Belmont Desalination Plant – Comments

Submitted by Ross Kelly

There are two main areas of the Belmont Desalination report that I feel need further explanation and review.

1. Area to be served by desalination plant

No details have been given in the report of the area intended to be serviced by the desalination plant. It has been stated that this information is to be covered in a separate report on the delivery system at some point in the future.

Reference is made in Section 3.3.1 to the construction future potable pipework from the plant but no details are provided other than a statement that "the pipelines can provide an additional level of redundancy for the existing trunk water main network and can be utilised independent of the desalination plant". Two potable pipelines, a northern and a southern pipeline, are shown on the concept design drawings leaving the plant. It is not clear what the destination or function of the northern pipeline is intended to be.

However, without this information it is difficult to understand how the projected output of the plant is to be utilised. The report states that the proposed output from the plant will be 15 MLD and it is assumed that the plant will deliver this output at a constant rate over 24 hours.

The Belmont Desal plant, unlike a plant located at, say Stockton, is remote from the major trunk feeds from the Grahamstown, Tomago and Chichester sources and therefore its output cannot be directly added to these trunk feeds. Because the Belmont plant is located near the outer limits of the Hunter Water supply system it poses the question as to how the full output from the plant can be successfully utilised across the wider supply system if this was the intention (the report seems to imply this).

As demand varies significantly throughout the day, with morning and evening peaks and minimal overnight usage, use will need to be made of storage to control the rate of flow into the reticulation system. Flow from the treatment plant cannot simply be directly fed into the existing reticulation system.

The storage at the plant itself is limited to a 1.8 ML tank with less than 3 hours storage with an inflow rate of 15 MLD. It would therefore seem necessary to make use of the existing larger local Hunter Water storage reservoirs for flow averaging.

The Belmont No 1 Reservoir, located in Violet Town Road (storage 4.6 ML, TWL 88.45) would seem the obvious destination for the output from the plant as it is the main reservoir controlling supply south for the Belmont – Swansea region. Because of the higher hydraulic head on the supply side of this reservoir (as a result of gravity and pumped flows) it would not appear practical to gravitate flows in a northerly direction.

Based on the above assumptions, a trunk main, approximately 6 km in length, would need to be constructed from the Desal Plant to the reservoir with appropriate inlet controls installed to permit inflow from either the Desal Plant or the existing sources of supply.

Based on 2016 census figures the population of the suburbs of Belmont, Belmont North, Jewells, Floraville, Belmont South, Marks Point, Pelican, Swansea, Caves beach, Murrays Beach and Nords

Wharf was 33,868. This could have increased to, say 36,000, in 2019. This would give an approximate estimate of the population serviced by the Belmont No 1 Reservoir.

Recent published consumption figures for Tamworth (population 62,000), which is currently on level 5 restrictions, were 16.1 MLD (Ref: The Northern Daily Leader, 2 October 2019). No outdoors water usage is permitted under Level 5 restrictions This consumption amount represents residential and non-residential usage. The local council claims to have reduced daily per capita consumption to 150 litres per day. This would be comparable to what would apply with Hunter Water supplies if falling storage levels required Level 4 or 5 restrictions to be introduced (at 25% and 20% storage levels respectively).

If these assumptions are correct and the Belmont Desalination plant output is regulated to meet only Level 4 or 5 usage (which could apply by the time the Desal Plant is finally operational) rather than Level 3 usage as stated in the report, then on a pro-rata basis the required output from the Belmont Desal Plant could be scaled back to, say, 9 to 10 MLD, which could result in a worthwhile saving in costs.

As water restrictions are meant to apply uniformly across Hunter Water's supply system it would be unacceptable to offer some areas a more abundant supply than the rest of the system.

It has been noted in Section 2.4.1.4 - Capacity of the desalination plant - that the modelling undertaken during the development of the LHWP was based on the supply of 9 ML/day of desalinated water.

As long as provision is made in the design for scaling up the capacity of the plant to 15 MLD, it could be worthwhile from an economic point of view to initially only install two 5 MLD desal modules, deferring the installation of a third 5 MLD module to a future date.

2. Collection Well Design

It is agreed with the conclusions of the report that the preferred intake option for the Belmont Desal Plant should be the use of horizontal sub-surface seawater intake wells.

The use of collection wells with horizontal filters is well established in the United States, Europe and parts of Asia where they are used for both seawater and river aquifer extraction. The original Ranney design method for inserting the horizonal filters has evolved to include other designs such as Nebolsine, Fehlmann and Preussag gravel cover.

The method of inserting the horizontal filters involves the use of specialised jacking systems (not microtunnelling equipment referred to in the report). The usual diameters of the collecting well caissons also fall in the range 4 to 6 meters, not the larger diameters (9 to 10 metres) mentioned in the report. Lineshaft vertical turbine pumps, as opposed to submersible pumps, seem to be the preferred method of pumping in overseas installations. However, as the motors of these pumps are surface mounted. they will require a suitable above ground pump house to be installed.

There does not appear to be any comparable examples of horizontal collection wells being constructed in Australia or any evidence of local expertise in this area. The caissons could certainly be constructed by local contractors but the expertise and equipment needed for the construction of the horizonal filters would need to come from overseas.

If the horizontal filters are not correctly installed to suit local conditions there is a real risk of the filters clogging and being unable to sustain the required rate of delivery.

As the output capacity of the Desal Plant is dependent on the ability of the collection well to deliver the required input it would be prudent to give the highest priority to the construction and testing of the collection well system. If the collection well fails to deliver as expected, the success of the Desal Plant will be put in jeopardy and the whole exercise could be a costly and embarrassing failure, especially as it will occur at a critical time when water supplies are at their lowest.

Serious consideration should therefore be given to an immediate start of the detailed investigations required to allow an early start on the collection well system. This will necessitate the involvement of overseas firms who have the expertise required to undertake the work.

To allow testing of the collection system it will also be necessary to bring forward the construction of the brine disposal pipeline and the provision of power for the collection well pumps.

It is suspected that the construction timetables put forward in the report could be overly optimistic and have not given sufficient regard to the amount of work that will be involved in preliminary investigations and contract preparation. As stated in the report, if the current drought persists, water storages could fall rapidly, dropping from 35% to 15% in the space of 10 months.

Consideration should therefore be given to starting on the detailed investigation and planning for the collection well system well before the trigger point of 35% storage to allow adequate lead times for construction.