THE HYDROLOGICAL SOCIETY OF S.A. INC.

c/o Water Resources Branch
Box 1751, Adelaide, S.A. 5001

NEWSLETTER NO. 63

FEBRUARY 1990

GUEST EDITORIAL

DRYLAND SALINITY IN SOUTH AUSTRALIA

Saline seepage in South Australia is not new although its effects are now better recognised. Dryland salinity has degraded, we estimate, 225,000 ha or $195 M of agricultural land and this area is increasing. It is disturbing to go onto farmers properties who have had to watch the best part of their land become saline over the past five years and expect more to be degraded. Land-holders in many of these areas (Kangaroo Island, East Mount Lofty Ranges, Meningie, Upper South East, Mid North, Lower Eyre Peninsula, Upper Eyre Peninsula) have recently formed land care groups to bring community action in catchments to manage the problem.

What solutions have we been able to develop for them? From a ground water management point of view, very little. The Department of Agriculture has spent the past five years developing techniques to manage the discharge areas. Salt land agronomy is well developed and while important in stabilising and rehabilitating salt scales, it does not stop the ground water process which is making scalds occur. I am pleased a Dryland Salinity Committee was formed from the major organisations with expertise that can be used to combat the problem (Department of Agriculture, Mines and Energy, E. & W.S., Environment and Planning, CSIRO Division of Soils and Water Resources Centre for Research in Ground Water Processes and Waite Agricultural Research Institute). This committee has developed an integrated approach towards tackling the dryland salinity problem. The strategy sets out to determine the size of the current area and potential area affected, rate of the change occurring to that area, and defining and developing options for treatment of different hydrogeological provinces in S.A. The approach includes determining methods of management of recharge and discharge areas in affected catchments.

Will it be in time and will it solve the problems? While we have some simple solutions which help with the discharge areas (trees, salt tolerant grasses, structural works), we do not have scientifically based answers for the recharge areas, only broad "best bet" solutions. This requires a concerted effort by the hydrologists amongst us working with geologists, soil chemists, agronomists and foresters to develop with the landholders economic catchment plans. We cannot have these disciplines working in isolation from each other and from the landholders. Management plans have to have a sense of reality in them recognising the social as well as the physical constraints to various treatments, otherwise they will not be adopted, particularly by those landholders in the upper reaches of catchments. We must also be sure the treatment we recommend will provide the changes to the water balance we predict in the landscape.

It is not easy to determine what is occurring in catchments, but the problem has to be tackled urgently. We have a number of joint initiatives in place between these organisations and we encourage

others to join. There are many small and large issues which need to be answered (student projects through to catchment programs) in a logical sequence.

By 1995 we need to know the size of the problem, be able to monitor change and understand the hydrogeologic processes, and by 2000 have in place scientifically based whole catchment plans in the saline areas of S.A.

The Dryland Salinity Technical forum, which will be opened by the Minister of Agriculture on 14 February 1990 sat 9.00 a.m. at the Waite Agricultural Research Institute, will explore the strategy and technical needs further.

ROGER WICKES

DRYLAND SALINITY IN SOUTH AUSTRALIA

TECHNICAL FORUM

Wednesday 14th February, 1990

CHARLES HAWKER CONFERENCE CENTRE
WAITE AGRICULTURAL RESEARCH INSTITUTE
WAITE ROAD, URRBRAE

ORGANISED BY:

S.A. DRYLAND SALINITY COMMITTEE
CENTRE FOR GROUNDWATER STUDIES
HYDROLOGICAL SOCIETY OF S.A.
SOIL SCIENCE SOCIETY OF S.A.

PROGRAM

CHAIRMAN: Dr. Peter Dillon

8.30 - 9.00	**Registration**
9.00 - 9.05	**Welcome** - Dr. J. Radcliffe, Director-General, S.A. Department of Agriculture
9.05 - 9.15	**Opening** - Minister of Agriculture
9.15 - 9.40	**State Dryland Salinity Strategy** - Mr. Roger Wickes, Chief, Soil and Water Conservation Branch, S.A. Department of Agriculture
9.40 - 10.05	**Identifying and monitoring the cause of dryland salinity and predicting its spread** - Mr. Steve Barnett, Senior Geologist S.A. Department of Mines and Energy
10.05 - 10.30	**CSIRO and CGS research on factors causing dryland salinity and affecting remediation** - Dr. Glen Walker, Senior Research Scientist, CSIRO
10.30 - 11.00	**Morning Tea**

CHAIRMAN: Mr. Peter Smith

11.00 - 11.20	**Dryland farming - salinity interactions; salt tolerant species, high water use plants, management practices** - Mr. Don McCarthy, S.A. Department of Agriculture
11.20 - 11.35	**Dryland salinity effects on surface water catchments** - Mr. John Rolls, S.A. Engineering & Water Supply Department
11.35 - 11.50	**Salinity of rainfall** - Mr. Richard Clark, S.A. Engineering & Water Supply Department
11.50 - 12.10	**Woods & Forests and Environment & Planning salinity related programs** - Mr. Peter Bulman, S.A. Woods & Forests Department
12.10 - 12.40	**Dryland salinity and farm management; landholder expectations** - Mr. Jeff Pearson (Lower Eyre Peninsula) - Mr. Ian Wilson (Cooke Plains)
12.40 - 1.30	**LUNCH**

CHAIRMAN: Dr. Rob Fitzpatrick

1.30 - 2.30	**Summary of effective salinity containment methods; lessons from the W.A. salinity strategy** - Mr. David Williamson, CSIRO Division of Water Resources, Perth, W.A.
2.30 - 3.30	**Summary of effective salinity containment methods; lessons from the Victorian salinity strategy** - Dr. Phil Dyson, Department of Conservation, Forests and Lands, Bendigo, Victoria.
3.30 - 4.00	**Afternoon Tea**

CHAIRMAN: Mr. Roger Wickes

4.00 - 4.50	**Panel questions and discussion** **What needs to be done - working together to provide solution**
4.50 - 5.00	Conclusions: A summary of talks and discussion - Professor Emeritus John Holmes
5.00 p.m.	**Refreshments**

MORE ON DRYLAND SALINITY

[Reprinted from AWWA "Crosscurrent",
Vol. 1, Number 3, January 1990]

'The Land' reported that The Premier of New South Wales, Nick Greiner, identified dryland salinity as the most serious threat to productive agricultural land in the Murray-Darling Basin.

At that stage, 12,000 ha of land in N.S.W. was estimated to be affected by dryland salinity (most of it in the Southern Tablelands), but the problem is rapidly worsening.

Fears are held that unless something drastic is done, N.S.W. could end up in a similar situation to Victoria, where dryland salinity is estimated to have claimed more than 250,000 ha of agricultural land.

Nationally, it is estimated that about 500,000 ha of dryland agricultural soils and between 85,000 ha and 120,000 ha of irrigated lands are affected by salinity.

VIEWPOINT : WATER RESOURCE MANAGEMENT IN ARID AREAS

[Contributed by John Vandenberg]

Much has been said about South Australia being the driest State in the driest Continent, and how important the efficient management of our water resources are to the future of the State.

The Arid regions of South Australia are no exception, with the added problem of very little long-term hydrometeorological data existing on which to base future management plans. The lack of data compounds the problem by making it extremely difficult to design any system or structure in the Arid Areas.

The exceptional events of March last year highlight just how difficult it is to produce and guarantee a management plan for the Arid Areas of our State. The driest region of the driest state etc. being turned into a gigantic swamp overnight.

The water supply of Leigh Creek provides the perfect example of how difficult a problem water resource management in Arid Areas can be. Aroona Dam was commissioned in 1955 and has more or less supplied the township and surrounding areas continually up until now. There were some other minor inputs to the system such as the supply from the Sliding Rock Mine.

When Aroona Dam was completed the capacity was around 7,500 Megalitres. Large silt loads which are common to all inflows have since reduced this to about 5,000 ML (last estimate 1984). Interestingly a re-survey was scheduled for the week commencing 13th March 1989.

A lot has happened at Leigh Creek in the last 10 years culminating in the shifting of the township and a new coalfield being established at the site of the old township. Preparations for the shift were already underway in the late 70's and during this period and up until 1983 there were very few significant inflows to Aroona Dam. Thorough planning of the new township has meant that although the population has increased, consumption has decreased. Despite this it became obvious that the town's water supply could not be considered completely reliable. Due to the low level of Aroona Dam in 1983 and the lack of inflows over the preceding years, a study was commissioned to investigate the future water requirements and whether the existing system could fulfil this requirement.

The investigation took into account the expansion of Leigh Creek to serve the new Northern Power Station at Port Augusta and found that Aroona Dam could not be expected to meet the future demand, and steps should be taken to augment the system. Note that at the time of opening the new coalfield it was expected that it would have a life of 30 years and the study suggested that Aroona Dam was unlikely to be able to meet demand for more than half of this period. It was also reported that a lack of suitable data existed to fully investigate the terms of the study.

As a result of the recommendations, a Reverse Osmosis plant was built in 1984 and subsequently expanded. Also a system of bores was installed on local aquifers and these, along with Aroona Dam, could be directed to the R.O. plant for treatment before distribution to the consumers.

A minor inflow in 1983 alleviated the problem, but by late 1986 the Dam was extremely low and was nearing the level at which it could not be considered a suitable supply on the grounds of both water quality and quantity. At this time, following the recommendations of the study certainly seemed justified.

The need to bring the R.O. plant into operation at maximum capacity was avoided when heavy storms in December 1986 filled the Dam and produced a substantial overflow. Still there was no need to alter the expectations of the Dam nor the recommendations of the study.

However, since then there have been several good inflows causing some large overflows and keeping the Dam at or near full supply level into mid 1989. Three of these events, February 1987, December 1988 and March 1989 are estimated to have overflowed around 25,000 ML in total, or about 5 times the capacity of Aroona Dam.

The R.O. plant has still not been made fully operational but is being used to filter Aroona water. The question could be asked "Was an R.O. plant necessary or has the existing plant been over-designed?" If any of the storms in the last few years were of a 5 to 10 year return magnitude or less, then perhaps Aroona Dam could have supplied the needs of Leigh Creek, at least for the expected life of the new coalfield.

Has the town's water supply now been over-designed? Has the spillway at Aroona Dam been under-designed? What if the rainfall experiences at Motpena H.S. (340 mm over 3 days) had occurred in the Aroona catchment which only had about 125 mm over 2 days?

I am not suggesting that the steps taken by the Electricity Trust of South Australia to improve their water supply were unnecessary and they may yet prove to be essential. The issue is that the system has been designed with very little data available and therefore based largely on assumptions that have resulted in a large capital outlay that may or may not have been necessary.

In short, individual components or the water supply system as a whole could be over or under-designed - only time will tell. Similar problems exist for the Highways Department, Australian National, and Telecom. The classic example being the "flood proof" railway to Alice Springs, opened in 1983 and severely damaged by flood-waters in January 1984.

Unfortunately, despite the above problems of which everyone is aware, the current economic climate imposes restrictions on the amount of Hydrometeoroligical data that can be collected and the subsequent analysis of that data. The problem won't go away, but in a land of drought and flooding rains, it can't be ignored.

POSTSCRIPT [by Chris Wright]

As a rider to John Vandenberg's article, I would like to add a comment on the decision which led to the construction of the Reverse Osmosis Plant at Leigh Creek.

The issues were highly political, since they were concerned with a major expansion of the coalfield to supply the proposed expansion of the Northern Power Station at Port Augusta, which is entirely dependent on Leigh Creek for its coal. This expansion was one of a number of power generation options including the setting up of a complete new mine/generating plant at Bowmans, Lochiel, Kingston South-East or Sedan. There were other possibilities, such as the construction of a power station on the coast, which would burn coal imported from interstate.

One of the weaknesses of the Leigh Creek expansion, was the lack of a guaranteed water supply : the increased population would stretch an already doubtful supply. It should also be remembered that the reserves of saline groundwater in the Windy and Emu Creek aquifers had not been identified or quantified, and even the Sliding Rock Aquifers 30 km away had not been studied to any extent. Options for Leigh Creek water supply at that stage included a 300 km pipeline to the Great Artesian Basin, and even the use of coal trains to cart water from Port Augusta on the return run!

The groundwater exploration work, which was done in 1982/83 confirmed that significant quantities of water were present to supply the mine for at least the next 10 years or so, with indications that other, as yet unproven, aquifers should be capable of extending the supply for the projected life of the mine. The major part of this groundwater was saline, and the construction of a desalination plant was essential if this option were to be chosen. This information proved vital to the proponents of further development of the Leigh Creek mine. A secure supply of water to support the Leigh Creek community, at a cost which could be paid without an unacceptable increase in the cost per ton of coal, enabled the arguments against the mine to be rebutted.

It could happen that the Reverse Osmosis plant, and the bore-field which supplies it, are seldom or never used to capacity. However, the system provides a guaranteed water supply, whatever uncertainties there may be in the rainfall.

HIGHBURY LANDFILL : GROUNDWATER POLLUTION INVESTIGATION

[Reporter : Adrian Hall]

The East Torrens Municipal Destructor Trust (ETMDT) recently commissioned B.C. Tonkin & Associates to carry out some preliminary investigations of the Trust's domestic waste landfill at Highbury.

Landfilling first began 20 years ago, in a worked-out sand quarry, and the site is now just over one-quarter full. However, with the marked increase in waste intake rates, the remaining life is only 10 - 15 years. Highbury is now the disposal site for domestic (soft) garbage from the five East Torrens councils, and Campbelltown and Tea Tree Gully (i.e. about 25% of metropolitan Adelaide). B.C. Tonkin identified concerns over the possible ingration of leachates from the site, down-gradient through what appeared to be fairly permeable sand and gravel aquifers. Tonkins were therefore asked to engage Australian Groundwater Consultants (AGC) to carry out a groundwater pollution investigation, to establish the characteristics of the groundwater regime, and to ascertain the extent of leachate movement. AGC (under the day-to-day supervision of Bryan Stevens) have just completed a drilling programme. Eight bores were drilled, mostly around the site perimeter (some upgradient, some downgradient) and the hydrogeological characteristics of the underlying strata (up to 40 m to bedrock) are being logged. Six of the bores have been completed for sampling - and for use as future monitoring bores. Sampling will be carried out in two weeks time, and a variety of water quality parameters (including an organic scan) will be analysed.

EFFECTS OF URBANISATION OF GOLDEN GROVE UPON COBBLER CREEK HYDROLOGY

[Reporter : Chris Purton]

One of the largest housing developments in Adelaide is the Golden Grove project to the north-east of the city. Extensive housing and associated civil works have already been constructed in the Wynn Vale area, and development is commencing in the Cobbler Creek catchment.

Salisbury Council has expressed concern that the impending urbanisation of the Cobbler Creek would increase the frequency of occurrence of larger flood flows. It was feared that this would cause flooding and scouring problems where Cobbler Creek flowed onto the Salisbury Plain.

B. C. Tonkin & Associates have been retained to carry out extensive hydrological modelling of the Cobbler Creek catchment. The RORB model was calibrated for the natural (rural) catchment using stream gaugings from the early 1970's. The catchment model for the urban case was then used to derive an urban flood frequency curve.

Finally, in consultation with Salisbury Council and the Joint Venturers at Golden Grove, an acceptable layout of 8 small flood detention basins has been designed. These 8 basins will reduce the urban flood frequency curve to below the natural rural flood frequency curve. This scheme ensures that the Golden Grove development will not lead to any increase in the flood risk in Cobbler Creek above that which exists with the present rural catchment. Instead, the 8 basins will provide some flood mitigation as a temporary measure until a major flood control dam is built on Cobbler Creek, as recommended by the Little Para Hydrology Study of 1981.

REFLECTIONS ON THE SUN.....

[Contributed by Claus Schonfeldt]

Climatic variations are related to variations in the Sun's energy output.

For a long time the Sun was thought to be constant; perfect in fact. We now know that it is far from constant. Sunspots and solar flares which vary markedly over time are testimony to this. Dramatic auroras are the most obvious effect on Earth.

The intriguing question is whether or not the variation is erratic or regular. Can a pattern be established from which climatic variation on Earth can be predicted?

Scientists have gathered evidence to support medium and long-term patterns.

Sunspot activity seems to vary in an 11 year and a double or 22 year cycle. The next 11 year peak will be in 1991.

The link with natural phenomena on Earth is established through study of tree rings in North America, and banding in siltstone and sandstone cliffs in the Flinders Ranges.

A pattern in tree ring growth (fat in wet years, lean in dry years) shows remarkable similarity in the double sunspot cycle and major droughts over a 300 year period.

The banding in the rocks offers a far longer history; possibly 18,000 years of continuous history. But it is of course ancient history. The banded deposits were laid down some 700 million years ago.

The theory is that the bands represent annual deposits resulting from glacial meltdown and deposition on a lake bed. Wide bands represent warmer summers (more meltdown) and narrow bands, cooler summers.

These rocks also exhibit both 11 and 22 year cycles.

It appears that Adelaide's annual rainfall (since 1844) also resembles variations in sunspot activity over that period.

However this cycle hasn't always been consistent. In the 17th century there was a period of almost no sunspot activity recorded for about 70 years. This coincided with the Little Ice Age when the Thames, the English Channel and the canals of Holland froze over year after year.

The rock record also suggests that the deepest sunspot minimums recurred every 275 to 333 years. If there is such a connection, another minimum, and possible Little Ice Age, is due near the start of the 21st century.

Since 1980 scientists have been accurately monitoring solar energy variations. So far this has been observed as declining at a 'substantial rate' of 0.004% per year. This may or may not continue, but if it does, it infers the possibility of another Little Ice Age within a century. Support indeed for the rock record's message.

Just as there remains much factual mystery about the Greenhouse consequences, there is much to be confirmed about these speculations.

At the very least they are interesting, if not confusing, to the debate about our possible climate in 50 to 100 years.

SOUTH AUSTRALIA'S FIRST EFFLUENT-IRRIGATED FOREST UNDERWAY

[Reprinted from AWWA "Crosscurrent", Vol. 1, Number 3, January 1990]

The Minister for the Environment, Ms Susan Lenehan, announced major Federal funding for the Government's project to establish and irrigate a forest with treated effluent from Bolivar sewage treatment works.

The Federal Government has provided $110,000 under the National Afforestation Programme to help establish the project this year, and negotiations are continuing for funding in subsequent years.

Ms Lenehan also said that the private sector was extremely interested in becoming involved in the development and the Government was having on-going discussions with various groups.

The Government is also investigating the feasibility of supplying up to 10,000 megalitres of treated effluent to the local horticulture industry, which currently uses a small amount of reclaimed water.

The current rate of groundwater used for horticulture - three times the natural recharge rate - is causing increased salinity.

Two effects of this are increased pumping costs because of declining water levels, and progressive reduction in crop yields.

Bolivar sewage treatment works is the largest facility of its kind in S.A. and processes about 50,000 megalitres of sewage each year.

The trial follows the establishment of an inter-departmental working party in April to examine land-based alternatives to piping the effluent to sea.

The major pilot programme at Bolivar will gauge the feasibility of establishing large-scale plantations of native hardwoods to make use of the unallotted effluent from Bolivar, north of Adelaide.

As well as providing a land-based use for the effluent, future plantations are expected to produce a sustained yield of commercially viable forest products and will improve productivity on under-utilised land.

The trial is expected to show that hardwood species normally grown in high rainfall areas, can produce similar high growth rates when irrigated on arid land.

The land to be used has a saline water table at moderate depth and the trees will be efficiently irrigated with reclaimed water of moderate salinity and relatively low nutrient content.

Ms Lenehan said that six species of trees on separate plots will be drip-irrigated with the reclaimed water.

Two growing methods will be investigated for the species which include Flooded gum, River Red gum, Spotted gum, Swamp oak and River oak.

The project is jointly funded by the State and Federal Government, and the departments involved are the Department of State Development and Technology, Engineering and Water Supply Department, Environment & Planning, Woods & Forests, and Agriculture.

SECRETARY'S NOTES

The programme of meetings for this year will be as follows :

February 15 *Hydraulics in the Atmosphere*
speaker Warwick Grace of the Bureau of Meteorology.

April 19 *Gawler River flood plain mapping*
speaker Ken Potter, Lange Dames & Campbell.

June 14 *Microbiology in Groundwater*
speaker (to be advised).

August 9 *Clay Mobilisation*
speaker (to be advised).

October 11 *Tatiara Groundwater Basin. What's Going on?*
P. Smith to organise.

Nov. 29 *Blue Lakes Limnology*
speaker P. Harvey et al.

Dates for the meetings could change, however the usual circulars will be issued giving details nearer the time.

The first meeting of the year will be addressed by Warwick Grace, from the Bureau of Meteorology in Adelaide, who has been doing research into the cause and effect of "Gully Winds". He has identified the effect as a standing wave or hydraulic jump in the atmosphere, and has some interesting comments to make and photographs. As can be imagined, the effect of flying an aeroplane into the turbulence within a Hydraulic Jump could be catastrophic, and in fact several crashes are known to have been caused by this effect. So come along on the 15th and learn all about it!

A list of all members and contacts addresses is available to members of the Hydrological Society on application to the Secretary.

NEWSLETTER : THANKS PETER DILLON!

The last two editions of the Society's Newsletter, Nos. 61 and 62, were produced by Peter Dillon of CSIRO Division of Water Resources. Peter filled in for John Argue while he was on Study Leave in U.K. Thank you, Peter, for a good job well done.

While on the subject, John Argue informs me that his 3-year "contract" as Editor subsequently extended by a further 2 years, ends in August 1990 when he will edit his last Newsletter. We will therefore need a replacement for John to take over editorial responsibility commencing with Newsletter No. 67 in October 1990.

Please let our Chairman, Peter Smith, or Secretary Chris Wright, know if you would like to take on the Editor's job and thereby make an important contribution to the continuing success of the Society.

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