Submission No 31

INQUIRY INTO A SUSTAINABLE WATER SUPPLY FOR SYDNEY

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Subject:

Summary

Sydney's water management has been unsustainable for a long time and needs a reform plan to move it towards sustainability. Our city is piped up to use high quality drinking water once and dispose of the sewage and all our local rainfall in the sea. Sydney is not short of water. Trillions of litres of urban run-off, roof water, sewage effluent and grey water are discarded each year. If we substituted some of this wasted water, appropriately treated, for most of the present drinking water uses, we can reduce drinking water consumption by 90%. Then Warragamba would last Sydney for the forseeable future, without high energy water pumped from Tallowa. The sustainability plan would include changed water pricing, modernisation of the city's plumbing, and decentralisation of recycling and rain water harvesting. Most homes and industries would have three sources of water of different grades fit for their usage.

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Ms Beverly Duffy
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Dear Ms Duffy

SUBMISSION TO GENERAL PURPOSE STANDING COMMITTEE NO.5
INQUIRY INTO A SUSTAINABLE WATER SUPPLY FOR SYDNEY

I am a retired water engineer, a chemical engineer, with 30 years experience in the water industry and have built 400 sewage treatment plants to my own patent design, successfully using simple but superior technology. In retirement I have become very interested in water recycling.

Summary

Sydney's water management has been unsustainable for a long time and needs a reform plan to move it towards sustainability. Our city is piped up to use high quality drinking water once and dispose of the sewage and all our local rainfall in the sea. Sydney is not short of water. Trillions of litres of urban run-off, roof water, sewage effluent and grey water are discarded each year. If we substituted some of this wasted water, appropriately treated, for most of the present drinking water uses, we can reduce drinking water consumption by 90%. Then Warragamba would last Sydney for the forseeable future, without high energy water pumped from Tallowa. The sustainability plan would include changed water pricing, modernisation of the city's plumbing, and decentralisation of recycling and rain water harvesting. Most homes and industries would have three sources of water of different grades fit for their usage.

Introduction

Traditionally, Sydney has had an abundant drinking water supply which has been managed in an environmentally unsustainable way by Sydney Water for the last 50 years. All the rivers within sensible piping distance were dammed and the city was plumbed up to use high quality drinking water just once for everything in the home and in industry and to discharge most of the resulting sewage in the sea untreated along with all the urban rainfall run-off. Because drinking water was in abundance, it was thought appropriate to ban other sources of water such as roof water which might have some

small health risk. Rain water tanks were banned. Now under NSW Planning Department Basix regulations, rain water tanks are virtually compulsory for all new dwellings.

Sydney's water infrastructure is mostly 50 to 80 years old and leaks profusely. Since it was built, there has been progress in development of many technologies: in telecommunications, computers, automation, water treatment technology, piping, and information technology. If we had to build Sydney's water infrastructure today it would not look anything like the present system. There is a need for complete reform of water management to bring it up to date.

Sydney's water management is at a crossroads:

Do we continue with the out of date "single use and dump it" philosophy and build a desalination plant, so we have more high quality drinking water to waste?
or
Do we go down the recycling/local rain water collection route to environmental sustainability?

Sydney's per capita drinking water consumption is very high, ie. 400 litres per capita day (including a 30% non-domestic component). By substitution of recycled water and locally collected rain water, it could be reduced by 90% to 40 litres per capita day (again including a non domestic component). The challenges for the sustainability route are great but the rewards are also great. It will require a detailed long term plan backed by research effort

Imagine Sydney beaches with no ocean outfalls because we have recycled all the waste water for irrigation or in industry. Imagine Sydney being able to survive on Warragamba alone for the foreseeable future without high energy pumped transfers from Tallowa dam. Imagine our water ways not polluted with sewage every time it rains. Imagine environmental flows in all our rivers.

90% of our drinking water is inappropriately used and all our rain water run-off and sewage effluent is wasted. We could have happy healthy lives with only 25 litres per capita day domestic drinking water consumption.

I would like to outline some of the elements of the long term plan to achieve environmental sustainability:

<u>Sydney is not short of water</u>

- Sydney still receives about 900 mm of rain per year which is more than London.

- The average population density of all suburbs is approximately 1200 person per square kilometre, as Sydney's 4.2 million people occupy about 3500 square kilometres (approximately 60 km x 60 km). Much of this area is impervious to rain because of roofing, paving and roads so that most of the rain that falls on this area runs off rather soaking in, unlike our 16,000 square kilometres of dam catchments where perhaps 4 or 5% of rainfall collects in our dams.

- In the older denser suburbs such as Leichhardt, with populations of 5000 person per square km, the city is virtually impervious to rain, being 100% paved or roofed. The whole 900 mm of annual rainfall ends up in downpipes or street drains where it can be collected and used. **This flow, on a per capita basis, averages 500 litres per person per day in these dense suburbs, ie. more than the present drinking water consumption.**

- In low density suburbs such as in the Sutherland Shire, with populations of only 600 persons per square kilometre, the availability of local rainwater for collection is much higher on a per capita basis.

- It is likely that the total urban rainfall run-off for metro Sydney is about 1500 billion litres per year which includes 300 billion litres per year of roof water. This water is available locally in some 7.5 million down pipes and 500,000 street drains, each a water resource.

- Yet only 1% of homes presently have rain water tanks.

- **The shortfall in Sydney's water supply last year was only 33 billion litres with restrictions in place, although the fall in dam levels over the last 4 years has been 10% per annum, equivalent to 240 billion litres per annum**. The proposed capacity of the first stage of the Kurnell desalination plant was 46 billion litres per year. Hopefully this is now permanently on hold. Desalination is about as unsustainable as you can get. The high fossil fuelled energy consumption of 5 KWH per KL is the last thing a warming globe needs.

- **Also as a water resource we have about 400 billion litres per year of sewage effluent and grey water. 98% of this is wasted at present**. Of the 400 billion litres, some 150 billion litres of shower water and laundry water are available locally for recycling after appropriate and cheap treatment. Here again we should consider every shower and washing machine a water resource.

- **We can substitute local rainwater and recycled water for 90% of our present drinking water consumption**. We only really need drinking water for drinking, cooking, washing up, cleaning out teeth and washing our hands. This requires 25 litres per capita day, not ten times that amount. We can shower and wash our clothes in filtered disinfected rain water. We can water the garden with shower water and we can flush the toilet with laundry water.

Sydney is not short of water. Urban run-off and sewage effluent together amount to 1900 billion litres per year, more than 50 times the water shortfall last year.

Water pricing for sustainability

- Water is not priced to encourage water saving. After the recent price rises the variable cost of drinking water is still only $1.20 per KL and the fixed water supply sewerage and drainage service charge is equivalent to $2.00 per KL for the average home ($500 per year).

- It would greatly encourage recycling and rain water substitution if the variable cost of water were higher. I suggest $3.00 per KL with the fixed charge equivalent to 20 cents per KL ($50 per year).

This price structure would make it much easier to devise cost effective rain water substitution and recycling schemes and would not increase water bills.

The changed economics of water management

A greater understanding of water management and technology advances has changed the economics of water management.

Large pipe work schemes have diseconomies of scale

- The bigger the pipe work scheme the more it costs for each connection. This is built into the way pipes are manufactured. To contain hoop stress the wall thickness of pipe has to increase in proportion to its diameter. This means that a 300 mm diameter pipe has the same amount of material in it as four 150mm diameter pipes. Also much more small bore pipe is made than big bore pipe so the there are production economies with small pipe.

  The net result is that a city should be sewered with a large number of small schemes rather than a few big schemes. These smaller schemes make recycling much easier.

The economies of scale in sewage treatment plants ceases above 2000 persons

- Sewage treatment plants are made of large concrete water tanks where the sewage is subjected to a number of treatment processes. When these tanks reach a size of about one million litres they are duplicated. A single one million litre tank will treat the sewage of 2000 persons using the intermittent extended aeration process favoured by the NSW Public Works Department.

  This basically means that economies of scale cease at this 2000 person size.

It is cheaper to move information by radio wave than sewage by pipe

- Sewage treatment plants can now be fully automated, totally enclosed and underground. 50 plants can be remotely controlled from a central computer with operators only visiting them for routine checks and malfunctions.

  It is much cheaper to move operating information from a large number of small treatment plants by radio wave than to move sewage by pipe to large treatment plants.

Most of our pipes are now the wrong size, going to the wrong place and are too old and leaky

- Sydney Water has been trying to encourage people to use less water by installing triple-A fittings and appliances. Many of these simply restrict flow to 9 litres per minute. Most homes have 20 mm diameter water mains capable of 100 litres per minute. **We could put in much smaller mains to restrict the flow and save a lot of copper as well as water**.

- Similarly, 100 mm diameter sewer connections can take the whole daily flow of sewage from a home in less than a minute. Why not just delump the sewage and halve the size of the sewer.

- **Roof down pipes are designed to run choked with leaves and could easily handle 3 metres of rain per hour if unchoked. This rain intensity never happens**. If we want to use the rain water, it is logical to screen the water before the down pipe and then we can divert the water to rain water storage in 20mm pipe not a 50x100 mm box section. Down pipe screens cost $20 in hardware stores.

- It is well known that Sydney's sewers fill up with rain water infiltration in heavy rain periods. Most of Sydney's sewage ends up in our recreational waters in wet weather. A large amount of the problem is the thousands of kilometres of clay pipe on private land laid many years ago. The joints have failed and it all needs repair. Main sewers are usually oversized to cope with 5 to 7 times average flow to allow for rain water infiltration.

- **Many parts of Sydney's system can only take twice average flow and these are generally associated with flows to our main ocean outfalls. During heavy rain 70% of Sydney's sewage never gets treated**.

- Obviously if we need the water we should not have ocean outfalls.

Basically our water system is mostly obsolete and needs replacing. The replacement must be sustainable.

Centralised versus decentralised recycling

I have my doubts that "third pipe" or dual reticulation sewage effluent recycling can ever be cost effective.

By my calculation, Rouse Hill recycled water costs Sydney Water $8 per KL and they sell this water for 30 cents per KL. The two cost problems are:

1. The degree of extra treatment required to keep Health Authorities happy. The effluent is treated to less than 1 E.coli count per 100mls and is run through a desalination process. (I have put in sewer mining for golf course irrigation with much lower treatment requirements).

2. The second cost problem is the third pipe. Running third pipes in existing suburbs is prohibitively expensive.

Shower and laundry water recycling in the home can be done very much cheaper at around 60 cents per KL. Obviously you need very little pipe to run your shower water onto the lawn or to flush the toilet with your laundry water. Also the health risks of home recycling are much reduced because healthy people do not excrete pathogens. Most of us are healthy.

Unfortunately the NSW Health guidelines for recycling grey water do not reflect this reduced health risk and the levels of treatment required are exactly the same as for discharge of community's sewage effluent to the environment.

Because so many government authorities have an interest in water there are some interesting and illogical contradictions –

> **The EPA's E.coli count limit for safe bathing waters is 150 per 100mls.**
>
> **The E.coli count limit from NSW Health for grey water used to flush the toilet is 3 per 100mls.**

I use screened, settled and tablet chlorinated laundry water to flush my toilets with an E.coli count of less than 150 per 100mls. This means the EPA would allow me to swim in my laundry water but NSW Health does not allow me to flush the toilet with it. The E.coli count in laundry water is, of course, insignificant in the typical toilet bowl anyway.

Obviously the required reform in water management must be applied to all the authorities involved in water: NSW Health, Sydney Water, NSW Planning, Local Council Building and Health Inspectors, The Environmental Protection Authority, The Sydney Catchment Authority , etc.

Australians have a healthy disrespect for authority and home recycling of laundry water and shower water is widely practiced informally in contravention of NSW Health guidelines. It would be the commonest form of recycling at present.

Rain water tanks and swimming pools

- Sydney swimming pools are half full of rain water because the annual evaporation rate in Sydney is 1800 mm and the annual rainfall is now about 900mm.

- By diverting one roof downpipe into the pool, it will be 100% full of rain. It is much cheaper to do this than buy a pool cover. This would have to be the simplest way to reduce drinking water consumption and would save approximately 9 billion litres per annum.

- Swimming pools and rain water tanks are obviously similar structures. They both are just water tanks. It costs very little to make a swimming pool double as a rain water tank and the converse also applies.

- Swimming pools are equipped with some form of filtration and disinfection. This can be used to create high quality rain water suitable for showering and the laundry at low cost.

It is very difficult to justify the cost of a rain water tank with drinking water at only $1.20 per KL.

- With much of Sydney now worth $2000 per square metre, rainwater tanks have to be below ground.

- NSW Planning's Basix suggests having rainwater tanks of around 5000 litres and that the water saving of approximately 25% is achievable based on the old rainfall figures before global warming. (Sydney rainfall has since fallen about 25% and a 5000 litre tanks is much too small).

- A 5000 litre rainwater tank might save you $75 per year in water charges. **Below ground tanks cost about $5000 so the pay back time is 67 years**. That is not a good investment.

People are prepared to invest in a swimming pool. 18% of existing homes have a swimming pool and 40% of new homes have one. **By using the top 300 or 350 mm of the pool as rainwater storage you get a rain water tank for free. Only minor modifications are required and Sydney has 250,000 back yard swimming pools**.

Basix's at present applies to all new homes. Next July it will apply to all renovations. If you have a swimming pool installed you will be required to also put in a rain water tank. If you can make a swimming pool double as a rain water tank or a rain water tank double as a swimming pool, why do we need both? I will be making a submission on this point.

Three waters policy

Every home, in my opinion should have three water sources –

1. **Drinking water** as at present but only 10% of present usage (25 litres per capita day) for drinking, cooking, washing dishes and hands, cleaning teeth, etc.

2. **Swimming pool grade water** which would be microbe-free, sand filtered and disinfected locally-harvested roof water. It would not be suitable for normal drinking requirements but would be suitable for showering and the laundry use and would account for 50% of present usage (125 litres per capita day).

3. **Pond grade water** which would be locally treated shower or laundry water and would be used on the garden and for toilet flushing. It would comply with EPA safe bathing water standards as far as E.coli count and would account for 40% of present usage (100 litre per capita day).

With these two extra water supplies, 90% reduction in drinking water consumption can be achieved. I believe a similar approach can be applied to industrial water use.

Shower water and laundry water do need some treatment before recycling in the home but not nearly as much as the present NSW Health guidelines suggest.

These two grey water streams are quite different in character:

- Shower water is a weak waste but is full of faecal bacteria, although they are your own family's. It gets odorous very quickly if stored without aeration. If it is intermittently aerated for two days and tablet chlorinated satisfactorily, water for use on gardens results. Alternatively, it can be cleaned up by 15 days in a goldfish pond using solar oxidation. You need one square metre of pond per person.

- Laundry water is a much stronger waste because of its detergent content and is alkaline and saline and not suitable for prolonged garden application. If it is screened and settled to remove lint and tablet chlorinated it is quite suitable for toilet flushing. Its microbe content is then insignificant in a toilet bowl.

Conclusion

I would like to see the elements outlined above included in a plan to achieve sustainability in Sydney's water management which will require a period of far reaching reform.

- **Sydney is not short of water** and reform will include substitution of locally harvested rainwater and locally recycled water for drinking water through out Sydney.

- **Ocean outfalls will gradually be shut down** and all sewage will be treated within one kilometre of where it is generated in small, automated, remote controlled, plants with effluent disposal by irrigation on local parks, sports fields, golf courses, bowling greens, farms and reused in local industry. Urban run-off should be used in combination with recycled effluent is many instances.

- A large reduction in drinking water consumption would restore flow in many of our dammed rivers and **Warragamba would last Sydney for the foreseeable future**.

Yours sincerely,

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