

## SHOALHAVEN RECLAIMED WATER MANAGEMENT SCHEME (REMS)

Bill Tomkinson ( [tomkinson@shoalhaven.nsw.gov.au](mailto:tomkinson@shoalhaven.nsw.gov.au) )  
Planning/Development Manager, Shoalhaven Water Division, Shoalhaven City Council

### Abstract

REMS is one of the largest and most complex water-recycling schemes undertaken by an Australian water authority. It is being developed in two stages, at a total cost of \$64.5m, to beneficially re-use up to 80% of reclaimed water from six Wastewater Treatment Plants (WwTPs). On completion REMS will serve an estimated population of 58,000.

REMS first stage, costing \$39M, was commissioned in January 2002, fully subscribed with 370 hectares under irrigation on the lower Shoalhaven River floodplain supplied from four WwTPs.

When Nowra and Bomaderry WwTP's join the Scheme in 2006 the irrigation area will increase to 750 hectares, mainly for irrigation on dairy farms, golf courses and recreation areas.

The Scheme will significantly reduce discharges to the environment and drought proof dairy farms with the water resource.

### Introduction

REMS has been based on combining community preferences with expert technical advice to build an innovative solution to regional reclaimed water management issues. The result is a Scheme that exceeds government, community and end-user goals in terms of cost, environmental protection and operational efficiency.

A key success factor for REMS has been the ability to involve key stakeholders, such as user groups, in the consultative process to ensure the Scheme was tailored to their specific needs.

REMS began as a local solution to a local problem and is now delivering significant benefits in terms of social, economic and environmental outcomes for the northern Shoalhaven region. The Scheme was driven by a strong community desire to protect the environment of the Shoalhaven Region - Jervis Bay in particular - in light of a rapidly expanding population base.

Seven Scheme strategies were considered with three being shortlisted for community opinion. These included ocean release at three alternative locations, land-based re-use on forestry plots and river release via constructed wetlands with local re-use.

At the end of an extensive community information program, a statistically-based community survey was undertaken. 55% of first preferences were for land application of reclaimed water, with 80% of respondents willing to pay an additional sewerage charge to implement the management option they preferred.

REMS fits within Shoalhaven City Council's economic development strategy by boosting rural production and farming opportunities. It is anticipated that by 2015 up to 1,000 hectares of land will be under irrigation. This could result in up to 80 additional jobs in the region and a boost to regional farm and food processing incomes.

The Scheme avoids the need for a new ocean outfall and reduces power requirements and Greenhouse gas emissions by approximately 45% compared with the original concept. Through design innovations the scheme improves the ability to fully treat wastewater, including inflows during large storm events, and reduced infrastructure costs.

The scheme protects Shoalhaven waterways by stopping discharges into the newly created Jervis Bay Marine Park and improving the water quality of surplus Scheme flows released to the ocean at Penguin Head, near Culburra Beach.

The scheme will also improve water quality and reduce releases to the Shoalhaven River in Stage 1B

Potable water is conserved by providing an alternative for activities such as dairy yard wash down. Investigations have commenced into using the water for stock drinking and if implemented will save additional potable water.

The long-term viability of the local dairy and other agricultural industries will benefit the local economy through continuing job creation resulting from ongoing irrigation management and maintenance and increased dairy production.

**600 ML Bulk (wet weather) Storage 3**

**600 ML Bulk (wet weather) Storage 3**

**600 ML Bulk (wet weather) Storage 3**

*600ML Bulk (wet weather) Storage*

**Co-ordination of a complex range of issues & groups was vital to REMS successful completion**

The co-ordination of all levels of government and a diverse range of community groups commenced in 1989 and was pivotal to successful completion.

A technical advisory group was formed to steer the community consultation process

and the technical investigations. The group included local affected community groups (local progress associations, the local Conservation Foundation branch and farmers). The group also comprised representatives of government authorities including EPA, DLWC, NSW Fisheries, NPWS, and Dept of Agriculture.

The initial consultation was completed with the exhibition of the EIS for the scheme in 1997.

To ensure that the scheme could proceed to implementation, further detailed investigations were necessary. These were managed by a Steering Committee comprising the scheme proponents (Shoalhaven Water and the Department of Land and Water Conservation), supported by the scheme project managers (Department of Public works and Services) and specialist consultants in communications, agriculture and engineering.

The Steering Committee promoted a Monitoring Liaison Committee (MLC) and Farm Irrigation Committee (FIC).

The MLC comprised government authority and community representatives to develop and oversee a baseline monitoring program and develop a post implementation monitoring program.

The FIC comprised farmer representatives and other potential users such as golf course operators. The FIC was a sounding board for technical investigations in developing supply agreements and user environmental management plans.

A Heads of Agreement was signed by potential users, who also provided a monetary deposit (refundable at signing of a Supply Agreement), to permit detailed design to proceed.

**Optimised design resulted in a \$10M cost saving**

The adoption of optimised design flows, based on loadings that occur over most of the year, resulted in significant cost savings. The originally adopted design flows were based on short-term, summer loadings. The optimised concept utilised the capacity of existing storage ponds at treatment plants to attenuate peak summer loadings.

The distribution system was subsequently designed, using dynamic simulation, to further reduce costs by adopting lower pumping rates. The pumping capacity was reduced from 3 times average dry weather flow (adwf) (pumping off-peak) to 1.5adwf, a total reduction of 70% when compared with the original design (10% reduction is due to revised loading projections). These two concept refinements led to significant reductions in the required capacity of tertiary treatment (filtration and disinfection) facilities

at each treatment plant.

The existing ocean release at Penguin Head can also be used for surplus REMS flows, without enlargement, subject to ongoing performance monitoring.

A reduction of over \$10M in capital costs has been achieved by optimising the Scheme in this way.

The EIS required that wet weather balancing storages provide security against overflows for rainfall events having a twenty-year average recurrence interval to minimise risks of impacts from overflows at wastewater treatment plants. Detailed computer simulation was undertaken to size storages to meet the above requirement and reduce frequency and volume of wet weather overflows to sensitive waterways. Existing

plant storages have been modified to meet both dry weather flow balancing and storm detention requirements at relatively low cost

### **Performance against critical client targets**

The deregulation of farm-gate dairy milk prices in July 2000 was a major potential risk to participation by farms in the Scheme. Farm gate prices for milk fell by 30% as a result of deregulation.

The Scheme negotiated some financial incentives for initial irrigators including a lengthy free-supply period and subsidies for the cost of constructing farm irrigation storages and irrigation electricity supply upgrades. In the case of the Shoalhaven dairy farms, deregulation probably encouraged a higher level of investment than expected due to the need for farms to intensify to survive a deregulated environment.

When the agreements were due for finalizing to guarantee commencement of construction, applications for water allocation exceeded available water by 50%.

A commitment was made to users that reclaimed water would be available from October 2001. Despite prolonged wet weather delays and poor ground conditions on the Shoalhaven River floodplain, reclaimed water was delivered to the first of the 14 farms in November 2001, and all participating farms by December 2001.

Commonwealth Government support was provided through the Natural Heritage Trusts' Clean Seas Program and the Regional Assistance Program. A Memorandum of Understanding between Shoalhaven City Council and the NSW State Government provides for the joint funding and implementation of all stages of the Scheme.

### **Scheme Description**

Filtered, disinfected reclaimed water is pumped from the wastewater treatment plants to a central distribution storage at Coonemia. From here water is distributed through 22 Km of pipelines to user balance ponds sized to store one peak day supply.

When demand from users is less than supply the distribution storage overflows into a 600 megalitre bulk storage. When demand is greater than supply, water is pumped from the bulk storage to the distribution storage.

(DPWS, 2000<sup>1</sup>). <sup>1</sup> REMS Distribution System Concept Design Study

The bulk storage ensures a constant supply to users even when treatment plant pumping stations are not operating.

In prolonged wet weather periods and when the bulk storage is full, surplus water is released to the ocean at Penguin Head and the Shoalhaven River. This will occur twice per year on average.

*Distribution pipeline Construction on piled foundations*

### **Construction co-ordination**

REMS first stage, overall costing \$39m, commenced in November 2000 and was commissioned in January 2002. Stage 1A was fully subscribed with 370 hectares under irrigation on the lower Shoalhaven River floodplain supplied from four WwTPs. When Nowra and Bomaderry WwTPs join the Scheme in 2006 the irrigation area will increase to 750 hectares, mainly for irrigation on dairy farms, golf courses and recreation areas.

The scheme was constructed using a total of nine main contracts ranging from \$0.6 million to \$7.5 million for a total construction cost of \$30.5 million.

The scheme was project managed, including design and construction management, by the NSW Department of Public Works & Services.

REMS Stage 1A comprised the following components:

- 0 An Upgraded Vincentia WwTP to provide tertiary filtration, chlorination, a pumping station for both Vincentia & St. Georges Basin reclaimed water. Value \$7.5M
- 0 A 16 kilometre, 375 mm diameter, pipeline, from Vincentia to the distribution storage at Coonemia Value \$3.3M
- 0 An upgraded Culburra WwTP to include filters, chlorination and a reclaimed water pumping station Value \$5.15M
- 0 A 4 megalitre capacity concrete distribution storage at Coonemia Value \$1.1M
- 0 A 600 megalitre capacity earthfill bulk storage at Coonemia Value \$3.3M
- 0 A pumping station & chlorinator at the bulk storage (with provision for future treatment facilities if necessary) to deliver water to the distribution storage at Coonemia Value \$1.1M
- 0 A distribution system comprising 18.4 kilometres of pipelines varying from 600 mm to 200 mm diameter from Coonemia to properties on the Nowra floodplain Value \$6.2M
- 0 15 balance ponds varying from 1.1ML to 2.7ML Value \$0.6M
- 0 A trial tree lot of 2 hectares to be established at Coonemia

*400dia poly pipe pull through under Currumbene Creek*

### **REMS required complex engineering & resolution of significant problems**

REMS construction challenges saw Australia's longest ever 400mm diameter directional drill through sand (550m) underneath environmentally sensitive wetlands at Currumbene Creek, near Jervis Bay. The 375mm diameter pipeline extended a total length of 4.4km and required crossings of both Moona Moona and Currumbene Creeks. These crossings (210m and 550m in length respectively) were designed and constructed using directional drilling rather than conventional trenching techniques to protect the sensitive estuary environment.

The distribution network of pipelines from Coonemia to properties on the Shoalhaven floodplain vary in diameter from 600mm to 200mm. Poor ground conditions along Pyree Lane required some 2.6km of pipes to be supported by timber piles whilst the majority of other sections required some form of foundation improvement.

Two crossings of the Crookhaven Creek were successfully carried out using thrust boring with strict environmental protection measures.

### **Management measures in place to handle operational challenges**

Irrigation of floodplain areas, which have a relatively high water table level and receive a reasonably high but variable annual rainfall, will require close monitoring and effective irrigation scheduling. The water table will be

monitored by 13 regional bores and on-farm bores.

An integrated monitoring program has been implemented to manage the Scheme effectively and ensure all relevant public health and environmental requirements are met. This program, developed with diverse stakeholder input, will require continual review and refinement as operational experience is gained.

Continual liaison will be required with REMS users to ensure that irrigation management is effective in achieving Scheme objectives and that Scheme operation meets user needs to provide benefit for all stakeholders. As most users have not used irrigation before, there is a 'learning period' where support is being provided by REMS managers to ensure the success of the Scheme.

Management of reclaimed water quality in the extensive distribution system, bulk storage and farm balance ponds will require an adaptive management approach which will to be refined as operational experience is gained.

The above management measures are included in the REMS Operations Environment Management Plan. The Plan requires an annual Scheme audit and reporting to regulators and the community on REMS performance.

### **REMS provides for equitable supply of reclaimed water to end-users**

The Scheme has been developed around a maximum (normal) supply rate of 35kL/ha/d (3.5mm/ha/day). The rate of supply to each irrigation property is precisely controlled via a constant flow valve. These valves ensure equitable access to water throughout the distribution system.

In extended dry periods, with the bulk storage low or empty, the available rate of supply may fall below this rate. Under these conditions, the flow valves can be adjusted to ensure each user receives their share of available Scheme supply. Water balance simulations have indicated that even in very dry times (ie one in five driest summer) farms will be able to keep plant moisture stress at reasonably low levels.

Irrigation will be scheduled to ensure efficient water application. A range of management tools have been made available to users

including a computer based irrigation scheduling program. Regular advice will also be given to users on the amount of nutrients applied through reclaimed water irrigation and their irrigation usage benchmarked against the other REMS irrigation properties.

*Reclaimed water discharging into farm balance pond with center pivot irrigator in the background.*

### **REMS management requires a strong partnership with end-users**

A REMS Management Advisory Board has been established to provide Shoalhaven City Council and Shoalhaven Water with advice and feedback on the operational management of the Scheme.

Each participating irrigator has signed a use/supply agreement with Shoalhaven City Council covering water supply, conditions of use and irrigation management issues. End-users have day-to-day responsibility for reclaimed water irrigation while Shoalhaven Water manages the supply.

Ongoing advice and training has been given to all irrigators to ensure they get the most benefit from their irrigation systems. This has included an understanding of their soils, plant moisture requirements, irrigation scheduling and application rates and maintenance of equipment.

### **REMS exceeds project, community & user objectives**

Stage 1 of REMS is already delivering significant benefits in terms of social, economic and environmental outcomes, including:

- successfully achieving the community's aims at an affordable cost;
- elimination of reclaimed water discharge into Jervis Bay, now a marine national park, and phasing out of discharges into the Shoalhaven River (Stage 2);
- reduced capital and operating costs by scheme optimisation. By careful staging and financial planning, Shoalhaven Water has also been able to achieve its capital works program (including other large sewerage schemes) while containing increases in sewerage rates in line with community expectations;
- improved long-term viability of the local dairy industry;
- further promotion of the region's clean and green tourism image;
- reduced potable water consumption as all participating farms in Stage 1 are connected to town water for domestic use and dairy wash-down. REMS water is used for dairy wash-down and the use of reclaimed water for livestock drinking is also being investigated; and
- establishment of an enhanced value for reclaimed water which, with the inclusion of Nowra and Bomaderry in Stage 2, has the potential to attract other rural industries such as horticulture, farm forestry, cropping (eg, tea-tree) and other primary and manufacturing industries requiring significant volumes of good quality water.

## **CONCLUSION**

REMS demonstrates the need for effective integration of stakeholder consultation in the development process for complex reclaimed water management schemes that involve a diversity of interest groups from the broader community to regulators and end users.

The outcome of this involved process has been the delivery of a scheme that has wide support from an informed community and the specific stakeholder groups that were the focus of consultation through REMS development.

A key success factor for REMS has been the ability to involve key stakeholders, such as user groups, in the consultative process to ensure the Scheme was tailored to the specific needs of these groups.

It will be important for the process to continue through the implementation phase as Scheme operation is fully established and end users move to irrigated agricultural production. In the longer term, the consultative process will be a key component of planning to diversify re-use opportunities to ensure the future success.

## **Acknowledgement**

John Gould, Shoalhaven Water Manager, Paul Lee, Department of Land and Water Conservation representative and Bob Mulligan, Department of Public Works and Services REMS Project Manager, are recognized for their partnership role in implementation of REMS.

## **References**

Hird C. and Moore W. *Re-use development for the Northern Shoalhaven Reclaimed Water Management Scheme (REMS)*. PJ Dillon (ed.)(2000). Water Recycling Australia: Proceedings of the 1<sup>st</sup> Symposium. CSIRO/AWA publishers.

NSW Department of Public Works and Services (2000). *REMS Distribution System Concept Design*.

**Author Biography**

**Bill Tomkinson** has been with the Shoalhaven Water Division of Shoalhaven City Council for seven years. Bill has over 30 years working in the water industry, the last 23 with local government as a qualified civil engineer.

Bill has an interest in water resources and has developed re-use schemes in Victoria and NSW. Having a background in heavy construction, irrigation and community liaison, assisted him in the implementation of REMS, the largest re-use scheme in NSW.

He also has a strong belief in the value of promoting authority, community and agency partnership in the development and realization of major projects.

**Postal Address:** Planning/Development Manager, Shoalhaven Water, PO box 42, Nowra, 2541.

**E-mail:** [tomkinson@shoalhaven.nsw.gov.au](mailto:tomkinson@shoalhaven.nsw.gov.au)

**Telephone:**  
(02) 4429 3223