

DESALINATION – A DROUGHT RESPONSE



Paper Presented by :

Dean Boyd

Author:

Dean Boyd

Manager Technical and Environmental Services

Grampians Water



*64th Annual Water Industry Engineers and Operators' Conference
All Seasons International Hotel - Bendigo
5 and 6 September, 2001*

DESALINATION – A DROUGHT RESPONSE

Dean Boyd, *Manager Technical and Environmental Services*, Grampians Water

ABSTRACT

Grampians Water provides urban water and wastewater services to 74 towns in the west of Victoria. The town of Edenhope, with a population of around 800, is situated in the West Wimmera near the South Australian border.

Drought conditions have continued over recent years, and winter rainfall run-off has been insufficient to replenish the town's normal source of water, Lake Wallace. The lake water levels are now at an unprecedented low level, and water salinity levels have risen to unacceptable levels. Supplementary groundwater supplies are available for emergency purposes, although this water source also has relatively high salinity.

Faced with diminishing water quality and quantity, an immediate need to implement a more suitable alternative water supply arrangement arose. The resulting action plan included the installation of a desalination facility suitable for dealing with the brackish groundwater.

The necessary works to install the alternative water supply and treatment works were successfully completed within a very tight timeframe. It is believed that this innovative solution to a unique problem is the first application of its type in Victoria.

This paper outlines the Authority's response to the impact of long-term drought conditions at Edenhope.

KEY WORDS

Desalination, Drought, Edenhope, Groundwater, Salinity, Water.

1.0 INTRODUCTION

The town of Edenhope is located on the banks of Lake Wallace in the far west of Victoria, near the South Australian border. Grampians Water provides urban water and wastewater services to the town's population of approximately 800.

Lake Wallace provides a picturesque backdrop to the town, and is regarded as a local focal point for a range of recreational and commercial activities within the region. The lake foreshore is well appointed with facilities including a caravan park, recreation reserve, and sporting areas to service both local and visitor activities. Fishing, boating, sailing and other associated services enhance tourism in the area.

The lake is also the town's normal raw water supply, which is then treated for potable use. The raw water is pumped to a Dissolved Air Flotation and Filtration (DAFF) Treatment Plant (commissioned in 1997), and supplied to the town reticulation system to service around 500 property connections.

As the lake has a history of occasional blue-green algae blooms, the treatment process is supplemented with ozone and activated carbon components.

An alternative groundwater supply is also available, which has previously been used for short-term emergencies. Local bores, located in and around the town, have previously been installed and connected directly to the reticulation system. The most recent use of this alternative water supply system was in response to a blue-green algal bloom in 1996, prior to construction of the Water Treatment Plant.

This pre-existing alternative water supply arrangement provided insufficient quantity and quality for longer-term use. The groundwater is of relatively high salinity (around 2,800-3,000 EC), and contains high Iron and Hydrogen Sulphide levels.

2.0 THE EMERGING DROUGHT

Drought conditions have persisted in the Grampians Water Region over recent years, and winter rainfall run-off has been insufficient to replenish drawdown in the water level of Lake Wallace. Grampians Water's Drought Response Plan was called into action, and water restrictions were invoked in December 1999.

Subsequent drought response actions focussed on maintaining raw water supply to the lake pump station, as the water level retreated below the available pump draw-off level. Secondary pumping was installed late in 1999.

Since the lake recorded its last maximum water level in December 1996, continuous drawdown had subsequently reduced the water level towards the minimum draw-off level early in 2001. The total drop in level over the four years had been almost 4.5 metres and less than one metre of depth remained.

Water quantity was not the main immediate concern however as the lake's water salinity levels were also rising during this drought period. Normal salinity readings of around 1,000 EC rose to nearly 3,000 EC in January 2001. A sharp increase in salinity was recorded during the last summer period in 2000/2001, which was one of the hottest summers on record. The higher than expected levels of evaporation during this time had reduced the lake level to unprecedented low levels.

Grampians Water's specific drought response strategy for Edenhope was progressed during this period, which focussed on contingency plans for short, medium and long-term needs. This strategy expanded upon the Authority's general Drought Response Plan, and provided more detailed assessment of available options for the on-going provision of an adequate water supply to Edenhope.

In January 2001, the community of Edenhope made it clear to the Authority that there was a high level of concern regarding the water quality then being experienced. In response, Grampians Water fast-tracked its investigations into potential alternatives, particularly to address the immediate needs to maintain short-term water supply.

3.0 INITIAL DROUGHT RESPONSE

As the level of Lake Wallace receded below the fixed level of the gravity drawoff for the raw water pumps late in 1999, the Authority arranged installation of additional temporary pumping facilities and suction line. The suction pipeline was subsequently further extended into deeper parts of the lake as water levels continued to drop.

Improvements to the floating draw-off were required over time to allow constant checking and clearing of weed from the floating draw-off. A suitable floating working platform was constructed and installed in late 2000, under difficult access conditions, the components of which had to be delivered and installed by helicopter.

A depth survey of the lake was carried out to confirm the volume of available water. Based on this information, contingency plans were based on ensuring sufficient water quantity from Lake Wallace. As stated above however, the available water quality continued to deteriorate dramatically, due to increasing salinity.

Consultation with key stakeholders had also taken place, including update meetings with municipal representatives. Information to residents has also been presented via media releases and letterbox drops.

4.0 STRATEGY DEVELOPMENT

The Authority's approach to the problem was targeted at three levels, being; immediate needs, medium term, and long term solutions. The options to provide an alternative water supply to Edenhope in the short term are summarised below;

4.1 Local Bore Supply

The geology of the region around Edenhope comprises the relatively shallow Loxton-Parilla sands, overlying the Murray Group (Duddo) limestone, with the Renmark Group (Tertiary) aquifer available in some parts of the area. The majority of bores in the immediate vicinity of Edenhope intersect the Duddo Limestone aquifer.

4.2 Tertiary Aquifer

There was some anecdotal evidence to suggest that the deeper tertiary aquifer that exists near Edenhope may yield sufficient quantity and quality of groundwater for the purpose, however a preliminary assessment indicated that this was unlikely (SKM 2000).

Local opinion continued to demand that this be further explored however, and a more detailed evaluation was undertaken early in 2001. This study indicated that the Tertiary aquifer was most likely to be available in sufficient yield and quality some 10 to 12 km north of Edenhope (SKM 2001a). The distance to this source, and the associated infrastructure needed to access it, meant that development in the short term was unlikely.

This still did not satisfy local opinion to the point where the Authority arranged for an investigation bore to be constructed on the northern edge of the town. The bore proved that the Renmark Group aquifer did not exist at the site and was unlikely to exist beneath Edenhope (SKM 2001b). Finally most of the locals were convinced.

4.3 Desalination

This option would be required to produce water of reasonable quality, either from Lake Wallace or from existing bore supplies.

4.4 Alternative Surface Water

Collins Lake is a body of reportedly fresh water approximately 7 km to the northeast of Edenhope. Initial results however indicated high salinity and high pH. Supply infrastructure would also be too extensive for consideration at this stage.

4.5 An Action Plan

Various combinations of the above options were also considered, however from a strategic and practical perspective, the selected short-term response strategy was to continue with the local bore supply, with desalination.

In accordance with the Authority's general water quality strategic plan, it was considered that an untreated supply would be unacceptable to the Authority and its customers (Egis 2000). Pipeline extensions were therefore required to connect the main bores to the raw water pump station for supply to the Water Treatment Plant.

Having decided upon the preferred short-term strategy, and in response to earnest representations from the Edenhope community, Grampians Water committed to implementing the necessary immediate term works within a very short timeframe.

A number of works projects were fast-tracked and implemented over a five-week period, mainly during March 2001. The main project components were;

- ◆ A pipeline connection, comprising approximately 1,000 metres of 150 mm diameter PVC pipe, was installed from the existing Scrubby Lake Road bores to the existing raw water pump station.
- ◆ Bore pump tests were carried out to confirm the expected yield and aquifer recovery of the Scrubby Lake Road bores.
- ◆ A chlorine gas dosing plant was installed at the raw water pump station as a pre-treatment to the DAFF plant, to oxidise iron and odour-causing compounds.
- ◆ A Reverse Osmosis (RO) plant was sourced and installed, initially on a hire basis, at the existing DAFF plant site. This plant is under-sized for peak day demands however.
- ◆ Temporary brine disposal was directed to the Wastewater Treatment Plant.

The works were installed and commissioned within the expected timeframe.

5.0 THE FUTURE

Further actions must address the medium and long-term issues as outlined below;

5.1 Medium Term

Arrangements have been made for procurement of a suitable RO plant.

Provision for brine management, including Environment Protection Authority approvals, is in progress. Interim arrangements have been made in the short term.

The potential recovery of the lake is uncertain at this stage. Medium term planning must consider that water quantity and quality may be compromised for several years at least.

The management of the lake is fragmented among several bodies, including the Council, Wimmera Mallee Water and the Department of Natural Resources and Environment.

Communication with customers and stakeholders is critical. Solutions include maintaining dialogue with Council and residents about water supply management.

5.2 Long Term

The ability to maintain Lake Wallace is the primary long-term water source for Edenhope needs to be assessed against possible alternative sources. Grampians Water has invested in a Water Treatment Plant to remove algal toxins and needs to seriously consider any move from Lake Wallace.

6.0 CONCLUSIONS

One of the most crucial elements of Grampians Water's experience in dealing with this localised drought response problem is customer consultation and communication. Every effort must be made to firstly ask customers what they want, advise what is to be done, and finally, to deliver what is promised. Often the focus is on the final step as an engineering solution, however the importance of customer involvement in the early stages is most important. Maintaining the consultation effort also requires consistent effort.

An innovative short-term solution to this water quantity and quality problem was implemented at Edenhope, in response to community concerns. It is understood that this approach is unique in Victoria.

7.0 ACKNOWLEDGEMENTS

The efforts of the various Grampians Water staff, consultants and contractors who were involved in delivering this solution in a timely manner at Edenhope is recognised and commended.

8.0 REFERENCES

Sinclair Knight Mertz (SKM), *Groundwater Database Request - Edenhope*, Facsimile, September (2000).

Sinclair Knight Mertz (SKM), *Investigation of Deep Tertiary Confined Aquifer Around Edenhope*, Report to Grampians Water p2, January (2001a).

Sinclair Knight Mertz (SKM), *Results of Investigation Bore - Edenhope*, Report to Grampians Water, p2, February (2001b).

Egis Consulting Australia (Egis), *Water Quality Improvement Plan – Final Report*, Report to Grampians Water, p 26, March (2000).

Egis Consulting Australia (Egis), *Water Supply and Treatment Strategy for Edenhope*, Report to Grampians Water, p 26, February (2001).