

Some suggestions
for the future of

Tamworth Water Supply

Considering some
**Environmental,
Thermodynamic, and
Engineering** issues

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The purpose of this presentation

- *To raise awareness*
- about potential

MAJOR WATER PROBLEMS

- and suggest a solution

PREAMBLE: before 2019

- Natural rainfall, and normal river flows
- provided enough water.
- Storage in **Chaffey and Dungowan Dams**
- provided a buffer for dry times.

In 2019, we just made it through

- Drought has caused reduced river flows
- Reserves in Chaffey dam at all time low in May 2020
- Underground aquifers are being drawn upon

Underground water supplies (1)

- There is ANECDOTAL EVIDENCE that
- many bores are now going deeper
- Some are now twice the depth of 20 years ago.



Underground water supplies (2)

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- As well, increasing extraction of groundwater is turning some aquifers salty.
- Some of the great aquifers of the world are now seen as at risk in near future *(New Scientist, 16 Jan. 2021, p 18, "Groundwater may turn salty")*
-

Indications from this are

There may not enough natural **rainfall**
and **underground water**

to provide **a reliable supply** to the city
over the longer term

Consider two further factors

- 1) **increasing populations**
- 2) **higher temperatures**
- *Both of these will **increase demand for water***

As well, **Global Warming**

- Is causing **higher ambient temperatures** worldwide
- This may be causing **CLIMATE CHANGE**
- which may be causing these **long dry periods**
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What can we do about it?

- We have to
- **create potable water**
- *How do we do this?*
-

DESALINATION

- If we are going to create potable water
- *there seems no alternative*
at this time

DESALINATION – what is it exactly ?

- The desalination process enables the

- **removal of unwanted material**

- from water

to make potable (drinking grade) **water**

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What processes are used in Desalination?

- **REVERSE OSMOSIS**

forcing water through very fine filters – usually used for very dirty water such as effluent

- **DISTILLATION**

basically boiling water and condensing the vapour – suitable for seawater

If we go for **DESALINATION**

- What **FEEDSTOCK** do we have?
- 1) **effluent** *(water from city waste water systems)*
- 2) **seawater**

Feedstock 1)--EFFLUENT

- Effluent is being processed and recycled in many cities,
- The worlds largest effluent plant is being built in Egypt now
- But in Tamworth, effluent is already utilized in **useful crop production**
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EFFLUENT AGAIN

- Treated effluent **may not be sufficient** to provide enough potable water for Tamworth
 - *(estimated 30% at most)*
- Inland processing also creates the **problem of salty residue disposal** (a big problem)

Feedstock 2) --SEAWATER

Is available in **unlimited quantities.**

- **Large scale plants** are feasible *(already in use in many countries)*
- **Possible Lower cost per unit**
- **Disposal of salty residue** (brine) **is easy**

Desalinated Seawater

- Can be produced in **large quantities**
- Is produced **at sea level**
- There appear to be **no detrimental environmental effects**

Moving desalinated sea water

- Will require a **pipeline to Tamworth**
- Raising the water to 600 metres will also require **a lot of energy**
- *however*
- *Pumping water through pipes encounters much lower losses than running water down river beds*

Desalinated water COSTS MONEY

- so losses need to be minimised
- may need covered storage tanks
- *However, with assured daily supply, smaller stored volumes are needed*
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The energy – **reliability is essential**

- *The desal plant and pumps will need*
- **assured daily energy supply**
- *In two forms*
 - 1) **direct heat** for the distillation process, also steam raising for the steam turbine pumps
 - 2) **electric power** for the service systems

Possible Energy sources -EXTANT (1)

- *At the present stage of their development*
- **Renewables**, such as wind and solar PV
may not really be capable
because of
- **conversion losses** and their intermittent nature.

Possible energy sources- Extant (2)

- **Another extant energy alternative** is to use the IR (Infra Red) radiation to heat the water direct
- Such a process would provide **direct heat for the distillation process.**
This approach minimises energy losses (as when using electric power)
- This source may need some development, however.

ENERGY SOURCES – thermal power stations

- There are three main types of **thermal power stations**
- **Coal**
- **CSG** (coal seam gas)
- **Nuclear**
- *Any of these could power a desalination plant efficiently*

ENERGY SOURCES - Coal

- A coal fired power station
- **converts energy by combustion**
- and can be
- **large enough to provide direct heat as well as the electric power for process systems**
-
- But it is considered a dirty process, producing **unacceptable emissions of CO₂.**

ENERGY SOURCES - CSG

Again, **Conversion is by combustion**

Can be large enough to power a desal plant.

- The **conversion produces less CO₂**, but the supply chain emits methane, both green house gases.
- CSG could be considered as an
- **interim energy source,**
even though it is not really ideal, from a green perspective.

Alternative energy source

- - *The only other source of sufficient direct heat at the temperatures needed is a*

- **nuclear reactor**

*A nuclear reactor can provide enough direct heat for a very large distillation process,
as well as the power to pump the water to Tamworth.*

Environmental aspects

The **most valuable environmental outcome** would be

**Restoration of the natural
flows of the Peel River**

with all the environmental benefits of an
improved ecosystem

Other environmental aspects

Chaffey Dam will fill over time

and could provide water for

future intensive agriculture

in the Tamworth area

Final notes

The provision of a reliable water supply will be

A major benefit for Tamworth into the future

and can be achieved by using some

powerful technology

Disclaimer

These are my *personal views only*

They are based on a lifetime of environmental concern
and a distillation of my research on
energy and energy conversion processes

Raymond McLaren. March 2021

The Honourable Minister Melinda Pavey

Submission to NSW Water regarding the NSW Water Strategy.

Dear Madam,

We, the undersigned, would like to present the document "Suggestions for the Future of Tamworth Water Supply" for consideration in the present planning schedule for NSW Water.

In this presentation, we propose the case for a major Desalination Plant to provide a reliable supply of potable water for Tamworth into the possibly uncertain climatic future that we face.

As stated in the document, it attempts to see beyond political and vested commercial interests, to provide a possible guide for reliable water supply for Tamworth into an unpredictable future.

The proposed plant would be a seawater desalination unit, possibly in the vicinity of Port MacQuarie or Taree, depending on the logistics involved.

The presentation is based on known environmental, engineering and thermodynamic principles as far as we understand them. There are no unproven, experimental or new processes or systems required to achieve this objective. The slide show has been put together by Raymond McLaren over several years, based on his lifelong interests in environment, engineering and energy conversion, with in principle support from Michael McHugh on the legal, social and community benefit aspects of the proposal.

We have prepared this out of concern for the overall water future, and especially for concern over the serious degradation of our river systems, including the Peel River, caused by over-extraction in recent years.

The concept presented here is focussed on Tamworth, but the principles can be applied more broadly to other towns, cities or indeed the entire North West area of NSW.

This submission is in principle only, and has not been costed or quantities calculated at this time.

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For your consideration

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