

# Demonstration, the solution to successful community acceptance of water recycling

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**Abstract** The Department of Natural Resources in Queensland, Australia are presently carrying out a comprehensive Strategy called the Queensland Water Recycling Strategy (QWRS) to determine future Government directions in the whole area of water recycling. This strategy is considering the beneficial use of all waste streams such as domestic sewage, industrial and agricultural wastes, as well as urban stormwater. Following a workshop held during the initial phase of the strategy it was determined that a high priority must be given to the demonstration of recycling practices not being utilised in the State, or presently being practiced in an unsustainable manner. Three separate types of recycling projects are being carried out, the first being based on demonstrating recycling on a large new urban development close to Brisbane, the second associated with demonstrating the complex treatment processes associated with the higher levels of recycling, and the third associated with demonstrating community based recycling schemes.

**Keywords** Water recycling; demonstration; treatment; community consultation; education; stormwater

## Introduction

In July 1997 the Queensland Government gave the approval for the Department of Natural Resources to produce a Strategy for the recycling of all types of all wastewater generally in the State. The main reason behind this strategy being produced was a growing awareness by the general community of a perceived deterioration in the state of the environment surrounding many urban communities in the State. Most of the large towns in Queensland are close to the East Coast of the State and dispose of their effluent into coastal estuaries or directly to the ocean. While the disposal of the effluent is being carried out in accordance with the license conditions placed on it by the State Environmental Protection Agency, there is a growing push by the community for this wastewater to be recycled.

In Australia over recent years there has been a dramatic increase in community involvement in environmental issues. A change in State Government was recently brought about mainly due to the positioning of a major highway, and one medium sized Local Government was defeated at the last election because it was investigating a possible potable water-recycling scheme. Because of this, Governments are now reluctant to make major policy statements on water recycling issues unless they are certain of the community acceptance of their policy.

It must further be realised that Australia is the driest of any of the inhabited continents, and most of the runoff that does occur is in the north of the country, away from the population centres. Through a number of *Waterwise* campaigns, there is now greater awareness of the wastage of water. In normal residential houses, over one half of the reticulated water is used external of the house, where a lower than potable water quality would be acceptable. Many environmental pressure groups are now lobbying government to make better use of our water resources, and one of the methods they are advocating is the recycling of our waters, rather than allowing them to simply flow to the oceans.

## Queensland Water Recycling Strategy

The stated aim of the QWRS is to maximise the use of water recycling across the State in an efficient, socially acceptable and sustainable manner, without causing undue health concerns. While the main output from the Strategy is a document that gives direction to the government on recycling issues, the community has already decided that inadequate demonstration of innovative ideas is occurring.

### Advantages of demonstration

Most recycling projects that have proceeded around the world have occurred with little or no community input, with various levels of success. A number of recent examples in Australia have shown that the community are extremely volatile on issues associated with recycling, often making major changes in direction with a small change in information being supplied to them. This situation has been attributed to the low level of understanding by the community of the basic issues associated with recycling, especially the health issues. There are many complex concepts associated with the health issues; e.g. risk analysis. A number of methods can be used to raise the awareness of the community to many of these issues. As well as the normal community based education campaigns, which are normally only successful with the younger generation, actual demonstration projects have been shown to give the community more of an understanding of the issues. The success of such projects can be greatly increased if the community is involved with the process of choosing and trialing such demonstration projects. This paper describes the process used by the QWRS in introducing demonstration projects as part of an overall strategy.

### Springfield development demonstration project

#### Demonstration concept

One thing that Public Utility planners often forget is that most decisions on water recycling schemes in community areas are actually made by land developers. This overall project is aimed at joining together State and Local Governments with Land Developers to come up with acceptable reuse practices. This project aims at developing a number of recycling demonstration projects in a new residential development that will have a final population of 60,000 persons. The project is being partly funded by a \$750,000 grant from the Australian Federal Government on the assumption that the project will lead to an improvement of the water quality of streams flowing to the oceans into which effluent is presently being disposed. As such the project will also involve a large monitoring component.

#### Communication consultation and education

The important point to note in this development is that the demonstration projects will be implemented with maximum community consultation and involvement. The community will be involved from the initial planning stages to the final operation and monitoring stages. A comprehensive education program will be developed in collaboration with the community addressing both the existing residents needs and that of future potential house buyers into the area. The cost of this may be significant.

#### Dual reticulation project

While in the USA there are now well over 1,000 dual reticulation systems, there are almost no examples of successfully operating systems in Australia. The main exception to this is at Rouse Hill in Sydney, which has experienced numerous problems due to both technical problems and a lack of community consultation. No examples presently exist within Queensland of dual reticulation systems in residential areas and much misinformation is being circulated about them.

This project is proposed to proceed with maximum community and environmental input right from the initial planning stage. In the initial planning stages the project will look carefully at the way that the recycled water is to be allowed to be used on private allotments. The project will produce data on the construction and operational costs associated with such systems based on Queensland conditions.

#### **Irrigation of public open space project**

This project will be undertaken in conjunction with the following project on urban stormwater harvesting. Numerous studies both overseas and in Australia have shown that the community believes that its standard of living is improved if they have access to green pleasant environments. Many of the areas being developed in Queensland, are on extremely marginal agricultural lands and would only be aesthetically pleasing if some type of irrigation was introduced. This project aims at maximising community benefit from both the treated sewage effluent and harvesting of stormwater. It would be expected that quite a complex computerised control system would need to be designed to make the optimum use of the two effluents. In order to determine which areas of public open space should be irrigated, a number of community surveys will be undertaken. This will be fed into the design phase. It is expected that the types of areas that will be irrigated will include;

- major road verges and dividing strips,
- sporting fields,
- public parks,
- pathways and bikeways,
- drainage and wildlife corridors, and
- surrounds to major shopping complexes.

#### **School irrigation project**

Within Queensland, at the present time, a number of schools are already using recycled water for irrigation. An inspection of some of these schools revealed that most of these practices were unsustainable and some extremely dangerous from the public health point of view. This project will be carried out in collaboration with the Queensland Department of Education and the Department of Public Works to demonstrate safe and sustainable practices for recycling within schools. This is expected to include a number of subsurface irrigation systems with computerized control systems for the timing of irrigation.

#### **Urban stormwater harvesting project**

This project is closely related to the public open space irrigation project as is explained (elsewhere) in this additional information. The project is basically involved with the harvesting of first flush urban stormwater in the head of a catchment and using it in conjunction with treated sewage effluent to provide a total integrated system for public space irrigation. This has the advantage in greatly reducing pollution of local creeks that ultimately feed to Moreton Bay, as well as reducing the need to construct large dams within the catchment.

#### **Advanced water recycling treatment demonstration project**

##### **Initial concept**

In 1995 the Australian Water and Wastewater Association (AWWA), developed the concept of constructing and operating a *Potable Water Reuse Demonstration Plant*. This plant had as its main objective, the demonstration to the general community of the treatment methods necessary to produce a recycled water to a potable standard. This was to be part of an overall community education project. The basis of the project was to produce a

transportable treatment unit that could be set up and run by a Local Government at a sewage treatment plant to demonstrate the technology. As well as the actual demonstration treatment plant it was proposed that there would be an interpretive centre associated with the plant where the community could, through a number of displays, understand the issues associated with potable water recycling.

Because AWWA did not have funding in its own right, it made a number of applications to Government funding bodies and approaches to a number of Local Governments to progress the project. Although the State Government supported the project in principle, it had a number of problems with some areas of the project. Because of the volatile nature of the community in the area of potable recycling, the government did not agree with promoting a plant solely based on potable recycling. It also believed that the plant should address the technical demonstration aspects as well as the community education issues. The project was not successful at obtaining funding, and so did not progress.

Following the initiation of the Queensland Water Recycling Strategy, it became evident that there was a desperate need for demonstration projects to be initiated. One of these areas was to demonstrate the technical issues associated with the treatment of effluent to produce a recycled water of a quality necessary for particular applications. Based on this the QWRS made special application to the Department of Natural Resources for funding for a project similar to the original AWWA project. The Department agreed to provide funding for the construction of the plant. Because of the large amount of work that had already been done on the original concept, AWWA were asked to provide on going advice to the Strategy to progress the project, which they readily agreed to do.

#### **Multiple objectives of project**

Prior to the planning commencing on the preliminary design of the plant, a check was carried to see if any similar project was presently underway elsewhere in the world. The main plant that is well represented in the literature is the Denver Reuse Demonstration Plant. This plant was constructed mainly as a technical demonstration plant to research the efficiency of the processes necessary to produce direct potable water for the city of Denver. The plant itself was not linked directly to a consultation or education program. A local company, Pridesa, has recently constructed a second plant in Spain, which again is a technical pilot plant to demonstrate the individual processes necessary to produce a high quality water. In many ways this plant is similar to the plant presently being designed for the QWRS, because of its modular design.

One of the important aspects of this particular plant is the multiple objective nature of the total project. The plant as described below will meet objectives of State and Local Government, as well as research organisations and private industry.

*State government objective.* One area that has not been well reported on in the literature is the dependability of different processes involved with complex water treatment processes. Each of the individual treatment processes will be monitored for large variety of physical, chemical and microbiological parameters. This will include the recent health concern parameters of endocrine disrupters and pharmaceuticals. The output from this exercise, especially the distribution in water quality parameters will be linked into a health risk analysis process. It will also take special note of operation and maintenance aspects of the individual processes.

*Local Government Objective.* Individual local governments will be using the plant to optimise the processes necessary to produce recycled water to a particular quality. Because of the modular nature of the plant, it is a relatively simple matter to trial any particular group

of processes and compare them to other variations. It is proposed that the actual day to day operation of the plant will be under the control of the local government where the plant is located.

*Demonstration objective.* It has been determined that it is important that the plant is constructed in such a way that it is easy to demonstrate to both technical groups and the general community the complexity and sophistication necessary to produce a high quality water. The individual pipe layout, process layout and water quality monitoring system is being set up to facilitate this. Special attention will be given to the computerised outputs to maximise the demonstration potential. Where possible glass viewing windows will be installed to show the working interiors of the units.

*Research objective.* It is also proposed that a number of research projects will be carried out simultaneously on the plant. Two projects have already been identified associated with the plant. The first is a project looking at optimising the use of membranes in the treatment process, being carried out by the University of New South Wales. The second is a project based on trialing a new product based on a modified kaolin, which uses the mechanism of both ion exchange and adsorption for the removal of heavy metals, nutrients and organics, being carried out by the University of Queensland. More projects will be identified as the project progresses.

*Private industry objectives.* The plant has been specially designed based on a modular concept so that additional processes can be added as need be. It is expected that a number of manufacturers will want to trial there individual process, and compare them against existing processes. This can be easily done.

The coordination of all of these objectives is expected to be a difficult task. A pilot plant manager is presently being employed to undertake this task. He will need to have skills in the area of process design and operation, as well as research and communication skills.

#### Treatment modules

The pilot Plant has been based on nine separate modules, and a simplified diagram of how these fit together are shown in Figure 1. A brief description of the processes on the individual modules is given in Table 1 below.

#### Progress to date

As at June 1999, the preliminary design has been carried out on the plant, contract documents produced and an open tendering process completed. A Queensland-based firm, Aquatec Maxcon, won the right to construct the plant for a tendered price of \$A1,065,448.

**Table 1** Details of processes included in individual modules

Module No	Processes Included
1.	Main plant feed tank: Lime Addition, Flocculation, Clarification; pH Adjustment (CO <sub>2</sub> addition).
2.	Flocculation; Dissolved Air Flotation
3.	Coagulation (three stage); Direct Filtration (two parallel units).
4.	Ozone production; Ozone dosing columns.
5.	Activated Carbon Filters (two parallel columns).
6.	Chemical Addition; Micro Filtration Units
7.	Chemical Conditioning; Reverse Osmosis Membrane Unit.
8.	UV Disinfection; Chlorination
9.	pH Adjustment; Purified Water Storage
10.	Control and Instrumentation

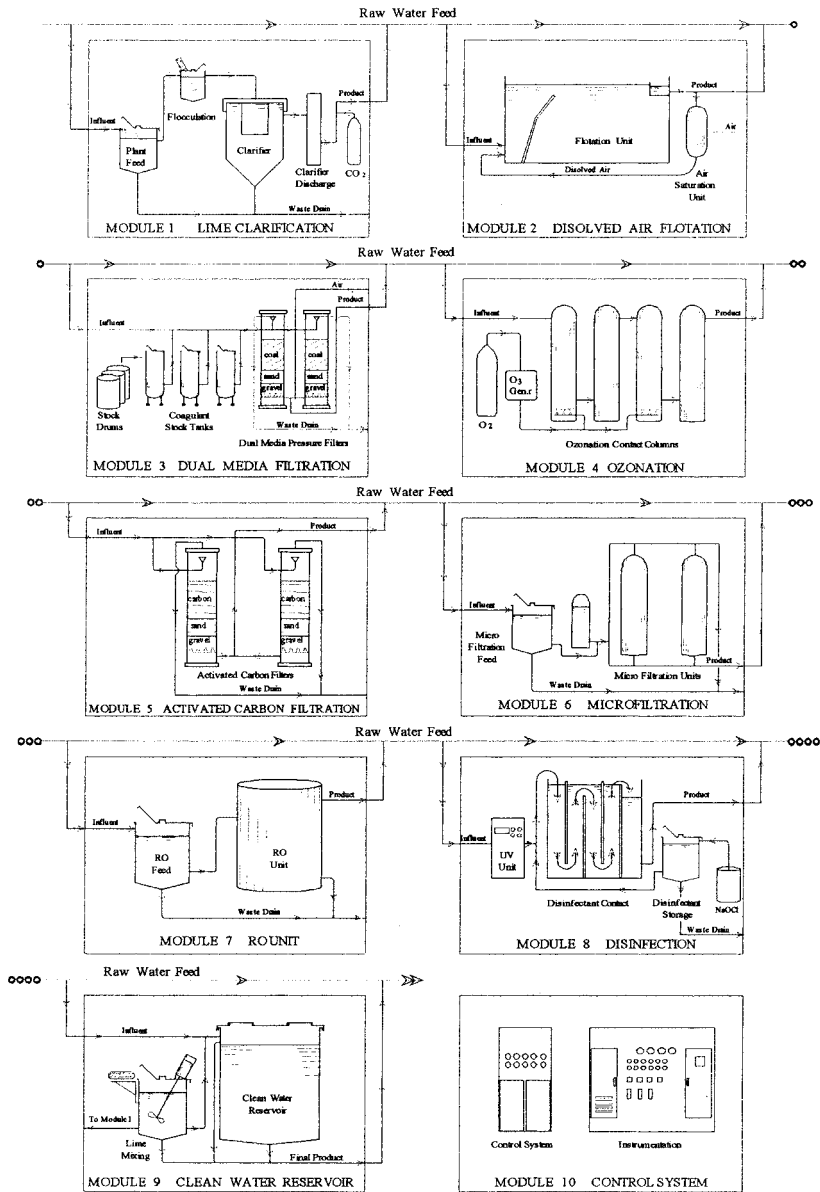


Figure 1 Diagrammatic layout of advanced water recycling demonstration plant

The tender accepted was for a design, supply construct and commissioning of the plant. It is expected that the design of the plant will be completed by August 1999, construction completed by December 1999, and commissioning completed by January 2000.

### Community demonstration projects

#### Project concept

In a number of countries the importance for their ultimate success has now been well demonstrated of community involvement in the selection of recycling applications. The QWRs called for applications from the general community for recycling projects that were based on existing technology but showed some level of innovation in their application. Thirty applications were received, and after some negotiation stages, it was decided that

fourteen of these would receive funding. The grants being made do not involve large amounts of funds, approximately \$A20,000 per year for between one and three years, however the rewards from such an approach are seen as being large. The QWRS will help the proponents will a number of aspects of the projects including monitoring and promotion. This process is now intended to be repeated over the next few years.

### Individual projects

The actual selection process for the choosing of successful projects is almost complete and a number of the likely projects are described briefly in Table 2.

### Future directions in demonstration

#### Demonstration gaps

Even with the three separate types of demonstration projects described above it is believed that there are still areas of demonstration that have not been addressed. One of these areas is industrial recycling. Negotiations are taking place with the *Sustainable Industries Unit* of the State *Environmental Protection Agency* to see if partnerships can be used to demonstrate innovative industrial recycling. In the area of agricultural recycling, a separate program is being initiated by the Department of Natural Resources, called the *Rural Water Use Efficiency Initiative*, which should address the rural issues.

### Conclusions

The QWRS initiative of the Queensland Government has now been underway for two years and it has now been acknowledged as a successful model for progressing water recycling. One of the main reasons for this is the community involvement approach in all levels of decision making. This shows out well in the area of demonstration projects where the community has major input into which projects are chosen and how the information is delivered to the community on the performance of the projects. This is done with the backup of suitably qualified technical advice where necessary. The community will no longer trust the

**Table 2** Examples of community based demonstration projects being funded

Project	Name Description
(a) City farm demonstration water recycling project (Brisbane)	This project is designed to demonstrate to city dwellers, local governments and industry the potential for recycling urban produced wastewaters either for direct irrigation or aquifer recharge.
(b) Fraser Island water recycling project (Fraser Island)	The project aims to demonstrate a 30% reduction in ground water extraction in an environmentally sensitive environment through the demonstration of dual supply and waste collection systems.
(c) Healthy Homes Project (Gold Coast)	This project aims at demonstrating the limitations of a self sufficient house in a sewered area to operate in a sustainable manner.
(d) St Rita's stormwater recycling strategy (Brisbane)	This school, situated in northern Brisbane proposes to demonstrate stormwater recycling from water collected from a new multipurpose hall, including monitoring and education programs.
(e) Demonstration models for sustainable water recycling on golf courses (State wide)	The project aims at demonstrating the use of successful sustainability models on three golf courses in different climatic situations across the State.
(f) Plant nursery water recycling project (Brisbane)	The project aims at demonstrating the recycling of nursery runoff waters blended with stormwater captured from buildings on the site to reduce the intake of reticulated water.

technocrats to make decisions on issues that will directly affect the local environment unless they are involved in the decision making.

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