AquaAustralis

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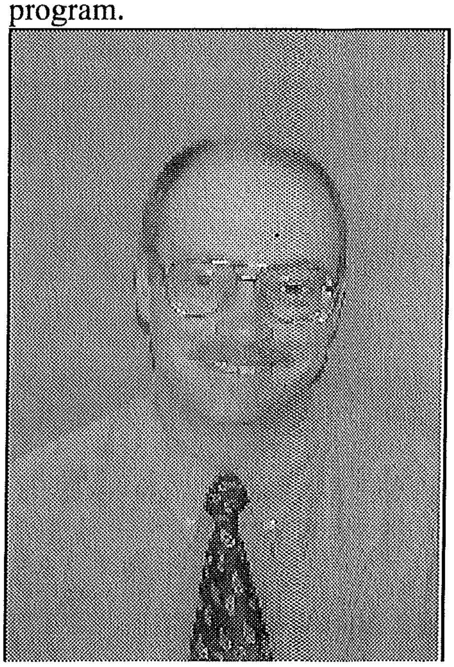
Welcome to the new look newsletter. It's a change we have introduced in an effort to increase the frequency of the newsletter and our ability to distribute it to a wider audience. We would welcome your feedback on the new format.

For those of your who don't know me, I am now in my second term of Chairman of the Hydrological Society. I have been a member of the Society for around 15 years and have a Civil Engineering Degree specialising in Surface Water Hydrology.

At the last AGM I indicated that we intended to review the role and functioning of the Society (within the terms of reference allowed in our constitution). The review is proceeding slowly but we have already identified a need to increase the frequency of our newsletter, to increase our relevance to country members, and to review the need for part-time administrative help. (It appears gone are the days that public or private enterprises can help carry the Society).

I am pleased to see the role of the Society in promoting excellence and sharing of knowledge continues to be seen as an important and worthwhile one.

We have also recently changed venues for our regular technical seminars. The new venue across the road has much better facilities, easier parking and comes at a most attractive price (free), so I encourage members to continue to support our technical program.



As with every Society, there is a hard working committee. The Hydrological Society's current committee is listed on the back of this newsletter. I would encourage you all to contact these people should you have any queries about the Society or should you have any suggestions on how it could be improved.

Regards,

Geoff Fisher

The Ian Laing Prize

The Hydrological Society of SA offers an academic prize to students undertaking the final year of an ordinary or honours degree course or post graduate diploma course which involves some study of hydrological and related sciences or water resources management.

The value of the prize is $500 and is awarded on the basis of overall academic record, performance in subjects or units specifically related to water studies and a demonstrated interest in water studies.

Requests for applications are sent to all South Australian Universities in October of each year. The year 2000 Ian Laing Prize was awarded to Mr Philip Mill of Flinders University. Philip is now a partner with Ecophyte Geophysics, a company he set up with some fellow students to deal with groundwater and environmental geophysics. The abstract of Philip's paper is printed below.

The 1999 winner of the prize was Kathy Thomas of Flinders University. Kathy's paper will be presented in the next issue of AquaAuastralis.

Assessing the environmental impact at a former landfill, Port Lincoln SA: *The need for a multidisciplinary approach*

Philip Mill
(Flinders University of South Australia)

The coastal and marine environment surrounding Port Lincoln was identified by the National Heritage Trust as being worthy of attention under the Coasts and Clean Seas Program in 1998, and followed widespread local concern over trade and domestic waste management practices. Recent attention has focussed on a continuing problem of persistent algal blooms and the subsequent ban on shellfish collection in Boston and Proper Bays.

Concerns have been expressed about the possible environmental impact of the town's landfill which has been in operation for about 50 years but which closed in the early 1990's. The landfill lies within several hundred metres of the coast. Investigations were carried out to determine the extent of contamination caused by the landfill and likely future impacts, particularly on neighbouring land and coastal environments.

A multidisciplinary approach was employed and included:
(i) a hydraulic investigation to determine contamination pathways and migration rates,
(ii) chemical analyses of surface water and groundwaters both within and surrounding the landfill,
(iii) a natural isotope investigation of groundwater to determine flow system dynamics, and
(iv) a geoelectrical characterization of the site to elucidate key geological and hydrogeological parameters of the system.

The paper presents an overview of the geological, geophysical and hydrogeological investigations carried out as part of this project. It focuses on geological and geophysical work using vertical electrical soundings and high resolution profiling resistivity methods. Surveys completed within and outside the landfill area investigated lateral and vertical extents of waste, delineated containing and underlying stratigraphy and identified preferential flow paths. Lateral extents of dumping were clearly defined and wastes were identified in a number of locations using both methods. Near surface geological features including calcrete horizons were imaged though site conditions conspired against repeated attempts to locate basement. Electroconductive anomalism was detected beneath the landfill and signatures suggest conductive fluid phases. The existence of preferential flow channels is suspected as manifest by coherent areas of anomalously low resistivity and these features were observed on many transects.

Investigation of a Household Water Saving Device

Daniela Heubusch
Dept. Civil & Environmental Engineering, Adelaide University

Summary

Whenever a hot water tap is turned on, be it in the bathroom, in the kitchen or in the shower, a considerable amount of cold water is wasted while the user waits for heated water. A detailed patent search revealed that the problem has been recognised and tackled by various people in the past. Most inventions comprise of a pump operated recirculation system with a return line from the hot water outlets back to the heater. The aim of this project was to further develop water saving techniques and design an improved device without pumps or excess piping.
During this project a survey was conducted in Adelaide households to establish the exact amount of water wastage from each tap and shower in the house. On the basis of these results, a water saving device has been developed that stores the unwanted cold water from the hot water line. The device consists of temperature sensing valves to divert cold water into a container and let hot water run out of the tap. The stored water is reused when cold water is desired by extracting it from the container by a venturi application.

1. INTRODUCTION

Water resources are becoming scarce all over the world and it is in everybody's interest to save water wherever possible. Domestic water use represents a considerable part of the overall worldwide water consumption and it becomes more and more important to find ways of reducing the per capita use of water. A great scope for water savings was found in the hot water use of households. Whenever a hot water tap is turned on, be it in the bathroom, in the kitchen or in the shower, a considerable amount of cold water is run down the drain while the user waits for heated water. Each time hot water is needed the user wastes 1 to 10 litres of potable water. The problem arises because the water heater is usually located some distance away from the actual outlet points and the water needs to be carried from the water heater to the taps. When turned off, the line to the fixture represents a "dead end" as the water is not moving and cools off. When hot water is required some time after the last use, this cooled down water needs to be drained out in order to get to the heated water.

During the literature review it was found that this problem had been addressed by a number of inventors who had developed various patented systems to overcome the wastage of cooled off water from the hot water line. However, no detailed studies of actual wastage and specific tap use could be found in literature and none of the patented systems seemed to have become common devices in households because of the use of pumps or long recirculation pipes.

The aim of this study was therefore to develop an easily installed and operated device that would conserve the cooled water from the hot water pipe. The amount that can be saved was to be predicted from a detailed survey of actual wastage in Adelaide households. It was aimed at providing statistical data of water wastage as well as developing a prototype of a new water-saving-device with a prediction of installation cost and possible savings. Further development and refinement of the device could lead to a marketable product but these tasks were not addressed within the scope of this project.

The following sections present the results of the survey of household water wastage and a summary of existing patents related to the problem. A description of the prototype of the new water saving device is given. The theoretical design was built, tested and improved, to make the model work as desired.

2. WATER WASTAGE SURVEY

A survey of water wastage at different taps was conducted including 30 Adelaide households. A questionnaire was handed out that required the measuring of cold water wastage from hot water taps in the shower, at the bathroom sink, at the kitchen sink and the laundry sink. Additional inquiries were made about the age of the residence, the pipe material, pipe insulation and on which floor the measurements were carried out. It was also asked, how many people lived in the house, how many taps and showers existed and how many times the test person used a hot water tap per day.

The results gave a good indication of how much water could be saved by implementing the water saving device in households. 73 taps were tested and the amounts of wasted water were within a range of 0.2 litres and 4.0 litres, with an average value of 1.72 litres and a median of 1.8 litres. A graph of the results for taps is shown in Figure 1.

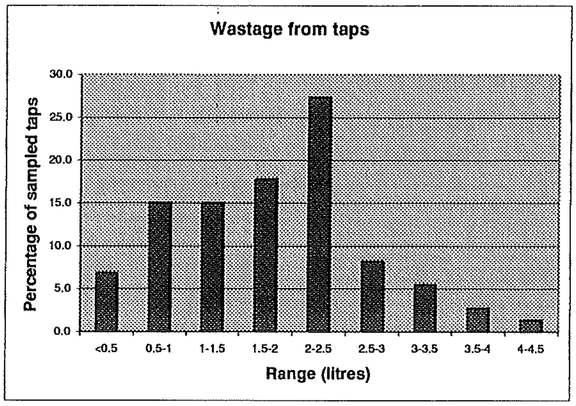


Figure 1: Survey results for tap water wastage

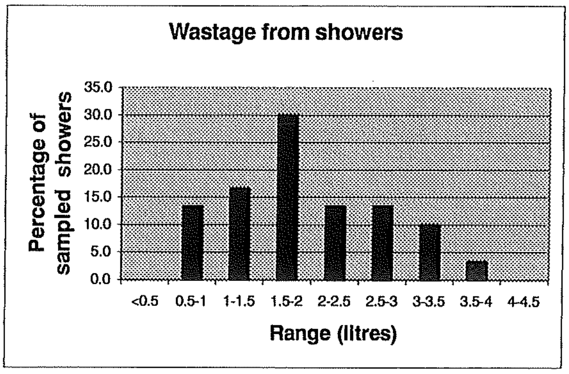


Figure 2: Survey results for shower water wastage

The results for 30 tested showers ranged from 0.6 litres to 4.4 litres with an average of 1.82 litres and a median of 1.7 litres. The graph of the shower results is shown in Figure 2.

The age of the surveyed houses or flats ranged from 5 years to 90 years. However, no significant relation was found between water wastage and the age of the house or flat. Only 13.3% of the surveyed houses had fully insulated pipes and 20% had partial insulation. Wastage from these pipes was reduced to an average of 1.52 litres per tap use, which is not significantly lower than the wastage from normal lines. The amount of cold water in the hot water line also highly depends on the time that has passed since the last use of hot water at the same tap or another close tap or shower. In most cases the amount wasted at a tap after use of hot water at a different close tap is reduced to around 0.6 to 1.5 litres. The correlation between time-intervals between uses and water wastage can be seen in Figure 3. The graph was set up for an example household with a value of 1.9 litres maximum water wastage at the kitchen tap.

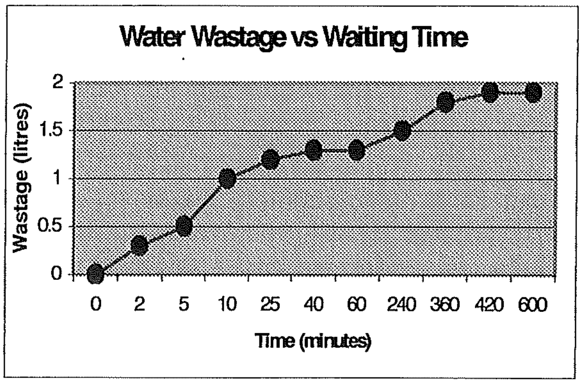


Figure 3: Relationship between water wastage and the time that has passed since the last use of hot water

The average number of hot taps per household was calculated at 4.8 for an average of 3 people living together. 14 houses had one shower and 16 houses had 2 showers.

With the above information an estimate could be made of how much water could be saved per day in an average household with three residents. It is assumed for each person to have one shower and use a hot water tap 6 times a day. These were average usage times drawn from the additional questions on the survey form. The amount that could be saved therefore adds up to 36.5 litres a day, which is 3.1% of the average consumption per household in Adelaide. For the entire city this would mean a saving of 18250 cubic meters which is the equivalent of 12 Olympic size swimming pools per day!

3. EXISTING PATENTS

A detailed review of literature and patent data-bases revealed that "dead water" in hot water pipes was first described by Conny H. Houghton (1973) as a problem and various solutions were developed. Some are now commonly used and other have remained theory.

Circulating hot water distribution systems that constantly circulate hot water through a building have become the standard installations in large buildings. Water wastage is therefore reduced and other saving devices are not acutely necessary in such buildings.

For small family houses however, these circulation systems are far too expensive and the standard family residence is usually fitted with a non-circulatory hot water supply system.

Many inventors have addressed this problem by developing a variety of water saving devices for the use in family homes. These apparatuses pump hot water to the fixtures thus returning the dead cold water from the hot water pipe to the water heater. Many variations of the system have been put forward and individual inventors have patented their models. The main points of variation are the mechanism that turns on the pump, the way it takes to get to its destination and the location to where the water is pumped (US Patents 4750472, 3776261, 5009572, 5042524, 4450829, 4738280, 4142515, 4201518 and 5261443.

Despite the range of existing devices to resolve the problem of water wastage from hot water pipes, it was found that none of these apparatuses have experienced a market breakthrough. They were either too difficult to install or they required too much effort by the user. In response to the findings of the literature review a list of desired features for the new water saving device could be created. The device was to operate without a pump and without any effort by the user. It needed to be easily installed and be cost effective.

4. DEVELOPMENT STAGES OF THE MODEL

The proposed model was to consist of two main parts, a first part that would divert cold water from the hot water line into a tank instead of letting it flow out of the tap. Once a set temperature would have been reached, the water would be allowed to flow freely out of the outlet. This part of the model was realised using two 2/2 – way normally closed type solenoid brass valves and a PDTF 120R 8M-C-HC ½" NPT temperature switch. The switch is connected to both solenoid valves. Valve 1 is opened and valve 2 is shut when the temperature of the oncoming water is below 40°C. As soon as the temperature reaches 40°C, valve 1 closes and valve 2 opens to let the water run through the tap. This setup of the valves and the temperature switch can be seen in Figure 4.

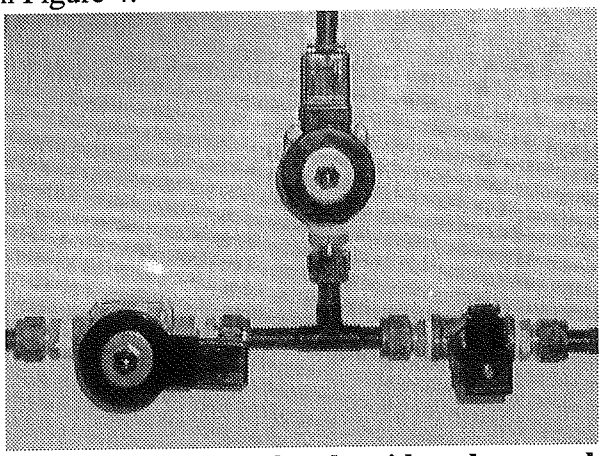


Figure 4: Setup of solenoid valves and temperature switch.

The more challenging part of the design was the second part, in which the diverted water was to be stored and then re-introduced into the water supply system for further use. Several possibilities were contemplated and many tests were necessary to get to the final design.

4.1 Expanding Storage Container

As the storage device was only needed for short time intervals and in order to save space, the idea of an expanding and contracting reservoir seemed very appealing. If it could be achieved to lead the water into a rubber hose which would expand in accordance to the volume that was filled into it, and which would contract again when the water was drained out of it, a maximum effectiveness in space use would have been achieved. In addition the pressure build-up inside the rubber bag would facilitate drainage of its content at a later point in time. It was planned to press the saved water back into the water line after the hot water tap was turned off. It became clear however that this idea had too many disadvantages. The pressure bag design was finally disregarded, as it would be unsafe as well as posing major problems with pressure and undesired filling from other sources.

4.2 Venturi Principle

With the rejection of the pressure bag model another option, how to store the saved water and most importantly reintroduce it into the system, had to be found. It was decided to examine the feasibility of using a venturi application to drain the water from its storage container. The venturi principle works on the basis of the Bernoulli equation for two sections of pipe with different diameters (see equation 1) and states that pressure in pipelines is reduced with increasing flow velocity. The increase in flow velocity is achieved by a decrease in pipe diameter.

$$\frac{v_0^2}{2g} + \frac{P_0}{\gamma} + z_0 = \frac{v_1^2}{2g} + \frac{P_1}{\gamma} + z_1 \qquad (1)$$

where v = velocity, g = gravity, P = pressure, γ = specific weight of water and z = elevation.

In a first series of tests, a model was built that incorporated the previously described valves and the temperature switch as well as a small plastic container into which the saved water could be diverted. The second part of the model constituted of a T-intersection that connected the cold line with the storage container and a one way stop valve to prevent back-flow into the container. The diversion of cold water was completed without problems and water was stored in the plastic container. Once the temperature of 40°C was reached, the water flowed from the tap outlet. Unfortunately the diameter of the T-intersection was not small enough to sufficiently reduce pressure and create suction from the container.

The solution to the problem of how to create enough suction in the cold water line to empty the water saving container presented itself in the form of a device used in irrigation. The part is called the Mazzei™ Injector and is used to accurately inject fertilisers, chemicals and water treatment additives through an irrigation system. It works through the application of the venturi principle and thus there is no requirement of external energy. For the second test series, the T-connection to the tank on the left side of the model was taken out and replaced by the Mazzei™ Injector. The stop valve formerly needed to prevent backflow into the tank from the cold water line was also taken out, as the Mazzei™ Injector comes with its own check valve. All other parts of the water saving system were left the same as in the first test. During the test run all sorts of flow settings were tried on the setup but no suction could be created. Worse even, instead of sucking out the water from the container, the device filled it up despite its in-built stop valve.

Further investigation revealed that a pressure differential between inlet and outlet of the Mazzei™ Injector was required for the device to create suction. This was achieved by creating a bypass line with an in-built flow control valve around the injector, as can be seen in Figure 5.

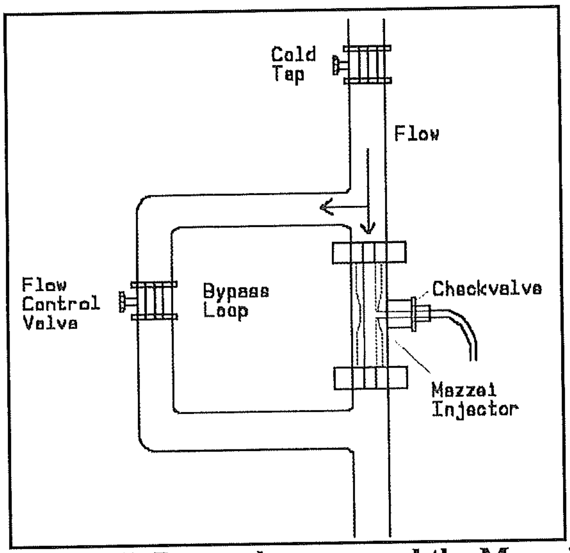


Figure 5: Bypass loop around the Mazzei Injector to create suction from the storage tank.

The pressure could thus be adjusted to be lower at the outlet of the device than at the inlet. The main shut off valve for the system, the cold tap in this setup, also had to be relocated before the bypass line to prevent the injector from being exposed to mains pressure which had previously caused the failure of the stop valve. The tank had to be lowered to a position below the inlet point into the cold pipeline, otherwise the water would have siphoned out of the container even with the cold tap closed.

The water saving system worked with this new setup. The saved water was drained out of the storage container as soon as the cold water was flowing at a rate of 8.6 litres per minute.

5. FINAL MODEL DESIGN

With regard to the results of the test series, a final model setup was constructed (see Figure 6). A picture of the experimental apparatus can be seen in Figure 7.

The right part of the model consists of a shut-off valve, the setup of the two solenoid-valves and the temperature switch as seen in Figure 4, and a power switch. The shut off valve acts as the hot tap for the system and the power switch turns the power supply for the valves and the temperature switch on and off. The line that connects valve one with the supply line leads into a 5litre plastic storage tank. The line through valve two leads to the water outlet. Following this water outlet a pipe goes to the bypass loop with a flow control valve in the bypass line and the Mazzei™ Injector in the main line. A second shut off valve acts as the cold tap for the system. A thin hose that is connected to the Mazzei™ Injector is inserted into the storage tank and is used to suck out the water into the cold line. Both the cold and the hot inlet into the entire system are connected to the main water supply by garden hose and hose fittings. For the installation in an actual household it is suggested that an overflow hose be connected from the top of the tank into the drainage pipe of the sink or shower to prevent the tank from overflowing in periods of unexpected excessive use.

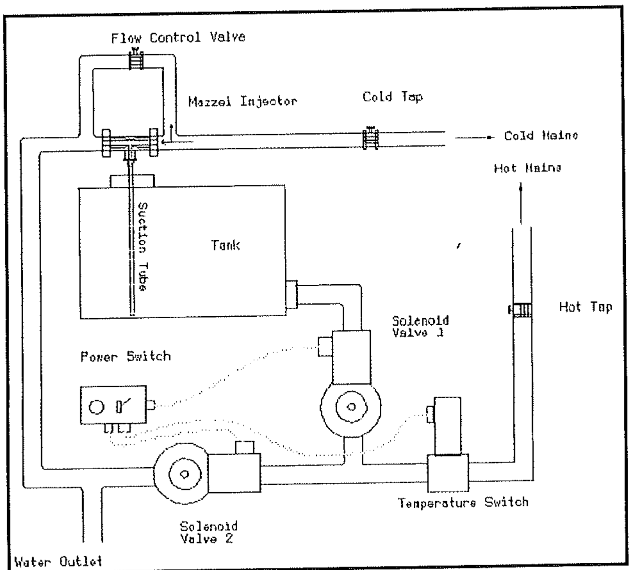


Figure 6: Final model setup

6. DISCUSSION

It was interesting to investigate a new research area without the existence of an extended literature base. Even though all parts of the model as well as all principles had previously been known, the research resulted in a very new way of applying them.

In the project the focus was on saving cold water from hot water lines, but the principle of the apparatus can easily be used in other areas such as saving warm water from cold pipes that had been exposed to the sun. The locations of the tank and the water re-injection part of the model are not restricted to being close to the tap. The model can be extended to fit a

whole household with a central storage container and a suction inlet in major indoor or outdoor pipes.
The survey sparked interest in the project from many people, which led to valuable suggestions. Responses however were scarce with only 30 replies from 120 sent out forms.

The amounts that can be saved are small on a scale of overall consumption, being only around 3 to 4% of the average daily water usage of 295 litres per capita per day (Daniell, 1999), but they are definitely not negligible. Currently the price of water in South Australia is an annual access charge of $123 plus 36c per kilolitre for the first 125kL and 92c from then on (SA Water brochure, waterline, 1999). A four people household would thus save $16.12 per year with the implementation of the water saver. Economically it would not be worth installing it in a house, but with decreasing water resources it is not impossible that water prices will drastically rise, as they already have in country areas, and start a demand for more savings. From the ecological point of view there is a greater need to conserve water, especially in remote and hot areas. It would also be possible to install the system in touring vehicles for the outback that carry a hot water supply, and where water conservation is vital.

Out of the four criteria for the new device that were set in section 3, three have been met. The system works without a pump, it does not require any effort by the operator and it would be easy to install. Cost effectiveness needs to be improved, by decreasing the cost of production of the device, as well as refining it towards a standard small design.

Before being able to possibly market the water saver, it is vital to protect the design by lodging a patent application. The criteria for receiving patent protection have been met in this project. The invention is new, as has been proven in the patent search. It is not obvious to somebody with knowledge in the field, as I found out when consulting people. It is useful in the way it saves water, and finally it is not merely a mental process but a product, which is proven by having a prototype of the device (see IP Australia, The Patents Guide).

7. CONCLUSION

A new water saving device has been developed for the use in family households with no recirculating hot water system. It has been proven that the theoretical system of diverting unwanted cold water into a container and using a venturi application to re-introduce it into the cold water supply line is working.

Water savings can be made every time a hot tap is used and increasing environmental awareness will spark higher demand for new saving technology.

A working prototype has been built and presented, but there is big scope for refinements into a smaller and cheaper product for standard households.

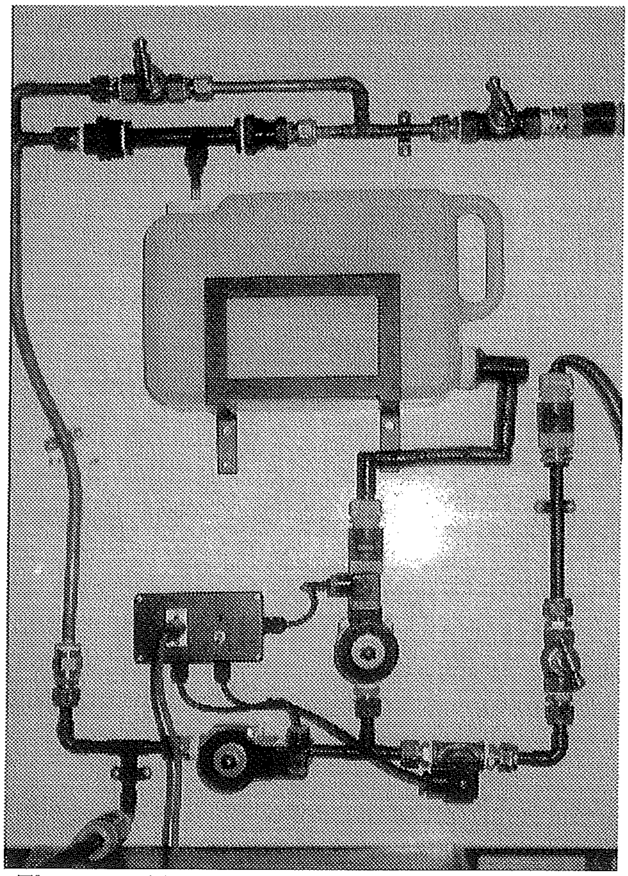


Figure 7: Experimental apparatus in the laboratory

8. ACKNOWLEDGEMENTS

I would like to sincerely thank Steve Huskinson for building every part of the model and patiently making all changes when things did not work the way we had hoped. Without his tradesmanship the model would not have been up and running as quickly and it would not have looked as good as it does.

9. REFERENCES

Daniell, T. (1999). 5980 *Advanced Water Resources Management. Lecture Notes.* Department of Civil and Environmental Engineering. The University of Adelaide.

Fazekas, D. J. (June 14, 1988). Control means and process for domestic hot water re-circulation system. *United States Patent* 4,750,472.

Houghton, C. H. (Dec. 4, 1973) Water Conserving Apparatus. *United States Patent* 3,776,261.

Imhoff, et al. (April 23, 1991). Water conservation device. *United States Patent* 5,009,572.

IP Australia. (1999). The Patents Guide, The basics of patenting explained. Information brochure from the patent office.

Lujan, Jr. (Aug. 19, 1986). Multi-controlled water conservation system for hot water lines with low pressure utilization disable. *United States Patent* 4,606,325.

Lund, W. J. (Aug. 27, 1991). Demand Recovery Hot Water System. *United States Patent* 5,042,524.

Morita, D. and Morita, M.K. (May 29, 1984). Water Saving System. *United States Patent* 4,450,829.

Oberholtzer, S. L. (April 19, 1988). Hot water supply system. *United States Patent* 4,738,280.

Stevenson, A. (May 6, 1980). Recirculation fluid pump control system. *United States Patent* 4,201,518.

Walsh, P. F. (Nov. 16, 1993). Watersaving Recirculation System. United States Patent 5,261,443.

Water pricing for 1999 / 2000. *Waterline. SA Water Brochure.* Government of South Australia.

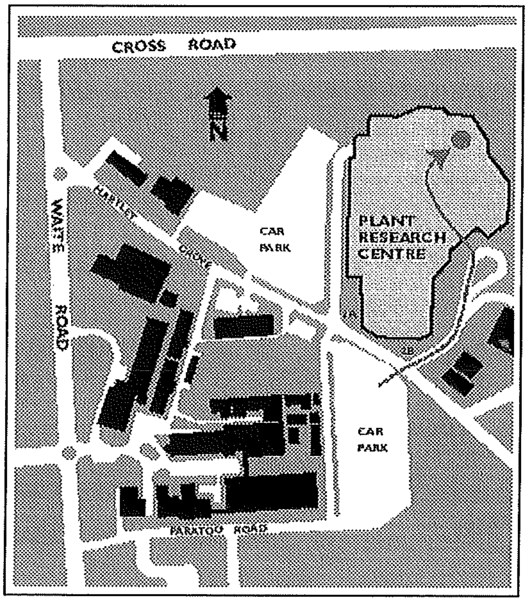
Technical meetings

Our last technical meeting was held on April 26th featuring Dr Henning Bjornlund from the University of South Australia's School of International Business. Dr Bjornlund spoke about water rights trading, discussing the outcomes of early Australian water markets, both permanent and temporary. He argued that the question of markets' achievement of policy expectations in a socially and environmentally sustainable manner cannot be answered in isolation, but only in the context within which the market operates.

The next technical meeting will be held on Thursday 28th June at the new time of 4:30. Further details of this meeting will be forwarded shortly, so keep an eye out for the notice. As always the audience is invited to join the Speaker and other Hydrological Society members for dinner at a restaurant after the meeting. Details of the restaurant venue will be given at the meeting.

STOP PRESS!!!

We have a new venue for our meetings, so if you haven't been to a technical meeting for a while then why not come along and check out the new facilities. We now hold our meetings at the SARDI Plant Research Centre (see below map) and are trialing the earlier timeslot of 4:30.



Check out our Website!!!
http://www.civeng.adelaide.edu.au/HYDSOC/

Some up coming water seminars/conferences

06 -08 06 01	3rd Black Sea conference		Varna, Bulgaria		Dr Atanas Pakalev, 22 "Maria Luiza str, floor 3, room 23, 1505 Sofia, Bulgaria; tel/fax +359 2 980 3547; email watergl@ttm.bg; web www.iawq.org.uk/conpage.htm
26 -31 08 01	International public works conference: innovation, the key to the future		Perth WA		Promaco Conventions Pty Ltd, PO Box 890, Canning Bridge, WA 6153; tel 9332 2900; fax 9332 2911; email promaco@promaco.com.au
12 -15 09 01	Asian Waterqual 2001	International Water Association	Fukuoka, Japan	10/00	Asian Waterqual 2001 Secretariat, Prefectural University of Kumamoto, 3-1-100 Tsukide, Kumamoto 862-8502, Japan; tel +81 96 383 2929 ext 452; fax +81 96 384 0096; email asia2001@pu_kumamoto.ac.jp; web www.pu-kumamoto.ac.jp/~asoa2001/
15 -19 09 01	2nd World Congress of IWA	International Water Association	Berlin, Germany		DVGW fax +49 228 9188990; email info@iwa-berlin.de; web www.iwa-berlin.de
28 09 01	Water History	Hydrological Society of South Australia	Goolwa, South Australia	26/03/01	Bart van der Wel, Hydrological Society of South Australia Inc, PO Box 6136, Halifax Street Post Office, Adelaide 5000,8463 3140 vanderwel.bart@saugov.sa.gov.au

Water History - lessons for the future

Mark your diary now for the Hydrological Society's annual conference. This year the conference will be held jointly with the Heritage Branch of the Institution of Engineers and the Stormwater Industry Association.

The venue is historic Goolwa on the PS Murray Queen paddlesteamer and the program spans the afternoon and evening of 28 September (beginning of the Labour Day long weekend). The seminar is timed to coincide with the flotilla of boats down the Murray as part of Centenary of Federation (book early for accommodation) and the IEAust plaqueing of Goolwa Barrage as part of a program for marking historic engineering works.

The approximate cost of the seminar will be $70. Papers are invited on topics such as the history of water infrastructure, management and legislation; steps in preserving water history, groundwater development, saving cultural history from water development.

It's not too late to submit potential papers or trade displays.

For further information please contact

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