THE HYDROLOGICAL SOCIETY OF S.A. INC.

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

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MOUNT LOFTY RANGES REVIEW

by Paul Harvey

Well after nearly 5 years the Mount Lofty Ranges Draft Management Plan has been released for public comment amid considerable controversy.

The whole process of preparing the Plan was based on community consultation and establishing a consolidated set of both landuse planning and management policies to allow for the orderly coexistence of the many competing and potentially conflicting activities in the ranges. After an extensive period of public consultation, the preparation of a first draft report which was put out for community comment and a major interruption for the 1989 election, a final draft report was submitted to Cabinet by the joint state and local government Steering Committee and Working Group in October 1991.

Cabinet decided to make a few changes to this draft document in relation to the proposals for a system of Transferrable Title Rights. Unfortunately the furore over these changes has tended to swamp the significance of the myriad of other policies on issues such as water resources management, protection of prime agricultural land from continued alienation and the establishment of a Mount Lofty Ranges Authority to take over much of the landuse planning and management role from both state and local government.

However probably more important in the long term is the loss of trust between local government and the community on one hand and the Minister and state government on the other caused by the decision to make last minute changes without consultation.

In terms of water resources management, the plan indicates a new direction with the establishment of specific water quality objectives, a greater emphasis on the management of streams and their immediate surrounds and the scientific identification of areas more susceptible to pollution. In the Watershed, runoff from most areas does not meet the established objectives in some cases by up to a factor of 4 times.

The Plan seeks to achieve the required improvement in runoff water quality through education, peer pressure and incentives rather than legislative action.

This will require a considerable commitment from both state and local government and it is hoped that the agencies concerned will see the benefits to be gained and will ensure that suitable resources are devoted to the implementation of the policies and actions contained in the Plan.

For the long term future of the state it is essential that this Plan not be allowed to languish on the shelf as has happened so many times in the past.

The Plan is open for public comment until the end of June and it is important that all people with an interest in the Adelaide Hills or Fleurieu Peninsula at least find out how the policies might affect them.

I would encourage all members with an interest in any of the diverse issues dealt with by the Plan such as flooding, stormwater treatment,urban development, sewerage or STED schemes, agricultural waste management, groundwater protection and stream management to comment on relevant sections.

This is one of the rare opportunities where individuals or organisations may, through constructive comment, significantly affect the long term management of one of the state's most important natural resources.

LETTERS TO THE EDITOR - OCTOBER NEWSLETTER 70

WATER WATER ETC

I strongly disagree with your assessment of the problem. I see the problem as our own unwillingness to apply existing technology, political will, human resources and national wealth to a simple solution - at least as far as Australia is concerned. We have everything - seawater, sun, wind, high unemployment, national wealth (albeit most of it wasted). We lack the political will only.

The technology is simple, cheap and available in Israel. I know that if Australia were to employ a mere half dozen Israeli engineers to design and oversee several construction teams of unemployed people they could build a series of self-contained water desalination plants along the Bight. These plants can operate 24 hours per day 365 days per year supplying water to a dry land irrigation system as they do in Israel. The irrigated area would have to be protected by a fence for the first few years to allow native vegetation to take over. After a few years we would have a green belt of vegetation growing all along the Bight.

Each desalination plant would be self-contained and operate without external energy input or human supervision although regular maintenance would be necessary for the ordinary windmills. The total initial cost for 20 plants would be far less than the money lost through the bad debts of our State Bank.

If you are now aware of the technology and are interested, drop me a line.

(signed) FS Holder

GAMMON RANGES PROJECT

Chris Wright's report in the October issue of Newsletter No 70 is interesting. It is good to learn that the project is progressing so satisfactorily.

Readers will be interested to learn that neighbouring Arkaroola which possesses comparable high country and steep (east-facing) escarpment faces has been monitoring similar hydrological parameters for almost twenty years.

Arkaroola also maintained detailed creek salinity monitoring of major drainage lines in the area and a selection of lateral creeks throughout the 1970s 'wet cycle', in particular these included Balcanoona, Arkaroola, Wywhyana and Big John Creeks until these variously dried out down to local springs and small water-holes. As expected, salinities responded dramatically to flooding (quite fresh') rising to several thousand ppm TDS before drying out. Strangely, 'Balcanoona Creek, right to the last, varied little either side of 1 000 ppm TDS. I have enclosed a graph of this against local rainfall taken from my book 'Arkaroola - Mount Painter - the Last Billion Years'. Interestingly, the Arkaroola Waterhole became strongly salinity-layered, a factor which the kangaroos and euros quickly came to appreciate by digging out soaks in neighbouring interconnected sand beds to tap less saline water.

Monitoring of the salinities of satellite creeks readily demonstrated just which of them ran fresh water more consistently - such as those draining granite or schist areas - as against low profile and limestone-based basins which produced highly saline waters. Arkaroola sited its 20 million litre dam on this basin.

Arkaroola in 1986 also set up a net of eight rain gauges around its property at various altitudes. Although, various trends can be recognised relating to the directional incidence and rain shadows of the various storms and operating wind regimes, it is altitude that, so far, is seen to exercise the most pronounced overall influence.

Vegetative revegeration related dramatically to prolonged wet winter/wet summer successions of the mid 1970s in particular.

Right now there is a deepening drought in which 16 months have produced only a total 98.6 mm. Only one month's fall greater than 'one inch' has been recorded in this interval, 11 months have each produced less than 10 mm and 5 months have been precipitation free.

Village water supply (averaging 10 to 12 million litres used annually) is from a fractured Quartzite underground reservoir. Continuous monitoring of Static Water level has shown that efficient replenishment follows only when the local side creeks flow but that recovery occurs rapidly upon cessation of pumping, thereby indicating high porosity and permeability of the fractured reservoir rock.

The spectacular rains on March 1989 which produced 300 to 400 mm rain over the property, revived the static water by 7 metres in approximately 8 months; this was back to the original local watertable as first drilled in 1969. A total of 600 mm of rain fell during this period maintaining rising groundwater levels until late December since when the level has been declining rather alarmingly for the subsequent 22 months. It has maintained a decline averaging 5.5 cm per month, but with significant 'pauses' relating to various local rains. The reservoir (30 metres to SWL) does respond quite rapidly in replenishing. Almost unique, I think. The level still has another 4 metres to fall to equate to pre-1989 levels but hopefully flood rains that make side creeks flow will come before that. With automatic recording equipment in place any such recovery can be closely monitored.

(signed) Reg C Sprigg,
Chairman Arkaroola Pty Ltd

AO, D Sc hc ANU and Flinders University Fellow
Aust Aca Tech Sci.

RECENT FLOODS ON FLEURIEU PENINSULA

Two further intense rainfall events have occurred over the settled area of South Australia in the last six months, this time on the Fleurieu Peninsula.

Sunday 15 September 1991

Near Mount Compass rain began falling early Sunday morning and 75 mm was recorded between 8.30 am and 12.15 pm. However, the highest gaugings were around Myponga with over 100 mm received over the entire weekend and 90 mm being recorded in an 8 to 12 hour period on the Sunday.

This corresponds to an average recurrence interval (ARI) of the rainfall of between 45 and 80 years (depending on the period chosen).

One report in the area quoted 75 mm in three hours which if correct equates to a 100 year ARI. Another report of 25 mm in 15 minutes corresponds to approximately a 70 year ARI.

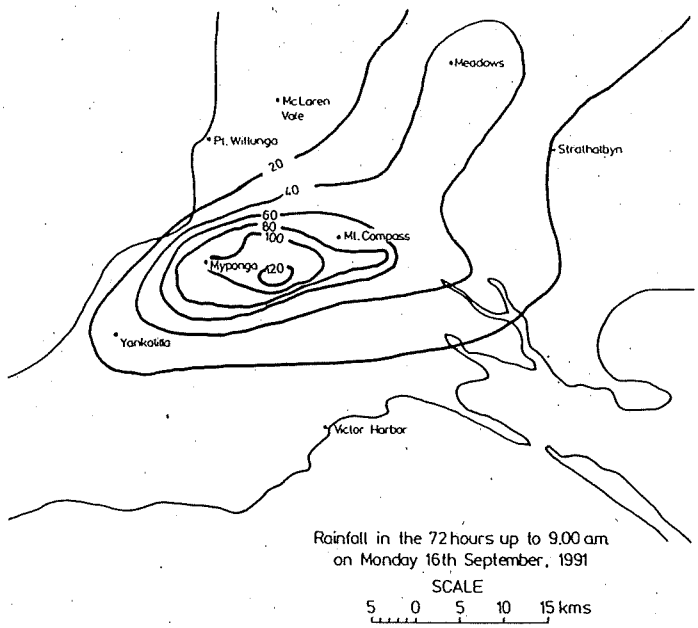
All dams were full and there had been substantial rainfall earlier in the week saturating the ground. It is therefore likely that the flooding ARI was in excess of the rainfall ARI, as flooding ARI = rainfall ARI for 'average' catchment conditions only.

Floodwaters from the Tookayerta Creek flowed over the Adelaide to Victor Harbor Road for half the day and Mt Compass to Goolwa Road was partly washed out by water flowing parallel to the road.

Severe road shoulder damage occurred in other locations due to water flowing along and/or over the road. Several farm dams in the area failed and a few houses were flooded.

A joint investigation by the Department of Road Transport's Drainage Section and the Bureau of Meteorology was carried out following the above event.

Sufficient information was gathered to show that most rain fell in a band including the Myponga/Mount Compass and Meadows areas. The figure shows the extent of the rainfall involved.



Monday 10 February 1991

A storm which struck Strathalbyn at about 3.30 pm caused the flooding of approximately a dozen houses in the northern part of the township.

One report quoted 62 mm in 40 minutes which equates to around a 500 year ARI event. The storm was very localised with an estimated area of 1 square km.

The local council is collecting information from various rain gauges in the area. Substantial flooding occurred on the Callington Road at Strathalbyn as a result of this storm.

Ironically a stormwater drain is being constructed by council, with subsidy drainage assistance, to drain the area inundated by the storm. Whilst it is unlikely that the drain would have been able to cope with the peak flows of water involved it would have helped ameliorate the worst effects of the storm.

JOINT STATE AND LOCAL GOVERNMENT TASK GROUP

METROPOLITAN ADELAIDE STORMWATER OPTIONS FOR MANAGEMENT

In recent years there has been increasing community concern regarding the need to consider stormwater as a resource, particularly since the annual amount of runoff has been estimated to be about equal to the annual consumption of mains water in Adelaide. Previously stormwater has been treated as a nuisance to be disposed of as cheaply as possible while preventing flooding. The adverse impacts of this narrow management approach are also now being recognised. Adelaide's stormwater is degrading the sea, streams and lakes into which it flows.

An environmentally responsible management approach is needed and ways of improving the quality and reducing the quantity of stormwater runoff and multi-objective re-use options should be studied. The continuing growth of metropolitan Adelaide and urban consolidation will place additional pressures on the existing drainage systems in future years.

In the past the partnership between State and local government has produced a cost-effective drainage system. It is now appropriate that both spheres of government should cooperate to identify and develop new ways of meeting the challenges of the future. To this end the Engineering and Water Supply Department recently commissioned the consultant Environmental Consulting Australia, to study the multi-objective management of Adelaide metropolitan stormwater. A series of engineering works, management strategies and organisational, financial and legislative options were identified in the report 'Metropolitan Adelaide Stormwater - Options for Management'. This report was released to the public by the Minister of Water Resources in October 1991 and a condensed version entitled 'Options for Managing Adelaide Stormwater - A Summary' was published in November of the same year.

A joint local and State government task group has been set up to recommend to government what form the future management of stormwater in metropolitan Adelaide should take.

The task group is currently undertaking a community consultation process, part of which involves contacting local councils, organisations and community groups to seek views on the management of stormwater.

The membership of the group is as follows:

Jeff Tate	(LGA)
Colin Pitman	(SCC)
Gordon McIntosh	(EWS)
Roger Cooke	(HVCC)
Grant Lewis	(EWS)
Bill Lipp	(DRT)
David Ellis	(DEP)

In particular the group is investigating and seeking comments on the following areas of concern:

- The need for improved management of urban stormwater.
- Acceptance of the benefits of multi-objective stormwater management.
- The preferred administrative and funding option of those presented in the reports on managing metropolitan Adelaide stormwater, or other options not so far presented.
- The administrative framework considered to be appropriate and effective in achieving the identified stormwater management objectives.
- The funding option considered to be the most equitable and appropriate.
- The geographic boundaries of the management area.
- The desirability and nature of any community education program.

The task roup will oversee any required amendments to legislation and facilitate the introduction of any new arrangements, to the stage where fully operational.

The task group is presently preparing a draft recommendations report which will submitted to negotiation teams then the State Government and the Local Government Association. It is envisaged that during this process the report will be available for broard commnuity discussion as well.

NEW STORMWATER RESEARCH PROJECT AT HAPPY VALLEY

Funding has just been approved for a new research project on urban stormwater through the Urban Stormwater Drainage Subsidy Scheme. The research is to be located in Happy Valley and conducted by Adelaide University Department of Civil (and soon Environmental) Engineering.

The Happy Valley Council, through City Engineer's Roger Cook, is also providing financial and material support. Trevor Daniell of Adelaide University will be the project supervisor, with Masters candidate Douglas McCarty in the field.

The Happy Valley Research Project is intended to examine a number of aspects of urban stormwater, in particular the relationships between rainfall and runoff in an urbanising relationship Adelaide catchment and the quality of that runoff when conducted through different stormwater systems and when various stormwater management practices are employed within a catchment.

On one of he catchments, stormwater will be detained in a seasonal Water Pollution Control Pond at the catchment outlet.

In the other (adjacent) catchment stormwater runoff will be directed through a series of small detention basins and cascades along the naturally vegetated and/or grassed watercourses.

In the first instance, it is intended to establish a monitoring system for rainfall and runoff. The runoff will be gauged at stations established at the detention basin weirs.

At the same time the runoff quality will be studied by systematic sampling and testing, though the desirable intensity of sampling and testing will require additional funding.

It is intended that the detailed data obtained in the study will provide essential information in the planning of stormwater management in Adelaide, as well as base data for the calibration of computer models.

NEWS FROM THE CENTRE

The centre for Groundwater Studies is involved in a number of projects in the South-East of SA - an area where groundwater resources are vital to the community.

- Non-point source contamination of groundwater by nitrate is a significant problem in the Lower South East. Current pollution is among the severest in the settled parts of Australia and the source of nitrate is grazed legiminous pastures. Therefore, a study which looks at key processes of the nitrogen cycle in the pasture, soil-plant system has been undertaken in an intensively grazed dairy farm near Mt Gambier.

  Twenty six lysimeters have been installed to estimate the amount and concentration of nitrate leached from the soil profile during winter. The lysimeters also refine previous estimates of recharge and evapotranspiration adjacent to irrigated and non-irrigated paddocks. Most of the leached nitrate originates from mineralisation of soil organic matter and nitrogen fixed by legiminous pasture crops.

  Animal wastes are expected to play a significant role in cycling of nitrogen in the pasture system. This project will also focus on the animal wastes on the quality of water recharge beneath pastures.

- The increased use of groundwater from the unconfined limestone aquifers of the Naracoorte Ranges region led the South Australian Government to proclaim the groundwater resources of the area in 1986. While the groundwater system was not displaying signs of stress, experience in nearby areas suggested that, at the current rate of development, problems such as these may not be far away.

  Two AWRAC/EWS funded studies involving CSIRO and DME staff and equipment were undertaken to provide a better estimate of recharge for this area. Recharge is one of the hardest hydrological parameters to estimate under the best conditions. The diverse nature of soil and aquifer material in the South-East makes the potential multiple recharge mechanisms in this area even more difficult to study.

INNOVATIONS BY LOCAL HYDROGEOLOGISTS

SCINTILLATING SAVINGS

A new method of carbon-14 analysis being used by the CSIRO in Adelaide make previous technics seem as unwieldy and extinct as the 'two-brained' brontosaurus. In the past it took a lot of fieldtime to precipitate the necessary 3-5 g of inorganic carbon as barium or strontium carbonate from 200-300 litres of water. It then took a full day to convert the sample to benzene for counting.

At the CSIRO Division of Water Resource, Fred Leaney and John Dighton have built a production line for the direct absorption of carbon dioxide from inorganic carbonate samples into a Permafluor/Carbasorb mixture. Their technique is based on a design originally developed at Waterloo University in Canada.

The CSIRIO modification involves a recirculating system which means no carbon dioxide is lost to the atmosphere and saturation is reached after only 1.5 hours.

Samples are analysed using a state-of-the-art LKB Wallac Quantalus scintillation counter. The design of this counter results in low background/high precision counting which allows as little as 0.5g of carbon (extracted from a 20L water sample) to be analysed for carbon-14. The new technique saves time in collecting samples and analysis and is half the cost of conventional methods.

This breakthrough technique is currently being used in two projects analysing carbon-14 in groundwater samples. The first concerns locating preferential recharge sites in the Naracoorte Ranges area in the South East of SA, while the second involves dating deep groundwater beneath the Adelaide Plains.

The Division now offers a service in radiocarbon-analysis of inorganic carbon for $150-$200 per analysis.

For further details contact:

Mr Fred Leaney (08 274 9396).

HYDAT

HYDAT is a relational hydrogeological database which has been developed by SADME, using the database manager DATAFLEX as a shell. HYDAT manipulates a number of distinct (but related) databases that contain subsurface hydrogeological information in the form of complex spatial and temporal well data, including:

- Unique identifies.
- 3-D spacial data.
- Areal parameters.
- Physical and chemical time series data (eg water level and salinity monitoring), physical and chemical depth series data (eg water cuts and salinity profiles).
- Contaminant depth series data.
- Hydrostratigraphy (tops and bottoms of aquifers).
- Well completion time series, depth series (history of well construction).

The department is interested in exploring the commercial potential of HYDAT. To our present knowledge there is no equivalent database available which addresses the complete range of data items used in hydrogeological evaluation of large regions. To this end HYDAT has been evaluated by CSIRO and a number of their suggestions are being incorporated.

The development of HYDAT beyond the needs of the Department of Mines and Energy will depend largely on its assessed commercial potential. That assessment will be made within the next few months.

For further details contact:

Stephen Howles (08) 274 7649

The initial study indicated that, for three cleared sites, diffuse recharge rates are low (less than 10 mm/y), which can be attributed to the high amount of storage in the top few metres of soil and poor drainage of the soil.

The present investigation seeks to determine the importance of several point recharge sites to the regional water balance. Several swamps, runaway holes and a drainage bore were targetted for investigation with nests of bores and water level recorders. Water samples were taken at least every two months and analysed for stable isotopes, chlorine 36 and radon in addition to conventional major anion and cation chemistry.

The results to date show clear differences in the hydrological and hydrochemical response for the different point source features to rainfall.

Water within the vicinity of these features displays a different chemical and isotopic signature from the regional groundwater. This suggests that recharge from these features is not the dominant recharge process on a regional basis. It is now planned to place limitations on the range of relative contributions from point source and diffuse recharge compared with that of lateral inflow to this area.

o Environmental isotopes can be be used in conjunction with hydrochemical and hydrogeological data to provide information on present day groundwater flow systems as well as providing windows into past hydraulic and climatic conditions.

Groundwater samples were collected and analysed for major ions, stable isotopes and radiocarbon along two transects following flowlines for the northern and southern sections of the Otway Basin for both confined and unconfined systems. The deuterium and oxygen-18 composition of groundwaters from both aquifers suggest that recharge takes place via two mechanisms:

- directly via rapid infiltration without isotopic fractionation
- water delayed and subjected to evaporation in the unsaturated zone or swamps that are scattered throughout the region.

Stable isotope ratios for deuterium and oxygen-18 for the confined aquifer show a clear trend of depletion either along the transect or with reference to Percent Modern Carbon.

Confined groundwaters with a carbon-14 age over 10 000 years are isotopically lighter with respect to younger groundwaters suggesting that these groundwaters were recharge either under a colder climate or different atmospheric circulation pattern than today.

The corrected ^{14}C 'velocity' in the confined aquifer is higher than the hydraulic velocity calculated from Darcy's Law by a factor of 2 to 4. This is possibly because groundwater levels were lower in the past as they responded to a eustatic sea level lowering of about 150 m during the last glacial 18 000 years BP.

An analytical hydraulic model was developed that predicts the change in water level response to an instantaneous change in sea level at the downstream boundary of the system throughout the last 27 000 BP. The model predicts that a lower sea level stand would result in partial dewatering of the unconfined aquifer and lowering of the confined potentiometric surface This would result in increased gradients and drainage and as a consequence higher velocities than those calculated from the present day head distribution. The ^{14}C 'velocity' is considered to integrate the hydraulic heads of the system during lower sea levels in the past. The model also indicated changes in both the location and magnitude of recharge and discharge zones to confined aquifer throughout the last 27 000 BP.

NEXT HYDSOC MEETING

The next meeting will be on 11 June when David Cresswell of the EWS will describe his investigation of the impact of farm dams on streamflows in the Adelaide hills including the North Para River catchment.

In particular David will describe the noval technique he developed to model the impact of farm dams on streamflows using the GIS ARC-INFO in combination with conventional hydrological models.

JOINT MASTERS IN HYDROLOGY AND WATER RESOURCES

A joint Master degree will commence in Adelaide in 1994. The University of Adelaide, Flinders University and the University of South Australia are all involved as well as the Centre for Groundwater Studies and the Centre for Water Quality.

Students will be able to come from either a science or an engineering background. Enrolment in the following programs will be available:

1. Master of Science - Flinders, School of Earth Sciences.
2. Master of Engineering Science and Master of Applied Science - University of Adelaide, Department of Civil Engineering.
3. Master of Engineering Science, University of South Australia, Department of Civil Engineering.

The course will provide the choice of undertaking 2/3 course work, 1/3 research or a full coursework Masters. The joint venture will enable around 20 water related academics, researchers and practitioners to be involved with teaching of course and supervision of research.

A management committee has been formed to plan and implement the introduction of the course, including:

Doug Lane (Chairman)	Centre for Water Quality
Gordon Stanger	Flinders University
Angus Simpson	University of Adelaide
Graeme Dandy	University of Adelaide
Trevor Daniell	University of Adelaide
John Argue	University of South Australia
Dilup Chirmuley	University of South Australia
Dennis Mulcahy	University of South Australia
Malcolm Hall	MFP
Malcolm Oades	WAITE, University of Adelaide

There will be 4 areas of specialisation, which students will be able to take including:

- Arid zone hydrology
- Surface water and groundwater quality
- Water resources planning
- Tropical hydrology

For students enrolled in the full coursework Masters program the core curriculum will include:

- Water resources planning
- Water quality fundamentals
- Groundwater hydrology
- Computing statistics in water resources
- Surface water hydrology

The course will be taken full time or part-time and is aimed at both Australian students and full fee paying overseas students. In addition, in-career scientists and engineers will be able to take individual subjects as part of a continuing education program.

The following sub-committees have been set up to implement the Masters course.

1. Marketing, business plan and publicity
2. Curriculum
3. Regulations
4. Fee sharing
5. Distance education

Detailed course outlines are currently being prepared.

If you have any ideas on marketing contacts in SE Asia or the Middle East or would like to know more about the proposed course, please contact one of the following people:

Angas Simpson 228 5874 | Gordon Stanger 201 2709 | John Argue 302 3131