

High-efficiency reservoir mixer

Fact sheet
High-efficiency
reservoir mixer

Queensland Sustainable Energy Innovation Fund



A reservoir mixer unit being installed. Once assembled, the unit floats with the impeller immersed and is tethered to the bottom of the reservoir

Installation of the reservoir mixer unit at Little Nerang Dam at the Gold Coast hinterland. The extendable collar guides the water flow to the bottom of the reservoir. This one unit mixes and aerates the entire dam, whose length exceeds one kilometre and depth varies up to 32 metres.



Water Engineering & Research Solutions

QSEIF Funding: \$85,250

An ingenious reservoir aeration system which uses about one-twentieth the energy of conventional systems, while providing superior water quality, has been developed by Water Engineering and Research Solutions (WEARS) with assistance from the Queensland Sustainable Energy Innovation Fund (QSEIF).

Dams and deep lakes undergo a natural process of stratification. As the surface layer of water is warmed by sunlight, it becomes more buoyant than the colder water below, preventing the underlying water from reaching the surface. Trapped beneath the warm surface layer (about 2-3 metres deep), the main body of water

becomes depleted of oxygen. The resulting low concentration of dissolved oxygen causes iron, manganese and other metal salts to leach from sediments, and leads to discolouration, odour and bad taste. Stagnation of the water also encourages the growth of algae in the surface layer.

Conventional methods of mixing reservoirs, by pumping compressed air through perforated pipes at the bottom of dams, requires large amounts of electrical energy and is grossly inefficient.

Stephen Elliott, the founder of WEARS, studied stratification while undertaking a thesis for a Bachelors degree in civil engineering at Griffith University, Gold Coast. He set out to develop an innovative new technology that would

be more effective and energy-efficient in destratifying water supply dams in Australia and around the world.

The technology developed by Stephen Elliott uses a slowly rotating impeller (about 5 metres diameter) that pushes warm, aerated surface water to the bottom of the reservoir, and draws cold, deoxygenated water to the surface. QSEIF funding allowed Stephen's company to develop several prototypes and assess their effectiveness by monitoring water temperature, oxygen levels, metal concentrations and water quality over a wide range of depths and area and over extended periods of time.

Extensive field measurements showed that a single impeller unit can effectively maintain uniform water temperature and oxygen levels over an extended area.

Concentrations of dissolved oxygen were maintained at 2-4 mg/litre (high enough to maintain fish life) down to a depth of 20 metres. Without the reservoir mixer, dissolved oxygen levels generally declined to 1 mg/litre at 6 metres depth and were virtually zero below depths of 10 metres. Dissolved phosphorus, iron and manganese were about one-tenth the concentrations that were measured during periods without mixing.

The potential for toxic blue-green algae is reduced by constantly skimming water from the sunlit surface layer and disrupting algal cells by the sudden change in pressure as water is pushed to the bottom. No blooms of blue-green algae were observed in any dams where WEARS reservoir mixers have been in continuous operation.

The low energy consumption of this technology makes the use of solar power a practical option, avoiding the need for water treatment chemicals in remote areas. The first solar powered unit will to be installed at Cotter Dam in the ACT in late 2004.

WEARS has successfully translated its design expertise and field experience into a viable consulting and manufacturing business. By mid 2005, the company had installed 40 high-efficiency reservoir mixers throughout Australia, with a value of more than \$4 million.

The contribution made by WEARS founder Stephen Elliott in "applying science and technology to create new business, advance industry and solve community problems" was recognised by a 2003 National Science and Technology Award by the Clunies Ross Foundation (operated by the Australian Academy of Technological Sciences and Engineering).

This project is starting to realise its enormous potential benefits, by:

- providing major reductions in energy and chemical use for maintaining water quality in reservoirs and

dams. For example, aeration for Little Nerang Dam is provided by a single 3 kW WEARS unit, replacing two 37 kilowatt air compressors that were used previously. This constitutes a 95% reduction in energy use!

- creation of a manufacturing sector within Queensland, based on technology for maintaining and improving water quality. This would contribute to developing a "critical mass" of expertise in water supply and treatment, which is increasingly recognised as a key environmental and social issue in Australia and around the world.

- improved water quality for cities, towns, agricultural and industrial use, particularly in regard to avoiding blooms of toxic blue-green algae (cyanobacteria).

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The reservoir mixer showing the extent of the collar which carries warm surface water towards the bottom of the reservoir

For more information

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