THE HYDROLOGICAL SOCIETY OF S.A. INC.

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

NEWSLETTER NO. 59
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GUEST EDITORIAL BY OUR CHAIRMAN

Is our Society successful?
Do we provide a useful service to the South Australian community?
Indeed, should we be aiming to do so?
There are intriguing questions which suggest themselves easily but the answers are less evident.

As a professional society we seem to focus our attention inwardly, to our members. We strive to ensure that members are kept informed of recent development in hydrology (and related issues) both through the newsletter and general meetings. These provide the opportunity for exchange of ideas and for stimulating and critical discussion.

Those members who participate actively are likely to feel that in this regard the Society is both useful and successful. Of course the judgement is subjective and the committee will always welcome suggestions for improvement. The question is whether this is sufficient? Can the Society in some way be useful more broadly to the community?

Annually the Society provides the Ian Laing Prize to encourage and support students studying in an appropriate discipline, and from time to time the Society participates in organising workshops and seminars. These are worthwhile extensions into the broader community.

But we can probably do more. There is an extensive expertise represented in the Society. Much of this expertise is with people whose knowledge and opinions are respected. Could we not harness this to provide the community with worthwhile factual information on key issues in which the Society has a direct interest?

This of course was Ian Laing's dream with the concept of Discussion Papers.

One such topic is flooding and flood plain development ... what are the risks, the myths, and the realities?
If you have an interest in pursuing this idea, please contact Chris Wright and let him know your ideas.

CLAUS SCHONFELDT

ARTICLES OF INTEREST.....

NATIONAL KEY CENTRE AT ROSEWORTHY AGRICULTURAL COLLEGE

WHAT IS A KEY CENTRE?

A Key Centre is recognition of a Centre as a National Leader in teaching and research. Centres are designated every three years by the Commonwealth Goverments' Department of Employment, Education and Training. Applications were submitted in 1988 and 15 Key Centres were designated from among 210 applications from 69 Institutions.

Key Centres of Teaching and Research are designed to concentrate on high-level activity within higher education institutions based upon the teaching and research work of existing departments, units or groups. These are already operating at high standards and have the potential to develop increased capacity to attract high-quality students and staff.

Key Centres will be guaranteed modest funding for the first three years, after which their performance will be reviewed. Pending a satisfactory outcome, further funding will be provided. It is the Government's expectation that Key Centres will become self-funding in due course. The Commonwealth funds can be seen as "seed" money and, as such, the funds can be used for such items as research budgets, purchase of equipment and library materials, and payment of contract academic and support staff.

NATIONAL KEY CENTRE IN DRYLAND AGRICULTURE AND LAND USE SYSTEMS

The Roseworthy Agricultural College-based Key Centre will be established as a core unit within the College's Land Management Division. It will promote excellence in research and teaching in dryland agriculture and land use systems and disseminate findings, results and information to Government agencies, landholders, private industry and the land care profession.

Further information :

Dr. V. R. Squires or Mr. P. J. Ninnes
Roseworthy Agricultural College
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PREPARE TO BE FLOODED!

[by Chris. Wright]

In November 1988 a conference was held at ACDC (Australian Counter Disaster College), Mount Macedon, Victoria, on the question of flood preparedness. Delegates attended from all groups concerned with flooding, including the Bureau of Meteorology, state water authorities, local government representatives, State Emergency Service and Australian Federal Police amongst others. Catering for such a wide range of interests must have been a problem for the organisers.

The lectures included information on meteorology, estimation of probable maximum precipitation, computer technology uses for flood estimation and warning, and descriptions from each of the states as to their own developments in flood detection and warning. On the last day a series of case studies was presented by groups of delegates, including a close look at Googong Dam, just upstream from Queanbeyan and Canberra, and what would happen if it failed!! (A whole lot of wet politicians was the general conclusion.)

For those interested in evaluation of the potential cost of flood damages, and ways of estimating the incremental cost of flooding with rising water level, the ANUFLOOD program developed at Australian National University is a potentially useful tool. David Ingle-Smith and Mark Greenaway provided some excellent examples of its application, and can be contacted for details at A.N.U.

It should be noted that for some reason ACDC is a duty-free area for alcohol - I couldn't fathom why. However, the evening sessions at the bar were well subscribed and a certain amount of musical talent was provided by the South Australian contingent.

It never stopped raining for the four days of the conference, and severe flooding occurred in Melbourne while it was on. The Victorian representatives were able to give a live demonstration of their rainfall and streamflow data collection system.

LAKE ALBERT SALINITY MITIGATION

by Claus Schonfeldt

Lake Albert is somewhat like an appendix alongside the large intestine that is the River Murray (at least in the sense that the Murray collects and drains salt to the sea).

There is no throughflow and only constricted access through a narrow channel at Narrung.

The lake, as Lake Alexandrina, is like a shallow saucepan. Evaporation is high.

Consequently its salinity level increases in a natural cycle between significant flushing events. Salinities up to 5000 E.C. units have been experienced.

The lake supports an important part of South Australia's dairy industry, and cost-effective salinity mitigation is an important aspect of enhanced fodder production.

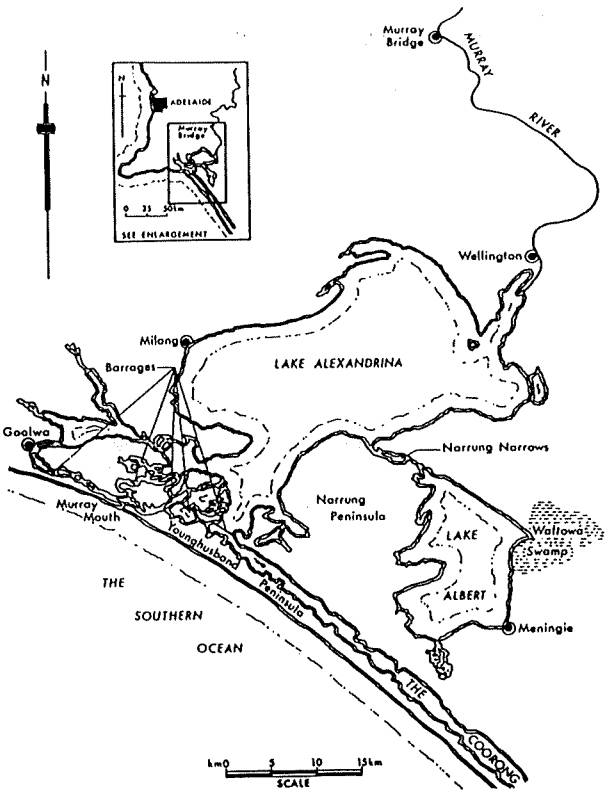
In 1983 an innovative salinity reduction strategy was introduced. It required no capital outlay and relied solely on an explicit operating strategy to take advantage of occasional fresher flows in the river to replace the more saline water in the "appendix".

The results are presented in the diagram below which shows river flow and Lake Albert salinity since 1974.

It is difficult to isolate conclusive evidence from this for various reasons. Nevertheless the results are very encouraging.

There is an obvious difference in salinity prior to and post-1983.

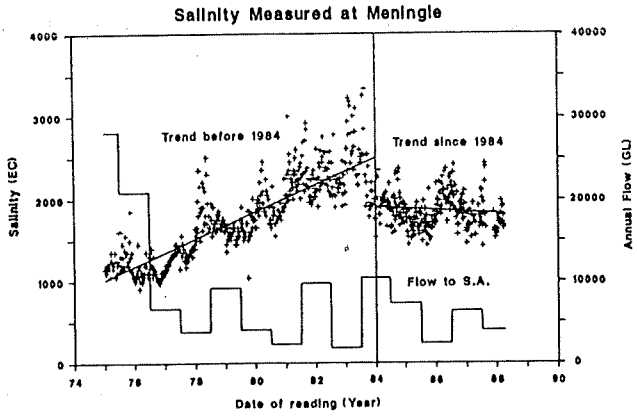
In particular salinity has not been increasing since 1983 as might have been expected in those flow conditions without the strategy operating.



LAKE ALBERT LOCALITY PLAN

LAKE ALBERT SALINITY

Salinity Measured at Meningie



FROM THE HYDROLOGICAL TRAPS.....

PROCLAMATION OF BAROSSA VALLEY GROUNDWATER RESOURCES

[Reporter : X. P. Sibenaler]

Continuing declines in water levels in the Barossa Valley after a 2-3 year period of relative stability are considered to be due to increases in groundwater usage over the last 2 years. This market-driven trend to increase the area of irrigation and rate of application is not expected to abate in the short term.

The Barossa Valley area has accordingly been recently proclaimed under the Water Resources Act to protect the resource and to ensure its long term viability for existing and future users.

[In a proclaimed region a licence is needed to withdraw water from the groundwater basin for irrigation, industrial and recreation/environment (e.g. ovals) purposes. As the main objective of proclaiming the Barossa Valley groundwater resource is to prevent additional development of the resource, only existing users, and those people who have made in recent times a financial commitment to commence usage, will be issued with licences.]

LEIGH CREEK AREA

[Reporter : David Kemp]

A heavy rainfall event occurred in the vicinity of the Leigh Creek South township and areas to the east of the Flinders Rangers early on 25th December 1988. Leigh Creek South recorded 77 mm of rainfall in six hours, equivalent to a 1 in 30 year ARI event. Windy and Emu Creeks flowed strongly, and the Aroona Dam spillway flowed approximately 1.5 m deep. It is hoped that this storm will yield more valuable data on the hydrological behaviour of the area.

E.T.S.A. have engaged Kinhill Engineers to review the spillway capacity of the Aroona Dam in light of the improved knowledge of the flood hydrology of the area.

GAWLER RIVER FLOODPLAIN SUPPLEMENTARY DEVELOPMENT PLAN

[Reporter : David Kemp]

A Supplementary development plan commenced operation on 10th November 1988 to provide control of development in the Gawler River Floodplain. The Supplementary Development Plan covers three council areas - District Council of Mallala, D.C. Light, and C.C. Munno Para. It freezes sub-division within the floodplain, and sets controls on building levels, fence types and extent of filling permitted.

The S.D.P. is intended as an interim measure, until floodplain mapping is completed and a comprehensive policy is determined and put into place.

ULTRASONIC FLOW MEASUREMENT

[Reporter : David Beale]

Conventional flow measuring techniques are not reliable for low velocity flows. This is of particular interest for the River Murray, and the E. & W.S. Department has been investigating the viability of ultrasonic flow measurement techniques. The techniques use the principle that sound waves travel faster downstream than upstream. The difference in travel time over a known 'flight' path is used to calculate the instantaneous stream velocity.

The equipment and techniques were developed jointly by AMDEL and the E. & W.S. Department commencing in 1978. The first prototype was installed at Woods Point in 1983 to evaluate the feasibility on site.

There were teething problems as expected and progressive refinements have been introduced. More recently a potentially better site near Woolpunda has also had equipment installed.

The results are currently being reviewed.

URBAN STORMWATER AS A RESOURCE FOR ADELAIDE?

[Reporter : Geoff Fisher]

The E. & W.S. Department will soon be undertaking a preliminary desk-top study to investigate the potential for development of urban stormwater runoff into a domestic water supply.

The resource potential is large, some 150,000 ML per annum, which approximates our present sustainable yield from local hills catchments.

Whilst it is unlikely all of this could be "harvested", mainly due to poor water quality, smaller suburban areas may provide reasonable quality water which could be "naturally" treated via artificial wetland construction.

It is envisaged that the treated water would be stored underground in Adelaide Plains Tertiary Aquifer A, being extracted later, connecting into the existing distribution system via the numerous (existing) balancing storage tanks scattered throughout the city.

In addition to making Adelaide's water supply a more secure one, the development of urban stormwater as a resource could have other benefits. For example, it could

- reduce flooding risk,
- reduce pollution of the natural creeks and estuaries of Adelaide,
- provide passive recreation facilities,
- further improve the aesthetics of the Adelaide environment.

Irrespective of the outcome regarding large scale development, it is hoped the study will help to encourage a less wasteful approach to stormwater management, particularly for new suburban development.

FAR WEST COAST WATER SUPPLY

[Reporter : Graham Spangler]

Water supply to communities on Eyre Peninsula has always evoked much interest. Recently the issue of water supply to west of Ceduna has been prominent in the press.

One outcome of the recent events has been to focus attention on harvesting and conserving the natural water resources in the area, rather than extending the Tod Reservoir Trunk Main.

Trials with sealed and unsealed catchments, similar to designs established in Western Australia, will be used to determine the best approach. Development of local groundwater supplies drawn from coastal sand dune aquifers will also be studied.

NATIONAL WORKSHOP ON PLANNING AND MANAGEMENT OF WATER RESOURCE SYSTEMS

[Reporter : G. Dandy]

The above workshop with a theme of "risk and reliability" was held at the Adelaide Festival Centre from November 23 to 25, 1988. The objective of the workshop was to identify recommendations for:

(i) Techniques to be used in estimating the yield of headworks systems,
(ii) suitable levels of reliability to be used in the design of water resource systems, and
(iii) acceptable frequency and severity of water restrictions.

Seventy-five delegates from all states of Australia (and one from New Zealand) attended the workshop.

The workshop was officially opened by the State Minister for Water Resources, Susan Lenehan. A stimulating keynote address entitled "risk, reliability and political realities" was delivered by John Paterson (Director-General of Water Resources in Victoria).

Each major water authority in Australia had prepared a position paper summarising its current practices in relation to the design of operations of head works. Summaries of these papers were presented at the workshop.

Other papers which generated considerable interest were:

(a) "A survey of Australian yield estimation practice", presented by Tom McMahon and K.C. Gan (University of Melbourne).
(b) "The effect of long-term climatic change on water resources", by Barrie Pittock (CSIRO Division of Atmospheric Research).
(c) "Capacity sharing and its implications for system reliability", by Warren Musgrave and Chris Alaouze (University of New England), and Norm Dudley (University of New South Wales).

The Friday consisted of workshop sessions where participants were formed into smaller groups and attempted to formulate recommendations for future practice for major urban, minor urban and irrigation systems. These recommendations have been summarised by a small writing group and will be passed on to the AWRC planning subcommittee for possible adoption.

A set of proceedings of the workshop is currently under preparation. This will include all papers, summary discussions and recommendations from the workshop, and should appear as an AWRC publication in March of this year.

WATER PROBE PLANNED

[Reporter : Bart van der Wal]

The Engineering and Water Supply Department is to investigate alternative water resources available to supply existing and future development in the South Coast area including Victor Harbour, Port Elliot, Middleton and Goolwa.

The comprehensive investigation will determine a resource which would ensure South Coast area residents receive a satisfactory water supply into the 21st century.

Predictions indicate that the number of houses in the South Coast area will increase 240% over the next 23 years, from 8000 now, to about 19,000 in the year 2011.

Even with a proposed minor upgrading, the existing water supply system has sufficient capacity to provide a satisfactory supply only until the late 1990's.

The two existing water resources to be considered are:

- Myponga Reservoir, and
- the Lower River Murray at Goolwa.

The three possible water resources to be considered are:

- Hindmarsh River Reservoir
- Hindmarsh River Groundwater Basin, and
- Lake Alexandrina near Milang.

Drilling and testing of bores near to the Hindmarch River about six kilometres north-west of Victor Harbour will be required as part of the investigation.

The investigation, which is expected to be completed by the end of 1989, will cover the works required to develop the resources, to provide water of a suitable quality, and to deliver the water to the South Coast area.

FROM THE SECRETARY.....

After a quiet spell over Christmas, Hydsoc activities are under way again, and the first meeting of the year will be addressed by Andy Telfer on "Problems and Effects of the Woolpunda Groundwater Scheme". Members who have attended previous meetings on Woolpunda will be interested to hear the outome of long deliberations on the most appropriate site for the disposal basin, a much vexed question.

Preparations for the Workshop session on Australian Rainfall and Runoff are well under way. The first circular calling for registration of interest was mailed before Christmas. Anyone who has lost his/her copy will receive another before long, however the bookings are expected to be heavy. Chris Purton (223.5833) will register anyone who is interested. Both Prof. David Pilgrim and Associate Professor Ian Cordery will be conducting the workshop.

Hydrological Society Executive Committee, Contact telephone numbers:

Claus Scholfeldt,	Chairman	226.2520
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Chris Purton		223.5585
Anwen Aukland	Records Sec.	274.7570
Bill Lipp		343.2264
Fred Leaney		274.9396
John Argue	Newsletter Ed.	343.3131

STOP PRESS : HOT NEWS!

SEMINAR : IRRIGATION SOUTH AUSTRALIA - THE INTEGRATED APPROACH

The Engineering and Water Supply Department and the Department of Agriculture have organised an afternoon/evening seminar to discuss the integrated approach towards irrigation that has been developed in South Australia, with a focus on Government Irrigation in the Riverland. The seminar will be held on 16th March 1989 in the Convention Centre, Education Building, in Flinders Street, and has been planned in association with the Irrigation Association of Australia, the Australian Water and Wastewater Association and our Society.

The afternoon session (commencing 2.00 p.m.) will be devoted to a presentation by E & WS and SADA Officers on rehabilitation, irrigation management, equipment testing and related issues. A buffet tea will preceed a paper entitled "Feasibility of Rehabilitation of Government Irrigation Areas" to be presented by Tony Read of Kinhill Engineers Pty. Ltd.

Members will probably be interested in the Kinhill paper, however an open invitation is extended to attend the complete seminar. A more detailed programme and registration details will be forwarded shortly.

YOUR 1989 HYDSOC DIARY!

January 27	Cut-off date for newsletter contributions to John Argue.
February 6	Newsletter and meeting notice posted.
FEBRUARY 16	MEETING : Woolpunda Groundwater Scheme (Andy Telfer).
March 7	Committee Meeting.
April 3	Meeting notice posted.
April 4	Committee Meeting.
APRIL 13	MEETING : Hydrology and Water Quality (Richard Clark).
May 2	Committee Meeting.
May 26	Cut-off date for newsletter contributions to John Argue.
June 5	Newsletter and meeting notice posted.
June 6	Committee Meeting.
JUNE 15	MEETING : On-Site Detention & Urban Stormwater (John Argue).
July 4	Committee Meeting.
July 17/18	AR&R Workshop (David Pilgrim & Ian Cordery).
July 21	Cut-off date for newsletter contributions.
July 31	Newsletter and meeting notice posted.
August 1	Committee Meeting.
AUGUST 10	MEETING : Bugs, sunlight and water (Alison Turnbull).
September 5	Committee Meeting.
September 22	Cut-off date for newsletter contributions.
October 2	Newsletter and meeting notice posted.
October 3	Committee Meeting.
OCTOBER 12	MEETING : Domestic W/W Disposal, Land Capability & W/R Planning.
November 7	Committee Meeting.
November 20	Notice posted.
NOVEMBER 30	MEETING : Hydrology in the wild blue yonder.

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THE HYDROLOGIC IMPACTS OF THE GREENHOUSE EFFECT

The Institution of Engineers, Australia

A Position Paper prepared by the National Committee on Water Engineering

INTRODUCTION

The Greenhouse Effect is a warming of the earth's atmosphere, caused indirectly by increasing levels of certain gases in the earth's atmosphere. These gases, which include carbon dioxide, nitrous oxide, methane and chlorofluorocarbons are mostly by-products of industrialization. Because these gases are partially opaque to heat radiation from the earth's surface, they cause heat to be trapped in the lower layers of the atmosphere; thus, increased concentrations of them produce an increase in average air temperatures.

Over the last 100 years, the average atmospheric temperature has risen by about 0.5° C; over the next 30 to 50 years it is expected to increase by a further 1.5 to 4.5° C. This increase is forecast to result in changes to the general circulation of the atmosphere (and hence a redistribution of climatic zones) and a rise in sea level.

The change in climatic patterns could extend the southern limit for tropical cyclones, by 200-400 km, and increase cyclonic intensities by 30-60%. The frequency of occurrences of tropical cyclones may also change.

The sea level rise will be due to both the thermal expansion of the upper layers of the world's oceans and the melting of the ice sheet. However, only the former is likely to be significant within the next 30 to 50 year period.

At present atmospheric physicists are still undecided as to the extent of the Greenhouse Effect. Whilst a world wide meeting of scientists in Villach, Austria (1986) confirmed that a general warming trend of the atmosphere is occurring, there is still considerable debate about both the timing and the impact of the temperature increase.

THE IMPACT OF THE GREENHOUSE EFFECT ON THE HYDROLOGIC CYCLE

The effects of a rise in air temperatures on the general circulation (and therefore the climate) for Australia are uncertain. Current global general circulation models give contradictory results for the Australian Region; it may be up to five years before better predictions are available.

This paper presents a *preliminary* engineering assessment of the possible impacts of the Greenhouse Effect upon the hydrologic cycle.

Sea Level

A general rise in sea level of 20 to 140cm is expected. This general rise may not be uniform around the Australian coast. In some areas there may be little change in sea level, depending upon changes in the regional air and ocean circulations.

Coastal Plains

Where sea levels do increase, the salinity of rivers and estuaries will alter and low-lying areas, including some coastal farm land will be salt affected and/or inundated. Water tables in coastal areas will rise. Canal estates and similar low-lying developments might experience stormwater drainage problems and increased frequency of flooding.

Rainfall

It is uncertain how rainfall charactistics in Australia will alter with rising atmospheric temperatures.

One scenario is for higher spring, summer and autumn rainfall (by up to 50%) in those regions deriving such rain from the southward penetration of tropical/subtropical air during the Australian monsoon season. Daily maximum rainfall may increase by 20-30% with some change in the frequency distribution of the rainfall. This change will be a maximum at the southern limits of the summer rainfall regime. Winters may be generally drier by 20% or more in those areas deriving such rain from the eastward passage of mid-latitude high and low pressure systems and associated frontal storms (with the possible exception of Tasmania and southern Victoria).

Other scenarios give different rainfall distribution and pattern changes over Australia.

Snow Line

The snow line could rise about 100 m per 1° C warming. However, local variations related to changes in storm frequency may be equally significant.

Wind Speeds

Wind speeds could decrease by 20% north of 36° S but should increase south of 36° S due to changing north-south temperature gradients.

Evapotranspiration

Evapotranspiration could decrease due to higher stomatal resistance at higher ambient CO_2 concentrations. However, expected greater leaf areas may partially compensate for this effect.

CONSEQUENCES FOR ENGINEERING STRUCTURES

The consequences of the Greenhouse Effect for any given regions will depend on what climatic changes occur there.

In **areas where rainfall intensities increase,** drainage and flooding problems will worsen. The standards of performance of existing urban stormwater systems, highway culverts and bridges, flood mitigation structures and dam spillways will be reduced. Engineering measures will be required to counteract the increased flood risk in many cases.

In **regions where streamflow yields are reduced** the reliability of existing water supply systems will decrease. This raises the possibility of more or larger reservoirs to provide increased storage, or greater use of demand management strategies.

In **locations affected by increased sea-levels,** problems of saline watertables, drainage and tidal inundation will be major concerns. Engineering remedies (e.g. sea walls, stormwater pumping) will be expensive and not always effective.

WHAT CAN BE DONE?

- The trends in key hydrologic variables (rainfall, streamflow and evaporation) must be carefully monitored.
- Close liaison needs to be established between hydrologic engineers and professionals in relevant disciplines such as atmospheric physics and meteorology.

The questions to be addressed include:

- At what point in time should the Greenhouse Effect be considered in hydrologic engineering practice?
- To what extent should it be considered now?
- What design allowances are appropriate?

WHO IS RESPONSIBLE?

Water engineers and hydrologists have a duty of care with respect to the provision of advice, the design of water structures, and construction of such works in the Australian environment. Our present level of knowledge makes it difficult to adequately quantify the impacts of the Greenhouse Effect; however, when **quantitative** estimates of the effects of any climatic changes are available, they should be used by the engineering profession.

ACTION REQUIRED

1. A concerted effort to improve the estimates for sea level and climatic change effects for the whole of Australia
2. An evaluation of the impact of these effects on the social, environmental, and economic fabric of the nation and its implications for water management strategies and engineering practice.
3. The establishment of an expert committee to develop rational and consistent guidelines for engineering practice in hydrology.
4. The establishment of a review process so that management strategies and engineering practice can be varied as further information comes to hand.
5. A strategy to make political and economic decision makers aware of the potential seriousness of the problem, so that adequate funds are made available to implement the above actions.

FOR FURTHER INFORMATION PLEASE CONTACT:

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