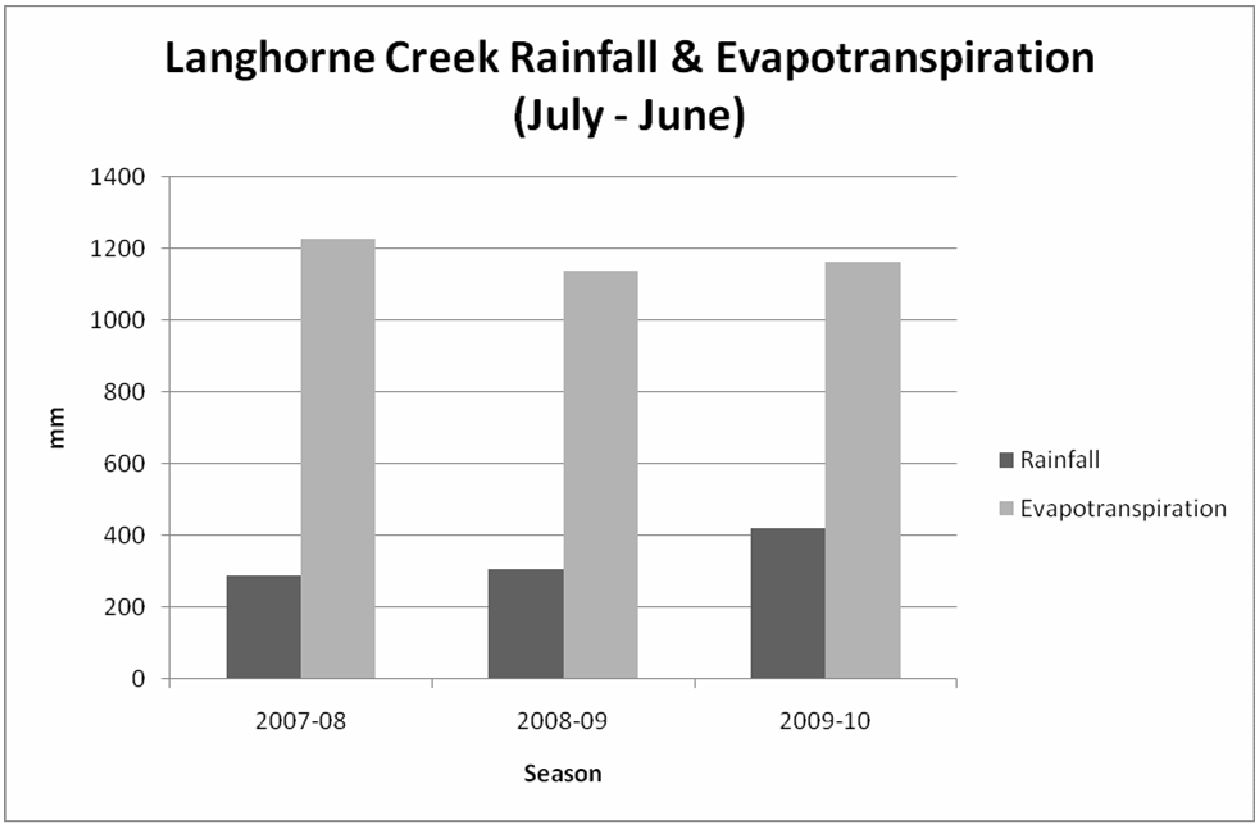
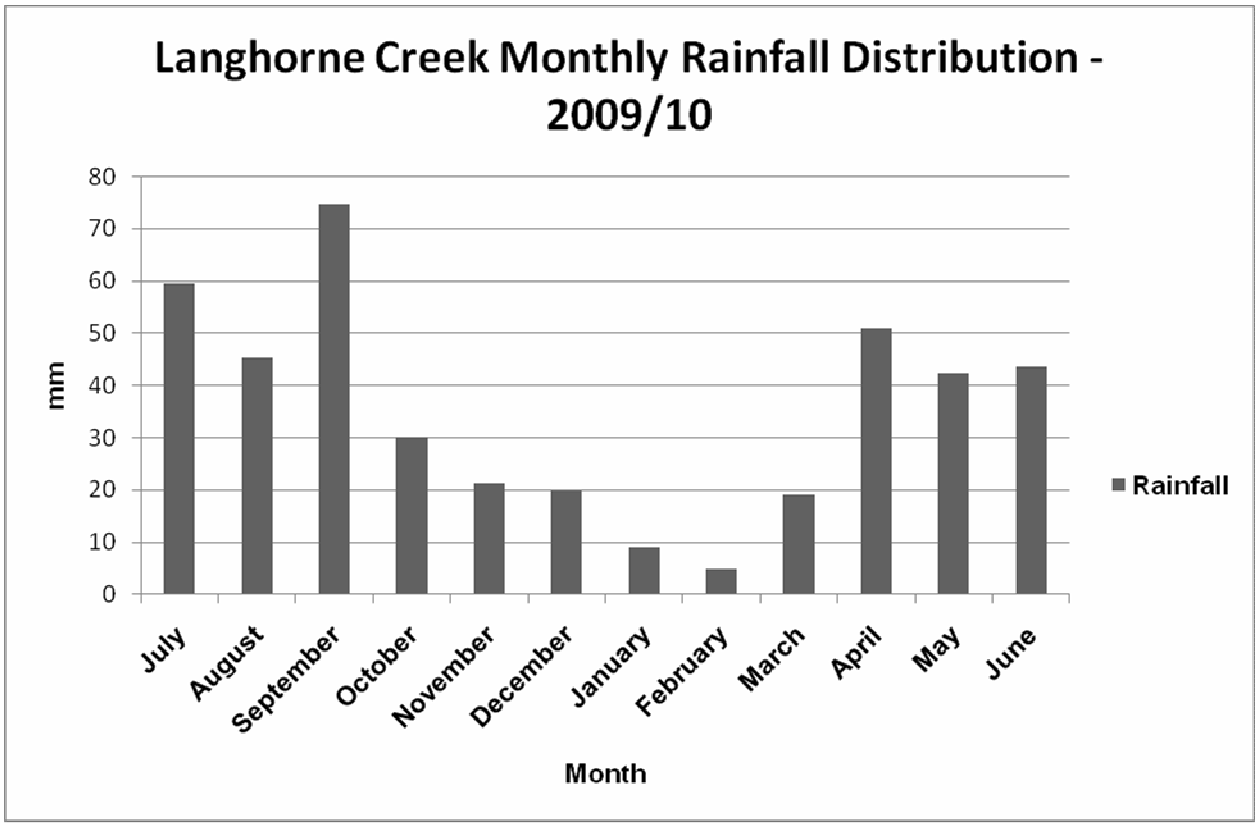


Chart 22 indicates that the large majority of 2009/10 rainfall was received outside of the active growing season but this is fairly typical for the region. The November – March period which coincides with the peak irrigation season for wine grapes recorded 74.2mm of rain.



In terms of temperature extremes the hottest daily maximum recorded at the Lake Breeze site was 43.8°C on the 12th January 2010 and the coldest -2.8°C which was recorded on the 15th May 2010.

Interestingly the maximum daily evapotranspiration figure of 8.64mm was recorded early in the season on the 20th November which highlights that other parameters (principally wind) are key drivers of evapotranspiration rates and hence crop irrigation requirements.

Angas Bremer Water Management Committee
Annual General Meeting
30th August 2010
Langhorne Creek Football Clubrooms

Minutes

Attendees:
Sylvia Clarke, Mardi Van der Weilen, Cameron Welsh, Tom Mowbray, Andrew Emmett, Steve Barnett, Hugh Middlemis, Rick Trezona, Ray McDonald, Terry McAnaney, John Pargeter, Sam Newell, Bruce Nelson, Dennis Clements, Darren Aworth, Tony Cleggett, Brett Cleggett, James Stacey, David Eckert, Tom Keelan, Ken Follett, Don Nelson, Mark Cleggett, Dale Wenzel, George Borrett, Colin Cross, Mark Potts, Randall Follett, Graham MacGillivray, Trevor McLean, Tony Nurse.

Apologies:
Rob Giles, Len Case, Brad Case, John Follett, Bryan Wyatt, Guy Adams, Rob Tonkin, Barry Potts, Bill Potts, Mac Cleggett, Roger Follett, Tim Follett.

Meeting opened: 7:40 pm

Chairman's report:
The Angas Bremer Water Management Committee have met every month and have had another busy year but we have been frustrated with having to deal with a lack of future funding which will be explained a little later. We trust that we have handled the district's water resource issues to your satisfaction but to fully represent your interests it is essential that we have your input and therefore we encourage your proactive involvement in today's meeting.
Over the past year the region's position with water resources have improved with the new pipeline, improved rainfall and allocations (pity the wine industry has not enjoyed the same improvements) however we are on the eve of some high impact changes to the regulations governing our water availability. The vastly improved water quality from CPC was most welcome and came just in time for the last season. Not only has this high quality water been directly irrigated we have seen considerable volumes recharged into the aquifer with vast improvements in water quality in localised areas of the basin.
We are all familiar with the requirement for the Eastern Mount Lofties Water Allocation Plan and the Murray Darling Basin Authority's Basin Plan and the process to date. Full details of the current EMLR draft WAP is yet to be released. The current draft is with the new Minister, and will be released to the public once he has signed off on the draft. Public consultation will occur thereafter. In our last public meeting there was strong support for the details of the Department of Water modelling utilising the model developed by Aquaterra to be considered prior to the final draft being completed and released. We will today hear from Hugh Middlemis and Steve Barnett and no doubt you will have some questions for them. After their presentation and subsequent discussion we the Committee will seek the guidance of this meeting. We will thereafter make representation to the Minister via the NRM Board as to the current contentious points of the draft WAP. Please have you say today.
The release of the MDBA's Basin Plan has been delayed as we all know, largely because of the election. We trust it will be made public very soon after the formation of a Government. The detail of the plan has been speculated upon for some time now and no one outside of the Authority and Government is in the know but is fair to say that a permanent cut to the current allocations is highly likely. The cut is unlikely to be consistent throughout the Basin as each water resource within the Basin will be analysed and cut as

the water balance dictates. Whilst a permanent cut to our water licence as we once knew it is unpalatable one would hope that it will put more reliability into the supply and quality of what licence volume remains and will be in fact a benefit to us all, particularly as we are on the bottom end of the system. As with the EMLRWAP there will be public consultation period once the Plan is released and to this cause the Committee will assist in the facilitation of a unified and strong regional response. It is critical that you have your say.
During the year the Committee has be made aware of severely reduced funding from the SAMDNRM Board. We have had numerous discussions with Board staff and the Chair Bill Patterson but without improving their funding position. Whilst NRM levies go up and spending on water issues come down it is apparent that the dramatically reduced and uncertain funding by the State Government is the main cause. The NRM Board have undertaken to assist in our grant applications and to provide in kind support for projects such as our new full stop project. Our Treasurer Rick Trezona will make a brief comment on this in his report a little later however in brief we have the funds to operate until June 2011 and thereafter our future is in some doubt without new funding sources. We have carefully looked at our current activities and have reduced expenditure in all areas, including cutting some monitoring that was not absolutely necessary and are also actively pursuing all alternative sources of funding including the various grant schemes. Sylvia Clarke has been very busy putting grant applications together. I would seek your advice and wishes in regard the future of the Committee - either later in this meeting or afterwards directly with myself or any of the Committee members.
Included in this meeting's papers was information in regard the new automated monitoring installed recently by the NRM Board on the Bremer River. The paper contained the website details and navigation advice together with a phone number to call in case of problems. You are encouraged to utilise this website.
Sylvia Clarke will report on our Annual Irrigation Report later on in this meeting. A larger number of returns were received on time however Sylvia did need to follow up with many irrigators. May I take this opportunity to remind you that the completion of our annual irrigation report is a component of our Code of Practice and thus is an essential part of complying with water licence requirements.
In closing I would like to thank our Secretary Barb Blaser, our Project Coordinator Sylvia Clarke, and all Committee members - in particular Rick Trezona and Colin Cross, and to make mention and thank Sarah Keough who left the Committee recently and to thank Lyz Risby of the NRM for her past involvement with the Committee. Lyz has moved to the Department of Water. Cameron Welsh and Michael Cutting will continue to represent the NRM Board on the Committee. We welcome their continued involvement.

John P Pargeter
Chair – Angas Bremer Water Management Committee

Mardi Van der Wielen (SAMDBNRM Board) discussed Environmental Water Requirements for surface waterways in the Eastern Mt Lofty Ranges.
See attached extract of slides. A full copy of the presentation can be obtained by contacting the ABWMC project coordinator or SA MDB NRM Board.

Hugh Middlemis (Aquaterra) and Steve Barnett (DFW) discussed the hydrological model for the aquifers.
See attached extract of slides. A full copy of the presentations can be obtained by contacting the ABWMC project coordinator or Steve Barnett at DFW.

An independent reviewer has looked at the model and claimed that the aims for the model were ambitious but the model was sound, and suitable and good enough for its current purpose.

The model currently has relatively good calibration. It needs good data on injection, extraction and salinity for it to work well. It would also be useful to know the likely volume of water to be injected over the next 10 years and where it is likely to go in. Irrigators were encouraged to collect as much detail as they can of what they are doing in terms of injection and extraction of water. The committee could facilitate the collection of such information from the community if the NRM Board would assist.
13.5GL injection and extraction was trialled as a scenario because it represented the most extreme situation likely to occur. This scenario resulted in a small issue of rising saline water table near the lake and generally decreased salinity in the confined aquifer over time.
It takes 2-4 days to run a scenario as a volume and length of time need to put against every bore hole.
A little more interrogation of the model is needed before final decisions can be made for the WAP.
It was noted that more realistic numbers for injection should be tested in a scenario and that it was unlikely that the full 6,500ML on allocation would be taken from the aquifer because in some areas it is unusable.
Overall, it appears that the future of irrigation in the district without ASR is not rosy and that ASR is the future of the district.

There was a 10 min break and the meeting resumed at 6pm.

Jarrod Eaton discussed the current status and future of the River Murray.
The carryover policy is likely to remain permanently.
A question was raised as to whether water would flow back into Lake Alexandrina if the Goolwa Channel was opened. The answer was that it shouldn't.
It was noted that Lake Albert at full supply requires 270GL. Only about 120GL would be needed to reach +0.75m.
The new Dept for Water was explained. DWLBC split on 1st July and the NRM sections (150 people) have moved to Dept for Environment and Natural Resources (DENR) leaving staff with a dedicated water focus. A Memorandum of Understanding was signed with SA Water relating to roles and responsibilities, leading to some shifting of roles. DFW, DENR and SA Water are now all under Minister Caica.
Information can be found at www.waterforgood.sa.gov.au.

Project Coordinator Sylvia Clarke gave a presentation of the interim Irrigators Annual Report and an update of the committee's other projects

Rick Trezona- treasurers report
The financial report to June 2010 had been circulated with the notice of meeting.
There has been a loss over the year of $7000. With limited funding available, the committee currently has a problem in terms of remaining sustainable, but is in a solid position at the moment. Rick expressed that committee members and irrigators need to actively support Sylvia when she compiles funding applications. The financial report was accepted by the meeting.

The Chair asked for comments relating to the future of the committee.
Ray McDonald stated that it would have been very difficult for the government to get the original cuts in allocations without a committee. It is important for the committee to keep going. It has a history of doing the right thing.
These comments were supported by Ken Follett.

The issue of NRM boards deserting the committee and deserting weeds and feral animal issues while raising levies was raised.
The Mallee Irrigation Area has a levy of $4/ML which is used to fund staff to carryout monitoring and Annual Reporting and is spent only in the Mallee area. This arrangement appears to work well.
The levies raised in the Angas Bremer Area go to the NRM Board. The current issue with funding is that the funds for water projects previously came from the State Government. This had now dried up meaning that the levy funds need to be spread over a wider area.
The poor turnout at the meeting was discussed. Most attendees were in favour of the earlier timeslot.

Election of Committee Members

Retiring members:
John Follett, Rick Trezona, Bryan Wyatt, John Pargeter and Phil Reilly were all due to retire by rotation.
John Follett had previously indicated that he is not seeking re-nomination. Bryan Wyatt, John Pargeter and Phil Reilly had earlier indicated that they would stand for re-election and were renominated at the Annual Public Meeting and accepted.

Nominations for committee:

1. Dale Wenzel had previously been nominated.

Nominations were called from the floor. Michael Clements was nominated by James Stacey. This was seconded by Rick Trezona and accepted.

The Chair nominated Rick Trezona to fill the casual position left by Sarah Keough for 12 months. This was seconded by Graham MacGillivray.

The Chair moved that they all be accepted for positions on the committee. Seconded – Colin Cross. Carried by the meeting.

General Business
There was no general meeting.

The outgoing Chair thanked all for attending

Meeting closed 7:10pm.

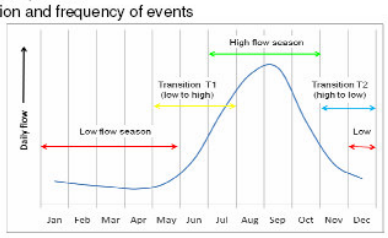
Mardi Van der Wielen, SA MDB NRM Board.
Environmental Water Requirements. Presentation Extract.

Environmental Water Requirements (EWRs)

The water regime needed to sustain the ecological values of aquatic ecosystems at a low level of risk

Key parts of EWRs:

- Flow seasons
- Flow components
- Duration and frequency of events



Example of environmental water requirements for Mountain Galaxias

Process	Water requirements
Refuge pools stay wet	Groundwater inflow & low flows over Low Flow Season
Refuge pools not too salty	Freshes over Low Flow Season to reduce salinity in refuge pools
Refuge pools stay deep enough	Bankfull flows to scour out silt and maintain deep pools any time
Movement between pools for breeding and recolonising	Freshes and high flows to link pools for Transitional flow seasons and High Flow Season (autumn to spring)
Clean areas to lay eggs	Freshes to flush silt in Transitional 1(low-high) season (late autumn)
Triggers to spawn	Increased flows in Transitional 1(low-high) season
Discourage exotic fish	High and bankfull flows to wash them out any time

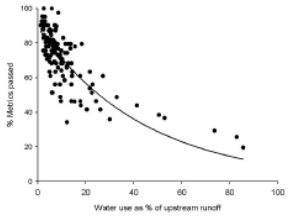
- Expert panel worked out environmental water requirements for major groups of fish, bugs and plants – "functional groups"

Turning words into numbers

- Need to express EWRs as numbers
- Picked 45 measures or "flow metrics" that represent environmental water requirements – for example:
  - » Average length of zero flow in low flow season
  - » Average frequency of freshes in high flow season
- Set limits or targets for each metric
  - » Metric "passes" if value is within acceptable limits
  - » Metric "fails" if value is outside limit→ that environmental need is not being met
  - » Percentage metrics passed at a site shows overall impact on flow regime there

Are EWRs currently being met?

- Meeting EWRs = passing 100% metrics at a site
- Looked at impact of current development at 135 sites
- Average % metrics passed at a site is 68% (only 2 sites passed 100%) → EWRs generally not being met



Are EWRs currently being met?

- Meeting EWRs = passing 100% metrics at a site
- Looked at impact of current development at 135 sites
- Average % metrics passed at a site is 68% (only 2 sites passed 100%) → EWRs generally not being met

Season	Average % metrics passed
Low flow season	51%
Transitional 1	66%
High flow season	83%
Transitional 2	64%
Bankfull (any time)	96%

- Reduced low flow level (passed these metrics at only 16% of sites over all seasons)
- Delay of T1 (28% of sites passed) and truncation of T2 (47% of sites passed)
- Reduction of frequency and duration of freshes in low, T1 and T2 seasons

Requirements vs provisions

- Environmental water requirements = passing 100% metrics
- Not likely to be achievable in the current landscape
- Set environmental water provisions that balance social, economic and environmental needs for water
  - » Environmentally sustainable extraction rules that meet ecological objectives (maintain self-sustaining, resilient populations)
  - » What are acceptable ecological outcomes that meets the objectives?
  - » How does this relate to the metrics?
  - » Look at environmental monitoring data – ecological condition vs metrics for different sites

Environmentally acceptable outcome

- Environmental water requirement (low level of risk to ecosystems and processes)
  - » Pass 100% of metrics – already allows significant deviation from natural flow
- Environmentally acceptable outcome (acceptable risk, balancing against existing demands)
  - » Pass at least 85% of metrics at the majority of sites where scenario testing is done
- Next step – converting this to an extraction limit

Sustainable extraction limit

- Use surface water model to assess different combinations of usage (from dams) and diversion rules (returning low flows)
- See which combination(s) meet the requirement (passing 85% of metrics at majority of testing sites)
- Results:
  - » Extraction limit is 10% of runoff (zone scale); plus
  - » Low flows returned or bypassed around licensed dams and watercourse diversion points

Steve Barnett, DFW. Presentation Extract.

ANGAS BREMER GROUNDWATER MODEL

What does the model tell us about our management issues ?

Steve Barnett
DFW

Management Issues

- Is recharging volumes of 13.5 GL/yr feasible ?
- Should ASR be permitted south of Ballandown Road ?
- Is extracting 6500 ML/yr sustainable into the future ?
- How much recharged water should remain in the aquifer ?

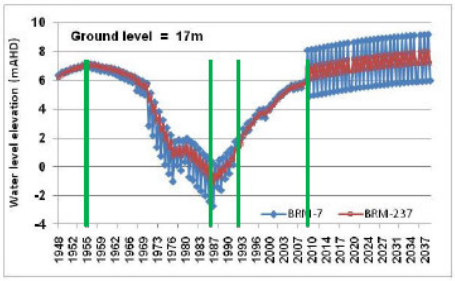
Is recharging volumes of 13.5 GL/yr feasible ?

Scenario 1

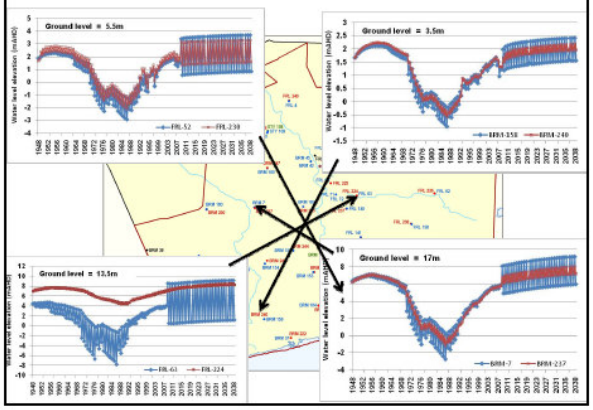
- 13.5 GL winter injection in 40 existing designated ASR bores.
- 13.5 GL summer extraction from the same 40 existing designated ASR bores.
- 2004/05 extraction regime.

Is recharging volumes of 13 GL/yr feasible ?

Scenario 1



Scenario 1 13.5 GL in and out



Is recharging volumes of 13.5 GL/yr feasible ?

- Limestone pressure levels show greater seasonal variation than before.
- Limestone pressure levels rise gradually to up to 5m higher than historical levels (but still below ground level).
- Upward leakage causes watertable to rise.
- No significant adverse impacts.

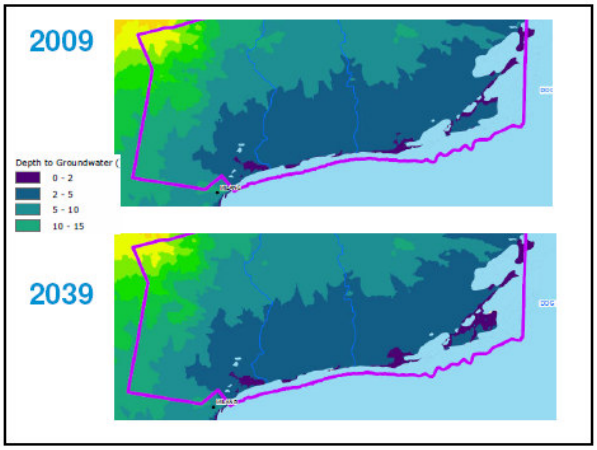
Government of South Australia
Department for Water

Should ASR occur south of Ballandown Rd ?

Previously restricted due to risk of rising watertable;

- 80% of wells have significant clay in 5m above Lst.
- Watertable levels fallen due to low lake level and below average rainfall.
- Model shows watertable levels should not rise above historical levels with 13.5 GL injected.
- Model also shows no significant increases in the area of WT less than 2m below ground.
- Restriction should be lifted.

Government of South Australia

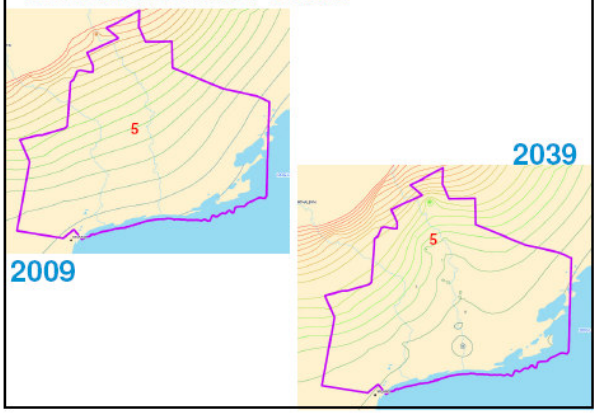


Is extracting 6500 ML/yr sustainable?

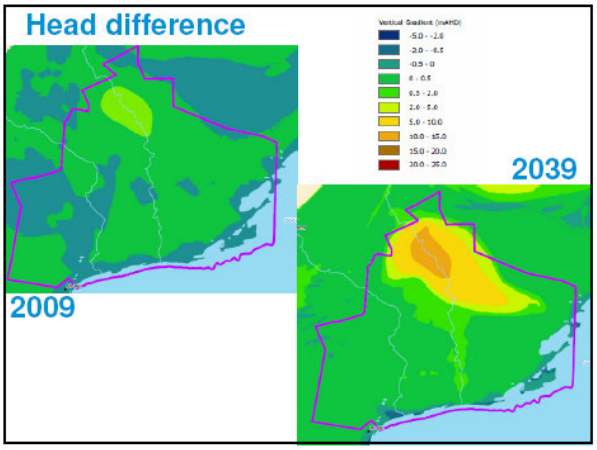
- Flow model indicates increase in downward leakage in some areas.
- This will cause salinity increases in these areas.

Government of South Australia
Department for Water

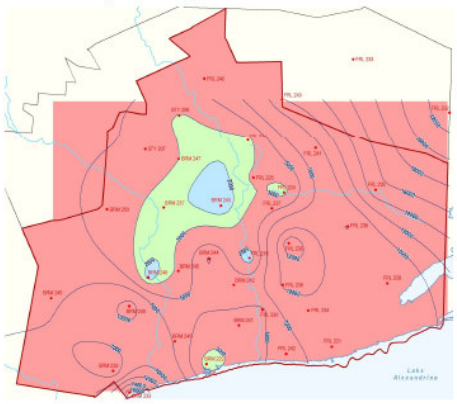
Limestone water levels



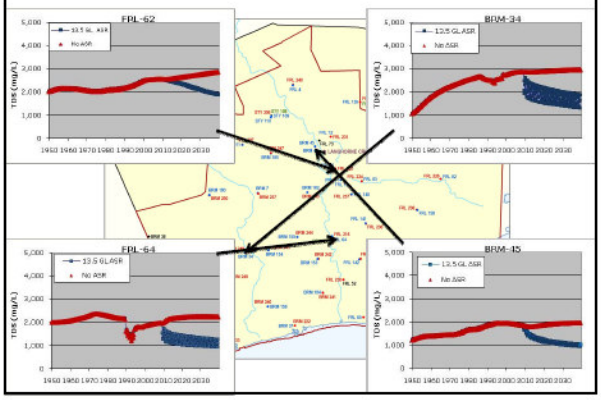
Head difference



Quaternary salinity 2007



Scenario 3 6,500 ML, with ASR and no ASR



Is extracting 6500 ML/yr sustainable?

- Need further modelling using likely recharge volumes (not 13.5 GL) and possible future drought ie pumping 1500 ML/yr for 5 years, then 6500 ML/yr for 3 years.
- Solute transport model need refinement around the boundary. This may change some salinity responses.

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How much recharged water should remain in the aquifer ?

- Modelling suggests very little difference between 100% and 80% recovery.
- Animation shows long term freshening with 100% recovery

Government of South Australia
Department for Water

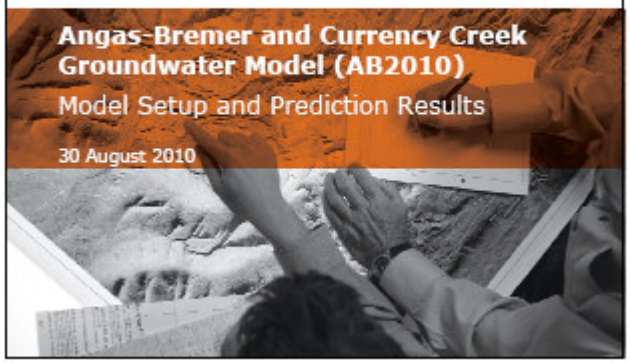
Hugh Middlemis, Aquaterra. Presentation Extract.

aquaterra
Water and Environment

Angas-Bremer and Currency Creek Groundwater Model (AB2010)

Model Setup and Prediction Results

30 August 2010



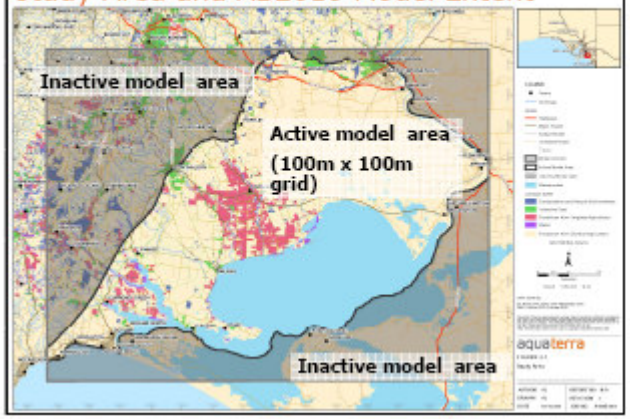
Outline

- Model Purpose and status
- What does AB2010 model "look like"?
- Data inputs & hydrological processes
- History Match calibration/benchmark
- What model "can do" -> predictions

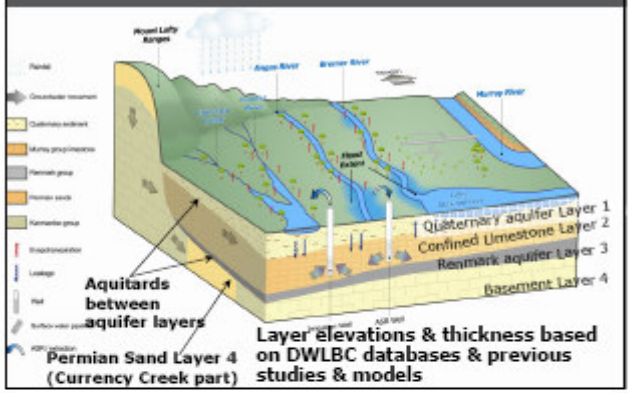
AB2010 Model Purpose and Status

- 3D numerical model to simulate groundwater flow & salt transport
- History-match to water level & salinity
- Predict flow/pressure/salinity effects from all influences (especially ASR injection and groundwater pumping)
- Status: model developed, compliant with MDBA Model Guidelines, and independent peer review completed

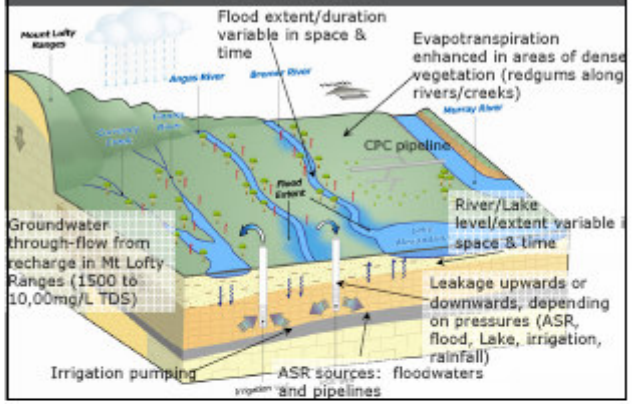
Study Area and AB2010 Model Extent



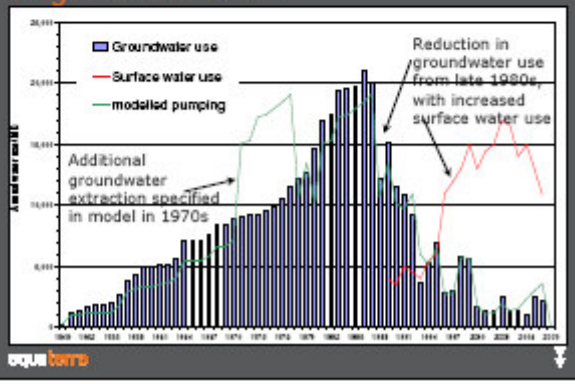
Aquifer Layers (with spatially variable properties)

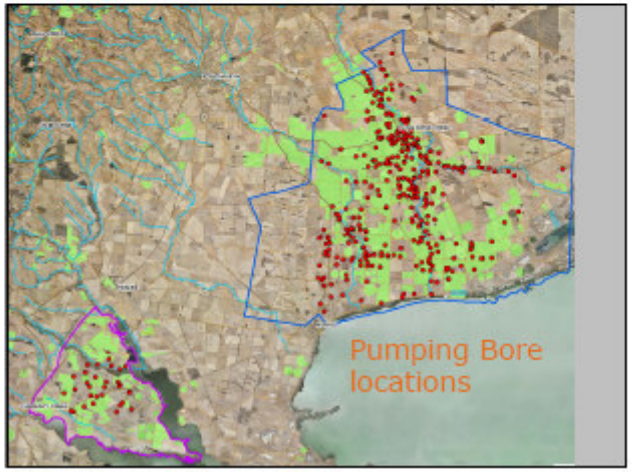


Recharge & Discharge Processes

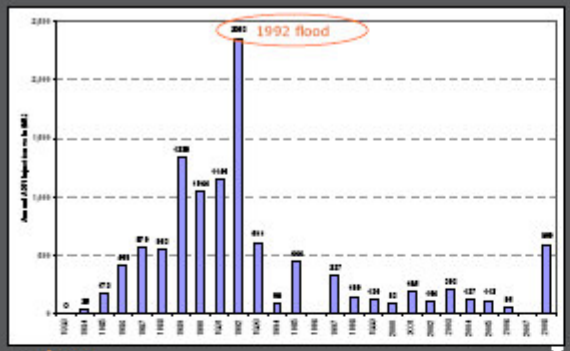


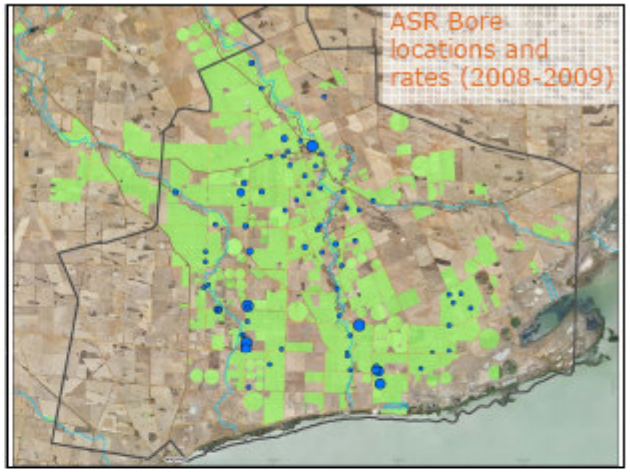
Groundwater & Surface Water Use; Angas-Bremer PWA





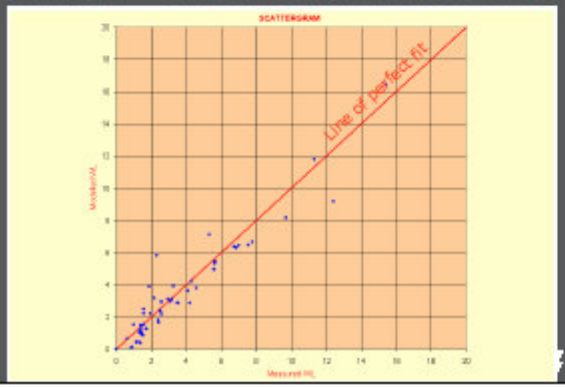
Aquifer Injection – Angas Bremer PWA





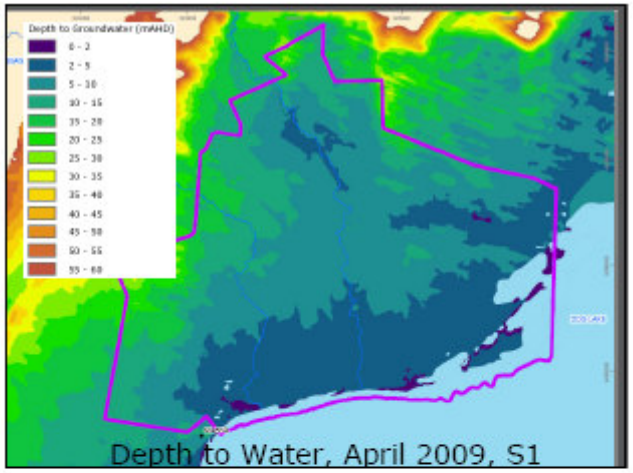
History Match 1948-1987-2009

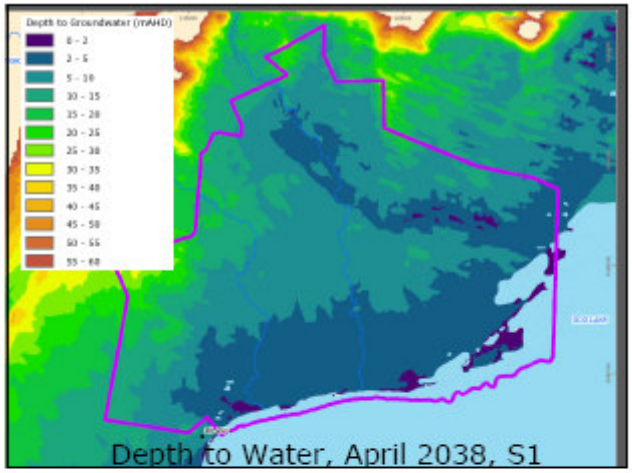
Scaled RMS = 6.5% at 2004 (guideline: 5%-10%)

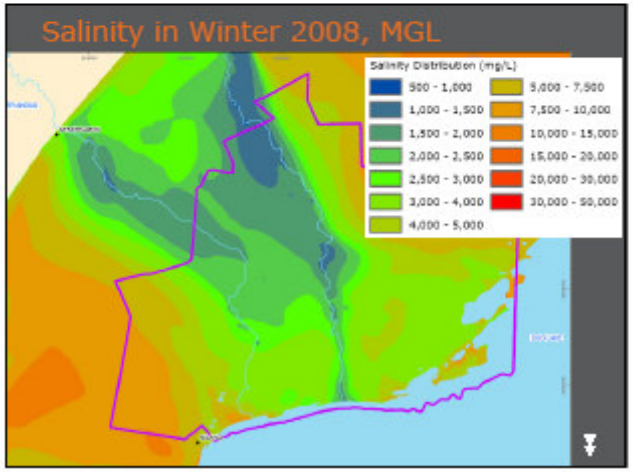


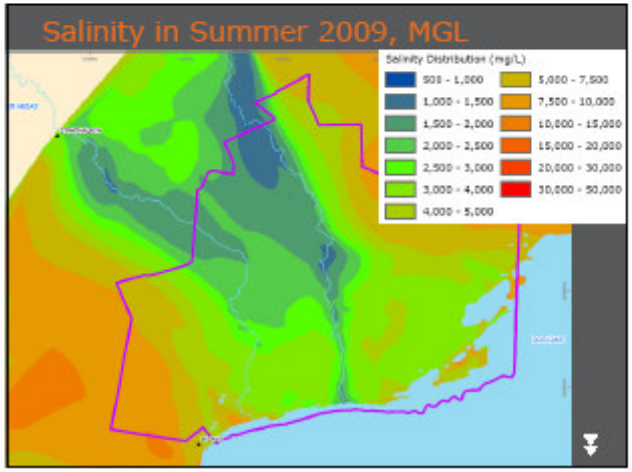
Prediction Scenario 1 – recharging and extracting 13.5 GL each year (with existing 1.5 GL extraction)

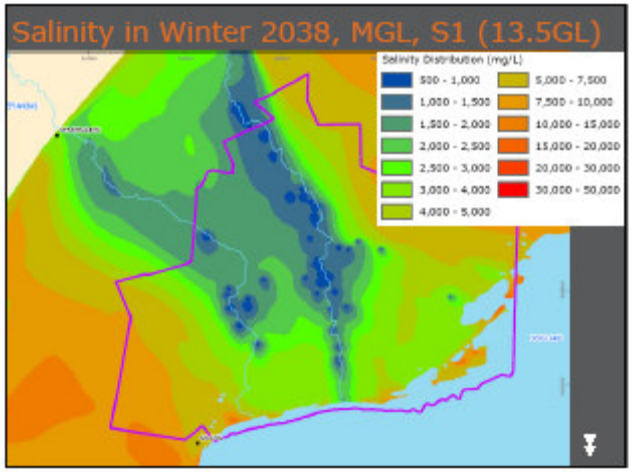
- Prediction starts at October 2009
- 2004/05 extraction (1566 ML/year) repeated every summer for 30 years
- 13.5 GL winter injection spread evenly across 40 existing ASR bores
- 13.5 GL summer extraction spread evenly across the same 40 ASR bores (extra to 1566 ML/year)

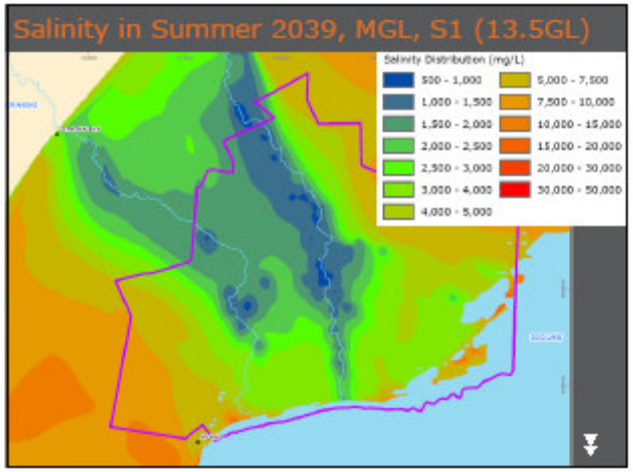

Depth to Groundwater (mAHD)
0 - 2
2 - 5
5 - 10
10 - 15
15 - 20
20 - 25
25 - 30
30 - 35
35 - 40
40 - 45
45 - 50
50 - 55
55 - 60
Depth to Water, April 2009, S1


Depth to Groundwater (mAHD)
0 - 2
2 - 5
5 - 10
10 - 15
15 - 20
20 - 25
25 - 30
30 - 35
35 - 40
40 - 45
45 - 50
50 - 55
55 - 60
Depth to Water, April 2038, S1


Salinity in Winter 2008, MGL
Salinity Distribution (mg/L)
500 - 1,000
1,000 - 1,500
1,500 - 2,000
2,000 - 2,500
2,500 - 3,000
3,000 - 4,000
4,000 - 5,000
5,000 - 7,500
7,500 - 10,000
10,000 - 15,000
15,000 - 20,000
20,000 - 30,000
30,000 - 50,000


Salinity in Summer 2009, MGL
Salinity Distribution (mg/L)
500 - 1,000
1,000 - 1,500
1,500 - 2,000
2,000 - 2,500
2,500 - 3,000
3,000 - 4,000
4,000 - 5,000
5,000 - 7,500
7,500 - 10,000
10,000 - 15,000
15,000 - 20,000
20,000 - 30,000
30,000 - 50,000


Salinity in Winter 2038, MGL, S1 (13.5GL)
Salinity Distribution (mg/L)
500 - 1,000
1,000 - 1,500
1,500 - 2,000
2,000 - 2,500
2,500 - 3,000
3,000 - 4,000
4,000 - 5,000
5,000 - 7,500
7,500 - 10,000
10,000 - 15,000
15,000 - 20,000
20,000 - 30,000
30,000 - 50,000


Salinity in Summer 2039, MGL, S1 (13.5GL)
Salinity Distribution (mg/L)
500 - 1,000
1,000 - 1,500
1,500 - 2,000
2,000 - 2,500
2,500 - 3,000
3,000 - 4,000
4,000 - 5,000
5,000 - 7,500
7,500 - 10,000
10,000 - 15,000
15,000 - 20,000
20,000 - 30,000
30,000 - 50,000

Angas Bremer Irrigators Revegetation Association Inc.

ABIRA is continuing to operate and is currently reorganising itself and pulling everyone together since properties have changed hands and people have resigned. John Cranwell is currently acting as Secretary for ABIRA and John Hodges is organising a meeting of the group.

Langhorne Creek Grape and Wine Inc

Environmental work has continued this year under the regional EMS program, Environmental Management in Viticulture – Langhorne Creek with support from the Goolwa to Wellington Local Action Planning Board. Activities have included the following:

- Rick Trezona attended the 5th Australian Wine Industry Environment Conference, including a field trip to the Barossa in September 2010.
- Lian Jaensch attended the Keep it Cool 2009 - national food safety and quality and environmental assurance conference in Launceston in November 2009 for an update on environmental and food systems.
- The national wine industry launched its environmental accreditation system, Entwine Australia, which has been taken up by many irrigators in Langhorne Creek. The Langhorne Creek Grape and Wine has provided assistance to grapegrowers to meet their Entwine requirements. Support has included a Nature Maps mapping workshop, a Carbon Calculator workshop, a generic recycling and waste management plan and the development of a Langhorne Creek vegetation and environmental assets reference map.
- A formal poster was produced explaining the climate change risk management planning undertaken by the group. The poster was presented at the 14th Australian Wine Industry Technical Conference in July and has been used to explain this activity to other groups.
- Three remnant vegetation photo monitoring sites have been established to track the impact of climate change. Photos are taken each 6 months.
- A demonstration re-vegetation site has been established at Cross Road, off the Strathalbyn to Milang Road. The re-vegetation has been quite successful and the site continues to be maintained.
- Langhorne Creek Grape and Wine hosted a group of about 30 participants on a field trip from the National Landcare Forum held in March. Two hours were spent showing and explaining environmental initiates of the region.

Activities will continue this year with support for Entwine Australia accreditation and a trial on Redgum health.